Keynote Address Program
100 Bio-Behavioural Synchrony and the Development of Social Reciprocity
Speaker: R. Feldman *Bar-Ilan University*

The talk will present our conceptual model of bio-behavioral synchrony - the coordination of physiological and behavioral responses between attachment partners during social contact - as a theoretical and empirical framework for the study of attachment bonds and the origins of social reciprocity. I will describe how micro-level social behaviors in the gaze, vocal, affective, and touch modalities are dynamically integrated with online physiological processes and hormonal response to create dyad-specific attachments and support children's capacity to become members of the social group, understand complex social signals, and develop social collaboration. Studies across multiple attachments throughout life and following children from infancy to adolescence are presented to show that the extended oxytocin (OT) system provides the neurohormonal substrate for parental, romantic, and filial attachment; that various forms of close relationships are expressed in similar constellations of synchronized behavior and OT increase; and that OT is stable over time within individuals, is mutually-influencing among close partners; is linked with distinct patterns of brain activations and genetic markers; and that mechanisms of cross-generation and inter-couple transmission relate to coordinated social behavior. Longitudinal studies assessing bio-behavioral processes in conditions associated with high risk for social development, including prematurity, maternal post-partum depression, or war-related trauma detail specific alterations to social behavior and neurohormonal systems and highlight specific targets for intervention. Overall, the findings suggest that human affiliation and social reciprocity develop within the matrix of biological attunement and close behavioral synchrony and have conceptual implications for the study of inter-subjectivity and the formulation of a brain-based epistemology as well as translational implications for the integration of OT and behavioral interventions for the treatment of social disorders originating in early childhood.

100.001 Bio-behavioural Synchrony and the Development of Social Reciprocity. R. Feldman*, *Bar-Ilan University*

The talk will present our conceptual model of *bio-behavioral synchrony* - the coordination of physiological and behavioral responses between attachment partners during social contact - as a theoretical and empirical framework for the study of attachment bonds and the origins of social reciprocity. I will describe how micro-level social behaviors in the gaze, vocal, affective, and touch modalities are dynamically integrated with online physiological processes and hormonal response to create dyad-specific attachments and support children's capacity to become members of the social group, understand complex social signals, and develop social collaboration. Studies across multiple attachments throughout life and following children from infancy to adolescence are presented to show that the extended oxytocin (OT) system provides the neurohormonal substrate for parental, romantic, and filial attachment; that various forms of close relationships are expressed in similar constellations of synchronized behavior and OT increase; and that OT is stable over time within individuals, is mutually-influencing among close partners; is linked with distinct patterns of brain activations and genetic markers; and that mechanisms of cross-generation and inter-couple transmission relate to coordinated social behavior. Longitudinal studies assessing bio-behavioral processes in conditions associated with high risk for social development, including prematurity, maternal post-partum depression, or war-related trauma detail specific alterations to social behavior and neurohormonal systems and highlight specific targets for intervention. Overall, the findings suggest that human affiliation and social reciprocity develop within the matrix of biological attunement and close behavioral synchrony and have conceptual implications for the study of inter-subjectivity and the formulation of a brain-based epistemology as well as translational implications for the integration of OT and behavioral interventions for the treatment of social disorders originating in early childhood.

Invited Educational Symposium Program
101 Friendship In ASD Through the Life Span: Nature, Trajectories, Importance and Treatment
Chair: N. Bauminger *Bar Ilan university*

Having friends is cardinal to children’s well-being and for the development of ample cognitive, linguistic, and social skills in

typical development. Despite the fact that the majority of individuals with ASD(between 60%-75%) have significant difficulties in friendship formation, it is an overlooked topic. Thus, zoom-into research into friendship processes in ASD is greatly needed. In this session, we provide descriptions of friendship's nature, quality, and importance in ASD across development, from preschool through adulthood; as well as pointing out individual, familial, and environmental components that may contribute to friendship formation in ASD. Finally, we review recent evidence from treatment models that aim to enhance friendship in ASD. Novel data will be presented that is based on quantitative and qualitative multidimensional assessment procedures, including semi-structured and spontaneous observations of friendship as well as self- and others' reports, combining current and longitudinal evaluations of friendship.

101.001 The Beginning of Friendship—Friendship In Preschoolers with HFASD: New Evidence and Implications. N. Bauminger-Zviely*, *Bar Ilan university*

Stable friendships that are based on mutual affection and provide emotional support have been well documented for typically developing preschoolers. Also, interactions with friends reveal greater social complexity than interactions with acquaintances. We know very little about peer relations and friendship in young children with ASD. Likewise, friendship development is a neglected aim in early interventions. In this presentation, current knowledge on peer relations in preschoolers with ASD will be reviewed, and innovative data on friendship evolvement and characteristics in this population will be presented, based on semi-structured and spontaneous observations of children's interactions with a friend versus non-friend partner, as well as based on parents' and teacher's reports. Research gaps and new research trends will be discussed.

101.002 Using Parent-Supervised Play Dates to Improve Peer Relationships for Elementary School Children with HFASD. F. Frankel*, *UCLA Semel Institute for Neuroscience & Human Behavior*

Play dates are ubiquitous and important events that help neurotypical children develop best friendships as well as solidly friendships at school. This presentation will discuss how parents can be trained to use play dates to develop and enhance the friendships of children with HFASD. It will review research with elementary school aged children with ASD on: (1) measuring play date success, (2) how play dates are related to peer interaction at school, (3) elements of a 12-session intervention aimed at developing skills needed to have successful play dates, and (4) the subsequent changes produced by this intervention upon play dates 3-year after the intervention. The limitations of this approach will be discussed with an eye toward further refining intervention techniques.

101.003 Friendships In Adolescence: Developmental Challenges In Those with ASD. M. Solomon*, *Department of Psychiatry, MIND Institute, Imaging Research Center*

Adolescence is a period of complex physical, behavioral and cognitive growth and development. Not surprisingly, developmental tasks of this period are distinct and advanced. For example, the achievement of intimacy, which involves the ability to integrate a partner's needs and perspectives with one's own, is considered the most critical milestone for typical adolescent friendship. In this presentation, we review our work and that of others which examines (1) Friendship abilities in preadolescents and adolescents with ASD compared to those with typical development (2), Factors associated with the ability to engage in reciprocal friendships for individuals with ASD, and (3) Risks and benefits involved in having friendships during this period. Future directions for research also will be examined, with an emphasis on helping individuals with ASD develop the skills they need to have reciprocal relationships in adulthood.

101.004 Friendships and Social Activities In Individuals with ASD In Adulthood: Trajectories, Predictors, and Implications. M. M. Seltzer*, *Waisman Center, University of Wisconsin-Madison*

Little is known about how friendships and social activities unfold over the life course in individuals with ASD; yet it is well-established that in the general population these domains differ substantially from childhood to adolescence and adulthood. This presentation will build on quantitative and qualitative data collected during a 12-year longitudinal study of adolescents and adults with ASD to chart trajectories in (a) friendships, (b)

participation in social activities, and (c) social skills. We will report data provided by the mother as well as self-report data from the individual with ASD. In addition, we will examine how characteristics of the individual, family, and living environment predict social profiles, and further how social profiles are associated with adult outcomes.

Treatments: A: Social Skills; School, Teachers Program
102 Smaller Trials, Treatment Factors
Chair: C. Kasari *University of California, Los Angeles*

These papers present data on a variety of treatment trials in ASD including smaller pilot studies and exploration of various treatment factors.

102.001 Behavioral and Developmental Outcomes From Long Term Aripiprazole Treatment of Youth with Autism Spectrum Disorders. T. C. Bethea*, C. Alderman and L. Sikich, *ASPIRE Research Program, UNC-CH*

Background: Only two medications (aripiprazole and risperidone) are approved for youth with autism. Unfortunately studies to-date only address disruptive behaviors and suggest these drugs may have significant side effects. It is not clear these medications are safe and effective for the chronic treatment of disruptive behaviors or provide any benefits for core features of this neurodevelopmental disorder affecting 1 in 110 children.

Objectives: Assess long-term safety, tolerability and broad efficacy of aripiprazole in children and adolescents with autism spectrum disorders.

Methods: Thirty youths with autism were enrolled in the study. Twenty participated in open-label, flexible-dose treatment with aripiprazole (range 10 – 25mg/day). Those who tolerated 12 weeks of aripiprazole treatment continued into a maintenance phase to assess efficacy and safety over a full year. Ten youths participated as unmedicated controls. All participants were evaluated at baseline, 12 weeks, 24 weeks and 52 weeks with a battery of cognitive and behavioral assessments. The primary outcome was the change in overall functioning as assessed by the Clinical Global Impression – Improvement scale; CGI-I. Secondary outcome measures included change in the severity of disruptive behaviors (Aberrant Behavior Checklist – ABC), parent-identified target symptoms, restrictive/repetitive behaviors (Repetitive Behavior Scale – Revised), social behaviors (Social Reciprocity Scale) and family stress, as well as objective standardized measures of cognition (Stanford-Binet-5) and language. Safety and tolerability were monitored throughout using surveillance labs and a semi-structured interview for adverse events. All results are last observation carried forwards.

Results: Participants reached their optimal dose within 12 weeks. Three children withdrew during the first 12 weeks: 1 adverse event (enuresis week 6), 1 lack of efficacy (week 4) and 1 lost to follow-up (week 8). Twelve weeks of treatment coincided with a clinically significant mean CGI-I of 2.30±1.08. 25% (5) were rated very much improved, 50% (10) much improved, 15% (3) minimally improved and 10% (2) rated with no change. Seventeen children continued into the maintenance phase. Three subsequently discontinued: 1 adverse event (weight gain week 20), 1 loss of efficacy (week 18) and 1 lost to follow-up (week 24). Improvement (CGI-I) was maintained through 52 weeks in all but one youth. All ABC subscales improved ranging from 16% (inappropriate speech) to 43% (lethargy/social withdrawal). Except for inappropriate speech, improvements persisted through week 52 and were statistically significant compared to baseline. Stanford-Binet nonverbal fluid reasoning subscale increased by 9.3%, verbal knowledge 5.8% and abbreviated battery IQ by 2.3%. Weight increased by 5.5% in the first 12 weeks. In the fourteen participants who completed one year of treatment, weight increased by 5.8% during the first 12 weeks and 16% over the full year. No serious adverse events occurred.

Conclusions: Aripiprazole appears to be safe and well-tolerated for the chronic treatment of autism. Improvements were evident across multiple behavioral domains within 12 weeks and sustained with extended treatment. Decrease in CGI-S and ABC suggest aripiprazole may reduce maladaptive behaviors and some core features of autism. This pilot study highlights the practicality and necessity of long-term efficacy and safety trials as the standard for treating youth with serious pervasive neuropsychiatric illness.

102.002 Treatment of Behavior Problems Among School-Age Children with Autism Spectrum Disorders. J.

Harrington[1], K. Allen[2] and C. G. Cooke*[2], (1)*Children's Hospital of The King's Daughters*, (2)*Eastern Virginia Medical School*

Background: Disruptive behaviors (e.g., aggression, tantrums, and self-injury) are commonly reported in children with Autism Spectrum Disorder (ASD; Farmer & Aman, 2011; Guttmann-Steinmetz et al, 2009; McClintock et al, 2003; Bauminger et al., 2010; RUPP Autism Network, 2002, 2005) and represent one of the most common reasons for referral to pediatric and mental health clinics (Masse et. al, 2007). Disruptive behavior often leads to increased use of psychiatric services and medications, suboptimal participation in educational and intervention programs, increased emotional and physical distress in the child and family, and poor social interactions with family members and peers (Brosnan and Healy, 2011; Kanne and Mazurek, 2011; Farmer & Aman, 2011; Aman et al, 2009). A behavioral intervention that has led to improvements in behavior, parent-child interaction and compliance among children with oppositional-defiant behaviors is Parent-Child Interaction Therapy (PCIT). To date, few studies have been conducted to evaluate the effectiveness of PCIT among children with ASD and disruptive behaviors (Masse, McNeil, Wagner, & Chorney, 2008; Soloman, Ono, Timmer & Goodlin-Jones, 2008).

Objectives: The purpose of this study was to evaluate the effectiveness of PCIT to reduce disruptive behavior problems among school aged (5-10 years) children with ASD, improve parent-child interactions, and improve parental practices, efficacy and mental health. A secondary objective was to differentiate treatment gains made in the two phases of treatment (Child-Directed Interaction; CDI and Parent-Directed Interaction; PDI) to determine if PCIT should be modified for this population.

Methods: This prospective randomized clinical trial used a 2x2 quasi experimental design to compare PCIT versus community treatment as usual and medication status (psychiatric medication versus no psychiatric medication). Study participants included thirty female and three male caregivers and their 5-to 10-year-old children. Families were randomly assigned to treatment (TG) or the control group (CG).

Results: Study children were mostly boys (87%), with a mean age of 7.5 (SD=1.47). Racial/ethnic composition was 20% African American, 63% Caucasian, and 19% other. Fifteen TG and 10 CG families completed the study. On parent report measures, children in the treatment group demonstrated a significant decline in problem behavior intensity (Wilk's λ (2,21) = 16.179, $p < .001$; Partial $\eta^2 = .606$) and externalizing problems (Wilk's λ (2,19) = 7.571, $p = .004$; Partial $\eta^2 = .444$) compared to the children in the control group. In addition, treatment families showed a statistically significant time by compliance ratio change (Wilk's λ (2,17) = 5.35, $p = .017$; Partial $\eta^2 = .401$), with significant relative improvement occurring at post-test ($F(1,18) = 8.48$, $p = .009$). Exploratory analyses found that children with severe ASD made the greatest treatment gains during CDI with little change after PDI, whereas children with moderate to mild ASD made significant gains across both phases of treatment.

Conclusions: Families who completed PCIT demonstrated significant improvement in child problem behaviors and parent-child interactions. These results demonstrate that PCIT can be effectively translated to children with ASD and disruptive behavior and may need to be modified based on ASD severity.

102.003 Project SEARCH for Adolescents with Autism Spectrum Disorders: Increasing Competitive Employment Opportunities Post-High School. S. Carr*[1] and C. Schall[2], (1)*Virginia Commonqwalth University*, (2)*Virginia Commonwealth University Autism Center for Excellence*

Background: The transition of students with autism spectrum disorder (ASD) from school to adulthood is an increasing dilemma (Wehman, Smith and Schall, 2009). Thousands of children being identified with ASD nationally each year and as these children become adolescents there is greater need to identify meaningful transition services to postsecondary situations in the community, family and work for these students. Consistent with an ASD diagnosis most of these students present unique strengths as well as challenging social and communication disorders. The challenge for teachers and parents is to match the strengths of young

people with ASD to work and community environments where they can succeed.

Objectives: In a recent study, Shattuck (2010) examined patterns of service use among youth with ASD from the NLTS2 sample. Data on youth who exited high school revealed that 32% attended postsecondary education schools, 6% had competitive jobs, and 21% had no employment or education experiences at all. Further, 80% of these individuals were living with their parents, 40% reported having no friends, and only 36% had a driver's license. Thus, the transition needs of this group of students require further study.

Methods: The present study examines the effectiveness of Project SEARCH, a model transition program for adolescents with ASD utilizing supports specific to students with ASD include providing intensive instruction in social, communication and job skills, work routine and structure, and visual supports.
This study presents the first 2 years findings from the implementation of Project SEARCH for high school seniors with ASD in an Urban Hospital using a randomized controlled trial. To date, there has been a diverse group of 14 high school seniors ages 18 to 22 enrolled in the treatment group and 10 students enrolled in the control group.

Results: The outcomes for the first two years of this ongoing study reveal a 100% employment rate of those in the treatment group and a 0% employment rate for the non-intervention control group.

Conclusions:

The following with be discussed to support the findings of the effects of this model on employment opportunities for adolescents with ASD: a) present the components of Project SEARCH and how they were adapted for youth with ASD in a model program, b) describe the problem-solving approach we used when implementing Project SEARCH for youth with ASD, and c) qualitative examination of outcomes for a sample of students with ASD and their internships.

Demographic	Treatment Group – N = 14	Control Group – N = 10
Age	19.2 years	18.9 years
Gender	0.71 Males	0.75 male
Race	0.42 African American 0.58 Caucasian	0.39 African American 0.61 Caucasian
ASD Diagnosis	0.50 Autism 0.21 Pervasive Developmental Disorder- Not Otherwise Specified 0.28 Aspergers Disorder	0.4 Autism 0.3 Pervasive Developmental Disorder- Not Otherwise Specified 0.2 Aspergers Disorder
Employment Status		
Demographic	Treatment Group – N = 14	Control Group – N = 10
Graduation	1.00 Employed	0.00 Employed
3 months post Graduation	1.00 Employed	0.00 Employed
1 year post Graduation	0.92 Employed	0.00 Employed

102.004 Effectiveness of Classroom Pivotal Response Teaching: A Pilot Study. A. C. Stahmer[1], J. Suhrheinrich[2], S. R. Reed*[1] and L. Schreibman[1], (1)*University of California, San Diego*, (2)*Rady Children's Hospital, San Diego*

Background: Classroom Pivotal Response Teaching (CPRT) is a behavioral intervention for students with autism spectrum disorders (ASD) that was adapted from Pivotal Response Training through an iterative process of collaboration between researchers, teachers, and school administrators. Components of PRT were adapted for CPRT based on teachers' observed difficulty using the components in the classroom and teachers opinions on the benefits and barriers to using the approach (see Stahmer et al., in press). Resources for implementation (e.g., data sheets, training

materials, case examples) were created based on teacher feedback on areas of need. CPRT is a manualized intervention for autism that is specific to school settings.

Objectives: The objective of this study was to provide a preliminary examination of the effectiveness of CPRT for students ages 3-8. Goals included determining if teachers could learn and utilize CPRT in the classroom with fidelity and evaluating whether teachers' implementation of CPRT results in student improvement on standardized communication measures.

Methods: A multiple-baseline across participants design was utilized. Twenty teachers participated in a 3 to 6 observation baseline with bi-weekly observations of teaching techniques during regular classroom activities. Teachers then participated in a 6-week training workshop in CPRT, which included lecture, video examples, hands-on practice, and classroom coaching. Observations of teacher implementation of CPRT during classroom activities occurred throughout the baseline and training periods. Each teacher identified one to two target students with autism in her/his classroom. Target students were assessed at baseline on standardized communication measures and to confirm autism diagnosis. Student communication and engagement were assessed throughout baseline and training. Follow-up observations of teacher implementation and student outcomes occurred at two-months after the end of CPRT training.

Results: Teacher implementation of CPRT components was steady during baseline and increased throughout the training period. A total of 19 teachers (95%) mastered all eight components of CPRT and implemented the intervention with fidelity after receiving training. The majority of teachers had difficulty maintaining fidelity at two-months follow-up. Positive results were seen for student skills, with increases in communication and engagement after teachers began training. A total of 60% of students made accelerated progress on standardized communication assessments over the study period.

Conclusions: Teachers were able to accurately implement CPRT in their classrooms, but maintaining intervention use after the end of training was difficult. Teachers' use of CPRT led to substantial student progress. This preliminary study supports the effectiveness of CPRT and provides important pilot data for a larger-scale effectiveness trial.

102.005 Randomized Controlled Trial of Group Parent Education in Pivotal Response Treatment (PRT): Focus on Child Language Outcomes. M. B. Minjarez*[1], G. W. Gengoux[2], K. L. Berquist[2], J. M. Phillips[2], T. W. Frazier[3] and A. Y. Hardan[2], (1)*Seattle Children's Hospital*, (2)*Stanford University School of Medicine/Lucile Packard Children's Hospital*, (3)*Cleveland Clinic*

Background: The need for effective and efficient service delivery models to treat autism spectrum disorders continues to expand, as rates of this disorder have increased significantly in recent years. In previous studies of Pivotal Response Training (PRT), research has supported that parents can learn this evidence-based treatment using a family therapy model; however, few studies have looked at more efficient service delivery models, such as group treatment. Previous pilot studies have supported the use of a group therapy model, but no randomized controlled trials have been conducted to date.

Objectives: The current investigation is a randomized controlled 12-week trial, in its final year of data collection, which examines the effectiveness of Pivotal Response Treatment Group (PRTG) in targeting language deficits in young children with autism. This condition is compared to parents participating in a psychoeducational group (PEG). The research hypothesis is that parents participating in PRTG will demonstrate evidence of targeted PRT skills and that their children will show significant benefits in language abilities, relative to those in the PEG.

Methods: Participants include children (age range: 2-6.11 years) with autism spectrum disorder and significant language delay. Children are randomized into either the PRTG or PEG. The PRTG teaches parents PRT to facilitate language development. The PEG addresses general topics related to the assessment and treatment of autism. Standardized measures (e.g., Vineland-II) and video-taped assessments (structured lab observation of parent-child interactions) are

conducted at baseline, week 6, post-treatment, and three month follow-up and are rated by a blind investigator.

Results: This study is in its final year of data collection. To date, more than 42 participants have been randomized and 26 have completed the trial. Preliminary findings support that group parent education is an effective method for teaching parents to implement PRT with their children. Preliminary findings from subjects who have finished the trial (PRTG N=13; PEG N=13) reveal that children whose parents participated in the PRTG exhibited a significant increase in the number of utterances (29.7 ± 24.2) compared to those whose parents participated in the PEG (0.5 ± 19.9; t= -3.352; df 24; p= 0.003).

Repeated measures analyses (ANOVA) also revealed significant benefits from PRTG when compared with PEG on the Expressive Communication raw score of the Vineland-II (PEG: Baseline= 34.2 ± 18.4, Week 12= 34.8 ± 22.6; PRTG: Baseline= 37.0 ± 13.2, Week 12= 50 ± 10.6; F: 8.607; df 1,22; p= 0.008) and the Communication Scale standard score (PEG: Baseline= 75.91 ± 16.31, Week 12= 75.92 ± 18.9; PRTG: Baseline= 78.23 ± 9.9, Week 12= 87.1 ± 12.8; F: 4.761; df 1,22; p= 0.04).

Conclusions: Data will continue to be added until the trial is complete; however, these preliminary findings suggest that, compared with general parent psychoeducation sessions, specific instruction in PRT results in greater skill acquisition for both parents and children. These findings support conducting parent training in a group format and will be discussed in relation to the growing need for efficient dissemination of evidence-based parent education models.

102.006 Exploring the Behavioral Profiles of Preschoolers with ASD Using Cluster Analysis within the Context of An Intervention Efficacy Trial. L. D. Johnson* and E. R. Monn, *University of Minnesota*

Background: As evidence emerges to establish the efficacy of interventions, concurrent explorations of variables that may explain variability in individual responses to intervention may provide important guidance to the iterative process of tailoring practices to enhance efficacy.

Objectives: To determine if meaningful clusters would emerge based on the examination of nine variables that are theoretically linked to potentially moderating/mediating children's responses to intervention.

Methods: Of the 205 preschool aged children with ASD who participated in the efficacy trial, 163 were included in this study given the availability of data for all nine clustering variables based on first wave data collection at pretest. A hierarchical cluster analysis based on Ward's method and squared Euclidean distance was performed to explore a four cluster solution. Nine variables were included in the model: (1) calibrated severity of ASD measured by the ADOS; 2) PLS-4 auditory comprehension and (3) PLS-4 expressive communication; two subscales of the RBS-R—(4) RBS-R ritualistic and sameness behavior (5) RBS-R restricted interest behavior, 6) Vineland II (V-II) interpersonal relationships, (7) V-II play and leisure time, (8) V-II problem behavior internalizing, and (9) V-II problem behavior externalizing. Correlations and analysis of variance were also utilized to explore relations between variables and clusters.

Results: Four unique behavioral profiles emerged. Between cluster differences were observed for ASD severity [F (3, 159) = 7.21; $p < .001$] with, in general, Cluster 1 (n= 30) and Cluster 2 (n= 57) including preschoolers with more severe ASD symptomology. Auditory comprehension and expressive language skills also differentiated the clusters [F (3, 159) = 211.50; $p < .001$ and F (3,159) = 145.99; $p < .001$ respectively], with Cluster 3 (n= 43) and Cluster 4 (n= 33) including children with higher skills than Clusters 1 and 2. The four subscales of the Vineland offered significant contributions to differentiating the clusters (p values were all $< .001$). Cluster 1 exhibited stronger interpersonal skills and play and leisure skills than Cluster 2; however, Cluster 1 also exhibited more externalizing problem behavior. Similarly, Clusters 3 and 4 were also differentiated by externalizing problem behavior, with Cluster 4 exhibiting higher rates than Cluster 3. Interestingly, despite higher rates of problem behavior, Cluster 4 also exhibited the highest interpersonal skills of all clusters and play and leisure skills that were similar to Cluster 1. Cluster 3 was

differentiated from Cluster 4 by lower externalizing behavior problems as well as play and leisure skills. Ritualistic/sameness behavior and restricted interest behavior provided descriptively different patterns.

Conclusions: Severity of ASD symptomology, auditory comprehension, and expressive communication skills provide important insight when exploring child characteristics within the context of intervention outcomes. Beyond those characteristics, interpersonal skills, play and leisure skills, and externalizing problem behavior appear to offer unique contributions to different behavioral profiles for this particular group of preschoolers with ASD.

102.007 A Pilot Randomized Control Trial of the Functional Behavioural Skills Training Group for Young Nonverbal Children with Severe Autism. J. A. Reitzel*[1], J. Summers[1], L. Zwaigenbaum[2], P. Szatmari[3], E. Duku[3] and S. Georgiades[3], (1)*McMaster Children's Hospital/McMaster University*, (2)*University of Alberta*, (3)*Offord Centre for Child Studies, McMaster University*

Background: Currently, there is little research supporting the effectiveness of Intensive Behavioural Intervention for treating nonverbal children who are more severely affected with autism. Furthermore, there is little research focusing on alternative interventions such as functional behavioural skills training.

Objectives: This pilot randomized control trial (RCT) evaluates an innovative functional behavioural skills training for children with ASD and their parents. Changes in child functional skill and parent skill outcomes in the treatment and control groups were tested.

Methods: Twenty-four children (ages 38-82 months, mean = 58.8 months) with independent diagnoses of Autistic Disorder, who had not learned early cognitive skills such as verbal and motor imitation and expressive and receptive labels, were randomized to treatment or control groups. Eight children and their parents in the treatment group and 7 children and their parents in the control group completed the study. A manualized parent training and child training group was provided weekly for 4 months by trained ABA therapists who were not involved in assessing the outcome measures. At baseline, all child participants were assessed using the Mullen Scales of Early Learning, Vineland Adaptive Behaviour Scales-II , Developmental Behaviour Checklist (DBC) and Functional Behaviour Skills Assessment (FBSA). The Vineland-II, DBC and FBSA were repeated at post-treatment. Parents completed questionnaires including the Parenting Sense of Competence, the Caregiver Strain, and the Parent ABA Knowledge Questionnaire at baseline and post-treatment.

Results: The pilot RCT was completed by 62.5% of participants. Nine participants dropped out due to family issues, child care, and time constraints. Results from the treatment group improved more than results from the control group on difference scores for the DBC Total (treatment M= -5.83 SD=10.91, control M=10.5 S.D.= 15.9) and Parent ABA Knowledge (treatment M= 3.0 S.D. 2.52 and control M= 0.6 S.D.= 2.79). Post-treatment DBC Cohen's *d* effect size was 0.4 and Parent ABA Knowledge Cohen's *d* effect size was 0.2. Additionally, preliminary pre-post data from the FBSA handwashing skill indicated that 71.4% of the children in the treatment group became more engaged in the skill in comparison to only 28.5% of the children in the control group. However, results from the treatment group did not show improvement in comparison to the results from control group on difference scores for the Vineland-II ABC (treatment M= -1.29, SD= 6.95 and control M= 4, SD= 3.92).

Conclusions: This study has taken important steps forward in developing and testing the feasibility of functional behaviour skills intervention for nonverbal children with autism and their parents. Results indicated that skills that were directly taught to the children and parents tended to improve in the treatment group compared to the control group. Further study is required to increase sample size, to validate the initial findings from the FBSA and to offer this innovative treatment to more nonverbal children. Overall, this study will provide greater opportunity to maximize resources, individualize treatment options and increase the continuum of services.

102.008 Efficacy of Adapted Responsive Teaching for Infants At-Risk for ASD. G. T. Baranek*, L. R. Watson, L. T. Brown, S. H. Field, E. Crais, L. Wakeford and L. M. Little, *University of North Carolina at Chapel Hill*

Background: Studies of early behavioral interventions for toddlers with ASD are just beginning to emerge (Carter et al., 2011; Dawson et al., 2010); however, empirical data are lacking on the efficacy of interventions with infants **at-risk** for a later diagnosis of ASD in a community (non-clinical) sample. Theoretically, intervening with infants at-risk for ASD prior to the emergence of all the diagnostic symptoms could be more efficacious than interventions initiated after diagnosis, and may have implications for prevention (Dawson, 2008). Thus, empirically-validated interventions appropriate to very young infants and toddlers at-risk for ASD are needed.

Objectives: To evaluate the potential of a parent-mediated intervention (Adapted Responsive Teaching [ART]; Adapted from Mahoney & MacDonald, 2007) designed for one-year-olds at-risk for ASD to improve developmental functioning and ameliorate the severity of core symptoms of autism.

Methods: This randomized controlled trial tested effects of an experimental treatment (ART) versus a control condition (Community Services [CS]) with 16 infants at-risk for ASD, using an intent-to-treat (ITT) analysis. Infants were identified through birth records and screened with the First Year Inventory (FYI) at 12 months of age. Those with FYI risk scores >95th percentile were invited for a comprehensive developmental assessment (Time 1). If risk indicators were confirmed, families were invited to enroll in the intervention. Eligible families who consented were randomly assigned to either ART or CS, using a 2:1 randomization ratio. Sixteen families enrolled; 11 were assigned to ART and 5 to CS. ART families received a 6-month home-based intervention designed to enhance parent responsiveness and promote social-communication and sensory-regulatory functions. Children participated in Time 2 assessments immediately after completing the intervention phase (~22-24 months of age) and a Time 3 outcome assessment ~6 months after completing the intervention phase (~30-34 months of age). Hierarchical linear growth models where used to model growth in the assessments over the three measurement occasions. Estimation was conducted under a Bayesian framework, allowing for exact inference in finite samples (Yuan & MacKinnon, 2009).

Results: The ITT estimate is based on the expected difference between ART and CS groups at 20 months after the first assessment. The ART group significantly outperformed the CS group on the Mullen Scales of Early Learning with the largest effects for receptive language (effect size, mean of posterior distribution = 1.271) and visual reception (.525). Likewise, the ART group significantly outperformed the CS group on the Vineland Adaptive Behavior Scales with large significant effects for all subscales: socialization (1.274), daily living (.795), motor (=.882), and communication (.702). Although effect sizes were large on several measures of sensory processing and parental responsiveness, group differences failed to reach statistical significance in this small sample.

Conclusions: Although both groups made gains, there was broad supportive evidence for greater benefits of the ART treatment relative to the CS condition on overall development and adaptive behavior, particularly in the social-communication domain. These findings support the promise of parent-mediated early intervention with infants at-risk for ASD in improving developmental outcomes on standardized tests. Further analyses of parent responsiveness and sensory processing functions are warranted with a larger sample.

Clinical Phenotype Program

103 Clinical Phenotype: Assessing Diagnostic Criteria

Chair: C. E. Lord *University of Michigan Autism & Communication Disorders Center*

103.001 Phenotypic Profiles of Children with and without An Autism Spectrum Disorder in the Study to Explore Early Development. L. D. Wiggins*[1], S. E. Levy[2], A. M. Reynolds[3], L. A. Schieve[4], S. Hepburn[5], L. C. Lee[6], C. E. Rice[4], J. L. Daniels[7], L. A. Croen[8], E. Giarelli[9], C. Robinson[10], C. DiGuiseppi[3], L. Blaskey[2], L. Young[11], M. Yeargin-Allsopp[1], J. A. Pinto-Martin[12], P. A. Thompson[13], M. C. Souders[2] and D. E. Schendel[1], (1)*Centers for Disease Control and Prevention*, (2)*Children's Hospital of Philadelphia*, (3)*University of Colorado Denver*, (4)*National Center on Birth Defects and Developmental Disabilities*, (5)*University of Colorado / JFK Partners*, (6)*Johns Hopkins Bloomberg*

School of Public Health, (7)*University of North Carolina*, (8)*Kaiser Permanente, Division of Research*, (9)*University of Pennsylvania*, (10)*University of Colorado Denver School of Medicine*, (11)*University of Pennsylvania, School of Nursing*, (12)*University of Pennsylvania School of Nursing and School of Medicine*, (13)*Michigan State University*

Background: The Study to Explore Early Development (SEED) was funded by the Centers for Disease Control and Prevention to enhance knowledge of autism spectrum disorder (ASD) phenotypes and etiologies. SEED presents a unique opportunity to investigate ASD phenotypes because of its population- based ascertainment, large sample size, and comprehensive data collection, including a child developmental evaluation.

Objectives: Our objective was to describe different phenotypes (i.e., cognitive, adaptive, social, language, behavioral, medical, psychiatric, and developmental) of children recruited and enrolled in SEED. We compared the profile of children classified as ASD with the profile of children classified as developmental delay or disorder (DD) and children in the population control (POP) group.

Methods: Children 2-5 years old were ascertained through birth certificate records and multiple education and clinic sources serving children with developmental problems. All children were screened with the Social Communication Questionnaire (SCQ) upon enrollment and all families were asked to complete the Social Responsiveness Scale (SRS). Information on co-occurring conditions was obtained by telephone interview. Children without a prior ASD diagnosis who passed the ASD screen received a limited developmental evaluation, which included the Mullen Scales of Early Learning (MSEL) only. Children with a prior ASD diagnosis or who failed the ASD screen received a comprehensive evaluation, which included the MSEL, Vineland Adaptive Behavior Scales (VABS), Autism Diagnostic Interview – Revised (ADI-R), and Autism Diagnostic Observation Schedule (ADOS). After the developmental evaluation, all children were classified into one of four groups: ASD, DD with ASD symptoms, DD without ASD symptoms, or POP. Children had to meet ASD criteria on the ADOS and ADI-R, or have discordance between the instruments resolved, in order to receive an ASD classification. DD children with ASD symptoms were those who completed a comprehensive developmental evaluation but did not meet SEED criteria for ASD and DD children without ASD symptoms were those who completed a limited developmental evaluation due to low ASD risk.

Results: 2,233 out of 3,576 children enrolled had a final study classification as of May 2011: 600 ASD, 244 DD with ASD symptoms, 591 DD without ASD symptoms, and 798 POP. The mean age at time of clinic visit did not differ between final classification groups (M=58.65 months, SD=7.44 months). There were significant differences between all study groups on SCQ, SRS, and MSEL scores, with ASD children showing more deficit than other children. DD children with ASD symptoms had more cognitive and ASD deficit, but more adaptive abilities, than DD children without ASD symptoms. These two groups of DD children also differed in terms of presence of co-occurring developmental and psychiatric conditions (e.g., learning disabilities and sensory integration problems).

Conclusions: SEED ascertainment and recruitment methods yielded study groups with different phenotypic profiles. Cognitive and ASD characteristics were normally distributed in our sample. DD children with ASD symptoms were different from DD children without ASD symptoms and may represent children with sub-threshold ASD symptomotology. The unique study groups enrolled in SEED offer an ideal sample to explore phenotypic subgroups and etiologic factors associated with ASD.

103.002 A National Study of Autistic Symptoms in the General Population of School Age Children and Those Diagnosed with Autism Spectrum Disorder (ASD). S. Goldstein[1], J. Naglieri[2] and K. M. Williams*[3], (1)*University of Utah School of Medicince*, (2)*George Mason University*, (3)*Multi-Health Systems, Inc.*

Background: Autism spectrum disorders (ASD) are associated with myriad developmental difficulties. However, many of its current diagnostic symptoms were historically arrived at by consensus rather than research. As part of the development of

the Autism Spectrum Rating Scales (ASRS; Goldstein & Naglieri, 2010), parent and teacher ratings of clinical and non-clinical children were obtained, affording the opportunity to study autistic symptoms in a nationally representative sample as well as those diagnosed with ASD and other disorders.

Objectives: The purpose of the present paper is to identify the key symptoms of ASDs as measured by the ASRS, using a large representative sample of children and youth. Results would provide empirical support and direction for the accurate diagnosis of ASD.

Methods: Participants included two samples of children aged 6- to 18 years from 70 data collection sites in the U.S. and Canada. Parents rated 1,881 youth (54.4% male; mean age 11.0 years, *SD* = 3.7 years; 65.9% White). Most cases (76.9%) were without a formal clinical diagnosis of any psychological disorder. Of those cases with a diagnosis, the most common were ASD (43.4%) and ADHD (23.9%). Teachers rated 2,171 participants (51.4% male; mean age = 11.9 years, *SD* = 3.7 years; 58.5% White). Most cases (76.6%) did not have a formal clinical diagnosis of any psychological disorder and of those that did, the most common were ASD (41.9%) and ADHD (25.2%). The ASRS was designed to assess ASD-relevant behaviors as rated by parents and/or teachers, and shows strong reliability and validity (Goldstein & Naglieri, 2010). The 71 Likert-style items are based on a comprehensive review of current theory and literature on the assessment of ASDs, DSM-IV-TR and ICD-10 diagnostic criteria, and the authors' clinical and research experiences. Exploratory factor analyses (EFA) and factor congruence analyses were conducted separately on the parent and teacher data to identify the ASRS factor structure and its replicability across demographic groups.

Results: Various EFA criteria suggested the presence of three correlated factors: (a) *Unusual Behaviors* (stereotypical and repetitive behaviors), (b) *Self-Regulation* (inattention, impulsivity, non-compliance), and (c) *Social/Communication* (difficulties with social interactions, verbal and non-verbal communication). Factor congruence analyses showed replication of the factors between sexes (males vs. females), ethnic groups (White vs. non-White), age groups (6-11 vs. 12-18 years), and clinical status (clinical vs. general population).

Conclusions: Results from this study provide empirical support for a three-factor interpretation of ASD: Unusual Behaviors, Self-Regulation, and Social/Communication. There are several important implications of this factor structure. First, the Self-Regulation factor that emerged is novel in major symptomatic descriptions of ASD. Its strong correlation with the other two ASRS factors implies it is a core feature of ASD, not a simple co-morbidity. Second, social and communication symptoms merged into a single factor, contradictory to many current conceptualizations of ASDs (e.g., DSM-IV-TR). Finally, the large nationally representative sample of general population and clinical children, combined with the consistency of the factor structure across various demographic groups and in both parent and teacher ratings, suggests these results are highly generalizable.

103.003 Demographic and Clinical Correlates of Proposed DSM-5 Autism Symptom Domains and Diagnosis. R. A. Embacher*[1], T. W. Frazier[2], E. A. Youngstrom[3], A. Y. Hardan[4], J. N. Constantino[5], P. A. Law[6], R. Findling[7] and C. Eng[2], (1)*Cleveland Clinic Center for Autism*, (2)*Cleveland Clinic*, (3)*University of North Carolina at Chapel Hill*, (4)*Stanford University*, (5)*Washington University School of Medicine*, (6)*Kennedy Krieger Institute*, (7)*University Hospitals Case Medical Center*

Background:

Understanding the demographic and clinical factors associated with autism symptoms and diagnosis has both conceptual and practical implications relevant to assessment and future research strategies. Specifically, understanding the pattern of autism symptoms across single and multiple incidence families can inform the genetic epidemiology of autism spectrum disorders (ASD). Additionally, distinct patterns of correlates across proposed DSM-5 social communication/interaction (SCI) and restricted/repetitive behavior (RRB) domains may imply the need for separate consideration of symptoms, as opposed to only global symptom severity. Lastly, and most practically, demographic and clinical correlates may be important factors to consider when developing or revising measures.

Objectives:

The first aim of this study was to determine the influence of demographic and clinical correlates on SCI and RRB symptoms, before and after accounting for ASD diagnosis. The second aim was to determine whether caregiver-reported SCI and RRB symptoms, considered separately, provided incremental validity in the prediction of ASD diagnosis.

Methods:

We analyzed data from 7,352 siblings included in the Interactive Autism Network registry. SCI and RRB symptoms were obtained using caregiver-reports on the Social Responsiveness Scale. Demographic and clinical correlates were covariates in separate mixed effects regression models predicting SCI and RRB symptoms. Demographic and clinical correlates included: age, sex, race/ethnicity, birth order, and family type (single vs. multiple incidence), any ADHD, any anxiety disorder, or intellectual disability. The models were estimated with and without ASD diagnosis as an additional covariate to examine whether correlates persisted in influencing SCI and RRB levels even after accounting for ASD diagnosis (aim 1). Logistic regression and receiver operating characteristic curve analyses estimated the incremental validity of SCI and RRB domains over and above global autism symptoms in the prediction of ASD diagnosis (aim 2).

Results:

ASD diagnosis was the strongest correlate of caregiver-reported SCI and RRB symptoms. The presence of any ADHD, anxiety disorder, or intellectual disability diagnosis also increased SCI and RRB symptoms, even after accounting for ASD diagnosis. Non-ASD siblings of multiple incidence families had elevated symptom levels. However, ASD-affected siblings from multiple-incidence families had fewer symptoms than ASD-affected siblings from single incidence families. SCI and RRB symptoms provided incremental validity in predicting diagnosis above and beyond global autism symptoms.

Conclusions:

These findings suggest that ASD diagnosis is by far the largest determinant of quantitatively-measured autism symptoms. Externalizing and internalizing behavior, cognitive disability, and demographic factors may confound caregiver-report of autism symptoms, necessitating a continuous norming approach to the development and revision of symptom measures. SCI and RRB symptoms may provide incremental utility in the screening and diagnosis of ASD. Several alternative explanations for the autism symptom pattern across single and multiple incidence families should be considered, including rater effects and the possibility of unique mixture of genomic mechanisms across these family types. Future studies using blinded clinician ratings are needed to tease apart these alternatives. Additional studies replicating the pattern of clinical correlates and examining the incremental validity of SCI and RRB symptoms are needed to enhance the screening and diagnosis of ASD.

103.004 An Examination of the Proposed DSM-V Criteria for ASD. A. Taheri* and A. Perry, *York University*

Background:

The DSM-V, currently in development, proposes one diagnosis of Autism Spectrum Disorder (ASD), which will include individuals currently diagnosed with Autistic Disorder, Asperger's Disorder, Childhood Disintegrative Disorder, PDD-NOS. Instead of the previous 12 criteria , 4 each in the "triad of impairments", the criteria are reduced to 3 social-communication difficulties and 4 repetitive behaviour/interests criteria, based on research suggesting the social and communication items load together and are distinct from repetitive actions, speech, use of objects, and sensory issues.

Objectives:

The purpose of this study is to report on an initial examination of the proposed DSM-V ASD criteria in relation to: (a) the DSM-IV criteria; (b) autism severity; (c) cognitive level; and (d) adaptive behaviour level. We hypothesized that all children previously diagnosed with AD or PDD-NOS would meet criteria for ASD under the DSM-V criteria.

Methods:

The data for this study were based on a retrospective file review of 131 children (3 to 13 years old), previously diagnosed with Autistic Disorder (n=93) or PDD-NOS (n=38). A checklist was developed consisting of the 7 items from the proposed

DSM-V criteria. An experienced psychologist, who had originally diagnosed the children using DSM-IV, rated each of the 7 criteria on a 3-point scale (fully met, partially met, not met).

Results:

Contrary to our prediction, results indicated that only 63.4% of the sample met the DSM-V criteria for ASD; 91.6% of children with AD and 8.4% of children with PDD-NOS. The ASD met group had significantly higher autism severity on the CARS; lower Full scale IQ, Nonverbal and Verbal IQ, and lower adaptive behaviour scores on all domains. However, the age did not differ between the two groups.

The 7 specific criteria for ASD were examined to determine the number of children who fully met, partially met, or did not meet each criterion. In the social-communication domain, over 80% of children met each of the 3 criteria. For the domain of restricted, repetitive behaviour only 20% of children met the criteria for two items "excessive adherence to routines... or excessive resistance to change" and "highly restricted, fixated interests" but over 70% met the other two criteria (stereotyped behaviour and hyper-or hypo-reactivity to sensory input).

Conclusions:

Age did not differ between the ASD and non-ASD groups, suggesting that the criteria were equally sensitive for both younger and older children within the age range studied. However, the ASD group were significantly lower on cognitive and adaptive levels, suggesting the new criteria are sensitive in identifying autism in lower functioning children, but may be missing autistic symptomatology as manifest in more capable children

This study reveals that the new criteria, at least as implemented in this study, may have low sensitivity in less impaired children which has significant implications for both research and clinical practice. The findings imply that the proposed DSM-V criteria, if they remain as is, could result in many children who should receive a diagnosis being missed.

103.005 Factor Analysis of DSM-IV, DSM-5, and Other Models of Symptom Structure in Toddlers with Autism Spectrum Disorder

W. Guthrie*[1], V. P. Reinhardt[1], L. B. Swineford[2], C. E. Nottke[2], C. E. Lord[3] and A. M. Wetherby[2], (1)*Florida State University*, (2)*Florida State University Autism Institute*, (3)*Weill Cornell Medical College*

Background: Little agreement exists about the exact structure of autism spectrum disorder (ASD) symptoms, and the DSM-IV conceptualization has received little empirical support. As such, several other models have been proposed, including alternative three-factor models (Boomsma et al., 2008; Georgiades et al., 2007; vanLang et al., 2006), more parsimonious two-factor models (Frazier et al., 2008; Gotham et al., 2007; Snow et al., 2009), and a one-factor model (Constantino et al., 2004). However, none has emerged as the best fitting, perhaps due to variations in sample size and characteristics, and age range. In particular, examining the phenotypic structure with a broad age range likely fails to account for developmental changes in symptom presentation. Symptom structure has not yet been examined specifically in toddlers, although it is crucial to understand the phenotype early in development.

Objectives: To compare the relative fit of DSM-IV, DSM-5 and other proposed models of autism symptom structure using confirmatory factor analysis (CFA) in a large, representative sample of toddlers.

Methods: Children were recruited from the FIRST WORDS® Projects at Florida State University and University of Michigan Autism and Communication Disorders Center. Children included had one or more administrations of the Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T: Lord, Luyster, Gotham, & Guthrie, in press) between 12-30 months, and received a best-estimate diagnosis of ASD (total observations=387; unique cases=199). ADOS-T algorithm and play items provided indicators of autism symptoms for CFAs.

Results: Five models were specified: (1)one-factor, (2)two-factor DSM-5, (3)two-factor DSM-5 including play items in the social communication domain, (4)three-factor DSM-IV, and (5)three-factor model proposed by VanLang et al. (2006). A series of CFAs examining the relative fit of the specified models was run using Mplus software (Muthen & Muthen,

1998). Weighted Least Squares Mean and Variance Adjusted was used for estimation, as it is preferred when modeling ordinal data. DSM-IV, DSM-5, and VanLang models demonstrated good fit according to RMSEA (i.e., values ≤.08), CFI, and TLI values (i.e. values≥.95). Further comparison of fit using AIC and BIC, generated by rerunning models using Maximum Likelihood, indicated that the DSM-5 model demonstrated the best fit. Item loadings on factors and estimates of the relationships between factors will be discussed.

Conclusions: Results indicated the two-factor structure proposed for DSM-5 provided the best fitting model for a large, representative sample of toddlers. These findings lend support to the use of two distinct domains to characterize features measured by the ADOS-T, suggesting that although symptom presentation changes throughout development, factor structure in toddlers is similar to what has been documented in older children (Frazier et al., 2008; Gotham et al., 2007; Snow et al., 2009). The performance of the two-factor DSM-5 model is also consistent with studies that find that social and communication deficits represent just one domain, while repetitive/unusual language may be most likely to load together with repetitive and stereotyped behaviors. Finally, the goodness of fit provided by the models, which utilized observational ADOS-T items as indicators, supports the utility of this newly developed tool to capture the core components of the ASD phenotype in toddlers.

103.006 Stability and Predictors of the Developmental Course of ASD From Childhood to Adolescence. S. C. Louwerse*[1], M. L. Eussen[2], P. de Nijs[1], A. R. Gool[2], F. Verheij[1], F. C. Verhulst[1] and K. Greaves-Lord[1], (1)*Erasmus MC - Sophia's Children's Hospital*, (2)*Yulius*

Background: Studies regarding the stability of ASD from childhood until adolescence are sparse. The few studies available mostly included individuals with classical autistic disorder (AD) combined with mild to severe mental retardation, and concluded that autism is stable throughout life. Currently, the conceptualisation of autism is much broader and more insight is needed on the developmental course of individuals at the higher functioning end of the autism spectrum (ASD).

Objectives: The first aim of this study was to examine the diagnostic stability of ASD from middle childhood to adolescence. The second aim was to investigate putative predictors from childhood for further developmental course into adolescence.

Methods: A follow-up study was performed on a sample of originally 242 clinically referred, 6 to 12 year old children (T1: n=142 ASD, n=100 with subclinical ASD symptoms). Seven years later, at T2, 170 adolescents (n=113 of the original ASD group and n=57 of the 'sub-ASD' group) took part in diagnostic assessment with the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview (ADI-R). Four developmental course groups were computed based on best estimate clinical consensus classifications during childhood and adolescence; 1) persistent ASD, 2) individuals who improved from an ASD classification to subclinical ASD symptoms ('improvers'), 3) persistent sub-ASD, 4) individuals who declined from subclinical ASD symptoms to an ASD classification ('decliners'). The relative amount of individuals in these groups was regarded (aim 1). To evaluate predictors of developmental course (aim 2), T1 cognitive functioning, language abilities, and severity within symptom ASD domains were compared between the persistent ASD group and improvers (predictors of improvement) and between the persistent sub-ASD group and decliners (predictors of decline).

Results: 74% of the individuals received an ASD classification at both time points, whereas in 26% of the cases functioning improved. 68% of the participants who showed subclinical ASD symptoms during childhood also did not have an ASD classification during adolescence, but 32% declined into a full ASD classification. The individuals who improved showed better language and communication skills during childhood than the persistent ASD group. Individuals that declined into an ASD classification had worse language and communication skills during childhood than the individuals with subclinical ASD symptoms during both assessment waves. Social problem levels during childhood were also marginally different between the groups (p=.06). Cognitive functioning was not predictive of improvement or decline.

Conclusions: In higher functioning individuals, ASD is not as stable from childhood to adolescence as was previously found for more severe autism cases. More than one fourth of the ASD cases no longer meet diagnostic criteria in adolescence, but also one third of the individuals that did not meet full diagnostic criteria during childhood, did meet these criteria during adolescence. Therefore, it is important to re-evaluate the diagnosis of individuals who showed milder forms of ASD during childhood once they have reached adolescence. Language ability is an important prognostic factor regarding further developmental course into adolescence, since limited speech predicts decline, but good pragmatic language ability predicts improvement.

103.007 Investigating Phenotypic Heterogeneity in Children with Autism Spectrum Disorder: A Factor Mixture Modelling Approach. S. Georgiades*[1], P. Szatmari[1], M. Boyle[1], S. Hanna[1], E. Duku[1], L. Zwaigenbaum[2], S. E. Bryson[3], E. Fombonne[4], J. Volden[2], P. Mirenda[5], I. M. Smith[3], W. Roberts[6], T. Vaillancourt[7], C. Waddell[8], T. Bennett[1] and A. Thompson[1], (1)*Offord Centre for Child Studies, McMaster University*, (2)*University of Alberta*, (3)*Dalhousie University/IWK Health Centre*, (4)*Montreal Children's Hospital*, (5)*University of British Columbia*, (6)*The Hospital for Sick Children*, (7)*University of Ottawa*, (8)*Simon Fraser University*

Background: Autism Spectrum Disorder (ASD) is a complex disorder characterized by notable phenotypic heterogeneity, which is often viewed as an obstacle to the study of its etiology, diagnosis, treatment and outcomes. Until recently researchers have debated whether ASD should be conceptualized as categorical or as dimensional to better capture this heterogeneity. However, it is possible that a complementary model that integrates categorical and dimensional elements might be the best approach in delineating the ASD symptom phenotype.

Objectives: The current study uses the novel method of Factor Mixture Modelling (FMM) that allows for the integration of categories and dimensions, to stratify children with ASD into homogeneous sub-groups, based on their scores on the symptom dimensions of Social Communication Deficits (SCD) and Fixated Interests and Repetitive Behaviours (FIRB).

Methods: The study sample consisted of 391 newly-diagnosed children (mean age 38.3 months; 330 males) participating in a longitudinal study of ASD developmental trajectories. Data from the Autism Diagnostic Interview-Revised indexing the SCD and FIRB symptom dimensions were used in Factor Mixture Modeling to derive subgroups of children.

Results: Competing models were fit to the data and tested using a set of goodness-of-fit criteria. Results showed that a "2-factor/3-class" factor mixture model provided the best fit to the data. This model describes ASD using three subgroups/classes (Class 1: 34%, Class 2: 10%, Class 3: 56% of the sample) based on differential severity gradients on the SCD and FIRB symptom dimensions. Children within these subgroups were diagnosed at different mean ages and were functioning at different mean adaptive, language, and cognitive levels.

Conclusions: Factor Mixture Modeling is a useful method for understanding the phenotypic structure of a complex, heterogeneous disorder such as ASD. Study findings suggest that the two symptom severity dimensions of SCD and FIRB proposed for the DSM 5 can be used to stratify preschool children with ASD empirically into three homogeneous subgroups. Clinical and research implications are discussed.

103.008 The Autism Mental Status Exam: Sensitivity and Specificity Using Consensus Diagnosis. D. Grodberg*, P. M. Weinger, L. V. Soorya, A. Kolevzon and J. D. Buxbaum, *Mount Sinai School of Medicine*

Background: The Autism Mental Status Exam (AMSE) is a brief diagnostic observational assessment tool that structures the way we observe and record social, communicative and behavioral functioning in individuals with ASD (Grodberg, 2010). The AMSE comprises 8 operationalized items, which include: eye contact, interest in others, pointing skills, language, pragmatics, stereotypy, preoccupations, and sensitivities. The strong clinical utility of the AMSE derives from its low clinical burden. The AMSE does not add extra work to a clinician's exam, but rather structures the way data is observed and recorded. Each item is scored on a 0-2 scale yielding total scores that range from 0-16. A preliminary study

indicates that the AMSE has excellent inter-rater reliability and classification accuracy when compared to the Autism Diagnostic Observation Schedule (ADOS) in a high-risk population. This is the first study to assess the sensitivity and specificity of the AMSE using consensus diagnosis.

Objectives: To investigate the sensitivity and specificity of the AMSE using current DSM-IV-TR criteria and the proposed DSM-5 criteria for autism. This study seeks to determine the most effective cutoffs that predict clinical consensus diagnosis supported by ADOS and ADI-R in a high-risk population.

Methods: 136 children, adolescents and adults between age 19-months and 45-years received comprehensive autism diagnostic evaluations. Evaluations included an initial intake performed by a child and adolescent psychiatrist or a psychologist with autism expertise; the AMSE was administered in the context of this clinical evaluation. Participants were then administered an ADOS by a different clinician and, in most cases, an ADI-R was performed. Consensus diagnosis was ascertained by a team of clinicians using data from the clinical evaluation and diagnostic assessments. Subjects were grouped into two diagnostic categories: ASD and non-ASD. In an effort to assess the AMSE's predictive validity using current DSM-IV-TR criteria and proposed DSM-5 criteria, Analysis #1 grouped all PDD-NOS cases into the ASD category and Analysis #2 grouped PDD-NOS cases into the non-ASD category.

Results: Within this high-risk sample, 68% of subjects received a clinical diagnosis of Autistic Disorder or Asperger's Disorder, 12% received a diagnosis of PDD-NOS, and 20% received other axis I diagnoses. ROC curve analysis was used to determine the most effective criterion cut-off scores on the AMSE. In Analysis #1, which reflects DSM-IV-TR criteria, area under the ROC curve (AUC) was 0.91 (95%CI: 0.858-0.971). An AMSE cutoff score of ≥5 predicted ASD diagnosis with sensitivity of 90% and specificity of 89%. In Analysis #2, which more closely reflects proposed DSM-V criteria, the AUC was 0.88 (95%CI: 0.809–0.946). An AMSE score of ≥6 predicted ASD diagnosis with sensitivity of 79% and specificity of 79%.

Conclusions: This study demonstrates that the AMSE provides a standardized method to rapidly assess signs and symptoms of ASD. Findings indicate that the AMSE holds promise as a useful observational assessment tool for use with individuals suspected of ASD. Findings support the validity of the AMSE and add to previous results suggesting that the AMSE accurately predicts ASD diagnosis, even when rigorous standards for diagnosis are applied.

Cell Biology Program
104 Biological Mechanisms & Animal Models
Chair: E. DiCicco-Bloom *Robert Wood Johnson Medical School*

104.001 Decreased Akt and Changes in Relative Levels of TrkB Isoforms in Autism. C. Nicolini*[1] and M. Fahnestock[2], (1)*University of Trieste*, (2)*McMaster University*

Background: Defects in synaptic development and plasticity are thought to lead to autism. Since brain-derived neurotrophic factor (BDNF) plays a crucial role in synaptogenesis and synaptic plasticity in the developing and mature brain, altered BDNF signaling could contribute to the pathogenesis of autism. We have previously found increased BDNF levels in post-mortem brain tissue of subjects with autism compared to controls, as measured by ELISA, and a genetic association between the high-affinity BDNF receptor, TrkB, and autism has been reported. TrkB is expressed in three splice variants. Full-length receptors (TrkB-FL) contain an intracellular catalytic tyrosine kinase domain and mediate classic neurotrophic BDNF signaling. Conversely, the two truncated TrkB isoforms are able to bind and sequester BDNF but, lacking tyrosine kinase activity, cannot elicit the normal cellular response to BDNF. We hypothesize that altered relative levels of TrkB receptor isoforms may contribute to deficits in BDNF signaling which account for aberrant neuronal function in autism. BDNF is believed to regulate dendritic development through TrkB activation of the PI3K-Akt-mTOR signaling pathway. We propose that dysregulation of the pathway may occur at different levels including ligand, receptors, and downstream signaling cascade effectors.

Objectives: To investigate whether or not the BDNF/TrkB signaling pathway is disrupted in autism by comparing protein

expression of TrkB isoforms and Akt in cortical tissue of autism versus control subjects.

Methods: We measured protein expression of TrkB isoforms by Western blotting in post-mortem fusiform gyrus tissue of autism (n=11) and control subjects (n=13), and determined TrkB-FL and truncated TrkB isoform ratios. As a downstream effector of the BDNF/TrkB pathway, we next examined total Akt protein expression by Western blotting in the same cohort.

Results: We found significantly increased truncated TrkB isoforms, significantly reduced TrkB-FL and a highly significant reduction of the TrkB-FL/truncated TrkB protein ratio in autism subjects compared to controls. Akt protein levels were also significantly decreased in autism compared to control tissue.

Conclusions: Decreased TrkB-FL and Akt levels in autism suggest downregulation of the BDNF/TrkB signaling pathway. In addition, increased truncated TrkB isoforms may abnormally sequester the high levels of BDNF seen in autism. These findings point to an impaired cellular response to BDNF in autism. Moreover, a dysfunctional PI3K-Akt-mTOR pathway activated by BDNF through TrkB receptors may contribute to changes in dendritic development, thereby affecting communication at synapses. Aberrant cellular response to BDNF may lead to defects in synaptic development and plasticity which could account for the behavioral deficits typical of autistic disorder.

104.002 Elevated Fetal Steroidogenic Activity in Autism. S. Baron-Cohen*[1], B. Auyeung[1], B. Nørgaard-Pedersen[2], D. M. Hougaard[2], M. W. Abdallah[3], L. Melgard[2], A. Cohen[2], L. Ruta[1] and M. V. Lombardo[1], (1)*Autism Research Centre, University of Cambridge*, (2)*Statens Serum Institute*, (3)*Aarhus University Faculty of Health Sciences*

Background: Autism Spectrum Conditions (ASC) are much more common in males. One hypothesized biological mechanism that could potentially influence this male bias is fetal testosterone (FT) or more generally the broader steroidogenic pathway leading to the synthesis of testosterone (Baron-Cohen et al 2011, PLOS-Biology; Baron-Cohen et al, 2005, Science). Sex steroids are well established as an epigenetic fetal mechanism for modifying gene expression and a host of other molecular/cellular factors in early brain development and may be helpful as predictive markers for those who may be at increased risk for later diagnosis.

Objectives: To test for the first time the hypothesis that fetal steroidogenic activity is elevated in individuals who later receive a diagnosis of ASC.

Methods: 62 male cases of classic autism (without a comorbid diagnosis of 'mental retardation') or Asperger Syndrome and 231 typical male controls were selected from the Historic Birth Cohort, a biobank of amniocentesis samples taken from the Danish population since 1993. Using mass spectrometry we assessed the concentration of 4 hormones in the Δ4 steroidogenic pathway tied explicitly to CYP17 enzymatic pathway (i.e. progesterone, 17α-hydroxyprogesterone, androstenedione, and testosterone) in amniotic fluid sampled during weeks 10-20 of gestation. Cortisol was also measured as a control hormone that is not within the main Δ4 sex steroid biosynthesis pathway. Analysis of the main hypothesis (that Δ4 pathway hormones are elevated in ASC) consisted of computing the multivariate Wilk's lambda statistic within a permutation test (re-computed over 1,000,001 iterations). Further classification analyses were implemented using logistic regression and classification performance measures were compared to null distributions estimated under chance conditions via permutation tests.

Results: A permutation test (1,000,001 iterations) on the multivariate Wilk's lambda statistic showed that when testing all hormones there was an overall group difference in the direction of ASC>Control ($p=0.01$). Following up this multivariate result with tests on each hormone individually, we found that concentration of all 4 steroidogenic hormones in the Δ4 pathway were elevated in the ASC group, but there was no between-group difference in cortisol concentration. Logistic regression was then used to classify diagnostic status using all hormones. Classification accuracy, specificity, PPV, and NPV were all significantly higher than chance values estimated by permutation tests (all $p<0.02$). Sensitivity approached statistical significance ($p=0.06$).

Conclusions: This work represents the first direct verification that fetal exposure to sex steroids is elevated in those who later receive a diagnosis of autism. Given the role of sex steroids in a host of interactions at the genetic and molecular/cellular level, this finding represents an important breakthrough in understanding early factors that contribute to the pathophysiology of ASC. Classification analyses show that while these markers are statistically significant in predicting later diagnosis status, such markers should not be used as a fetal test. Future work comparing autism to other neurodevelopmental conditions will be important in clarifying the specificity of such markers to autism, and how such fetal hormones impact the neurodevelopment of autism.

104.003 Is Prenatal Testosterone Exposure Associated with Early Vocabulary Development? A Prospective Cohort Study. L. P. Hollier*[1], E. Mattes[2], M. T. Maybery[1], J. A. Keelan[1], M. Hickey[3] and A. Whitehouse[1], (1)*University of Western Australia*, (2)*Telethon Institute for Child Health Research*, (3)*University of Melbourne*

Background: Prenatal exposure to androgens is known to affect fetal brain maturation and later neurocognitive function. Baron-Cohen (2002) proposed that exposure to enhanced concentrations of prenatal androgens, may play a causal role in autism. Communication difficulties are at the core of ASD, and any aetiological theory must incorporate a plausible explanation of this symptom. However, research on the effects of prenatal androgen exposure has been limited by indirect measures of androgens (e.g. 2D:4D ratio) and small unrepresentative samples.

Objectives: The aim of this study is to investigate whether circulating fetal testosterone concentrations are associated with language development in early childhood, using umbilical cord serum testosterone as a surrogate measure of prenatal testosterone exposure in a large unselected birth cohort. We hypothesised that higher fetal testosterone concentrations will be inversely related to spontaneous language ability in early childhood.

Methods: Umbilical cord serum samples taken immediately after delivery in a subset of the Western Australian Pregnancy Cohort Study (N=373; M=197, F=176) were assayed for testosterone by liquid chromatography-mass spectrometry. Expressive vocabulary was measured at two years of age using the Language Development Survey (LDS; Rescorla, 1989). A range of sociodemographic variables posited to influence neurocognitive outcomes were also investigated.

Results: Cord blood testosterone levels were significantly correlated with spontaneous language at two years in males (r=-.19, p=.007) but not females (r=.08). Multivariate regression analyses found that, when a range of sociodemographic variables were controlled for, testosterone concentrations significantly predicted spontaneous language development in males, such that higher concentrations were associated with lower LDS scores (β=-.159, p=.025).

Conclusions: These findings indicate that higher circulating fetal testosterone concentrations at birth may be associated with slower language development in early childhood among males. This relationship did not extend to females. The significant association in males may have implications for developmental disorders that involve poor language development, such as autism.

104.004 Impaired Development of Brain and Behavior in Mice with 16p11.2 Deletion Found in Autism. G. Horev*, R. Puzis and A. A. Mills, *Cold Spring Harbor Laboratory*

Background:

Autism is a genetically determined neurodevelopmental syndrome, yet, its diagnosis is based primarily on behavioral assessment and its etiology remains elusive. A number of copy number variations (CNVs) have been associated with autism. For example, deletion of 16p11.2 occurs in approximately 1% of autism patients, making it one of the most common rearrangements associated with autism. Our recent work indicates that chromosome engineered models of 16p11.2 CNVs have profound brain architectural and behavioral phenotypes, providing the first functional evidence for the causal role of 16p11.2 dosage in autism.

Objectives: The goal of this study is to gain mechanistic insight into impairments in neurodevelopment and behavior in mice with chromosomal rearrangements corresponding to 16p11.2.

Methods: We will monitor the behavior of our 16p11.2 CNV models using a video tracking system to characterize motor and feeding deficits in the neonates. We will also characterize the temporal and spatial expression pattern of genes mapping to 16p11.2 by immunohistochemical analyses of brain sections from neonates and embryos.

Results: We used chromosome engineering to generate mice with the deletion allele (*df*) as well as those with the reciprocal duplication allele (*dp*) of the chromosomal region syntenic to human 16p11.2. Our behavioral analyses revealed that *df/+* mice differ from controls in multiple measures, with *dp/+* mice having reciprocal effects. Using MRI, we identified eight distinct brain regions of *df/+* mice with significantly increased volumes. At weaning, *df/+* mice are underrepresented, but throughout embryogenesis and immediately after birth, ratios are Mendelian. Further examination revealed that some *df/+* neonates lack milk sacs in their stomachs; these mice die within 48 hours of birth. The cause of lethality in half of the *df/+* mice is currently unknown. Immunohistochemistry revealed that the expression of *MapK3*, a gene within 16p11.2 and a major component of ERK signaling, is specifically expressed in neurons that form circuits with the hypothalamus. Our work provides the first functional evidence that 16p11.2 dosage has a profound effect on both behavior and brain anatomy. Furthermore, these findings suggest that the alterations in behavior and brain architecture are due to an impairment of the hypothalamus. The hypothesis that hypothalamic defects link brain anatomy, behavior, and neonatal death may have important implications in autism.

Conclusions:

Autism is usually diagnosed between 2-3 years of age, but precisely when its earliest signs develop is unknown. Here we use mouse models harboring chromosomal deletions associated with autism to define the window in which defects are first noticed, and to assess how this affects the behavior in the neonate. *Mapk3*-expressing neural circuits that pass through the hypothalamus are impaired in *df/+* mice, and may be responsible for feeding problems and behavioral defects after birth. If these findings extend to humans, it would explain the feeding problems described in patients with 16p11.2 deletions. We believe that by determining the early consequences of 16p11.2 deletions, we will provide the foundation for approaches for early diagnosis and intervention in autism.

104.005 A Mouse Model for the Human Chromosome 16p11.2 Copy Number Variation. T. Portmann*[1], R. Mao[1], P. Bader[2], G. Panagiotakos[1], M. Miller[1], M. Shamloo[1] and R. E. Dolmetsch[1], (1)*Stanford University*, (2)*Department of Molecular and Cellular Physiology*

Background: A recurrent copy number variation (CNV) on chromosome 16p11.2 resulting in a 550 kilobase genomic deletion is a high penetrance risk factor for autism spectrum disorder (ASD).

Objectives: In order to understand the molecular mechanisms underlying ASD mouse models are a valuable tool. The human chromosome 16p11.2 CNV is amenable to modeling in rodents as all 27 genes in the locus are highly conserved on mouse chromosome 7F3.

Methods: Using Cre-lox technology and two-step homologous recombination, we have generated a mouse model for the human 16p11.2 deletion.

Results: Mice heterozygous for the 27 genes in this region (16p11+/-) display low body weight, and lower survival rate prior to weaning. Adult 16p11+/- animals are less prolific in breeding. Anatomical analysis of the brain suggests increased brain size and deficits in the organization of multiple brain regions including cerebral cortex and cerebellum at early postnatal stages. Behavioral phenotyping of the 16p11+/- mice suggests hyperactivity, altered habituation to a novel environment, and possibly altered social behavior.

Conclusions: Our data suggest a fundamental role of the genes affected by the human 16p11.2 CNV in the development of the central nervous system and in complex behaviors.

104.006 Autism-Relevant Social Abnormalities and Cognitive Deficits in Engrailed-2 Knockout Mice. J. Brielmaier*[1], J. M. Senerth[1], P. G. Matteson[2], M. Genestine[3], J. L. Silverman[1], J. H. Millonig[2], E. DiCicco-Bloom[3] and J. N. Crawley[1], (1)*NIMH/NIH*, (2)*Center for Advanced*

Biotechnology & Medicine, (3)*Robert Wood Johnson Medical School*

Background: Several association studies have identified the homeobox transcription factor *ENGRAILED 2 (EN2)* as a likely autism susceptibility gene (Gharani et al. 2004; Benayed et al. 2005; Wang et al. 2008; Sen et al. 2010; Yang et al., 2010). In the mouse, *En2* serves as a patterning gene of hindbrain and cerebellum, and impacts neurogenesis and development of monoamine systems (Joyner, 1996; Simon et al., 2005; Cheh et al., 2006). We previously reported that monoamine system development is disrupted in mice with a deletion in *En2*, producing elevated levels of these transmitters in midbrain and hindbrain regions and reduced levels and axonal fibers in forebrain structures, with the greatest changes occurring in norepinephrine and its biosynthetic enzyme tyrosine hydroxylase (Lin et al., 2010; Genestine et al., 2011). These monoamine system abnormalities were accompanied by increased depression-relevant behavior in the forced swim test (Lin et al., 2010).

Objectives: To understand additional consequences of *En2* mutations on behaviors relevant to autism, we conducted comprehensive behavioral phenotyping of *En2* mutant mice, employing social, communication, repetitive, and cognitive behavioral assays, and a series of control measures for physical abilities.

Methods: Male and female wildtype (+/+), heterozygote (+/-) and null mutant (-/-) littermate offspring were tested on multiple measures of social interactions and social approach, communication, repetitive behaviors, cognitive abilities, anxiety and depression-relevant behaviors, sensory and motor functions, exploratory locomotor activity, general health parameters and a sequence of neurological reflexes. To evaluate the robustness of the behavioral abnormalities detected, two separate cohorts representing all three genotypes were evaluated.

Results: *En2* -/- mice exhibited robust deficits in reciprocal social interactions as juveniles and adults, and absence of sociability in adults, replicated in two independent cohorts. No genotype differences were detected on measures of ultrasonic vocalizations in social contexts, and no stereotyped or repetitive behaviors were observed. Fear conditioning and water maze learning and memory were impaired in *En2* -/- mice. High immobility in the forced swim test, reduced prepulse inhibition, mild motor coordination impairments and reduced grip strength were additionally detected in *En2* -/-. Parameters of general health, olfactory abilities, exploratory locomotor activity, anxiety-like behaviors and pain responses did not differ across genotypes, indicating that the social and cognitive deficits detected in *En2* -/- mice were not attributable to physical or procedural confounds.

Conclusions: Our results are consistent with the subset of assays previously reported in *En2* -/- mice (Cheh et al. 2006). Higher immobility on forced swim replicates our previous report (Lin et al. 2010) and suggests a depression-like phenotype in *En2* -/- mice. Our findings support the interpretation that deletion of the neurodevelopmental gene *En2* in mice results in multiple behavioral phenotypes relevant to the diagnostic and associated symptoms of autism, offering a translational model for investigating mechanistically-driven therapeutics. We are currently assessing the potential of chronic oral treatment with desipramine, which selectively inhibits norepinephrine reuptake, to reverse the autism-relevant behavioral abnormalities and reduced forebrain norepinephrine levels detected in *En2* -/- mice.

104.007 Motor Abnormalities in Mice Lacking Major Isoforms of Shank3. Y. H. Jiang*, *Duke University*

Background: SHANK3 is a synaptic scaffolding protein enriched in the postsynaptic density (PSD) of excitatory synapses. Small microdeletions and point mutations in SHANK3 have been identified in a subgroup of individuals with autism and individuals with chromosome 22q13.3 microdeletion syndrome (Phelan-McDermid syndrome). Many individuals with Phelan-McDermid Syndrome show an autism phenotype including social-communication abnormalities, repetitive behaviors, and delayed cognitive and motor development.

Objectives: To evaluate the role of SHANK3 in the development of motor and other behavioral deficits associated with autism in Shank3 mutant mice.

Methods: We generated Shank3 isoform specific (exons 4-9 deletion, $^{e4-9}$) and complete knockout (exons 4-22 deletion, $^{e4-22}$) mutant mice using a conventional and Cre-loxP gene-targeting approach. All Shank3 mice used in the experiments had been backcrossed for more than seven generations onto a C57BL/6J background. Mice were assessed for biochemical, morphological, electrophysiological, and behavioral abnormalities. Motor assessment included the following: 1) a test of in which animals attempted to balance on an accelerating rotorod, 2) a test of balance in which they walked along narrow bars and "foot-faults" were counted, and 3) measurement of stride length and width and fore and rear foot-placement rotation-angle during movement.

Results: Isoform-specific Shank3^{e4-9} homozygous mutant mice displayed abnormal social behaviors, altered communication patterns, repetitive behaviors and impairments in learning and memory. Mutant mice also demonstrated deficiencies in gait and foot-misplacement tests in both sexes, but Shank3$^{e4-9\ -/-}$ male mice showed more severe impairments than females in motor coordination as assessed with a rotorod test. Shank3^{e4-9} mice had reduced levels of Homer1b/c, GKAP and GluA1 at the PSD, and showed attenuated activity-dependent redistribution of GluA1-containing AMPA receptors. Subtle morphological alterations in dendritic spines were also observed. Analysis of Shank3^{e4-22} mice is ongoing and data will be presented.

Conclusions: We conclude that loss of major Shank3 species produces biochemical, cellular and morphological changes, leading to behavioral abnormalities in mice that bear similarities to human patients with autism and SHANK3 mutations. Prominent among these behavioral abnormalities were significant motor impairments that disproportionately affect male mutant mice suggesting compromised development of functional brain systems underlying motor development in SHANK3 deficiency associated autism.

104.008 Anatomical Phenotyping in the IntegrinB3 Mouse Model Related to Autism. J. Ellegood*, R. M. Henkelman and J. P. Lerch, *The Hospital for Sick Children*

Background: The serotonin system, and genes relevant to it, are emerging as strong autism susceptibility candidates. Integrinβ3 is one of those genes. Integrinβ3 participates in cell adhesion and cell-surface mediated signaling (http://gene.sfari.org), and has been shown to be associated with autism in a large mutiplex study (Weiss et al. 2006a), Further, Integrinβ3 gene expression has been shown to correlate with another autism susceptibility gene, the serotonin transporter gene (SLC6A4) (Weiss et al 2006b).

Objectives: The purpose of this study was to examine the volume changes in the Integrinβ3 knockout mouse model related to autism with high resolution MRI.

Methods: Specimen Preparation – Sixteen B6/129 fixed mouse brains were examined, 8 wild-type and 8 Integrinβ3 knockout mice.

MRI Acquisition - A 7.0 Tesla MRI (Varian Inc., Palo Alto, CA) was used to acquire anatomical images of brains within skulls. A T2- weighted, 3D fast spin-echo sequence was used, with a TR of 325 ms, and TEs of 10 ms per echo for 6 echos, field-of-view of 14 × 14 × 25 mm3 and matrix size = 250 x 250 x 450 giving an image with 0.056 mm isotropic voxels. Total imaging time was ~12 h.

Data Analysis – We use image registration to align a neuroanatomical atlas defining 62 brain regions towards each scan. Volumes of structures for each mouse were calculated in mm^3. Group differences in volume were calculated using t-tests, multiple comparisons controlled using the false discovery rate (q value).

Results: The total brain volume of the Integrinβ3 knockout was found to be 12% less than that of the corresponding wild-type; therefore, the brain regions were calculated as relative volumes (% total brain volume). The corpus callosum, which is widely implicated in autism as being thinned or smaller in volume, was also found to be decreased in size in the Integrinβ3 mouse model (6%, q=0.01). Further, in spite of the large relative volume decreases in 14 of the 62 regions, there were a few (6) regions that increased in size, the aymgdala (8%, q=0.01) was one of those regions, which is particularly interesting as it has been related to emotions, memory, and

social interaction all of which are relevant to the autism phenotype. Also we looked specifically at changes in the raphe nuclei, due to their relevance to the serotonin system, and we noticed localized decreases within the nuclei themselves, which may have had some impact in the neurological development.

Conclusions: The Integrinβ3 mouse model used here shows some characteristic anatomical changes that are relevant to autism and the serotonin system in general. Further, when we compared the changes to 18 other mouse models related to autism, the changes found here correlated best with the BTBR mouse, which has been shown to have altered serotonin transporter functionality (Gould et al. 2011) as well as the Neuroligin R451C which displayed similar white matter changes as the Integrinβ3 mouse. Interestingly, the changes found in the Integrinβ3 did not correlate well with the SLC6A4 mouse as expected due to there close association.

Animal Models Program

105 Animal Models

105.001 1 Absence of Engrailed 2 (En2), the Autism Spectrum Disorder (ASD) Associated Gene, Produces Developmental Changes in Hippocampal Neurogenesis and Apoptosis. M. Genestine*[1], L. Lin[1], S. Prem[1], Y. Jiang[1], R. D. Dhiman[1], J. C. Ho[1], J. H. Millonig[2] and E. DiCicco-Bloom[1], (1)*Robert Wood Johnson Medical School*, (2)*Center for Advanced Biotechnology & Medicine*

Background:

We have found the *EN2* gene to be associated with ASD in 3 different datasets, and disease associations have been reported by 6 other groups. *En2* is a transcription factor that is expressed in and patterns the mid/hindbrain region where monoamines neurons originate. Importantly, hindbrain monoamine neuron projections are the sole source of forebrain norepinephrine (NE) and serotonin. Significantly, ASD patients exhibit 1) many behaviors influenced by monoamines, 2) abnormal development of serotonin systems, 3) positive responses to monoamine antagonist, risperidol.

Previously, we found that *En2* knock out (KO) mice exhibited decreased monoamines, especially NE, in cerebral cortex and hippocampus due to reduced innervation by the locus coeruleus. Monoamines impact development, and in humans as in mice, monoamine levels correlate with brain growth. In *En2* KO, 35% reductions in forebrain NE levels were associated with smaller hippocampus (-12%) and striatum (-13%). To explore relationships of reduced monoamines with brain growth, we defined neurogenesis in hippocampal dentate gyrus (DG) and subventricular zone (SVZ).

Objectives:

We aim to define changes in brain growth, neurogenesis and cell death in *En2* KO mice.

Methods:

Immunohistochemical markers of neural progenitors (Sox2, Dcx), apoptosis (Cleaced-caspase3, CCP3; pyknotic bodies) and proliferation (BrdU, PCNA) were assessed on brain sections. To define survival, newly born cells labeled by BrdU injection at P21 were quantified 3 weeks later at P42.

Results:

At P21, *En2* KOs exhibited increases in proliferation (BrdU +127%, PCNA +86%) and apoptosis (CCP3 +77%, Pyknotic body +66%) in DG. Similar changes were also observed in the SVZ (BrdU +65%, CCP3 +46%), indicating general dysregulation of neurogenesis. While proliferation was increased 2-fold at P21, the excess cells failed to survive 3 weeks later. At P21, there is no increase in pools of early (Sox2+) or late (Dcx+) neural precursors. However, we expect that more precursors will be in the cell cycle, which we will define by performing double immunostaining for markers of cell identity (Sox2+, Dcx+, nestin+), proliferation (BrdU+) and apoptosis (CCP3+).

Conclusions:

Eventhough *En2* expression is restricted to the mid/hindbrain region, its mutation induces reductions in forebrain size and monoamine neurotransmitters. In En2 KO hippocampus, both cell death and proliferation are increased, suggesting that

neurogenesis is dysregulated. While underlying mechanisms remain to be defined, these studies suggest that altered *En2* expression in the hindbrain produces abnormal forebrain growth, one feature of ASD. In separate studies in collaboration with JN Crwaley, these mice exhibit reduced social interactions, deficits in contextual fear conditioning and abnormal cognition. These studies now lay a foundation to explore therapeutic interventions using monoaminergic drugs to rescue the ASD associated structural and behavioral phenotypes present in this model.

105.002 2 An mGluR5 Negative Allosteric Modulator Improves Social Deficits and Decreases Repetitive and Stereotyped Behaviors in Mouse Models of Autism. J. L. Silverman*[1], D. G. Smith[2], S. J. Sukoff Rizzo[2], M. N. Karras[1], K. R. Fonesca[2], D. L. Smith[2], R. H. Ring[2] and J. N. Crawley[1], (1)*NIMH/NIH*, (2)*Pfizer Global Research and Development*

Background:

Antagonists of mGluR5 receptors, which modulate glutamatergic neurotransmission, are in clinical trials for Fragile X syndrome, the major genetic cause of intellectual disabilities. Approximately 30% of Fragile X cases meet the diagnostic criteria for autism. To evaluate mGluR5 receptor modulation as a potential intervention target for autism, we tested a mGluR5 negative allosteric modulator in mouse models of autism.

Objectives:

Our experiments assess the preclinical efficacy of a novel mGluR5 receptor modulator, PF-05212391, as a potential intervention target for autism spectrum disorders in BTBR T+tf/J (BTBR), a mouse model of autism.
BTBR displays multiple behavioral phenotypes with face validity to all three of the diagnostic symptoms of autism, including well-replicated low sociability, low levels of vocalizations in social settings, and high levels of repetitive self-grooming (Yang et al., 2009; Scattoni et al., 2010; Silverman et al., 2010). PF-05212391 was similarly tested in C58/J mice (C58), which display high levels of stereotyped jumping (Ryan et al., 2010), and a control strain, C57BL/6J (B6).

Methods:

BTBR, C58 and B6 were given an intraperitoneal injection of PF-05212391 (0.3 mg/kg, 1.0 mg/kg, or 3.0 mg/kg) or vehicle (10% Tween-80 in saline) 30 minutes before behavioral testing or collection of brain and plasma samples for pharmacokinetic and ex vivo receptor binding analyses. BTBR and B6 were tested in one of three behavioral tasks: (1) social approach in our three-chambered apparatus (Yang et al., 2011), self-grooming in a clean standard mouse cage for a 10 minute test session (Silverman et al., 2010), and open field locomotor activity as a control measure to detect confounding drug-induced behavioral sedation (Silverman et al., 2010). Number of vertical jumps in a clean mouse cage and open field locomotion were measured in C58 mice. Two cohorts of BTBR and B6 were tested at NIMH in Bethesda, MD. One cohort of BTBR and B6 and one cohort of C58 were tested at Pfizer in Groton, CT.

Results:

PF-05212391 strongly reduced repetitive self-grooming in three cohorts of BTBR mice tested in two different laboratory environments. PF-05212391 also reduced stereotyped jumping in C58 mice. Effective doses of PF-05212391 on repetitive or stereotyped behavior in BTBR or C58 mice, respectively, corresponded to 30-90% mGluR5 receptor occupancy levels in brain homogenates, and did not produce signs of sedation, as measured in the open field locomotor exploration test. Most intriguingly, PF-05212391 partially rescued the striking lack of sociability in BTBR on parameters of social approach. The relationship between free, unbound brain levels of PF-05212391 and mGluR5 occupancy were similar across all three mouse strains.

Conclusions:

Corroborative results across multiple cohorts of mice and two laboratories provide strong preclinical evidence that a novel, potent and selective mGluR5 negative allosteric modulator reduces repetitive and stereotyped behaviors in two mouse models of autism. Further, PF-05212391 improves parameters of sociability in the BTBR model. These findings raise the possibility that a single targeted pharmacological

intervention may alleviate multiple diagnostic behavioral symptoms of autism.

105.003 3 Assessment of Structural Brain Differences in a Mouse Model of Autism Using Magnetic Resonance Imaging. B. A. Babineau*[1], J. Ellegood[2], J. P. Lerch[2], R. M. Henkelman[2] and J. N. Crawley[1], (1)*National Institute of Mental Health* , (2)*The Hospital for Sick Children*

Background: The BTBR T+ tf/J (BTBR) inbred strain displays behavioral phenotypes relevant to all three diagnostic symptoms of autism including deficits on multiple social tasks, low vocalizations and scent marking in social settings and high levels of repetitive self-grooming (McFarlane et al., 2008; Yang et al., 2009; Silverman et al. 2010; Wöhr et al, 2011; Scattoni et al., 2011).

Objectives: To assess differences in neuroanatomy and white matter microstructure between the BTBR mouse and two control strains: C57BL/6J (B6) and FVB/AntJ (FVB) and compare behavioral measures with neuroanatomical variables.

Methods: 12 BTBR, 12 B6 and 12 FVB were bred from adult pairs purchased from The Jackson Laboratory.

Behavioral Testing and Perfusions: Social approach and self groom assessment were conducted on day P75 (+/- 2 days). Perfusions were completed on day P77 (+/- 2 days).

Social Approach Task: Sociability was tested in an automated three-chambered apparatus. In this task, sociability is measured by comparing the amount of time the experimental mouse spends with the novel mouse to time spent with the novel non-social object (Yang et al. 2011).

Self-Grooming Assessment: Mice were scored for spontaneous grooming behaviors when placed individually in a clean, empty, mouse cage (Silverman et al. 2010).

Magnetic Resonance Imaging (MRI) Acquisition - A 7.0 Tesla MRI scanner was used to acquire anatomical images of fixed brains as well as Diffusion Tensor Images (DTI) to assess changes in the white matter microstructure. Total imaging time for a set of 16 (anatomical) or 3 (DTI) brains imaged in parallel was ~12 h or 14 h for the two methods, respectively.

Data Analysis - To compare the volumetric and white matter changes, the brain images (or b=0 s/mm2 images for DTI) were registered together. For the volume measurements the registration resulted in deformation fields for each individual brain, which were used to calculate the individual volumes of 62 different structures from a segmented population average (Dorr et al. 2008). For the white matter structural changes the mean Fractional Anisotropy (FA) was calculated in the same 62 different structures. Group differences were calculated using t-tests, multiple comparisons were controlled using the False Discovery Rate (FDR).

Results: Significant brain volume differences were seen between the BTBR and both control strains in many regions. Areas of particular interest include regions often implicated in autism. For example, the hippocampus was larger in BTBR as compared to both B6 (9.64%, $q<0.001$) and FVB (4.24%, $q<0.001$). In contrast, the striatum was significantly smaller in BTBR (12.08%, $q<0.01$ vs. B6; 4.68%, $q<0.01$ vs. FVB). BTBR cerebellar cortex was significantly larger than B6 cerebellar cortex (15.69, $q<0.001$) but significantly smaller than FVB cerebellar cortex (2.32%, $q<0.01$). DTI analysis and behavioral correlations to brain-based variables are ongoing.

Conclusions: Volumetric differences were found in BTBR brains as compared to two control strains. Many of these differences occur in regions implicated in autism. These findings along with results from DTI analysis and correlations with behavioral measures will further enhance our understanding of the BTBR mouse model of autism.

105.004 4 New Touch Screen Technology for Evaluating Cognitive Flexibility in Mouse Models of Autism. P. T. Gastrell*[1], M. N. Karras[1], M. Solomon[2], J. L. Silverman[1] and J. N. Crawley[1], (1)*NIMH/NIH*, (2)*Department of Psychiatry, MIND Institute, Imaging Research Center*

Background:

The social and communication impairments in individuals with autism spectrum disorders may be compounded by additional difficulties with executive functions. Children on the autism spectrum often show intact learning on simple tasks but display deficits on aspects of inhibitory control, cognitive flexibility, and relational learning tasks as compared with age

matched controls (Christ et al., 2011; Solomon et al., 2008; Solomon et al., 2011). Our laboratory is interested in examining analogous cognitive deficits in mouse models of autism. Emerging literature indicates that mice are capable of complex visual discriminations and higher order tasks using methods and operant equipment that are similar to those used in humans and non-human primates (Brigman et al., 2005; Bussey et al., 2001).

Objectives:

Our long term objective is to investigate the hypothesis that the social and communication deficits in autism are related to cognitive disabilities. Impaired generalization (Stokes and Baer, 1977), deficits in cognitive flexibility or set shifting (Hughes et al., 1994; Ozonoff et al., 2004; Verte et al., 2006), and dysfunctional relational learning (Solomon et al., 2011) have been reported in autistic children and adults. A new technology, touch screen-based operant equipment for mice, incorporates capabilities for probing higher cortical functioning. The objective of the present experiments was to design and develop sophisticated touch screen cognitive tasks for mice. Our approach is based on the existing literature, using earlier equipment, for analogous tasks to measure executive functions mediated by the frontal cortex. Using novel methodologies for mice that parallel methods and equipment used in humans, we seek to understand complex cognitive capabilities of mice with genetic mutations associated with autism. To begin this endeavor, we employed the standardized inbred strain BTBR T+tf/J (BTBR) mouse model of autism, which displays social, communication, and repetitive behavioral abnormalities (Yang et al., 2009; Scattoni et al., 2011; Silverman et al., 2010).

Methods:

BTBR and C57BL/6J (B6) control mice were trained on a visual discrimination learning task and its reversal, as a measure of cognitive flexibility which involves inhibition of prepotent responses. Learning was assessed in touch screen-based operant equipment as described previously for mice (Brigman et al., 2008; Izquierdo et al., 2006) using commercially available touch screen chambers (Bussey-Saksida touch screen chamber for mice, Campden Instruments, UK) and its associated software (AbetII, Lafayette Instruments).

Results:

Our preliminary results indicate that BTBR are similar to B6 during the early shaping and training phases of the operant task. However, BTBR displayed slower initial discrimination learning compared to B6 control mice. Reversal learning is in progress. More complex tasks, including a relational learning task, are being designed and tested for validity for future use in BTBR and mutant mouse models.

Conclusions:

Here we provide preliminary data on the feasibility of operant touch screen tasks to measure cognitive flexibility in mice, using methods and equipment that are more closely analogous to procedures used in humans. We envision the automated touch screen system as a new research tool for exploring higher cognitive functions relevant to social cognition in mouse models of autism.

105.006 6 The Human AVPR1A BAC Transgenic Mouse: A Preclinical Model for Elucidating the Role of AVPR1A in Autism Spectrum Disorders. R. A. Charles*[1], N. Takahashi[1], T. Sakurai[1], L. Young[2] and J. D. Buxbaum[1], (1)*Mount Sinai School of Medicine*, (2)*Emory University*

Background: Genetic studies have demonstrated an association between arginine vasopressin receptor 1A (AVPR1A) and ASDs. Furthermore, knockout mouse models and vole studies have demonstrated the importance of the AVPR1A receptor in mediating behaviors associated with ASDs. Thus, the AVPR1A receptor has been highlighted as a key player in ASDs. Central vasopressin signaling is regulated by AVP release and AVPR1A receptor binding and expression. In particular, the brain AVPR1A expression pattern differs across species and this is thought to be a critical determinant of behavior, as evidenced by rodent and primate studies. Interspecies differences in AVPR1A thus limit the potential clinical translation of any rodent studies. We propose that generating a mouse expressing the human form of AVPR1A will provide a more relevant *in vivo* system in which we can

better understand the human AVPR1A receptor, its role in modulating behaviors associated with ASDs, while providing a preclinical model for the evaluation of treatments targeting the receptor.

Objectives: The purpose of this study is to generate transgenic mice expressing only human AVPR1A and to validate these animals via biochemical and behavioral analyses.

Methods: To generate fully humanized transgenic animals expressing only the human AVPR1A, we performed BAC transgenesis followed by an extensive series of selective breeding. Integration of the BAC was tested by PCR genotyping using primers directed at the non-conserved 5' flanking region of gene and mRNA expression was measured using UPL-based quantitative PCR. The AVPR1A protein expression pattern was mapped and quantified in transgenics by performing autoradiographic ligand binding using AVPR1A selective I-125 ligands. Preliminary behavioral tests have been performed, including measures of anxiety, social behavior and sensorimotor gating.

Results: In transgenic animals, the AVPR1A ligand binding was more intense and widely distributed than the expression pattern observed in wildtype controls. The human AVPR1A protein expression pattern showed some overlap with documented expression in humans and primates, including expression in regions distinct from the endogenous murine receptor. Given previous animal model studies as well as our data showing changes in expression in the lateral septum, ventral pallidum and amygdala among other regions in the transgenic animals, we expect behavioral alterations, particularly in social interaction and anxiety, to be demonstrated. Studies are ongoing but, preliminary results suggest that there may be changes in these behaviors in the humanized mouse as compared to wildtype and knockout animals.

Conclusions: Our findings demonstrate that transgenic animals robustly express human AVPR1A and the expression pattern is different from that of the wildtype animal, with similarities to the expression of humans and primates. These results suggest that the human and mouse forms of the AVPR1A gene are differentially regulated by *cis*-acting elements. Given that differential expression patterns of AVPR1A have been suggested as important determinants of behavioral differences between species, mice expressing the human receptor may be informative of human AVPR1A signaling and circuitry with possible therapeutic relevance to ASDs.

105.007 7 Neuroanatomical Alterations in Conditional Met Mutant Mice. J. M. Smith*[1], J. Xu[2] and E. M. Powell[2], (1)*University of Maryland Baltimore*, (2)*University of Maryland School of Medicine*

Background:

Hepatocyte growth factor/scatter factor (HGF/SF) and its receptor, Met, are involved in the development of the forebrain, and *MET* has been identified as a susceptibility loci for autism. In neural tissue, HGF/SF binding to Met induces a signaling cascade that can influence cell migration, proliferation, and formation of neurite processes. Previous studies have shown that grey and white matter volumes are altered in individuals with ASD relative to healthy controls.

Objectives:

HGF/SF and Met are known to be expressed in the developing telencephalon, and changes in HGF/SF or Met expression appear to alter proliferation and formation of processes in neurons. This study employed mutant mice with a targeted mutation of *Met* in the cerebral cortex and hippocampus to examine how changes in HGF/SF-Met signaling could lead to structural alterations in the forebrain.

Methods:

We employed a mouse line with a floxed *Met* allele coupled with an *Emx1-Cre* driver to ablate Met signaling in the cerebral cortex and hippocampus beginning on embryonic day 10.5. This study used structural MRI imaging as well as histological and immunocytochemical techniques to examine the effects of this mutation on brain structure in adult as well as post-natal day 30 (P30) mice.

Results:

Adult mice lacking normal Met expression in the cerebral cortex show alterations in both white and grey matter structures, including the cortex, corpus callosum, hippocampus, and striatum. Most structures are unaffected in P30 mice. Histological analysis also shows altered cortical lamination in these mice.

Conclusions: Our data suggest that loss of Met function in the cerebral cortex and hippocampus can lead to anatomical changes in both cortical and sub-cortical structures.

105.008 8 Maternal Immune Stimulation During Pregnancy Leads to a Pro-Inflammatory Phenotype in Offspring.
M. Mandal*[1], R. Donnelly[2], S. Elkabes[3] and N. M. Ponzio[4], (1)*UMDNJ - Graduate School of Biomedical Sciences*, (2)*Department of Pathology and Laboratory Medicine, UMDNJ - Graduate School of Biomedical Sciences*, (3)*Department of Neurology and Neuroscience, UMDNJ - Graduate School of Biomedical Sciences*, (4)*Department of Pathology and Laboratory Medicine, UMDNJ - New Jersey Medical School*

Background: Epidemiological studies show that infection during pregnancy is associated with increased risk of neurodevelopmental disorders in children. In rodents, injection of pregnant dams with infectious pathogens or agents that mimic viral or bacterial infections (e.g., poly(I:C) and LPS) also leads to neurological and behavioral abnormalities in offspring, as well as developmental changes in their immune system. These animal models are used to investigate diseases such as schizophrenia and autism.

Objectives: One objective of the present study is to determine if in utero exposure of the fetus to cytokines elicited by maternal immune stimulation (i.e., first hit), results in a developmental programming of the immune system. A second objective is to determine whether these changes persist postnatally and into adulthood, such that upon subsequent exposure to an immune stimulus (i.e., second hit), offspring exhibit an altered response.

Methods: Female C57BL/6 (B6) mice were immunized with allogeneic Balb/c spleen cells. One month later, immune and immunologically naïve wild-type (WT) B6 female mice were mated with B6 males. On gestational day 12, pregnant dams were injected i.p. with PBS (control) or poly(I:C), and scored for sickness behavior prior to and after injections. Sera and amniotic fluids from dams were tested for the presence of multiple cytokines, using a bead-based multiplex Luminex platform, and lymphocyte phenotype/functional analyses were performed on their offspring. In addition, offspring were given second immune stimulus, either by i.p. zymosan injection to induce a localized antigen non-specific acute inflammatory response or MOG_{35-55} to induce a systemic antigen-specific experimental autoimmune encephalomyelitis (EAE). Offspring were assessed for qualitative and quantitative differences in their responses to these immune stimuli.

Results: Overall, pregnant dams injected with poly(I:C) showed significant sickness behavior and transient increases in levels of pro-inflammatory cytokines in sera and amniotic fluids at 2hrs post injection compared to PBS-injected pregnant dams, indicating successful maternal response to poly(I:C). Poly(I:C)-induced changes in the levels of pro-inflammatory cytokines positively correlated with the sickness behavior in pregnant mice. FACS analysis of in vitro activated spleen cells from offspring of poly(I:C)-injected (compared to PBS-injected) dams showed preferential differentiation toward Th17 cell development. Offspring of poly(I:C)-injected dams also showed heightened acute inflammatory responses as shown by significantly higher numbers of total peritoneal exudate cells (predominantly neutrophils), and significant increases in levels of pro-inflammatory cytokines in sera and peritoneal cavity fluid after zymosan injection. In addition, offspring of poly(I:C)-injected dams also exhibited significantly earlier onset and higher frequency of clinical symptoms of EAE following immunization with MOG_{35-55}.

Conclusions: These results demonstrate that offspring of poly(I:C)-injected dams possess a pro-inflammatory phenotype, thus exhibiting more robust innate and adaptive responses upon postnatal immune stimulation. Such “fetal programming” of offspring from poly(I:C)-injected dams not only persist into neonatal and adult life, but also can have profound consequences on health and disease.

105.009 9 Animal Model of Autism Induced by Prenatal Exposure to Valproate: Changes in Hipocampal Glial

Parameters. V. Bambini-Junior*[1], R. B. Silvestrin[1], F. Galland[1], L. D. Bobermin[1], A. Quincozes-Santos[1], R. T. Abib[1], C. Batassini[1], G. Brolese[1], R. Riesgo[2] and C. Gottfried[1], (1)*Federal University of Rio Grande do Sul (UFRGS)*, (2)*Universidade Federal do Rio Grande do Sul - Brasil*

Background: Different theories have emerged trying to solve "*the autism puzzle*" and, although research in autism has evolved, its etiology remains unknown lacking an objective diagnostic criteria and treatment options. Environmental conditions have emerged as strong risk factors after epidemiological studies evidencing that maternal exposure to infections, ethanol and valproic acid (VPA) could lead to autism. Although most studies focus on neuronal parameters, glial cells have been gaining more attention in the last years. Astrocytes also have emerged as sophisticated cells which participate in a variety of functions vital for normal brain development, adult physiology and pathology and there are evidences showing the involvement of glial cells in ASD, such as increased GFAP expression, alterations in astrocytic aquaporins and connexins and mutant glial adhesion molecules. Therefore we focus on the glial activity, related to glutamate metabolism, on the animal model of autism induced by VPA.

Objectives: By means of the VPA-induced animal model of autism we aimed to characterize some astrocytic parameters, such as glutamate uptake, glutamine syntethase (GS) activity and glutathione (GSH) content in the hippocampus from young and adult male rats prenatally exposed to VPA.

Methods: Females received a single intraperitoneal injection of valproic acid (600 mg/kg, 250 mg/mL diluted in NaCl 0.9%) in the 12.5th day of pregnancy. Male litters were killed by decapitation at post natal day 15 (P15 group) or 120 (P120 group), had their brains removed and the hippocampal samples were kept in −80°C until the assays (GS activity and GSH content) were performed, except the glutamate uptake, which were carried out with fresh tissue. Data are presented as mean±SE and were analyzed statistically by Student`s *t* test. $P<0.05$ were considered as statistically significant. All analyses were carried out using the Statistical Package for Social Sciences (SPSS) software.

Results: Glutamate uptake was not statistically different at P15. At P120 there was a significantly increase in glutamate uptake in VPA group (0.99±0.07 nmol/mg protein/min), compared to the control samples (0.38±0.05 nmol/mg protein/min). The next question aimed to understand a possible destiny to the intracellular glutamate, particularly at P120 which had a higher glutamate uptake. Glutamine synthetase activity assessed in hippocampal samples obtained from P15 and P120 rats. At P15, GS activity increased 42.8% in VPA group when compared to the control group. However, the opposite effect occurred at P120 rats, where VPA group decreased 26.8% the activity of GS when compared to the control group. Other metabolic destiny of glutamate is GSH, which content was evaluated in hippocampal structures obtained from 15 and 120 days old rats. There was no difference in GSH content at P15 but at P120 rats, VPA group had 26.8% increase in GSH content as compared to the control group.

Conclusions: Once were found glial alteration on glutamate metabolism of VPA rats, the present data highlights that astrocyte clearance of glutamate from the synaptic cleft and its metabolic destiny are important aspects to be considered from both physiopathologic and pharmacological approaches in ASD.

105.010 10 Animal Model of Autism Induced by Prenatal Exposure to Valproate: Behavioral Changes and Liver Parameters. G. Mueller de Melo*[1], V. Bambini-Junior[1], L. Rodrigues[2], G. Behr[1], M. S. Michels[1], M. Dutra[1], G. D. Nunes[1], G. Zanatta[1], R. Riesgo[3] and C. Gottfried[1], (1)*Federal University of Rio Grande do Sul (UFRGS)*, (2)*University of São Paulo (USP)*, (3)*Universidade Federal do Rio Grande do Sul - Brasil*

Background: Even though twin studies show a strong genetic component in ASD and multiple interacting genetic factors as the main causative determinants of autism the etiology remains unknown. However, in addition to the genetic predisposition, epidemiological studies indicate that it is necessary for these genetic factors to interact with exposure to environmental factors e.g. prenatal exposure to xenobiotics, such as thalidomide and valproic acid (VPA). Based on these evidence, a rodent model to study autism was proposed. The

single injection of VPA on the pregnant rat lead to an offspring with several altered behaviors.

Objectives: The main aim of this work was to investigate additional behavioral rodent similarities with autism, as well as, liver redox parameters after prenatal exposure to VPA.

Methods: The behavioral tests we performed in young rats were sociability tests in a three chambered apparatus (one phase) and Y-maze; and in adult rats were sociability tests in a three chambered apparatus (two phases) and Morris Water Maze. Liver cytotoxicity was investigated by the serum activity of the hepatic enzyme markers aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Moreover, the activity of two important antioxidant enzymes, superoxide dismutase (SOD) and catalase (CAT) and oxidative damage, by damage on lipids (TBARS), damage on proteins (−SH and carbonyl content) had also been quantified in liver samples.

Results: Young rats from the VPA group presented aberrant approach to a stranger rat, decreased conditioned place preference to conspecifics, normal spatial learning and a lack of flexibility to change their strategy. As adults, they presented inappropriate social approach to a stranger rat, decreased preference for social novelty, apparently normal social recognition and no spatial learning deficits. Examination of the liver from the VPA group presented significantly increased (12%) levels of CAT activity, no alteration in SOD activity and a decrease in the SOD/CAT ratio. TBARS, sulfhydril and carbonyl contents, and serum levels of aminotransferases remained unchanged.

Conclusions: In summary, rats prenatally exposed to VPA presented decreased flexibility to change strategy and social impairments similar to the autism symptoms, contributing to the understanding of neurodevelopmental alterations and oxidative imbalance associated to the ASD.

105.011 11 Investigation of Vocalization and Play Behavior in Juvenile Offspring of Maternal Immune Activated Female Mice. J. Schwartzer*, M. Careaga, P. Ashwood and R. F. Berman, *University of California, Davis, MIND Institute*

Background: Activation of the maternal immune system is associated with an increased risk for autism and schizophrenia. While animal models have increasingly been used to investigate the behavioral and biological consequences of maternal immune activation in adult offspring, few findings have demonstrated alterations in juvenile behaviors. Moreover, differences in genetic background may confer increased sensitivity to the developmental effects of maternal immune activation. Therefore it is important to consider how various mouse strains may respond uniquely to the effects of maternal immune activation

Objectives: Investigate whether maternal immune activation alters ultrasonic vocalizations and juvenile play behavior in offspring of two mouse strains.

Methods: Pregnant female mice were exposed to a single injection of polyinosinic-polycytidylic acid [Poly(I:C)], or vehicle control, on gestational day 12.5 and offspring were measured for differences in ultrasonic vocalizations and juvenile play behaviors

Results: Offspring of females exposed to Poly(I:C) exhibited increased frequency of vocalizations on postnatal day 10 of development. Interestingly, pups from immune activated females displayed alterations in social interaction during juvenile play with a novel mouse.

Conclusions: Maternal immune activation on gestational day 12.5 results in altered patterns of ultrasonic vocalizations and juvenile interactions in offspring. These findings support the link between maternal infection and increased prevalence of autism.

105.012 12 Effects of Environmental Enrichment on Autism-Related Behaviors in the BTBR T+Tf/J Mouse. S. E. Reynolds*[1], S. Cameron[2], C. Mackiewicz[2], A. Millette[2], M. Urruela[2] and D. P. Devine[2], (1)*Virginia Commonwealth University*, (2)*University of Florida*

Background: Some core features of autism have been identified in the BTBR mouse including social deficits and repetitive and stereotyped behaviors. In addition, sensory processing differences and anxiety-like behaviors have been

reported in this mouse model. In humans, amelioration of some autism-related behaviors has been reported using sensory integration treatments which share core features of the animal sensory-enrichment paradigm. To date, no studies have looked at the effects of environmental enrichment on autism-related behaviors in the BTBR mouse. Therefore, the purpose of this study was to see if environmental enrichment influenced the development of social deficits, repetitive behaviors, exploratory behavior, and sensory responsivity in the BTBR mouse model of autism.

Objectives: 1) Examine differences in autism-related behaviors between BTBR and control (B6) mice at baseline (7-8 weeks) to expand upon and replicate previous studies using this animal model; 2) Compare changes in autism-related behaviors in BTBR mice following 30 days in either an enriched or standard housing condition.

Methods: Thirty one mice were divided into one of four experimental groups: Control Enriched (8), Control Standard (8), BTBR Enriched (8), and BTBR Standard (7). Baseline testing was done between 7-8 weeks of age; upon completion of this testing mice were placed in either enriched or standard housing for thirty days. The enriched housing cage was a large dog kennel divided into three levels with wire mesh. Novel items were placed in the enriched cage every 5 days. At the end of the 30 days, post-testing was conducted. The following behavioral tests were conducted at pre-test and post-test: Auditory and Tactile Startle Responsivity, Open Field, Socialization (3-chambered apparatus), Lower Order Repetitive Behavior (LRB) and Higher Order Repetitive Behavior (HRB) paradigms. The LRB paradigm focused on the animal's repetitive grooming behavior while the HRB paradigm examined patterns of object exploration.

Results: At pretest BTBR mice showed no differences in socialization compared to the B6 controls, however they groomed significantly more often, showed diminished auditory and tactile startle responses, and showed less exploratory behavior in the open field. At post-test BTBR mice housed in the enriched condition spent significantly more time engaged in social sniffing of a novel mouse and significantly less time grooming (LRB) compared to BTBR mice housed in standard condition. Enriched BTBR mice also showed a trend towards increased exploratory behavior in the open field, while BTBR mice housed in a standard condition showed a significant decrease in exploratory behavior at post-test.

Conclusions: Similar to previous authors, we found that BTBR mice exhibit autistic-like behaviors including high rates of repetitive grooming. Unlike previous reports, we did not find these animals to be hypersensitive to tactile stimuli, nor did we see differences in social behavior at baseline. Our results suggest that environmental enrichment may be beneficial in reducing lower-order repetitive behaviors, increasing social interaction, and increasing exploratory behavior in this animal model; findings may help guide outcomes research for children with autism using sensory integration treatment.

105.013 13 Sensory and Motor Behaviors in Rats Treated Postnatally with Sodium Valproate. S. E. Reynolds[1], A. Millette[2] and D. P. Devine*[2], (1)*Virginia Commonwealth University*, (2)*University of Florida*

Background: Approximately 80% of children with Autism Spectrum Disorders (ASD) exhibit altered responses to normal environmental sensations. Behavioral patterns of over-responding *and* under-responding, specifically to touch and sounds, have been widely described. Motor coordination deficits have also been identified in this population. An animal model has been established in which two core features of autism (i.e. social deficits, repetitive behaviors) are elicited through injection of sodium valproate during sensitive periods of brain development. While this model resembles some features of autism, we do not yet know the full spectrum of behaviors these animals exhibit. Specifically, we do not know if the range of sensory responsivity seen in children with ASD is represented in this model; only patterns of over-responsiveness have been documented in the more commonly used pre-natal valproate rat model. The purpose of this study was to characterize sensory and motor patterns in the post-natal valproate rat model of autism.

Objectives: Compare auditory and tactile startle responses, sensory gating, and motor coordination in rats post-natally exposed to sodium valproate and rats with no valproate exposure.

Methods: Thirty-four Long-Evans rats were bred in our lab. Pups were randomly assigned to either the valproate or control group, with similar numbers of males (11 control, 13 valproate-treated) and females (5 control, 5 valproate-treated) per group. The teratogen valproate was delivered post-natally on days 6-12, with rats receiving a signal i.p. injection of valproate (dissolved in 0.9% saline, pH~7.3) of 150 mg/kg/day. Liter mate controls received a saline injection. All rats underwent testing for tactile and auditory responsiveness and auditory sensory gating (pre-pulse inhibition) on post-natal day (PND) 23 and day PND45. Motor testing was done on day 52 and included a video-recorded vermicelli handling task and a sunflower eating task.

Results: Valproate-treated rats exhibited significantly smaller auditory startle responses compared to responses of control rats. These differences were present in male rats on PND23 and PND45. Female rats treated with valproate showed significantly smaller responses on PND45 but not on PND23. Tactile startle response magnitude did not differ significantly between groups. Group differences in prepulse inhibition were only seen on PND45, with valproate rats inhibiting less than controls.

The Sunflower Seed Eating task and the third trial of the Vermicelli Handling task were completed significantly slower by the valproate-treated group. During the Vermicelli Handling task, valproate-treated rats made significantly more paw adjustments and dropped the pasta significantly more often than the control rats. Valproate-treated rats were found to use a unilateral technique significantly more often than control rats and had more observed twirls, failure to contact reaches and atypical postures than the control group.

Conclusions: Findings suggest that post-natal valproate treatment elicits sensory and motor features often seen in individuals with ASD. Further, the hypo-sensitivity seen in post-natally valproate-treated rats contrasted with hyper-sensitivity previously reported in pre-natally valproate-exposed rats. This suggests that timing of teratogenic exposure during early brain development may be important to consider when investigating the neurobiological basis of sensory-motor impairments in ASD.

105.014 14 A Rat Model of Sensory Integration Impairment for Therapeutic Drug Development: Autoradiographic Observations in Postmortem Brain. A. Mahendra*[1], J. Skefos[1], M. Ghulam[1], E. Levin[2] and M. Bauman[1], (1)*Boston University School of Medicine*, (2)*Duke Institute for Brain Sciences*

Background: Pre-pulse inhibition (PPI) is a process in which the motor response to a startling stimulus is inhibited by a less intense stimulus immediately preceding it. Diminished PPI represents one of the many sensory integration impairments observed in patients with schizophrenia and autism.

Objectives: The objective of our project is to explore potential neuropharmacological mechanisms of clozapine-mediated PPI improvement.

Methods: In the current study 36 female Sprague-Dawley rats were used to study mixed-modal PPI with an acoustic prepulse and a tactile (air-puff) startling stimulus. Animals were chronically administered via osmotic minipump the NMDA glutamate receptor antagonist, dizocilpine (0.15 mg/kg/day), the H1 histamine receptor antagonist, pyrilamine (50 mg/kg/day), the combination of the two drugs or the saline vehicle (N=9/group). Following the completion of these psychopharmacological studies, we performed postmortem radioligand assays on histological sections to determine behaviorally relevant shifts in H1 receptor and nicotinic acetylcholine receptor binding within five brain regions in these animals: the hippocampus, amygdala, superior and inferior colliculi, and the anterior cingulate cortex.

Results: During the first week of administration pyrilamine caused a significant ($p < 0.025$) main effect of improving PPI. There was no indication of lessening of this effect with dizocilpine co-exposure. The addition of pyrilamine to dizocilpine treatment significantly ($p < 0.025$) improved PPI relative to dizocilpine alone.

Conclusions: H1 receptor antagonism is one of the proposed therapeutic mechanisms of the atypical antipsychotic drug clozapine, which has marked H1 antagonistic effects. These results implicate attenuation of histaminergic transmission within the anterior cingulate and heightened acetylcholine transmission in the limbic system as an important focus of

further study into treatment for disorders of sensory integration and behavioral inhibition.

105.015 15 Glial Activation in a Mouse Model of Fragile X Syndrome. L. K. K. Pacey*, S. Guan, I. Xuan and D. R. Hampson, *University of Toronto*

Background: Fragile X Syndrome is a neurodevelopmental disorder caused by a mutation in the X-linked FMR1 gene that results in complete loss of the protein product FMRP. Approximately 25% of individuals with Fragile X meet the diagnostic criteria for Autism Spectrum Disorders (ASDs). Postmortem studies have identified neuroinflammation and glial activation in the brains of individuals with idiopathic ASDs and studies suggest a similar pathology may be present in Fragile X Syndrome. Whether neuroinflammatory changes are pathogenic or protective in these disorders remains to be determined.

Objectives: To characterize neuroinflammatory changes and glial activation in the cerebellum of a mouse model of Fragile X Syndrome (FMR1 KO mice) at various developmental time points.

Methods: Quantitative immunohistochemistry and Western blotting were used to compare the expression of glial markers in wild-type and FMR1 knockout mice at several developmental time points.

Results: Expression of the astrocyte marker GFAP was significantly increased in the cerebellum of FMR1 knockout mice. In females, this difference was evident as early as postnatal day 30 (PND30) and persisted into adulthood. Increased GFAP expression was detected in male FMR1 KO mice in adulthood, but not at PND30. No differences in expression were detected at PND7 in either sex. Expression of S100B, which stains Bergmann Glia, was significantly increased in adult FMR1 KO mice, but was not different at earlier ages. CD68 expression (a marker of microglia) was not different in FMR1 KO cerebellum at PND7 or in adults.

Conclusions: Upregulation of glial markers in the cerebellum of a mouse model of Fragile X Syndrome indicate astrogliosis as early as one month after birth that persists into adulthood.

105.016 16 Risperidone Alleviates a Probabilistic Reversal Learning Deficit in the BTBR T+ Tf/J Mouse. D. A. Amodeo*, J. A. Sweeney and M. E. Ragozzino, *University of Illinois at Chicago*

Background:

The BTBR T+ tf/J (BTBR) mouse models repetitive behaviors and restricted interests as observed in autism spectrum disorder (ASD). We recently demonstrated that BTBR mice exhibit a probabilistic reversal learning deficit compared to that of C57BL/6J (C57) mice. Risperidone, the most commonly prescribed FDA-approved drug to treat irritability in ASD, reduces repetitive self-grooming behavior in BTBR mice. Unknown is whether risperidone may be effective in treating other repetitive behaviors such as behavioral inflexibility.

Objectives:

The present experiment investigated whether acute risperidone treatment affects probabilistic reversal learning in a spatial discrimination test in BTBR and C57 mice.

Methods:

BTBR mice were tested on acquisition, retention and reversal learning of a spatial discrimination using a 80/20 probabilistic learning procedure. In the spatial discrimination, mice were trained to obtain a cereal reinforcement from one of two food wells placed in distinct locations within a rectangular-shaped maze. The “correct” choice was reinforced on 80% of trials and the “incorrect” choice was reinforced on 20% of trials. Twenty-four hours after completion of acquisition learning, mice received a retention test followed immediately by reversal learning. Mice received injections of 0, 0.06, or 0.12 mg/kg of risperdone 30 min prior to the reversal learning test. The learning criterion for the acquisition, retention and reversal learning phases were each 6 consecutive correct trials.

Results:

BTBR and C57 mice performed similarly in initial acquisition and retention of a spatial discrimination as previously observed. Vehicle-treated BTBR mice required significantly greater number of trials to achieve reversal learning criterion

compared to that of C57 mice. Risperidone 0.12 mg, but not 0.06 mg, attenuated the reversal learning impairment in BTBR mice. Analysis of reversal learning errors, indicated that risperidone 0.12 mg treatment decreased regressive errors in BTBR mice, thus facilitating the maintaining of a new choice pattern after being initially selected.

Conclusions:

BTBR mice comparable to that observed in ASD individuals exhibit impairments in probabilistic reversal learning. The present findings indicate that acute risperidone treatement alleviates a reversal learning deficit in BTBR mice. Risperidone may serve as a potential treatment for reducing cognitive flexibility deficits in ASD.

105.017 17 Defects of Lipid SIgnalling in Early Neuronal Development and the Implications in Autism Spectrum Disorders. R. Bhogal*, H. Li and D. A. Crawford, *York University*

Background: Autism is a neurodevelopmental disorder caused by many genes in addition to the contributing environmental factors, which together determine the broad severity of autism phenotype. Recent literature suggests that defects in lipid signalling pathways contribute to the pathology of autism spectrum disorder (ASD). The plasma membrane phospholipids serve as a supply of bioactive molecules such as prostaglandins E2 (PGE_2) important for normal function of the brain. Abnormalities in lipid metabolism due to oxidative stress, infection or inflammation, events that increase the level of PGE_2, have been linked with malformations in the nervous system resulting in ASD. Moreover, increased level of fatty acid metabolites have been reported in many cases of ASD. Interestingly, recent studies have also shown a cooperative regulation of PGE_2 signaling with the early developmental pathways such as wingless (Wnt). Taken together these studies provide strong evidence for the important role of lipids in the nervous system. Our study will further investigate the role of PGE_2 in early neuronal development.

Objectives: We have previously shown that PGE_2 can interfere with cell function *in vitro* via modulation of calcium dynamics in neuronal cells. In this study we use an *in vivo* system to investigate (1) the molecular mechanisms associated with concentration-dependent PGE_2 signalling in the nervous system, and (2) its interaction with other pathways during early development.

Methods: We use brain tissues derived from mice deficient in COX-$1^{-/-}$ and COX-$2^{-/-}$ (enzymes that synthesize PGE_2) to detect gene expression using microarray technology. Wild-type mice administered with exogenous PGE_2 during a critical prenatal stage were also studied. Custom Taqman plates for real-time PCR encompassing selected PGE_2 and Wnt-target genes were used to observe differences in gene expression. Moreover, expression of affected proteins was studied using Western blot. We tested the PGE_2 effects on brains derived from the embryonic days 16.5 and 19, and postnatal day 8.

Results: We detected various differentially expressed genes found in the COX-$1^{-/-}$ and COX-$2^{-/-}$ mice with critical neurodevelopmental functions, such as modulators of cell migration, signaling molecules during early development, neuronal differentiation and maturation. Wild-type mice exposed to various doses of PGE_2 also show differentially expressed genes involved in neuronal synapses, and morphology of dendritic spines.

Conclusions: In this study, we found that abnormalities in the lipid signalling pathway as a result of genetic defects (Cox-$1^{-/-}$ and Cox-$2^{-/-}$) and using exogenous drugs to alter the PGE_2 signaling pathway, caused changes in expression levels of crucial neurodevelopmental genes during early stages of brain development. Dysregulation of important functioning genes may give some insight to the pathology of ASDs.

105.018 18 Further Behavioral Characterization of An Inbred Mouse Model of Restricted, Repetitive Behavior. A. M. Muehlmann*, A. Mihalik, D. Koppuzha and M. H. Lewis, *University of Florida*

Background: Although autism spectrum disorder (ASD) is a highly heritable complex genetic disorder, clinical and animal studies have provided only very limited findings with respect to the genes controlling restricted, repetitive behavior (RRB). It appears, however, that RRB is likely influenced by genes that are largely independent of those that influence the social or communication deficits. Moreover, RRB appears to be familial and several candidate genes have been advanced (e.g.,

GABRB3, SLC6A4, SLC25A12). Animal models with the requisite validity could aid substantially in identifying genomic factors associated with RRB. Thus, in order to investigate the genetics of RRB, we have further characterized the expression of the restricted, repetitive behavioral phenotype reported in the C58/J inbred mouse strain (Moy et al., 2008; Ryan et al, 2009). Careful, quantitative characterization of the behavioral phenotype is critical for subsequent genotype-phenotype correlations.

Objectives: 1) to assess both repetitive motor behaviors ("lower order" RRB) as well as to assess restricted behaviors and resistance to change ("higher order" RRB) in C58 mice. 2) to compare the behavior of C58 mice on these measures to C57BL/6 mice, a genetically closely related strain that does not appear to exhibit appreciable levels of motor stereotypy; 3) to assess repetitive motor behavior in the offspring of the C58XC57BL/6 F1 intercross.

Methods: We assessed repetitive motor behavior across the 12 hour dark cycle using automated apparatus and video-recording. We used a holeboard exploration task to assess restricted behavior, a reversal learning water T-maze task to assess resistance to change, and the marble-burying task to assess perseverative motor responding.

Results: C58 mice displayed high levels of spontaneous repetitive motor behavior, averaging 7,951 stereotyped responses (range of 2,918 to 14,679) for the 12 hour dark cycle whereas the C57BL/6 strain averaged only 29 responses (0 to 296) over the same period. These responses consisted of repetitive vertical jumping and backward somersaulting. No significant strain differences were noted in the holeboard exploration task. C58 mice engaged in less marble-burying than C57BL/6 mice and marble-burying was significantly inversely correlated with stereotyped motor behavior. C58 mice proved to have great difficulty in the T-maze task used to assess resistance to change precluding valid strain comparisons. Finally, the F1 C58XC57BL/6 intercross mice displayed an intermediate repetitive motor behavior phenotype compared to the parental strains with clear evidence of a sex effect with females showing higher levels of stereotyped motor behavior.

Conclusions: This study provides the first quantitative assessment of the spontaneous repetitive motor behavior of C58 mice and comparison to a genetically similar control strain. These findings confirm stereotypy as a robust, quantifiable, and reliable behavioral phenotype in this strain. Other measures of "higher order" repetitive behavior did not yield reliable strain differences. The F1 intercross findings support the genetic basis of repetitive behavior and provide further support for the C58 inbred strain as a useful animal model to investigate the genetic basis of repetitive motor behavior. Such studies should have important translational value in ascertaining the genetics of RRB in ASD.

105.019 19 The Use of Drosophila to Study ASD Candidate Gene Function. S. Q. Mehta*[1], K. S. Pappu[2] and L. Zipursky[2], (1)*Semel Institute/UCLA*, (2)*HHMI/UCLA*

Background: The number of ASD candidate genes has increased greatly in recent years with the completion of high resolution CNV analyses on simplex and multiplex families. That number is likely to increase further as genome sequencing efforts on patients with ASDs reach completion. However, there has been a lag between the identification of these candidate genes and our understanding of the pathophysiology of ASDs that is due to our ignorance of the biological functions of many of these genes. For a few candidate genes, the use of animal models has been informative, but it is impractical to make mouse knockouts of all of the ASD candidates. The fruit fly, *Drosophila melanogaster*, is a well characterized genetic model organism that has previously been used to gain insight about human diseases, particularly neurodegenerative disorders and cancer. The low cost, short generation time, and ease of genetic manipulation make *Drosophila* an ideal system for examining the biological functions of many ASD candidate genes as well as assessing the biological impact of human disease variants.

Objectives: We aim to show that *Drosophila* can be used to effectively study the functions of ASD candidate genes from the standpoint of neural development rather than behavior. To accomplish this, we have chosen to study Neurexin IV (the *Drosophila* homolog of a highly penetrant ASD candidate gene, CNTNAP2) as a proof of principle. We will examine the

effects of loss of Neurexin IV on CNS neurons, identify biochemical interaction partners, and assess the impact of evolutionarily conserved rare variants (missense mutations) in Neurexin IV that are linked to cases of Autism.

Methods: We have generated a molecularly defined loss of function allele of Neurexin IV that can allow us to selectively remove Neurexin IV in select populations of neurons. We have also generated transgenic flies that have tagged versions of Neurexin IV that will allow us to identify binding parters through mass spectroscopy. We have also generated transgenic flies that express the human CNTNAP2 gene under the control of the *Drosophila* Neurexin IV locus that will allow us to assess to what degree the human gene can rescue loss of Neurexin IV. We are currently generating transgenic flies that have ASD related variants of Neurexin IV and will assess their function in a Neurexin IV mutant background.

Results: Loss of Neurexin IV in the *Drosophila* eye results in defects in eye development as well as the loss of known Neurexin IV binding partners, Contactin and Coracle. We are currently investigating if loss of Neurexin IV leads to defects in synapse formation or function. Biochemical experiments to identify further binding partners are underway, as are experiments to determine the biological significance of ASD related rare variants.

Conclusions: We estimate that about 60% of current ASD candidate genes have a high degree of evolutionary conservation between humans and *Drosophila*. Based on our experiences studying Neurexin IV, *Drosophila* can be used to effectively probe the biological function of many ASD candidate genes and thereby increase our understanding of ASD pathophysiology.

105.020 20 The Temporal Relationship of Behavioural, Neuropathological and Lipid Fluctuations Following a Single Intraventricular Infusion of Propionic Acid in Rats. S. Holbrook*, F. Boon, A. R. Taylor, R. H. Thomas, L. J. Tichenoff, M. Kavaliers, K. -. P. Ossenkopp and D. F. MacFabe, *University of Western Ontario*

Background:

Dietary and gastrointestinal factors may be associated with behavioural fluctuations in autism spectrum disorders (ASD). Furthermore, unique enteric bacterial species as well as immune and metabolic alterations have been observed, but their relation to these behavioural changes are unknown. Propionic acid (PPA) is a dietary short chain fatty acid that is an intermediary of fatty acid metabolism, a fermentation by-product of ASD-associated opportunistic enteric bacteria (ie clostridia), and a common food preservative. PPA has broad effects on neurotransmitter synthesis and release, calcium signaling, cell-cell interaction, mitochondrial metabolism, immune function and gene expression. PPA administration in rats has been shown to mimic many features of ASD.

Objectives:

We have found that repeated intracerebroventricular infusions of PPA produces bouts of hyperactivity, repetitive movements, retropulsion, object fixation and social impairments. Brain tissue from PPA treated rats shows ASD-like changes in oxidative stress markers, lipid profiles and innate neuroinflammation. However the exact mechanisms of PPA exposure and its temporal relation to behaviour remain unknown.

Methods:

Using a single pulse injection paradigm, we studied the relationship between PPA induced locomotor activity, lipid and neuropathological changes across specific time points. Adult Long-Evans rats were intraventricularly infused with 4ul of a 0.26M solution of PPA (pH 7.5) or a 0.1M solution of PBS vehicle. Locomotor activity (Ethovision) was evaluated for 20 minutes immediately following infusion and again 48 hours later to assess reversibility. Rats were sacrificed at various timepoints (30 minutes , 1 hour , 24 hours or 48 hours) post-injection, and brain tissue extracted to biochemically (lipids) and immunohistochemically analyze the latencies of PPA induced alterations.

Results:

PPA rapidly increased locomotor activity and achieved a maximal response within 20 minutes of infusion and returned to baseline measures within 48 hours. Alterations in brain

phospholipid/acylcarnitine profiles transiently changed in relation to behaviour and preceded innate neuroinflammatory changes, the latter of which occurred when locomotor activity had returned to baseline.

Conclusions:

PPA rapidly increased locomotor activity and achieved a maximal response within 20 minutes of infusion and returned to baseline measures within 48 hours. Alterations in brain phospholipid/acylcarnitine profiles transiently changed in relation to behaviour and preceded innate neuroinflammatory changes, the latter of which occurred when locomotor activity had returned to baseline.

105.021 21 The Enteric Bacterial Metabolite Propionic Acid Alters Brain and Plasma Intact Phospholipid Molecular Species: Implications In Autism Spectrum Disorders. R. H. Thomas*, M. M. Meeking, J. Mepham, L. J. Tichenoff, F. Possmayer and D. F. MacFabe, *University of Western Ontario*

Background:

Phospholipids are the major structural components of neuronal membranes and are essential for proper brain function and development. Several recent studies have reported the existence of altered phospholipid profiles in patients with autism spectrum disorders (ASD). However, most of the analyses in these studies were done following hydrolysis of the separated phospholipids which destroys their structures. Consequently, there is a paucity of information concerning how the intact phospholipid molecular species are altered in ASD in relation to behavioral manifestations.

Objectives:

We used ESI/MS to determine how blood and brain intact phospholipid species were altered during the induction of ASD-like behaviors in rats following intraventricular infusions with the enteric bacterial metabolite propionic acid

Methods:

Animals were infused twice daily for 8 days, locomotor activity assessed and animals sacrificed during the induced behaviours and brain and blood samples collected for phospholipid analyses. Phospholipids were analysed by ESI-MS operated in positive ion mode, using precursor ion scans specific for each phospholipid class.

Results:

Brain and blood lipid analysis revealed propionic acid infusions increased ($p \leq 0.001$) locomotor activity and altered 21brain and 30 blood phospholipid molecular species. Most notable alterations were observed in the composition of brain SM, diacyl mono and polyunsaturated PC, PI, PS, PE and plasmalogen PC and PE molecular species.

Conclusions:

These alterations are suggestive that aberrations in lipid metabolism which are known to affect membrane fluidity, peroxisomal functions, gap junction coupling capacity, and signalling during neuroinflammation may be associated with the PPA induced ASD-like behaviours in the rodent model of ASD.

105.022 22 Acyl-Carnitine Abnormalities In Autistic Children Parallel Abnormalities In A Rodent Model of Autism. D. F. MacFabe*[1], R. H. Thomas[1] and R. E. Frye[2], (1)*University of Western Ontario*, (2)*Arkansas Children's Hospital Research Institute*

Background: Mitochondrial dysfunction has been suggested to explain the complex medical and physiological abnormalities found in some children with autism. However, only 23% of children with mitochondrial disease and autism have a known mitochondria DNA abnormality to explain mitochondrial dysfunction. Some have suggested that the systemic abnormalities seen in autism may arise from environmental triggers in genetically sensitive subpopulations. Mitochondrial are central to this theme as polymorphisms in mitochondrial genes can result in susceptibility to many diseases. Interestingly, mitochondrial dysfunction can be triggered by enteric short chain fatty acids such as propionic acid (PPA) that can be produced as by-product by opportunistic enteric bacteria that have been implicated in autism (i.e. Clostridia, Desulfovibrio and Bacterioridetes). We have developed an animal model of autism in which intraventricular infusions of

PPA produces reversible bouts of autistic-type behaviors. This animal model also demonstrates several characteristics that have been reported in autism such as redox, mitochondrial and acyl-carnitine abnormalities.

Objectives: To determine whether biochemical abnormalities found in our animal model of autism are also in a subset of children with autism, specifically, we sought to determine whether the pattern of acyl-carnitine elevations, redox abnormalities and mitochondrial dysfunction found in our rodent model could be found in at least a subset of children with autism.

Methods: Fasting acyl-carnitine panel was measured in 213 patients with autism. A workup for secondary causes of fatty-acid oxidation and mitochondrial disorders was recommended for patients with consistent (two or more occasions) elevations in three or more acyl-carnitine species. Mitochondrial and/or nuclear DNA gene abnormalities are examined in a subset as was muscle and/or skin biopsy with functional fatty-acid oxidation pathway and electron transport chain (ETC) testing. Markers of redox metabolism were also examined in a subset.

Results: Overall, 17% of children with autism had consistent elevations in multiple acyl-carnitines. Statistically significant elevations were found in short (C4OH) and long chain (C14, C16:1), but not medium chain, acyl-carnitines. Examination of the ETC in muscle and fibroblasts demonstrated great variability across individual complex function with particular deficits in the interaction of complex III with complex I or II. In fibroblasts, on average, revealed a relative deficiency in complex II/III was found. Examination of the fatty-acid oxidation pathway revealed no abnormalities except for those secondary to ETC abnormalities. Abnormalities in mitochondrial genes responsible for cytochrome b, an important component of complex III, were also identified in two patients but the majority of patients did not have any genetic abnormalities to explain the metabolic abnormalities. Redox abnormalities were also found in these children.

Conclusions: We identified a subset of children with autism with a pattern of acyl-carnitine abnormalities that is similar to our rodent models of autism. Like the rodent model, these children also have abnormalities in ETC function and redox abnormalities. Few patients demonstrated genetic defects to explain the mitochondrial abnormalities, leaving open the possibility that environmental factors could be resulting in mitochondrial dysfunction, similar to the rodent model.

105.023 23 Prenatal Exposure to Propionic Acid and Lipopolysaccharide Produces Developmental Delay, Anxiety-Like Behavior, and Hyper-Sensitivity to Acoustic Startle in Adolescent Rats. K. A. Foley*, M. Kavaliers, K. -. P. Ossenkopp and D. F. MacFabe, *University of Western Ontario*

Background: The etiology of autism spectrum disorders (ASD) is unknown, with genetic susceptibility interacting with environmental agents. Potential risk factors for ASD include prenatal exposure to medications (ie. valproate, thalidomide) or infections during the first trimester of pregnancy. Gastrointestinal (GI) system influences may contribute to the development of ASD as a subset of patients with ASD exhibit GI symptoms, with abnormal bacterial flora present in the GI tract of children. Propionic acid (PPA) is a short chain fatty acid, structurally related to valproate, and an enteric bacterial fermentation product, including opportunistic ASD associated bacteria such as *Clostridia* and *Desulfovibrio.*

Objectives: We have previously found that intracerebroventricular PPA infusion in adult and juvenile rats produces behavioral (hyperactivity, repetitive movements, impaired social interaction) and brain changes (neuroinflammation, oxidative stress, altered lipids) similar to those seen in ASD patients. The present work extended the PPA model to developing rats, examining alterations in behavior due to prenatal exposure to environmental agents.

Methods: Pregnant Long-Evans rats were injected once/day SC with PPA (500 mg/kg; G12-16), lipopolysaccharide (LPS, 50 µg/kg; G15-16) or phosphate buffered saline vehicle (G12-16 or G15-16). Pups were monitored for developmental milestones and assessed in multiple behavioral paradigms in adolescence (drug-free state), including open-field, startle response, and social interaction.

Results: Pups exposed to PPA or LPS prenatally displayed developmental delay compared to vehicle treated pups (ie.

pinna detachment, eye opening, incisor eruption). Hypersensitivity to acoustic startle, in the absence of prepulse inhibition deficits, was found in offspring prenatally exposed to either LPS or PPA. In an open-field, prenatally exposed PPA animals spent more time in the perimeter and while in the perimeter, travelled a greater distance than the LPS animals. Preliminary results suggest that offspring of treated dams also showed significant social impairment, avoiding conspecific animals in an open-field.

Conclusions: These results provide further support for the hypothesis that PPA and immune stimulation may be environmental factors contributing to the development of some forms of ASD. Ongoing work assessing the effects of prenatal PPA on brain neuroinflammation and lipid changes will add to the present behavioral evidence.

105.024 24 Time Course of Propionic Acid Induced Lipid, Neuroinflammatory and Cognitive Deficits In the Morris Water Maze-Further Development of A Novel Rodent Model of Autism. J. Mepham*, F. Boon, A. R. Taylor, R. H. Thomas, D. P. Cain, K. -. P. Ossenkopp and D. F. MacFabe, *University of Western Ontario*

Background: Autism spectrum disorders (ASD) are a cluster of neurodevelopmental disorders characterized by social deficits, cognitive abnormalities, and restricted interests. ASD patients often show perseveration of behaviour, including difficulty adjusting to non-routine activities. Dietary, infective and gastrointestinal factors have been suggested to co-exist with the development and fluctuation of ASD symptoms. Propionic acid (PPA) is a dietary short chain fatty acid and a metabolic fermentation product of ASD-associated bacteria (i.e., *Clostridia, Desulfovibrio*). Intracerebroventricular (ICV) infusions of PPA in rodents have been shown to produce behavioural, biochemical and neuropathological changes similar to findings in ASD patients, including bouts of hyperactivity, repetitive movements, perseveration, social impairment, coupled with brain oxidative stress, altered lipid profiles, and innate neuroinflammation.

Objectives: The time course and potential reversibility of the cognitive deficits associated with the PPA rodent model of ASD was assessed using adult male Long-Evans rats.

Methods: ICV infusions of either PPA (0.26 M, pH 7.4, 4 µl/infusion) or phosphate buffered saline (PBS, 0.1 M) vehicle were given twice a day for 7 consecutive days. Rats were then tested in the Morris water maze for acquisition on day 7 of infusions and then again one week later for reversal, and perseveratory behaviours were assessed. In a second experiment, rats were subjected to the same infusion schedule, but were nonspatially pretrained in the maze prior to drug treatment. Brain tissue was analyzed for lipid profiles and innate neuroinflammatory changes.

Results: Compared to controls, both pretrained and non-pretrained PPA-treated rats showed longer search latencies to find the hidden platform, indicating impairment during spatial acquisition of the maze. However, after a one-week recovery period these animals were able to reverse the maze at the same level as controls. Examination of PPA treated brain tissue revealed qualitative altered lipid profiles and innate neuroinflammatory changes, which partially returned to baseline after this one-week recovery period.

Conclusions: Prolonged exposure of PPA produced cognitive impairments, altered brain lipids and innate neuroinflammatory changes. However, some behavioural and brain changes from ICV infusions of PPA may be reversible upon discontinuation of exposure, providing further validity of this novel rodent model of ASD.

105.025 25 Intraventricular Enteric Short Chain Fatty Acid Infusions in Rats Induce Behavioural, Neuropathological, Lipid and Epigenetic Changes Consistent with Autism. B. B. Nankova*[1], E. LaGamma[1], A. R. Taylor[2], L. J. Tichenoff[2] and D. F. MacFabe[2], (1)*New York Medical College*, (2)*University of Western Ontario*

Background: Diverse cell-cell interaction, neuroinflammatory and metabolic processes are implicated in the pathophysiology of autism spectrum disorders (ASDs). Environmental agents may modulate these factors through mitochondrial dysregulation or epigenetic mechanisms. Propionic (PPA) or butyric acids (BA) are short chain fatty acids (SCFA) present in diet, and are also fermentation products

of enteric bacterial fermentation. SCFA have widespread effects on many of the above systems and may thus be possible environmental triggers in ASD. We have shown that PPA and BA can elicit consistent ASD related brain and behavioural changes in rodents, while BA can induce genes implicated in catecholamine, enkephalin and CREB related processes *in vitro.*

Objectives: To examine the effects of chronic intracerebroventricular infusions of SCFA on behaviour, neuropathology, mitochondrial function and gene expression in a rat model of ASD.

Methods: Adult rats received infusions of pH 7.5 buffered PPA or BA (.26M) or PBS vehicle (0.1M) twice daily for 7 treatment days. Immediately following microinfusion, the animals were placed into an automated open field (Versamax, Ethovision) and a variety of locomotor/social activity variables were assessed for 30 minutes. After sacrifice brains were examined either neuropathologically for innate neuroinflammation, lipid profiles (Mass spec) or via microarray analysis (Affymetrix Rat Genome GeneChip 230 2.0 microarrays/MetaCoreTM platform) for ASD related markers/genes.

Results: SCFA infusions increased locomotor activity and induced social impairment. Only PPA produced increased innate neuroinflammation (GFAP, CD68) but both PPA and BA increased vimentin immunoreactivity, and produced altered phospholipid/acylcarnitines. Comparison analyses of the microarray data was performed from three brain regions: hippocampus, neocortex and the caudate nucleus. While similar number of gene IDs were found differential regulated in both, hippocampus (BA- 1052; PA 1060, common gene IDs 769) and neocortex (BA- 1185, PA-862; common gene IDs 574), the expression of significantly less genes was affected in the caudate nucleus (BA-87, PA -61 common genes 22), suggesting region-specific responses to SCFA. The expression of autism candidate genes such as BDNF, gaba receptor GABRD and NRXN3 were down regulated in all three regions consistent with human data, TLR2 and TLR7 and ceruloplasmin, GCH1 (serotonin biosynthesis) genes, and those implicated in mitochondrial damage (Caspase 1,4,8) were up-regulated. Enrichment analysis (MetaCore) based on common genes identified functional ontologies like immune response TLR signaling, classic complement pathway, cell adhesion – ECM remodeling, inflammatory response as major processes affected by SCFA infusion.

Conclusions: SCFA produce behavioural, neuropathological, lipid and gene expression effects reminiscent of ASD when intraventricularly infused in rats, providing further evidence of a plausible dietary/gut/CNS link to this disorder.

Brain Imaging: fMRI-Social Cognition and Emotion Perception Program
106 Brain Imaging-Functional

106.026 26 Making Tough Decisions: The Neural Correlates of Categorization in Children with and without Autism. D. L. Williams*[1], E. J. Carter[2], J. F. Lehman[2] and N. J. Minshew[3], (1)*Duquesne University*, (2)*Carnegie Mellon University*, (3)*University of Pittsburgh*

Background: Studies of categorization of objects such as chairs or cats (e.g., Gastgeb et al., 2006, *Child Development*) or facial expression (Rump et al., 2009, *Child Development*) indicate that individuals with autism improve at categorization across development but do not reach the level of expertise demonstrated by IQ and age-matched typically developing (TD) participants. In these studies, individuals with autism had particular difficulty categorizing atypical exemplars. This difficulty is thought to be related to the tendency of individuals with autism to use explicit, rule-based strategies for information processing (e.g., Minshew et al., 2002, *Neuropsychology*); however, this hypothesis is difficult to test using traditional behavioral methods.

Objectives: To examine neurofunction during categorization of ambiguous and nonambiguous items to gain further understanding of the cognitive basis for the behavioral differences observed in autism.

Methods: Currently, fifteen 8- to 15-year-old children with autism (age M = 12.2, FSIQ M = 112.7) and twelve age- and IQ-matched typically developing children (age M = 11.5, FSIQ M = 113.8) have successfully participated in this IRB-approved study. This is a block-design fMRI study comparing activation

differences for photos of items that can be easily assigned a semantic or quantity label (control condition) vs. items that cannot (ambiguity condition). There are four types of pictorial stimuli (two semantic + two quantity). The semantic stimuli are cued with the question "What is it?" and are of two types: (1) control items with an obvious label (e.g., a car with the choices of car or plane); and (2) ambiguous items that cannot be easily assigned one of the two presented semantic labels (e.g., a *liger* with a lion's head and tiger's body presented with the options of *lion* or *tiger*). The quantity stimuli are single photos of groups of items and are cued with the question "How many?" and are of two types: (1) control stimuli with a correct answer presented (e.g., 3 apples presented with "about 3" and "about 4" as options); and (2) ambiguous items with potential responses that are equidistant from the actual number of items (e.g., 3 items with the options of selecting "about 2" or "about 4"). In this way, we can examine semantic and quantitative categorization under both ambiguous and unambiguous circumstances. All children have a minimum score of 70% correct, and there is no performance difference between the groups.

Results: For the children with TD, no activation differences are seen for ambiguous vs. non-ambiguous items; whereas, the group with autism has greater activation in bilateral inferior frontal gyri, medial frontal gyrus, right middle frontal gyrus, and right inferior parietal lobe. Compared to the group with TD, the children with autism have a network of increased activation for the ambiguous items including left inferior triangularis, right middle frontal gyrus, right superior medial frontal gyrus, right insula, and right supramarginal gyrus.

Conclusions: The results indicate that when making challenging categorical decisions, individuals with autism have a neural signature (increased use of frontal processing regions) consistent with use of an explicit, rule-based strategy.

106.027 27 Dynamic Stimuli in a Social Incentive Delay Task: Examining the Need for More Ecologically Valid Stimulus Sets in ASD Reward Research. M. T. Perino*[1], V. Troiani[1], E. Price[1], J. M. Taylor[2], S. J. Cayless[1], E. N. Madva[1], M. E. Riley[1], S. Faja[3], J. D. Herrington[1], R. T. Schultz[1] and G. Kohls[1], (1)*Children's Hospital of Philadelphia*, (2)*Dartmouth College*, (3)*University of Washington*

Background:

Although it has been suggested that the pervasive social deficits of autism spectrum disorders (ASD) are related to dysfunction of the brain's reward system, very little is known about the neural mechanisms underlying reward processing in individuals with ASD. There are now multiple imaging studies on reward responsiveness in ASD, but the results of these studies are inconsistent, particularly regarding neural responsivity to social rewards. A limitation of this research has been the reliance on static face images to serve as social rewards. By contrast, dynamic stimuli are perceived as more engaging than static pictures, and may therefore elicit more reliable activity in reward circuits, and reveal a clearer picture of putative ASD deficits.

Objectives:

The goal of this study was to evaluate the extent to which dynamic social reward stimuli would activate a key reward area, the nucleus accumbens (NAcc), in typically developing adults.

Methods:

We conducted a functional magnetic resonance imaging (fMRI) study using a social incentive delay task in order to examine participants' striving to receive social approval or to avoid social disapproval (N=22; 11 females; age: 25.6 ± 3.5 years). The event-related fMRI task consisted of 48 incentive trials (per incentive condition) and 48 control trials. Participants received social approval or avoided social disapproval by hitting a button-box during the presentation of a target symbol. Condition cues signaled potential approval, potential avoidance of disapproval, or non-reward control outcomes. Outcome stimuli consisted of a set of newly optimized video clips (validated for such factors as authenticity and likeability). The approval condition consisted of actors giving positive performance feedback by smiling, nodding and showing a 'thumbs up'. The disapproval condition comprised actors giving negative feedback by frowning, head shaking,

and showing a 'thumbs down'. The non-feedback control condition included actors showing a neutral expression while snapping their fingers. Imaging data were collected on a Siemens 3T scanner and analyzed with FSL. Based on apriori hypotheses, we conducted region of interest (ROI) analyses for the NAcc, which was structurally defined from the Harvard-Oxford probabilistic atlas, applying a FWE corrected threshold of $p \leq 0.05$.

Results:

On the behavioral level, participants showed faster response times under both incentive conditions relative to the control condition ($p < 0.001$). Consistent with our predictions, robust activation of the NAcc was observed during anticipation of social approval (vs. anticipation of control outcome). Additionally, to our knowledge, this is the first study to report NAcc activation while participants anticipated avoidance of social disapproval (which can be considered a 'reward').

Conclusions:

This data support that dynamic social reward stimuli elicit robust activity in the NAcc, a key reward area. Our lab is currently deploying variations on this paradigm to examine social reward responsivity to other types of incentives, such as food or money, in ASD. In the long term, these data may inform the choice of reinforcers for optimized behavioral treatment plans in ASD.

106.028 28 Processing of Image Categories Prior to Awareness in Children with Autism Spectrum Disorder.
V. Troiani*[1], E. Price[1] and R. T. Schultz[2], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background: Amygdala activation is observed even when face stimuli are rendered invisible via suppression techniques (Whalen et al. 1998,2004;Morris et al. 2001;Pasley et al. 2004). This amygdala activation is thought to guide attention towards salient locations, such as the eye region of faces (Adolphs, 2008). We have recently identified an amygdala-driven pre-attentive response to fearful faces in the absence of awareness in typical adults (Troiani et al, submitted). Because attention to faces is atypical in autism, understanding the response to face and non-face stimuli in the absence of awareness is critical to capturing the full integrity of face processing systems in autism.

Objectives: We compared neural activation in adolescents with an autism spectrum disorder (ASD) compared to typically developing children (TDC) to better understand if images are processed differently in these populations prior to awareness.

Methods: Continuous flash suppression (CFS) is a method whereby an image presented to one eye is suppressed from conscious awareness by a stream of rapidly flashed colorful patterns presented to the opposite eye. A stimulus of interest (i.e. target) is projected to one eye, but due to suppression, participants only perceive the flashing colorful pattern. We used continuous flash suppression (CFS) in conjunction with fMRI while participants were presented with target images including fearful faces, houses, or a no stimulus control outside of conscious awareness. Target images were rendered invisible via flashing colorful images presented to the opposite eye while participants performed an orthogonal task. This task was to detect whether centrally presented letters that appeared overtop the flashing colorful background were vowels or consonants. Whole brain fMRI images were collected from 28 participants (18 ASD;10 age-/IQ-matched TDCs;mean age:14;mean IQ:101). Five ASD participants were excluded from analysis because they perceived the stimuli (experienced breakthrough from suppression).

Results: First, we did a focused analysis based on our previous findings of amygdala and parietal activation in the absence of awareness in adults. We found increased amygdala activation in TDCs relative to ASDs for subliminally presented fearful faces compared to subliminal houses ($p<.001$ uncorr., apriori). Consistent with our previous findings, we also found increased parietal activation for face stimuli compared to house stimuli in TDCs ($p<.001$ uncorr., apriori), but not in ASD. Unexpectedly, a whole brain analysis of TDCs compared to ASDs showed lingual gyrus activation for houses compared to control condition (random effects; $p<.05$ FWE corrected). The lingual landmark area is thought to respond to visual configurations that may have wayfinding value (Aguirre et al., 1998).

Conclusions: While results are preliminary in light of ongoing data collection, we find that TDCs demonstrate associated neural signatures for social and non-social objects (amygdala & parietal activation in response to faces and lingual landmark area in response to houses). We interpret these findings as the intact differentiation of object categories in typical children, even when these images are presented without awareness. The lack of distinct neural signatures to faces and houses in ASD prior to awareness suggests disturbance of adaptive processing of visual categories even prior to awareness.

106.029 29 Atypical Development of Visual Processing During Adolescence in Autism. K. O'Hearn*,

Background: Results from the Cambridge Face Memory Task (CFMT; Duchaine & Nakayama, 2006) showed substantial development from adolescence to adulthood typically, but not in those with autism (O'Hearn et al., 2010). The current studies test skills related to the CFMT, including those may develop late typically (e.g., holistic processing) or be impacted to autism (e.g., encoding eyes).

Objectives: The goal of these studies was to further characterize the pattern of development on the CFMT, both behaviorally and neurophysiologically. We tested whether the findings were specific to faces, to face 'parts' (eyes or mouth), or to holistic processing, all of which have been suggested to differ in autism. Eye movement and neuroimaging measures were collected to provide insight into the mechanisms underlying the group differences on the CFMT.

Methods: Behavioral studies include the immediate memory task and the part/whole task from the Let's Face It battery (LFI; Wolf et al.,2008). To date, 8 children, 14 adolescents and 18 adults with autism (IQ's >80) have been tested on these behavioral tasks, as well as TD individuals matched on age, IQ and gender. In the immediate memory task, participants see a face or car for 1 s, and then pick it out of three objects from a ¾ view. In the part/whole task, participants view a whole face for 4 s, then choose the same face (or eyes or mouth) from two test items. Test items could be a whole face or part of a face, to examine holistic processing, and the change could be eyes or mouth, to examine performance with these important features. In addition, to date, 20 individuals with autism and 14 TD individuals completed the CFMT modified for neuroimaging in a fast event-related design. Cars were included in several runs, to examine the specificity of the results in terms of brain activation.

Results: The developmental pattern evident previously on the CFMT was replicated with both faces and cars on the immediate memory task, indicating the results were not specific to faces or the CFMT. It was also evident with both parts and whole conditions of the part/whole tasks, indicating that it did not reflect holistic processing. Indeed, all ages in both groups displayed holistic processing (i.e., better performance with the whole than the parts). Eye recognition in adults with autism was the exception, and also the only condition to display development in autism from adolescence to adulthood, suggesting compensatory strategies in these adults. Preliminary neuroimaging data from 20 individuals with autism (10 adolescents) and 14 controls (7 adolescents) suggests that increases in activation may occur with age in frontal regions typically but not in autism, mimicking the behavioral pattern.

Conclusions: The pattern evident on the CFMT is not specific to faces, features, or holistic processing. This pattern of development may generalize across a wide range of visual functions, making adolescence an crucial time for further study. Neuroimaging examination of this pattern of visual development will provide much needed insight into the developmental processes impacted by autism.

106.030 30 Modulation of Inhibition Processing by Serotonin in Autism: An fMRI Study with Acute Tryptophan Depletion. E. Daly*, K. Rubia, C. Ecker, C. M. Murphy, Q. Deeley and D. G. Murphy, *King's College London, Institute of Psychiatry*

Background:

A characteristic of Autism (ASD) is stereotyped and repetitive behaviors, symptoms that may be related to deficits in executive functions (EF); particularly inhibitory control of motor-response and interference inhibition. Research reports that inhibition tasks are mediated by the neurotransmitter serotonin (5-HT) and the 5-HT system is abnormal in ASD. Compared to controls, males with ASD showed increased brain activation when performing Go/No-Go task (GNG) of

motor-inhibition and "Simon" task of cognitive-interference inhibition. Reduction of 5-HT by Acute Trypthophan Depletion (ATD) has shown a modulation of inhibition processing brain activation in healthy adults. However, no one has examined this question in ASD.

Objectives:

To study the modulatory role of 5-HT on stereotyped and repetitive and obsessional behaviors, our objective was to compare the role of the 5-HT system on the neuroprocessing of two inhibitory tasks in people with ASD and controls using ATD and functional Magnetic Resonance Imaging (fMRI).

Methods:

We scanned 14 high –functioning adult males (age 37(16-57); FSIQ IQ 115) with an ICD-10 diagnosis of ASD (confirmed using the ADI) and 14 gender, age and IQ matched control subjects. Subjects were tested on two separate occasions using a double-blind, placebo-controlled, crossover designed experiment. An amino acid drink mixture was consumed on the both test dates after fasting from the previous day. The placebo or sham drink contained tryptophan, the precursor of 5-HT in the brain while the ATD drink did not contain tryptophan leading to the lowering of brain 5-HT. Then 4.5 hours post amino acid drink, subjects were scanned in a 1.5 Tesla GE Signa MRI machine measuring Blood Oxygenation Level Dependent (BOLD) signal while performing the GNG and SIMON inhibition tasks. A 2 drink (SHAM,ATD) X 2 group (control, asperger) factorial repeated measures ANOVA of the BOLD signal was undertaken to determine brain regions where there was an interaction of 5-HT status and group.

Results:

Both groups showed a 70% blood tryptophan reduction after consumption of the ATD drink. There were no differences in the performance of the task in either group, however, people with ASD showed significantly different brain activation patterns than controls in the 5-HT modulated experiments for both inhibition tasks. For the Go/No Go task, the interactions were found in the left-sided hippocampus, putamen and middle and inferior frontal gyri and right-sided temporal and occipital gyri while the Simon task, the interactions were found in bilateral caudate, temporal and parietal lobe, left-sided inferior frontal gyrus and right-sided insula. The interactions were an indication of a pattern of 'opposite effects' where ATD decreased the BOLD signal response for the controls and enhanced the BOLD signal response for ASDs in brain regions involved in inhibition.

Conclusions:

Attenuation of 5-HT levels in the brain by ATD leads to opposite effects on the neuroprocessing of inhibition tasks in controls and males with ASD. These results suggest that 5-HT dysfunction in ASD may be implicated in their altered brain activity during inhibition tasks and these differences in inhibitory control may contribute to the stereotyped and repetitive behaviors found in ASD.

106.031 31 Functional Brain Maturation of Attention and Temporal Discounting in Children and Adults with ASD: An fMRI Investigation. C. M. Murphy*[1], A. Christakou[2], E. M. Daly[3], C. Ecker[2], P. Johnston[4], A. Smith[2], V. Giampetro[1], M. J. Brammer[5], D. M. Robertson[6], D. Spain[4], M. Aims[7], D. G. Murphy[2] and K. Rubia[2], (1)*King's College London, Institute of Psychiatry*, (2)*King's College London, Institute of Psychiatry*, (3)*King's College London, Institute of Psychiatry,*, (4)*King's College London*, (5)*King's College London, Institute of Psychiatry*, (6)*South London and Maudsley NHS Trust*, (7)*Institute of Psychiatry, London; University of Oxford; University of Cambridge, United Kingdom*

Background:

Individuals with autistic spectrum disorder (ASD) have cognitive and behavioural difficulties with sustained attention as well as with temporal foresight and forward planning. However, little is known of the neurofunctional substrates underlying these deficits, nor of potential abnormalities in functional brain maturation during these functions in people with ASD.

Objectives:

We used fMRI across a large age range of 86 children and adults with ASD and typically developing controls between 11-35 years old to investigate 1) differences in brain activation in

children and adults with ASD relative to controls during two tasks that measure sustained attention and temporal discounting, respectively and 2) differences in the neurofunctional maturation in people with ASD relative to controls.

Methods:

46 males (11-35 years old) with ASD and 40 age/IQ matched typically developing male controls completed two event-related fMRI tasks on a 3T MRI scanner. All participants were right-handed, medication-naïve, IQ >70. All individuals with ASD were diagnosed with autism or Asperger (ICD-10) and met ADI and ADOS cut-offs for autism. The 12 minute parametric sustained attention task (SAT) requires subjects to respond as quickly as possible to a timer that appears under two delay conditions: 1) short, frequent, predictable delays (500ms), 2) randomly interspersed long, unpredictable delays (2s, 5s, 8s). Long unpredictable delays place a higher load on sustained attention (parametrically modulated with increasing delays); short predictable delays place a higher load on sensorimotor timing. The 12 minute temporal discounting task (TD) measures the effect of delay on reward-related decision making and temporal foresight. Subjects choose between small immediate rewards and larger delayed rewards. Data were analysed using non-parametric image analysis (XBAM: www.brainmap.co.uk). To investigate whether group differences in brain activation were associated with differential neurofunctional development, we performed a conjunction analysis between group differences in activation and group differences in whole-brain age correlations.

Results:

SAT: Individuals with ASD had slower MRT and greater intrasubject variability than controls and underactivated dorsolateral and inferior prefrontal, striato-thalamic, temporal and cerebellar regions. The conjunction analysis showed that most of these regions that differed significantly between groups also differed in functional maturation; they increased progressively with age in controls, but not in ASD. Furthermore, activation in these areas showed significant negative correlations with ADI and ADOS scores (social, communication and restricted interests/repetitive behaviour) and positively with task performance.

TD: TD data will be presented at the conference

Conclusions:

SAT: The findings suggest that individuals with ASD have significant differences from controls in the functional activation of brain networks central to sustained attention. Importantly, this study shows for the first time that functional activation deficits in ASD are associated with underlying abnormalities in functional brain maturation, suggesting that abnormal brain function may be due to abnormal functional maturation.

106.032 32 The Neural Correlates of Impaired Visual Interference Control in Individuals with Autism Spectrum Disorder. S. E. Christ*, A. J. Moffitt, L. E. Kester, K. E. Bodner and J. H. Miles, *University of Missouri*

Background: The social and communicative challenges faced by individuals with autism spectrum disorder (ASD) are frequently compounded by impairment in the ability to filter and resist interference from visual distractors (RIVD) (Christ et al., 2007, 2011; Geurts et al., 2008). Given the countless sources of interference encountered on a moment-by-moment basis, intact RIVD is essential for efficient functioning in home and school environments. Within this context, the neurocognitive locus of ASD-related impairment in RIVD remains unclear.

Objectives: In the present study, we utilized functional magnetic resonance imaging (fMRI) to examine the neurocognitive disruption(s) that contribute to RIVD impairment in ASD.

Methods: A sample of 16 individuals with ASD (mean age = 15.5 years) and 11 neurologically intact individuals without ASD (mean age = 15.9 years) participated. A 3T Siemens Trio scanner with a standard 8-channel head coil was used for data collection. Following acquisition of structural brain scans (for registration purposes), functional brain scans were conducted while participants performed a flanker visual filtering task (Eriksen & Eriksen, 1974). In this task, participants were asked to identify a centrally-presented target stimulus (e.g., press the left button when the letter “S” or “E”

appears and press the right button when the letter “H” or “U” appears). At the time of presentation, the target was flanked closely to the left and right by distracting stimuli. These stimuli could be either compatible (i.e., mapped to the same response; e.g., “ESE") or incompatible (i.e., mapped to a competing response; e.g., “HSH”) with the target. Participants had to ignore the distracters and instead respond to the centrally-located target. RIVD ability was assessed by comparing performance between trials with incompatible flankers and trials with compatible flankers.

Results: Group-differences in RIVD-related activity were observed in several brain regions, most notably the left dorsolateral prefrontal cortex (DLPFC), $t(25) = 2.22$, $p < .05$ FDR-corrected.

Conclusions: Although speculative, these results are consistent with the hypothesis that disruptions in DLPFC-mediated processes associated with the top-down monitoring and regulation of interference control may contribute to RIVD impairment in ASD.

106.034 34 fMRI Reveals Differences Between Neural Systems Recruited for Time Perception in Children with and without Autism. M. J. Allman*[1], S. E. Joel[1], W. H. Meck[2], J. J. Pekar[1], M. F. Cataldo[1], R. J. Landa[1], S. H. Mostofsky[1] and M. B. Denckla[3], (1)*Kennedy Krieger Institute*, (2)*Duke University*, (3)*Johns Hopkins University School of Medicine*

Background: There is a small, but growing number of empirical findings that suggest individuals with autism experience differences in timing and time perception, and it has been theoretically proposed that temporal processing deficits may contribute to characteristic features of autism. To-date these studies have included behavioral-cognitive assessments, and have not been extended into functional brain mapping. It is reasonably well established that typical individuals tend to recruit cortico-cerebellar circuits when actively timing relatively short durations (sub-second, e.g., <1-2 s) and cortico-striatal circuits when timing longer (supra-second, e.g., >3 s) durations (although this is not mutually exclusive).

Objectives: The current study sought to examine which brain regions children with autism recruit when making magnitude estimates of “time” (duration).

Methods: Children with and without a diagnosis of autistic disorder (8-13 years old) were scanned while performing a temporal ordinal comparison task; a standard duration (2 or 8 sec) was followed in quick succession by a comparison duration that was a deviant of the standard (± 12, 24 & 36%) and participants were required to judge whether the comparison was ‘shorter’ or ‘longer’ (than the standard).

Results: Group differences in regional activity were observed when children were timing both the standard and comparison durations. For instance, non-affected participants revealed greater activation in the cerebellum when timing the 2-s standard and the caudate-putamen when timing the 8-s standard (as expected); in contrast, children with autism recruited the caudate-putamen more heavily when timing the shorter standard (and not the longer one).

Conclusions: These results lend support to existing behavioral evidence that individuals with autism may subjectively experience the passage of time differently. The implications of these results to our understanding of autistic symptomology will be outlined.

106.035 35 Functional Brain Networks in Autism Spectrum Disorder in Different Attentional States. P. Barttfeld[1], B. Wicker*[2], S. Cukier[3], S. Navarta[1], J. Calvar[3], R. Leiguarda[3] and M. Sigman[1], (1)*Laboratorio de Neurociencia Integrativa, Physics Department*, (2)*Aix-Marseille University*, (3)*FLENI*

Background:

Interoception is our sensitivity to stimuli originating inside of the body. As humans, we perceive feelings from our bodies that relate our state of well-being, our energy and stress levels, our mood and disposition, all of which seem to be impaired in ASD. Anatomical and functional brain studies have converged to the hypothesis that ASD is associated with atypical connectivity, producing a system that is ineffective for integrating complex information at the neural and cognitive level. For instance, task positive (TPN) and task negative (TNN) functional brain networks of ASD and normal subjects

have qualitatively different intrinsic organization, with abnormal connectivity in the TNN but not in the TPN in ASD. It remains however unexplored if the TPN differentiates whether the task involves directing attention internally (interoception) or externally.

Objectives:

We reasoned that brain network organization during interoceptive states may show more pronounced differences between groups and hence constitute a precise physiological signature of ASD. To examine this hypothesis we measured functional connectivity in three different mental states varying the focus of attention of the subjects.

Methods:

Participants included 12 individuals with high-functioning autism or Asperger's Syndrome matched to a group of 12 typically developing individuals. Whole brain fMRI data were acquired with a GE HDx 3T scanner. Rest run : subjects lie eyes closed in the scanner. Introspective run : subjects had to count the number of their breathing cycles. Exogenous Run : subjects had to detect and count beeps (target) with a little higher pitch among others. Classic functional connectivity and network characterization using graph theory metrics were performed. Using graph theory metrics as characteristics of ASD and Control groups, we further performed a classification analysis, based on ROC curves.

Results:

Network changes between groups in the interoceptive and exteroceptive states showed opposite effects, revealing that inferences about connectivity in ASD are state-dependent. ASD functional networks largely vary across conditions: in the exogenous run, the analysis of ASD brain network reveals sub-optimal metrics, suggesting that it is badly suited for this kind of task. As attention shifts to self, ASD brain networks improve their metrics – even surpassing those of Controls'- suggesting that ASD networks reaches its optimum capabilities in those cognitive states related to introspective tasks and body perception. While network measures decode whether a patient belongs to the ASD or normal group at a modest performance of 60%, comparing how network parameters change with state achieves very accurate decoding performance (90%).

Conclusions:

Connectivity analysis revealed consistent and organized differences in functional connectivity between ASD and control groups, suggesting that a distinct pattern of dynamical connectivity may be related to the physiopathology of ASD. ASD process interoceptive information just as they process external information, without adapting information processing to the fact that the signal comes from their own body, possibly caused by an altered capacity to self awareness. This results may have important behavioural consequences : ASD individuals may exaggeratedly focus on internal physical sensations that tend to automatically elicit anxiety and panic, leading to inappropriate emotional reactions.

106.036 36 Searching for Neuronal Markers of Verbal Proficiency in Autism. A. Di Martino*[1], C. Kelly[1], M. Mennes[1], R. L. Grzadzinski[1], A. Schvarcz[1], D. Levy[1], N. Adamo[1], J. Raithel[1], J. Rodman[1], M. Garcia-Garcia[1], E. Denio[1], E. Petkova[2], C. E. Lord[3], F. X. Castellanos[4] and M. P. Milham[5], (1)*Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience*, (2)*NYU Child Study Center*, (3)*Weill Cornell Medical College*, (4)*Nathan Kline Institute for Psychiatric Research*, (5)*Center for the Developing Brain*

Background: Verbal proficiency at age 5 years is an important prognostic factor of long-term adjustment in autism spectrum disorders (ASD). Yet, the neuronal underpinnings of verbal proficiency in ASD are undetermined. Their characterization may lead to the identification of biomarkers applicable as early as the first identification of ASD, to guide treatment selection and track language outcomes. Our overarching aim is to obtain such a biomarker by means of resting-state (task-independent) fMRI (R-fMRI). R-fMRI is feasible in young populations, regardless of cognitive level, and it provides a wealth of information about intrinsic functional connectivity (iFC).

Objectives: We aimed to identify neuronal markers of verbal proficiency using R-fMRI measures of iFC applied to language-based circuits, first in a "training" sample of school-age children with ASD. Then, to explore the stability of the identified marker(s), we examined its relationship with verbal

proficiency in an independent sample of preschoolers with ASD.

Methods: Two independent samples of children with ASD were included: 34 school-age children (mean age 10.6±1.8years; 29 males) completing an awake R-fMRI scan; and 20 preschoolers (mean age: 60±10months; 18 males) completing a R-fMRI scan during natural sleep. To examine iFC of language circuits we focused on functional subregions of the left inferior frontal gyrus (lFG): the pars triangularis (pt), pars opercularis and the ventral premotor cortex, whose iFC was previously delineated by our group. Vineland Expressive Language (VEL) standard scores were used to index verbal proficiency. Two-step analyses were conducted. First, in the 34 school-age children with ASD, we examined the relationship between VEL scores and inter-individual differences in iFC patterns associated with each of the three lFG regions, at the voxel-wise, whole-brain level ($Z>2.3$, $p<0.05$, Gaussian random Field Theory corrected). Second, we examined the relationship between the iFC of circuit(s) identified in the first step with the VEL scores in the preschoolers with ASD. We also ran confirmatory analyses comparing iFC strength of the target circuit(s) between verbally and non-verbally proficient preschoolers identified based on the Autism Diagnostic Observation Schedule (ADOS) module level as proxy for expressive language use.

Results: Voxel-wise analyses of the school-age sample revealed a significant positive relationship between VEL scores and the iFC of left lFGpt with a cluster in the posterior aspects of the right superior temporal sulcus (STS). Guided by this finding, we correlated the iFC within this circuit with VEL scores of the 20 preschoolers with ASD. The iFC of this circuit explained 16% of the variance in verbal proficiency (corresponding to $r=0.40$). Weaker iFC in the L-lFG R-STS related to poor verbal proficiency was also evident from comparisons of this circuit iFC between verbally and non-verbally proficient preschoolers per ADOS modules.

Conclusions: Our findings underscore the role in ASD-related verbal proficiency of an interhemispheric circuit connecting the left lFG, typically involved in expressive language skills, with the right STS, classically implicated in broad aspects of social cognition. R-fMRI provides a feasible means for the identification of loci of disconnection in autism that may serve to identify prognostic markers of verbal proficiency.

106.037 37 Greater Right Hemisphere Recruitment in Response to Figurative Speech in Autism. H. M. Wadsworth* and R. K. Kana, *University of Alabama at Birmingham*

Background: Interpreting figurative speech involves inferring speaker's intent by integrating word meaning with context. This may pose challenge to individuals with autism perhaps due to their weak central coherence (Frith, 1989). It has been found that such difficulties are prevalent even when individuals exhibit otherwise fluent language ability (Szatmari et al., 1990). A pun is a figure of speech in which a speaker deliberately invokes multiple meanings through a word or phrase likely resulting in a joke. Comprehending puns may represent a unique challenge for individuals with autism since it involves identifying multiple meanings of a word, embedding it in right contexts, and understanding the underlying humor.

Objectives: The goal of the current study was to delineate the role of core cortical language areas (LIFG: left inferior frontal gyrus and LSTG: left superior temporal gyrus) and hemispheric differences in their recruitment in autism while comprehending figurative speech.

Methods: Sixteen high-functioning young adults with autism and 16 age and IQ-matched typical control participants took part in the study. The stimuli consisted of a series of sentences presented visually, in a blocked design format, in the MRI scanner. The sentences were grouped into two conditions: *pun* and *literal*. In the pun condition, the last word of the sentence was a pun that evoked multiple meanings (e.g., *my advanced geometry class is full of squares)*. A 24-second fixation repeated at several intervals during the scan formed the baseline for comparison. Each sentence was presented for 5000 ms and each block consisted of six sentences. Following the fMRI session, participants completed a short debriefing in which they were asked about their understanding of pun, the difficulty of the task, and the speed at which they performed the task. In addition to activation analyses, an Independent Component Analysis (ICA) was performed to determine the degree to which the components comprising

the left hemisphere language regions correlated with the predicted BOLD signal for each group.

Results: Participants with autism, relative to typical controls, showed an increase in overall activation while comprehending sentences containing puns, particularly within the right hemisphere as well as in relatively posterior brain areas. There was also reduced response in LIFG, LSTG, and in LSFG, and more distributed recruitment of regions in autism relative to control participants (p = 0.001; k = 64 voxels). A two-way ANOVA conducted to partial out the effect of VIQ confirmed that the differences in activation in these regions were due to a main effect of group. An Independent Component Analysis indicated that the component comprising of the LH language regions was significantly more correlated with the predicted BOLD signal for the control than for the autism group. Furthermore, symptom severity in autism was found to be negatively correlated with LMTG response to pun [$F(2)=6.79$, $R^2=0.80$].

Conclusions: The difference in the recruitment of brain areas in autism (decreased left hemisphere activation, reduced activation in regions associated with humor) as compared to that of controls may suggest compensatory processing and alternate neural routes to deal with language difficulties.

106.038 38 Cerebro-Cerebellar Resting State Functional Connectivity for Motor and Prefrontal Networks in Adolescents with Autism Spectrum Disorders. A. J. Khan*[1], A. Nair[2], C. L. Keown[1], P. Shih[3], B. Keehn[4] and R. A. Müller[1], (1)*San Diego State University*, (2)*San Diego State University / University of California, San Diego*, (3)*Neuroscience Department, Brown University*, (4)*Children's Hospital Boston/Harvard Medical School*

Background: The cerebellum is considered to play an important role in motor, somatosensory, and executive functioning. A number of studies have reported abnormalities in neuronal integrity, volume, metabolism, and activity in the cerebellum in autism spectrum disorders (ASD). A previous functional connectivity magnetic resonance imaging (fcMRI) study reported cerebro-cerebellar underconnectivity during motor performance in ASD. Resting-state (RS) fcMRI identifies spontaneous low-frequency blood oxygenation level dependent (BOLD) signal fluctuations allowing for the examination of intrinsic network connectivity. Impairments of motor and executive functions have been reported in numerous studies of ASD. Such impairments may be associated with abnormal cerebellar connectivity with prefrontal and motor cortices. However, a focused investigation of intrinsic cerebro-cerebellar connectivity for motor and prefrontal networks in ASD is currently unavailable.

Objectives: To examine cerebro-cerebellar intrinsic functional connectivity in motor and prefrontal networks in adolescents with ASD.

Methods: RS functional MRI data were acquired for 6:10 minutes on a 3T GE scanner for 18 adolescents with ASD and 22 age, sex, IQ, and motion-matched typically developing (TD) adolescents. Participants were required to remain still and fixate a crosshair in the center of a projection screen. Data were preprocessed using AFNI and included motion and field map correction, cardiac and respiratory regression, spatial smoothing, isolation of low frequency fluctuations ($.01<f<.1$), and normalization to Talairach space. The Talairach-Tournoux Daemon atlas in AFNI was used to obtain masks for the cerebellum as well as the motor and prefrontal cortices. Partial correlation analyses were performed between each voxel in the cerebellar mask and the time series extracted from motor and prefrontal regions of interest (ROIs), respectively. Pearson's correlation analyses were conducted for fcMRI effects (motor, prefrontal) with diagnostic (ADOS, ADI), Social Responsiveness Scale (SRS), and Visuo-Motor Integration (VMI) scores.

Results: Connectivity results in TD adolescents were consistent with previous findings by O'Reilly and colleagues (2010), with motor connectivity in anterior cerebellum and prefrontal connectivity in posteriolateral neocerebellum. Between-group comparisons revealed atypically increased cerebellar connectivity for the motor ROI, but reduced connectivity for the prefrontal ROI in the ASD group. Across both groups, significant negative correlations for motor-cerebellar connectivity and VMI scores, $r = -.761$, $p < .004$, and prefrontal-cerebellar connectivity and SRS scores $r = -.377$, $p < .05$. Increased motor-cerebellar connectivity correlated with reduced VMI scores in the TD group ($r = -.905$, $p < .005$),

whereas increased motor-cerebellar connectivity correlated with reduced ADOS-social subtest scores ($r = -.576$, $p < .05$) in the ASD group.

Conclusions: Our findings suggest reduced intrinsic functional connectivity between prefrontal cortex and cerebellum in ASD, accompanied by increased connectivity with cortical motor regions. Our latter finding for intrinsic connectivity contrasts with a previous report of cerebro-cerebellar underconnectivity during motor performance (Mostofsky et al., 2009). The pattern of group differences may indicate an expansion of motor-related cerebro-cerebellar connectivity at the expense of connectivity subserving executive functions, consistent with reports of executive impairment in ASD. Correlations of functional connectivity measures with social responsiveness and visuo- motor abilities support the behavioral relevance of cerebro-cerebellar connectivity.

106.039 39 'Spoken Vs Sung'- Investigating Auditory Brain Networks in Children with Autism. M. Sharda* and N. C. Singh, *National Brain Research Centre*

Background: A wide range of enhancements and impairments in auditory function have been reported in individuals with Autism Spectrum Disorders. These include impaired perception of speech and linguistic stimuli as well as enhanced responses to musical sounds. Recently, it has also been suggested that music-based interventions engage a large multimodal brain network and may hence be useful in entraining functions which might impaired in autism. However, not many studies have investigated the neural correlates of music processing in autism and how it might affect language and speech functions.

Objectives: The primary objective of our study is to identify the structural and functional networks involved in processing spoken speech, sung speech and music in children with autism as compared to typically developing children with a view to designing interventions targeted at entraining these communication networks via early music-based training.

Methods: We conducted a passive-listening task with three kinds of stimuli –spoken words, sung words and piano tones in a sparse-sampling, event-related fMRI paradigm. All words were bisyllabic nouns or verbs commonly used by children, such as 'balloon' and 'sleeping'. The melodies for the sung words were combinations of two major notes, which were also used for creating the piano tones. Both the spoken and sung stimuli were delivered by a professionally trained musician. The task was performed by 13 participants, 6 children with autism (ASD) diagnosed using DSM IV criteria (mean age 13.6 years) and 7 typically developing (TYP) controls (mean age 11 years). 90 volumes in 3 runs were acquired with TR=10s in a 3T scanner. In addition, a high resolution anatomical T1 image was also acquired. Data analysis was performed using SPM5.

Results: Preliminary data showed that perception of spoken words as well as sung words elicited a bilateral superior temporal network in both the TYP group as well as the ASD group. We also found that sung words elicited greater activity when compared to spoken words. However, the pattern of activity differed between the TYP and ASD groups in that the Sung>Spoken contrast recruited bilateral auditory networks in the TYP group whereas it was more right-lateralized for the ASD group. The Spoken>Sung contrast on the other hand showed greater left temporal activity for the TYP group and left frontal activity for the ASD group. Tones elicited right>left activity for both groups.

Conclusions: Our preliminary findings show that typically developing children recruit bilateral auditory brain networks for processing both spoken and sung word stimuli. However, children with autism show a rightward asymmetry in processing sung words. Given that sung stimuli are more salient than spoken words and show a greater recruitment of the right hemisphere, this finding may be explored further using connectivity studies to determine the notion of musical entrainment of speech and language.

106.040 40 Disruption of Functional Organization within the Primary Motor Cortex in Children with Autism. M. B. Nebel*[1], S. E. Joel[2], J. Muschelli[3], A. D. Barber[2], B. S. Caffo[3], J. J. Pekar[2] and S. H. Mostofsky[1], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins School of Medicine*, (3)*Johns Hopkins School of Public Health*

Background: Clinical observation and empirical studies suggest that children with autism spectrum disorder (ASD)

exhibit impairments in motor abilities that may reflect abnormal connectivity within networks underlying motor control and learning. Recently, several groups have used patterns of correlations in spontaneous BOLD activity, referred to as resting-state functional connectivity (FC), to localize functionally relevant subdivisions of anatomically defined regions.

Objectives: Motivated by the utility of these methods in establishing functional organization, this study had two aims: (1) parcellate a key area of the motor network, the precentral gyrus (M1), in neurotypical adults and typically developing (TD) children; (2) apply this approach to children with ASD to determine if M1 functional organization differs in children with ASD compared to TD children.

Methods: Resting state fMRI and anatomical images were collected from 32 children with ASD (8-12 years) and 33 TD children balanced for age, gender, handedness and perceptual reasoning. Scan-rescan reliability data from twenty neurotypical adults were also used for parameter estimation. Initial preprocessing steps of slice time adjustment, motion correction and spatial normalization were performed using SPM5, after which motion parameters, global signal and nuisance covariates were extracted. The data were then temporally filtered (0.01-0.1 Hz pass-band).

For each M1 voxel, an FC map with all voxels outside of M1 was generated. Similarity of FC maps for every pair of M1 voxels was computed using η^2, and a spectral clustering algorithm was applied to the resulting η^2 matrix. Adjacency matrices were constructed for each participant and averaged to generate a consensus matrix for each group; the elements of the consensus matrix corresponded to the proportion of times a given pair of voxels was assigned to the same parcel across participants. Spectral clustering was reapplied to the group consensus matrices, and the labels of the clustering solutions were matched by maximizing the average overlap of similarly-labeled parcels between groups.

TD and ASD parcels were compared by volume and spatial overlap. The significance of the observed group differences was assessed by permutation: diagnosis labels were randomly assigned, consensus matrices were recalculated, and second-level spectral clustering was reapplied 10,000 times.

Results: A gross dorsomedial to ventrolateral organization emerged bilaterally within M1 in both groups. However, the dorsomedial-most (DM) parcel was significantly larger in ASDs than in TDs and encompassed much of the space occupied by the adjacent dorsolateral (DL) parcel in TDs (+10.6 cm^3, p=.05). The displacement of the DL parcel in ASD caused additional functional segregation differences between groups in the region of M1 closest to the hand knob; group overlaps for the DL and anterior lateral parcels were significantly worse than predicted by permutation (.24, p=.02; .51, p=.02, respectively).

Conclusions: Given the organization of the motor homunculus, the observed differences between M1 functional subunits in TDs and ASDs may have interesting developmental implications. The enlarged ASD parcel included regions of M1 normally reserved for lower limb control but also areas normally recruited by the upper limbs, suggesting that developmental segregation of upper and lower limb control may be delayed in ASD.

106.041 41 Visuomotor Impairment and Underlying Cortico-Cerebellar Dysfunctions in Individuals with Autism. M. W. Mosconi*, *University of Texas Southwestern Medical Center*

Background: Dyspraxia is common in individuals with autism, but it remains unclear whether sensorimotor abnormalities reflect impaired processing of sensory feedback for action planning, or fundamental deficits in motor control.

Objectives: To clarify the integrity of sensorimotor and motor control systems in autism.

Methods: 26 individuals with autism and 26 matched healthy controls (ages 8-35) participated in two laboratory studies of motor skills; 15 individuals from each group also completed an fMRI study. Subjects performed sustained precision grip force tasks in which the amplitude of the target force and the precision of visual feedback were varied independently. They viewed a white bar that moved upwards with increased force toward a fixed green target bar. Subjects were instructed to

sustain a constant force in order to stabilize the white bar at the level of the green bar for 15 sec trials. During the "motor" manipulation, the green target bar was set to 5, 25, 45, 65 or 85% of individual subjects' maximum force contraction. During the "sensory feedback" manipulation, the vertical distance the white bar moved per Newton of force applied by the participant was set to visual angles of .02, .19, and 2.02 deg. When the visual angle was large, the white bar moved a larger distance for every Newton of force applied, increasing the precision of sensory feedback.

Results: Subjects with autism did not show atypical mean force levels, but they did show reduced control of their motor output as demonstrated by increased variability of sustained force during the course of trials ($F=14.87$; $p<.001$). This impairment was more robust at greater force amplitudes (Group x Amplitude: $F=9.47$; $p<.001$). Force variability was increased in individuals with ASD across varying precision of sensory feedback ($F=7.58$; $p<.01$), but particularly when feedback was less precise (Group x Visual Angle: $F=4.28$; $p=.02$). In fMRI studies, when sensory feedback was less precise, subjects with autism showed reduced activation in left motor cortex, left dorsal premotor cortex, superior parietal lobule and cerebellar lobules IV-VI. These brain abnormalities were not evident when sensory feedback was precise. Increased variability of sustained force was associated with clinical ratings of communication impairment and motor stereotypies in individuals with autism.

Conclusions: Our results provide evidence that visuomotor impairments in autism reflect deficits in controlling sustained motor output and in transforming sensory input for use in precise motor control. Further, motor impairments appear to be related to communication deficits and stereotypies, indicating a relationship with core clinical features of the disorder. Our fMRI studies highlight dysfunction in cortico-cerebellar circuitry which integrates sensory input to adjust movement plans organized by frontoparietal motor systems. Combined with findings from postmortem studies of autism documenting reduced Purkinje cell size and density, these results suggest that abnormal output from the cerebellum to neocortical systems may underlie the dyspraxia and poor fine motor control that are present in the majority of individuals with this disorder.

106.042 42 Oxytocin's Signature in Social Deficits of Patients with Autism Spectrum Disorders. E. Andari*, *Emory University*

Background: Our daily life is a constant stream of complex social situations, and adaptation is a key element of Human fitness. Patients suffering from autism lack social adaptation partially due to difficulties in feeling appropriate emotional states. Recently, *oxytocin* is attracting considerable attention for its role in Autism. Oxytocin is a fundamental mediator for a large range of behavior such as maternal attachment, pair bonding, social learning and prosocial behaviors. Since oxytocin plays a key role in social affiliation, and given that the major suffering of patients with autism is the social deficit, *a key question is whether oxytocin plays a role in social deficits of patients with Autism.*

Objectives:

- Studying whether patients with autism have deficits in their plasma oxytocin concentration and whether this measure can be used as a biomarker of decrease levels of affiliation.

- Investigating the structural correlates of plasma oxytocin variability among individuals in order to infer the mechanisms of action of this molecule.

- Determining whether intranasal administration of oxytocin can modulate prosocial feelings in healthy volunteers and in patients with Autism.

Methods:

Plasma oxytocin was measured using specific enzyme-immunoassay method of analysis in 30 healthy volunteers and 13 patients with Autism. Healthy individuals performed the Revised NEO Personality Inventory. Voxel-based Morphometry analysis was used to study the structural images of participants. Intranasal oxytocin spray was administrated to healthy subjects and patients with Autism in a double blind oxytocin-placebo controlled study. Oxytocin's effects were measured on self-perception of prosocial feelings toward others. Patients performed a social game where they

interacted with three fictitious partners endowed with different levels of trust and reported their feelings of trust. Healthy subjects self-reported their general feelings of trust toward others during personality test.

Results:

Baseline plasma oxytocin concentration in patients was intensely below the values observed in healthy subjects. Interestingly, plasma oxytocin was found positively correlated with social personality scores in healthy volunteers. In other terms, individuals with introverted personality presented lower levels of plasma oxytocin compared to extraverted individuals.

We also found that individual variability in endogenous oxytocin and in social affiliation is echoed in differences in grey matter volume of specific brain regions, the amygdala and hippocampus, regions controlling fear and anxiety. Moreover, oxytocin intake enhanced patients' capacities to process social cues and to report appropriate feelings of trust toward the trustworthy partner. These results are supported by the effects of oxytocin on enhancing healthy subjects' self-report of general trust toward.

Conclusions:

Endogenous plasma oxytocin might be a biomarker of the degree of engagement of individuals in their social life and eventually of social deficits encountered in psychiatric disorders such as Autism. Moreover, our findings suggest potential therapeutical implications of oxytocin in modulating adaptive prosocial feelings in these patients, a core deficit of autism. Potentially, the neuropeptide oxytocin is endowing key emotional brain regions such as the amygdala and hippocampus with the capacity to develop affiliation, by overcoming fear and stress of being deceived.

106.043 43 BEHAVIORAL and Neural ASSESSMENT of Implicit and Explicit SOCIAL Cognition In AUTISM. I. Dziobek*[1], G. Rosenblau[2], D. Kliemann[2], H. Kappelhoff[2] and H. R. Heekeren[2], (1)*Freie UniversitÃ¤t Berlin*, (2)*Freie Universität Berlin*

Background:

Understanding the mental states of others (social cognition) plays a key role in the adequate reaction to other people's behaviour. Standard social cognition tasks to date, however, often employ stimuli such as written stories or comics that are less vivid and rich than our real social environment. Although these tasks have proven sensitive in detecting social cognition difficulties in individuals with autism spectrum consitions (ASC), they do not allow generalization to real life social settings.

Objectives:

To develop two new movie-based behavioral tasks for the assessment of implicit and explicit social cognition and to adapt the more naturalistic task design to the fMRI environment.

Methods:

For the behavioural tasks we produced a new set of stimuli comprising film scenes (20-35s) displaying social interactions. In the implicit task, participants watch a social film scene and are then asked to select how the film will proceed out of four short film clips (4 s). In the explicit task, participants first watch a film scene and are then asked to pick one out of four text options that correctly describes the mental state of one protagonist. We adapted the explicit task for fMRI.

Results:

Preliminary reliability analysis of the behavioural tasks (N(ASD) = 9, N(NT) = 9) yielded for the implicit task a mean item difficulty of .69 (SD = .16) and a satisfactory reliability of .73 (Cronbach's alpha). In the explicit task the mean item difficulty was .65 (SD = .14) and reliability was .77 (Cronbach's alpha). Although there were no significant performance differences between ASD and NT in both tasks, which is likely due to small sample size, individuals with ASD showed trendwise significantly increased reaction times for the implicit task (ASD: 40.7s (SD = 11.04); NT: 32.0s (SD = 3.2); p = .055).

Preliminary fMRI analysis showed that the naturalistic task design robustly activated the mentalizing network in NT (e.g. bilateral superior temporal sulcus (STS), temporal parietal junction (TPJ), temporal poles), where this network

furthermore correlated with performance in the social cognition task in both groups. We found significant group differences (NT > ASD) within these mentalizing regions. Finally, the naturalistic social cognition scanner task activated the mentalizing network more robustly than a comparable pictorial social cognition paradigm.

Conclusions:

The newly developed naturalistic social cognition tasks are well suited for the assessment of social cognition on the behavioural and brain level.

106.044 44 Neuroendophenotype Discovery Using An fMRI Social Battery Task. A. Ahmed*, *Yale University*

Background: Copy number variants (CNVs) have been strongly associated with autism spectrum disorder (ASD), and pathway analysis has revealed that these genetic variations overlap genes coding for proteins involved in synaptic plasticity. However, the biological mechanisms by which these CNVs impact brain function at a systems level is unknown. Imaging genetics seeks correlations between genetic and neuroimaging data. Functional magnetic resonance imaging (fMRI) has identified neural correlates of key social cognitive deficits in ASD, specifically, activations differing from neurotypical individuals in posterior superior temporal sulcus (pSTS), amygdala, and fusiform gyrus. Finding genes that influence these brain-based phenotypes would thus help define functionally relevant disease mechanisms for ASD.

Objectives: Imaging genetics studies require carefully chosen stimuli to promote the discovery of meaningful genetic associations. To this end, we developed a social battery task that engages brain regions known to be involved with the social cognitive deficits underlying ASD. We empirically evaluated the components of the task that give rise to disorder-relevant brain phenotypes. We will also use metrics that characterize individual differences between subjects, as well as test-retest reliability. The goal of the present study was to evaluate the feasibility of our current paradigm and assess whether it produces usable and meaningful imaging data. Upon completion, the task can be used to correlate brain phenotypes with genetic variation.

Methods: To date, 11 school-aged children with ASD (n = 4, mean age = 11.18 years) and typically developing controls (n = 7, mean age = 9.18 years) have been recruited to the Yale Child Study Center. They were shown a 4’26’’ imaging paradigm containing two components: (1) a point-light display of biological motion and scrambled motion, and (2) a series of fearful faces and houses. These data were analyzed using regions-of-interest (ROIs) created with an activation likelihood estimation meta-analysis. The data extracted from these ROIs were then subjected to an event-related averaging analysis. Our initial analysis focused on identifying trends that replicate previously reported findings.

Results: We report event-related activations in the right pSTS and fusiform gyrus in response to biological motion and fearful faces, respectively. Typically developing controls show increased activation to biological motion compared to probands, with peak signal changes of +0.46% in controls and +0.24% in probands during the stimulus period. Control subjects show right hemisphere lateralization in the fusiform gyrus to fearful faces, while probands do not. Both probands and typical individuals show minimal activation to fearful faces in the amygdala.

Conclusions: Our initial study demonstrates the feasibility of a brief imaging battery to produce significant event-related activations in a population of typically developing children and children with ASD. The waveforms produced are consistent with known response properties of target brain regions to these stimuli. Ongoing collection of data will allow us to continue developing these stimuli by assessing multiple versions of these stimuli in typical adults. We will analyze activations at two time-points using test-retest reliability, and draw correlations with individual differences as measured by the autism quotient and the social responsiveness scale.

106.045 45 Autobiographical and Social Memory Narratives in Autism: Delineating the Role of the Hippocampus and Amygdala. R. S. Brezis*, *University of Chicago*

Background: Previous studies of memory in autism have consistently shown reduced memory for self and others, relative to a preserved memory for semantic facts (Boucher and Bowler, 2008). However, it is unclear whether such abnormal patterns of memory can be traced to structural

differences in the hippocampus or the amygdala (Salmond et al., 2005). Further, while most studies of memory in autism have employed simple measures of memory for words (Lombardo et al., 2007); fewer have examined autistic subjects' memory narratives. The current study aims to provide a more ecologically-valid view of memory in autism, in conjunction with anatomical analysis of subjects' hippocampi and amygdalae.

Objectives: (1) To determine whether children and adolescents with ASD provide narrative memories of themselves and others that contain fewer references to humans, mental acts, causality and evaluation than control subjects. (2) To determine whether autistic subjects' shallower memories can be traced to structural abnormalities in the relative size of their hippocampus and amygdala.

Methods: Participants included 34 8-18 year-old subjects with ASD and 35 age, sex and IQ-matched controls. Autism diagnoses were confirmed using ADOS (Lord et al., 1999) and ADI-R assessments (Lord et al., 2003), and all subjects completed the Social Responsivity Scale (SRS) (Constantino, 2000) and Social Communication Questionnaire (SCQ) (Berument et al., 1999). Subjects completed a narrative recall task (based on Crane and Goddard, 2008) comparing memory for self, mother and favorite fictional character. Narratives were coded for number of references to: human, non-humans, objects, physical acts, mental acts, causality, evaluation, time and place. A subset of 20 ASD subjects and 19 TD controls were scanned using Magnetic Resonance Imaging, and hippocampi and amygdalae region of interest volumes were measured using voxel-based morphometry.

Results: When telling narratives about themselves, children and adolescents with autism made significantly less references to humans (p=.007), objects (p=.003), physical actions (p=.001), mental acts (p=.019), locations (p=.007), time markers (p=.008) and evaluations (p=.001) per prompt than controls. In contrast, they made no less references to non-human animate beings (fictional characters and animals), than controls (.964). Both hippocampus (p=.041) and amygdala (p=.023) were significantly reduced in ASD subjects relative to controls, and neither the amygdala nor the hippocampus volumes correlated with age. Amygdala volumes correlated significantly with the number of subjects' references to humans (r=.451, p=.026), mental acts (r=.362, p=.009), and evaluations (r=.289, p=.036).

Conclusions: Results suggest that abnormal memory patterns in autism are associated with reduced amygdala volumes, rather than hippocampal volumes. Further analyses are underway to relate the qualities of subjects' memories to the gray and white matter with their hippocampi and amygdalae.

106.046 46 Early Neural Network Activation During Emotional Face Processing in Adolescents with Autism. R. Leung*[1], H. Qureshi[2], E. W. Pang[1], M. L. Smith[1] and M. J. Taylor[2], (1)*University of Toronto*, (2)*Hospital for Sick Children*

Background: Recognizing and allocating appropriate attention to emotional faces is integral to children's ability to acquire social skills. In autism spectrum disorders (ASD), impaired social skills and interactions are one of the diagnostic indices of the disorder. In children and adolescents with ASD, neuroimaging studies have suggested that deficits in emotional processing reflect abnormalities in underlying neural networks, particularly the amygdalae (Baron-Cohen et al., 2000). ERP findings of delayed and smaller neural responses to emotional faces in children with ASD highlight the importance of utilizing neuroimaging techniques with high temporal resolution, such as MEG, to investigate the temporal and spatial properties of the neural network underlying emotional processing in ASD (Batty et al., 2011).

Objectives: To assess neural network activation during emotional face processing in adolescents with ASD through the use of magnetoencephalography (MEG). We hypothesized that adolescents with ASD would show distinct emotional processing patterns, relative to controls, and atypical activation of specific brain regions, including the amygdalae and anterior cingulate cortex.

Methods: Six adolescents with ASD (6M, M=14.16+1.28 years) and 9 typically developing controls (6M, M=14.28+1.09 years) performed an attentional paradigm (Hung et al., 2010) involving implicit emotional face processing with a neutral, happy or angry face presented concurrently with scrambled

patterns, while in a MEG scanner. Participants responded as quickly as possible to the scrambled pattern. Event-related beamforming (ERB) analyses on the happy-neutral and angry-neutral comparisons were used to localize task-dependent brain activation. MEG data were co-registered to the participant's anatomical T1-weighted MRI scan.

Results: ERB analyses show early (time window of 80-120ms) bilateral middle frontal activation as well as left amygdala activation in adolescents with ASD in response to happy faces. In contrast, left anterior cingulate cortex and right middle frontal activation to happy faces were found in controls. In response to angry faces, adolescents with ASDs showed early left middle frontal and right inferior frontal activation while controls showed left medial frontal and right amygdala activation. Adolescents with ASD did not differ significantly from controls in response latency for either emotion.

Conclusions: Our preliminary results indicate differences in early neural network activation in adolescents with ASD compared to controls. Of particular interest are our findings of left amygdala activation in response to happy faces in adolescents with ASD, which are not only distinct from that found in controls, but resembles activation found in younger children, suggesting the involvement of an immature neural network (Hung et al, under review). Data collection is ongoing and will allow us to further elucidate the neural mechanisms underlying emotional processing in ASD.

106.047 47 Neural Correlates of Gender Differences in Patients with High-Functioning Autism Spectrum Disorder During Empathy. K. Schneider*[1], C. Regenbogen[1], K. D. Pauly[1], A. Gossen[1], D. Schneider[2], L. Mevissen[2], T. M. Michel[2], R. Gur[3], U. Habel[1] and F. Schneider[3], (1)*JARA Translational Brain Medicine*, (2)*RWTH Aachen University*, (3)*Perelman School of Medicine and the Philadelphia Veterans Administration Medical Center*

Background:

Supported by the "extreme male brain theory" (Baron-Cohen 1999), and influenced by prior investigations on the prevalence of autism spectrum disorder (ASD) proposing a male:female ratio of 6-8:1 (Fombonne 2005), ASD is still commonly seen as a male disorder. However, recent studies as well as clinical experience (Attwood 2008) suggest a clearly decreased male:female-ratio of 4:1 (Bartley 2006) also in high functioning patients with ASD.

Also, behavioral studies described different behavioral patterns of males and females with ASD, and particularly assigned a better social conduct to female patients. Nonetheless, to the authors' knowledge the number of behavioral studies on "female autism" is still small, and so far, there are no studies using functional magnetic resonance imaging (fMRI) which try to address this topic.

Objectives:

As a better social adaptiveness in females with ASD compared to autistic males was previously suggested, in our study we tried to clarify whether patients with high-functioning ASD reveal gender-specific characteristics on a behavioral and/or neural level during participating in an empathy task. Elucidating gender-specific characteristics of ASD might have important implications for education and treatment of autistic individuals.

Methods:

28 patients with high-functioning ASD and 28 healthy subjects, matched for gender, age, and education, took part in an event-related fMRI study.

Participants were confronted with either emotional (E) or neutral (N) video stimuli. Each video was followed by two seven-point rating scales, one asking for the intensity of participants' own emotions during the video ("SELF"-rating), and the second addressing the intensity of the emotion of the actor in the video ("OTHER"-rating).

Results:

Behaviorally, we neither found gender differences for the group of autistic patients nor for the healthy subjects. However, comparing the overall groups on the "SELF"- and the "OTHER"-rating revealed significantly less target-matching answers in the patient group. Moreover, patients rated the neutral videos (N) significantly more emotional.

Analysis of brain activation for the E>N contrast yielded activation of a network of superior frontal, superior temporal, and inferior frontal regions, accompanied by activation of the thalamus in case of healthy control subjects. In contrast to that, ASD patients revealed activation solely of superior frontal and superior temporal regions.

While there were no significant gender effects on brain activation for the healthy control group, we found increased activation in males with ASD compared to autistic females in the medial frontal cortex bilaterally, and in the precuneus.

Comparing both groups separated for gender yielded reduced activation in autistic females compared to their healthy control group in the amygdala, and in midbrain regions, in the periaqueductal gray in particular, while male patients compared to their healthy control group exhibited reduced activation of the bilateral middle frontal gyrus.

Conclusions:

Our data propose different ways of processing social information in males and females with ASD suggesting specific alterations on the level of "social motivation" in female patients, while male patients seem to exhibit stronger deficits in integrating multisensory information.

These findings might indicate gender-specific "endophenotypes" in ASD with potential implications for treatment.

106.048 48 Social Responsiveness Correlates with Neural Response to Affective Touch: An fNIRS Study. L. C. Anderson*, R. H. Bennett, D. Z. Bolling, K. A. Pelphrey and M. D. Kaiser, *Yale University*

Background: Functional magnetic resonance imaging (fMRI) studies from our lab have recently implicated the superior temporal sulcus (STS) and additional 'social brain' regions in processing slow, gentle touch targeting C-tactile (CT) afferents. These nerves are only present in the hairy skin and are hypothesized to support the role of the skin as a social organ because they respond especially well to stroking velocities characteristic of social, or affective, touch. Functional near-infrared spectroscopy (fNIRS) and fMRI studies indicate that the STS response to visual social stimuli (such as faces and biological motion) varies as a function of observers' autistic traits. Using fMRI, we recently discovered a similar relationship between STS response to CT-targeted touch and individuals' autistic traits. Autistic traits have been shown to vary in the general population; more autistic traits reflect less social responsiveness, as measured by the Social Responsiveness Scale (SRS).

Objectives: Using fNIRS, we sought to examine whether STS response to CT-targeted affective touch varies as a function of social responsiveness.

Methods: To date, 14 typical adults participated in this study. We monitored regional cerebral blood volume changes using a 52-channel NIRS apparatus over the prefrontal cortex and STS to measure brain activity while participants received continuous brushing to the arm and palm in a block design procedure. Brushing was administered by a trained experimenter using a soft watercolor paintbrush. Participants also completed the SRS.

Results: To implement a region of interest analysis, we coregistered participants' NIRS optode placement to their own structural MRI image to identify the four optodes measuring activity in the right STS. Preliminary results indicate that, as predicted, activation in the STS was greater during arm touch (CT-targeted) trials compared to palm touch (non-CT) trials during the 6-12 second post-stimulus onset period ($p < .01$). We identified a trend towards a negative correlation between SRS scores and each participant's average difference in STS activation between arm touch and palm touch ($p = .065$) and peak difference in STS activation between the two types of touch ($p = .116$) within the 6-12 second post-stimulus onset period.

Conclusions: Preliminary results from the current fNIRS study are consistent with our fMRI findings of STS involvement in processing CT-targeted touch. Importantly, we identified a negative correlation between participants' social responsiveness and their STS response to CT-targeted affective touch. Individuals with less social responsiveness exhibited a diminished STS response to social touch to the arm relative to the palm. This is the first fNIRS study to examine the neural response to social touch and lays the

foundation for follow-up studies with individuals with and without autism.

106.049 49 Social Responsiveness Scale Predicts Activity in Limbic Regions for An Emotion Recognition Task. W. K. Lloyd[1], J. H. G. Williams*[1], G. D. Waiter[1], J. S. Lobmaier[2] and D. I. Perrett[3], (1)*University of Aberdeen*, (2)*Universität Bern*, (3)*University of St Andrews*

Background: The Social Responsiveness Scale (SRS) is a questionnaire that correlates strongly with diagnoses of autism and is thought to reflect stable behavioural traits that are normally distributed within typical human populations. It therefore seems likely that neurobiological differences that contribute to the variability of SRS score will inform us about the neurobiology of autism spectrum disorder. This could stem from sensitivity to emotional stimuli or capacity to direct attention towards emotional stimuli.

Objectives: To investigate its neurobiological significance and relationship to emotional stimuli, SRS was used as a correlate in the analysis of an fMRI task of emotion recognition for a typically developing cohort of children and adolescents.

Methods: 33 subjects (23 female, 10 male), right-handed, aged 9.8-16.4 (mean age = 13.8, std. dev. 2.1) were considered in the analysis. Imaging (MRI) was performed using a 3T scanner. The functional protocol consisted of faces displaying an emotional expression that was either happy or fearful, subtle or obvious, and directed at or away from the observer. Conditions were presented in blocks for the tasks of identifying either the emotional state, or the sex of the presented face. Each face was positioned in the centre of the display, accompanied by a visual display of the words 'Happy' and 'Fearful' or 'Male' 'Female', in the bottom left and right corners. The participant was asked to choose the relevant word and respond via a push-button system activated by the left or right index finger. MRI data were processed and analysed using SPM8 (http://www.fil.ion.ucl.ac.uk/spm/). A whole brain voxel-based single group analysis was performed to produce activation contrasts for task dimensions of attention, emotional valence, emotional arousal and face direction. SRS data was applied to the model as a linear regressor to search for correlations between the metric and contrasts of interest. Statistical significance was considered at thresholded $p < 0.001$, FWE-corrected $p < 0.05$ at cluster level.

Results: The amount of activity in limbic and paralimbic areas in response to fearful expression relative to happy expression correlated robustly with score on the Social Responsiveness Scale (clusters included right medial temporal lobe: 701 voxels, $z=4.80$; right lateral orbitofrontal cortex: 1202 voxels, $z=4.77$ and anterior cingulate 2220 voxels, $z=4.73$). SRS score did not correlate with any differences relating to attention or gaze direction.

Conclusions: Higher SRS score was not determined by absolute sensitivity to emotional expression but a higher reactivity to fearful relative to happy emotional expression. Our findings suggest that variability on the autism construct among typical adolescents could be determined by degree of reactivity to expression of negative emotions relative to reactivity to expression of positive emotions.

106.050 50 Reduced Inferior Frontal Cortex Response to Explicit Emotion Judgment in Autism. M. S. Moore*[1], B. Wicker[2] and R. K. Kana[3], (1)*The University of Alabama*, (2)*Aix-Marseille University*, (3)*University of Alabama at Birmingham*

Background: The ability to accurately identify others' emotions is a critical skill for successful social interaction. Many individuals with autism spectrum disorders (ASD) struggle with everyday social interactions, largely due to difficulty reading others' emotions from faces (Harms et al., 2010) and from their body postures (Hadjikhani et al., 2009). Watching an agent in action can trigger emotional contagion which may be mediated by the inferior frontal cortex (IFC). Inferring emotions from actions and from their contexts (explicit vs. implicit) has been relatively under-examined in ASD. This study used dynamic action scenarios to examine the neural mechanisms, especially the role of the IFC, in mediating this process in ASD.

Objectives: The primary objective of this functional MRI study was to investigate the nature of brain responses associated with explicit and implicit perception of emotional information in high-functioning adults with ASD.

Methods: fMRI data were collected from 5 high-functioning adults with ASD and 5 typically developing control participants (data collection still in progress). Participants watched a series of short videos (9 seconds each) of characters involved in emotional action scenarios. Participants were told to judge the emotion expressed by the character (happy, sad, angry, or afraid) or identify an object in each video. In the control condition, participants watched neutral videos of characters and made a perceptual judgment. The stimuli were presented in an event-related design, and the data were acquired using a Siemens 3T Allegra scanner. Data analysis was performed with SPM8 (Statistical Parametric Mapping) software.

Results: Preliminary results of this study are: 1) Behavioral data showed that both groups performed significantly above chance on all video types ($p < .05$), and there were no significant group differences in accuracy. However, the ASD group had slower reaction times than the control participants for emotion and object videos; 2) There was robust bilateral extrastriate body area (EBA) activation (x = -46, y = -68, z = 0; x = 46, y = -66, z = 0) in both ASD and typical control participants for both emotion and object tasks, especially for the emotion task; and 3) There was a significantly decreased response in the right inferior frontal cortex (IFC) in the ASD participants, relative to typical controls, while judging emotions from the characters in the videos ($p < .005$, uncorrected; *cluster threshold* = 100 voxels).

Conclusions: Robust EBA activation seen in both groups across conditions suggests intact general perceptual brain responses to explicit and implicit emotional action observation in ASD. However, the IFC response exclusive to explicit emotion judgment in the typical group was absent in the ASD group. This points to a potential difference in the cognitive strategy between both groups: while explicit emotional information recruits high level frontal areas in typical individuals, this same information, although adequately perceived, may not be processed at this level by those with ASD.

106.051 51 Cerebellar Activation Differentiates Children with Autism and Siblings in a Static Face-Processing Task.

R. I. Pillai*[1], J. Tirrell[1], E. S. MacDonnell[2], H. Seib[2], K. A. Pelphrey[2] and B. C. Vander Wyk[2], (1)*Child Study Center, Yale University*, (2)*Yale University*

Background:

While face-processing deficits are known throughout Autism research, the exact mechanism is unknown. Prominent theories include problems in attentional modulation, global spatial processing, and errors in neural machinery. Knowledge of what the exact cause is may be essential to finding an effective intervention method.

Objectives:

Our objective was to examine what areas of the brain showed specific activation for various categories of visual stimuli between typically developing adults, children with Autism Spectrum Disorder, and unaffected siblings.

Methods:

Adults (n = 23), children with Autism (n = 22), and unaffected siblings (n = 27) were presented black-and-white visual stimuli containing either faces, houses, vehicles, letters, or numbers in a passive-viewing task. Regions of interests were established from adult data using a GLM and by using a conjunction analysis (e.g. face> house^object^letter^number), then extracting beta values. Average beta values were then compared between children with Autism and siblings using pairwise t-tests. In a novel analysis method, the inner product between vectorized representations beta weights for face, house, and object stimuli were computed between children with Autism and unaffected siblings relative to a canonical 'adult' vector, yielding a singular measure of multivariate similarity. A one-way ANOVA was then run on these data, and correlations with respect to age and IQ were calculated.

Results:

Of the face-selective regions found in the conjunction analysis, only one area—the left inferior semilunar lobule of the cerebellum—showed a significant difference in activation between children with Autism and unaffected siblings. The vector analysis yielded a similar result—of all the areas, only this cerebellar region showed a significant difference in

similarity: siblings were significantly more similar to adults than children with Autism. The ANOVA on this region showed a group by condition interaction as well. Across all house-selective regions, no single area showed significance in the vector analysis, but when combined, children with Autism showed significantly more similarity than did siblings, suggesting a preserved house-network in Autistic children. Finally, there was a significant negative correlation between IQ and similarity to adults in unaffected siblings.

Conclusions:

It is clear that the cerebellum requires more attention as a social mechanism. Its functional connectivity to the thalamus and striatum (which were also implicated as face-regions), as well as other work linking the cerebellum with attention, leads us to believe that the left inferior semilunar lobule may be an area for social attention. To further test this hypothesis, we are building a study examining 2-dimensional versus (simplistic) versus 3-dimensional (complex) facial stimuli, using the fusiform face area, amygdala, and inferior semilunar lobule as seed regions. Our goal in this is to further differentiate cerebellar function and to target a possible method of intervention using cartoon stimuli.

106.052 52 Spared Brain Function During Mentalizing and Self-Representation in Females with Autism Spectrum Conditions. M. V. Lombardo*[1], M. C. Lai[1], B. Chakrabarti[2], A. N. Ruigrok[3], E. T. Bullmore[4], J. Suckling[4], M. R. C. AIMS Consortium[5] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*University of Reading*, (3)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (4)*Brain Mapping Unit, University of Cambridge*, (5)*University of Cambridge, King's College London, University of Oxford*

Background:

Females with autism spectrum conditions (ASC) remain an important yet understudied population. Recent work suggests that females may be a sub-group within autism and possess different underlying mechanisms from their male counterparts (Schwarz et al., 2010, Mol Psychiatry). If females represent a sub-group within autism, it will be important to identify where females diverge from males at various levels of analysis and what mechanisms may be responsible for such sex-specific patterns. Finally, work on females will also have methodological impact in informing the extent to which heterogeneity is introduced by including mixed samples of males and females.

Objectives:

Here we investigate whether males and females with ASC show different patterns of response at the neural systems level. Our past work has shown marked hypoactivation of ventromedial prefrontal cortex (vMPFC) and right temporo-parietal junction (RTPJ) for self-representation and mentalizing respectively, in males with ASC (Lombardo et al., 2010, Brain; Lombardo et al., 2011, Neuroimage). In this study, we aimed to assess whether similar or different patterns are seen in matched samples of females with and without ASC.

Methods:

Twenty-nine males adults with ASC and 29 age- and IQ-matched females with ASC (all ADI-R confirmed) were compared to IQ- and age-matched typically-developing Controls (males n = 33; females n = 29). All participants were scanned with fMRI at 3T while making mentalizing or physical judgments about themselves or a familiar but non-close other (the British Queen). Regions of interest (ROI) were defined independently via a quantitative meta-analysis of mentalizing studies (Lombardo et al., 2011, Neuroimage) and included regions well-established for their role in mentalizing and self-representation; vMPFC, RTPJ, left temporo-parietal junction (LTPJ), posterior cingulate/precuneus (PCC), and dorsomedial prefrontal cortex (dMPFC). Main-effects (Mentalizing>Physical; Self>Other) and interaction contrasts were computed for each individual and were each input into a 2x2 factorial ANOVA (sex and diagnosis as factors) for each ROI.

Results:

Replicating past work in males (Lombardo et al., 2010, Brain; Lombardo et al., 2011, Neuroimage), PCC, LTPJ, and dMPFC showed no main-effect of diagnosis across any contrast as well as no main-effect of sex or a sex*diagnosis interaction.

However, vMPFC and RTPJ showed a significant sex*diagnosis interaction. In both vMPFC and RTPJ, the hypoactivation present in males with ASC was not apparent in females with ASC. Females with ASC showed a trend for an opposite pattern of increased activation compared to female Controls.

Conclusions:

Females with ASC show spared function of vMPFC and RTPJ during high-level self-referential and mentalizing processes. These observations are congruent with prior work (Lai et al., 2011, PLoS One) that this sample of high-functioning females adults with ASC presented less severe current symptoms on the ADOS, yet self-reported more autistic traits. This work suggests potential implications for females as a sub-group. Stratification of samples by sex in future studies will be important in reducing heterogeneity and may aid in detecting sex-specific biological and cognitive mechanisms at work in autism (Schwarz et al., 2010, Mol Psychiatry; Lai et al., 2011, PLoS One).

106.053 53 Optimal Face Network Localization in Autism: A Comparison of Two Methodologies. A. Browne*[1], V. Troiani[1] and R. T. Schultz[2], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background:

The vast majority of studies looking at category-specific processing identify regions of interest (ROIs) based on univariate localizer contrasts. Information regarding optimal localizer choice for a particular purpose (such as connectivity or multi-voxel pattern analysis) or population of interest (such as autism) is necessary for efficient data acquisition and optimal analysis implementation. Because hypoactivation in the face processing network has been independently replicated in autism, localization of these regions can be problematic. We compare two extremely different localizers that differ in a variety of ways and evaluate their capacity to activate regions in the face-processing network of subjects with an autism spectrum disorder (ASD).

Objectives:

To determine and compare the effectiveness of two localizing methodologies for regions involved in face processing in an ASD population.

Methods:

Whole brain fMRI images were collected from 10 male ASD participants (mean age: 14; mean IQ: 104) while they performed two tasks. The first task consisted of rapidly presented faces, places, objects, and scrambled objects. Face images consisted of uncropped, colorful, visually distinct, attractive faces of a variety of ages and ethnicities while places were colorful, visually distinct, scenes from unidentifiable locations. Images were not controlled on any low-level visual dimensions and were presented in 14-second blocks with 18 images per category per block. Participants performed an orthogonal task, which was to respond to a white fixation cross that appeared in the center of an image. In the second task, participants performed identity-matching judgments on simultaneously presented face or house image pairs. Images were well-controlled, black-and-white pictures of cropped faces and houses, presented at a rate of 10 images per 20-second block. Random effects analysis of activation differences between tasks was performed on whole-brain images. In order to additionally investigate differences between these two methodologies, we quantified a series of metrics on regions of the face-processing network (including fusiform face area (FFA), occipital face area (OFA), superior temporal sulcus (STS), and amygdala). We present data on both whole-brain and region of interest analyses including peak activation, mean activation, voxel extent, and voxel overlap between participants on each localizer task.

Results:

Whole brain analyses on the rapid presentation localizer revealed significant activation in ventral visual cortex ($p<.05$ FWE corrected). Results of the discrimination localizer did not reach whole brain significance. However, both tasks were successful in region of interest analyses using individually defined clusters of activation.

Conclusions:

Our findings suggest that a rapid-presentation, less visually controlled (colorful images of varying perspectives) paradigm with an orthogonal task is effective for localizing visual cortical

nodes of the face processing network. Significance at the whole brain level in the rapid presentation localizer suggests this may activate regions of ventral visual cortex that are more likely to overlap across individuals. This may be due to the increased number of images presented in this task or the engaging nature of the stimuli used. Our results are informative for making localizer choice decisions, particularly in regard to advanced analyses such as connectivity and multi-voxel pattern analysis.

106.054 54 Self Representation and Frontal Brain Structure in Children with ASD. N. H. Kim, D. P. Carmody* and M. Lewis, *Robert Wood Johnson Medical School - UMDNJ*

Background: Children with Autism Spectrum Disorder (ASD) have delayed development of self-representation. While typically developing children achieve self representation by age 2, children with ASD achieve self representation at later ages. The development of self representation is associated with structural changes in white matter in frontal brain regions. Children with ASD have increased frontal white matter relative to typically developing children. The deficits in self representation in ASD may be associated with alterations in frontal white matter volumes.

Objectives: We tested the hypothesis that increased white matter in frontal brain regions would be associated with deficits in self representation in children with ASD.

Methods: High resolution T1 images were obtained on 10 children with ASD (mean age 4.5 years) using a 1.5 T GE Signa System. Voxel-based morphometry (VBM) was performed using statistical parametric mapping software (SPM8). Preprocessing of images included spatial normalization, segmentation of white matter (WM) and gray matter (GM), modulation to adjust for volume changes during normalization, and smoothing. Region of interest (ROI) analyses were performed by applying brain masks (Wake Forrest University Atlas) to the whole frontal lobe, as well as to regions defined by Brodmann Areas (BA). Ratios of partial frontal volumes to the whole frontal lobe volume were obtained. Within two weeks of the MRI scanning, self representation was assessed by obtaining scaled scores for the behaviors of mirror recognition, use of personal pronouns, and pretend play involving another person. These three behaviors were combined into a scaled self representation score (SRS). Severity of the signs of ASD were obtained by the Autism Diagnostic Observation Schedule (ADOS-G).

Results: The associations between self representation and brain volume were assessed by R^2 (Pearson correlation squared). Strong associations were found between SRS and WM volume in both left and right whole brain ($R^2 > .4$) in that greater volumes were associated with lower self representation scores. ROI analyses showed that the associations were located in left BA 10 and 11 ($R^2 > .5$), as well as both left and right BA 4 and 6 ($R^2 > .4$). Strong associations between ADOS-G total score and WM volume were found in left and right whole brain ($R^2 > .4$), with regional associations in BA 8 and 9 ($R^2_{left} > .6$, $R^2_{right} > .4$), and in BA 4 and 6 ($R^2_{left} > .6$, $R^2_{right} > .35$). Strong associations were found between ADOS-G and GM volume in left and right whole frontal lobe ($R^2 > .45$), with regional associations in BA 10 and 11 ($R^2_{left} > .5$, $R^2_{right} > .6$), as well as left and right BA 8 and 9 ($R^2 > .6$). In both GM and WM analyses, greater volumes were associated with higher ADOS-G scores.

Conclusions: Regional increases in white matter in frontal brain area are associated with deficits in self representation in children with ASD as well as with increased behavioral signs of ASD. The delays in self representation are implicated in the delays in social development.

106.055 55 Self-Related Representation in Individuals with High-Functioning Autism. H. Komeda*[1], H. Kosaka[2], D. N. Saito[2], Y. Mano[3], T. Fujii[2], H. Yanaka[2], T. Munesue[4] and H. Okazawa[5], (1)*Carnegie Mellon University*, (2)*University of Fukui*, (3)*Northwestern University*, (4)*Kanazawa University*, (5)*Biomedical Imaging Research Center*

Background: Autism spectrum disorder is a developmental disorder which is characterized by the lack of social interaction with others, including natural communication and eye contact (DSM-IV-TR, American Psychiatric Association, 2000). Individuals with autism lack self-awareness (Lombardo et al., 2009; Toichi et al., 2002) and have difficulty empathizing with others (Baron-Cohen, 1995; Lombardo et al., 2007). Although these deficits were observed by previous studies, most of the target stimuli were constructed for neurotypical

individuals. It is still unclear how individuals with autism understand other people with autism.

Objectives: We investigated whether individuals with autism show self-awareness and empathize with protagonists of sentences who have autistic traits using fMRI. We hypothesized that ventromedial prefrontal cortex (vmPFC), known to be sensitive to self-relevant information processing (Lombardo et al., 2009), should be activated when judging someone similar to themselves.

Methods: 15 (2 females) high-functioning individuals with autism spectrum disorder and 15 (2 females) neurotypical control participants participated in the experiment. Age and IQs were matched between the groups. During the fMRI scan, participants read sentences and made judgments about them by using 2 buttons (Yes or No). Each sentence described the protagonist's behavior as autistic or non-autistic. For Self judgments with an autistic protagonist, they read a sentence (e.g., I would rather be alone than with others) and made a judgment (Do you agree with the sentence?). For Other judgments with a non-autistic protagonist, they read a sentence (e.g., Yuya would rather be with others than alone) and made a judgment (Do you think you are similar to him?). Gender was matched between the participant and the protagonist.

Results: In the behavioral results, the interaction between group and protagonist was significant ($F (1, 28) = 27.20$, $p < .05$, $MSe = 6.28$, $Prep = .99$, $\eta p2 = .49$). Post hoc analysis showed that while the autism group rated Yes responses for autistic protagonists more than the control group ($F (1, 28) = 16.26$, $p < .05$, $MSe = 4.55$, $Prep = .99$, $\eta p2 = .37$), the control group rated Yes responses for non-autistic protagonists more than the autistic participants ($F (1, 28) = 35.52$, $p < .05$, $MSe = 2.75$, $Prep = .99$, $\eta p2 = .56$). Thus, both groups found matched protagonists similar to themselves. In the fMRI study, during Self and Other judgments, vmPFC was activated in both groups: when the autistic group judged protagonists with autistic behavior, and the control group judged protagonists without autistic behavior. Moreover, in the Other judgment, precuneus was activated when the autistic group judged protagonists with autistic behavior and the control group judged protagonists without autistic behavior.

Conclusions: These findings suggest that individuals with autism spectrum disorder show self-awareness toward other individuals similar to themselves as well as neurotypical individuals do. Individuals with autism are likely to empathize with other people with autism. As these findings explain the characteristics of individuals with autism, they may also contribute to improving special needs education, educational intervention, and developmental support for individuals with autism.

106.056 56 Neural Connectivity in Young Adults with ASD: A Comparison of Brain Function During Theory of Mind and Resting State. J. Ren*, A. Smith-Collins, J. Clayden, C. Clark and D. H. Skuse, *Institute of Child Health, University College London*

Background: The measurement of 'resting state' during fMRI has led to the identification of a 'default mode network' (DMN) of brain regions, which are active at rest but which consistently show relative deactivations during cognitively demanding tasks. Decreased functional connectivity in this network is found in ASD, compared to neurotypical controls. The DMN overlaps with brain areas activated by theory of mind tasks. No previous study has attempted to study how functional connectivity in adults with ASD differs from typical controls by contrasting potential mechanisms during both resting state and a theory of mind paradigm.

Objectives: Our first objective was to contrast neural activity in the DMN during rest in high functioning autistic and control subjects with activation during a complex task demanding high -order theory of mind abilities. Our second objective was to examine the functional connectivity of the DMN in a number of different ways, in order to identify whether evidence for decreased functional 'connectivity' of the DMN in ASD is driven by neuronal fluctuations that are unrelated to task effects.

Methods: We recruited 25 adults with high-functioning autism and 25 IQ matched controls. Clinical group was defined by consensual diagnosis according to DSM-IV-TR criteria, and ADOS examination. None was medicated. Mean FSIQ of the control group was 123 (SD 21) and for the ASD group 132(SD 18). Subjects had their neural activity measured using BOLD contrast, both at rest and during a theory of mind task, by

acquiring T2*-weighted echoplanar images on a 1.5T Siemens Avanto MR scanner. Resting state activity was measured whilst subjects lay still with their eyes looking at a fixed point. Theory of mind processing was measured by requiring subjects to make judgements on a variant of the 'Mind in the Eyes' task (Baron-Cohen et al 2001). fMRI and connectivity data were analysed using SPM 8 (MatLab); resting state activity utilised REST state package (YF Zang) and the DTI data utilised FSL software.

Results: During the resting state, activity within the DMN was greater in controls in the posterior cingulate cortex, angular and supramarginal gyrus of the parietal lobe, relative to the ASD group. During the theory of mind task, the ASD group had relatively lower activity in the inferior frontal cortex (IFG), insular, anterior cingulate cortex (ACC), ventral medial prefrontal cortex (VMPFC), bilateral superior temporal gyrus (STG), temporal pole (TP), and precuneus.

Conclusions: Neural activity in the DMN and other social brain regions during rest is lower in ASD than controls. There is reduced activity in the same areas during a theory of mind task, based on reading 'The Mind in the Eyes'. Measures of functional and structural connectivity are currently being analysed. Fluctuations in task related signals will be contrasted with spontaneous fluctuations at rest, in order to address the question, is any difference in 'connectivity' between key brain regions of the DMN driven by task, or are there residual differences in spontaneous neuronal activity in ASD?

106.057 57 Autistic Traits Associated with Diminished Response to Affective Touch. A. C. Voos*, K. A. Pelphrey and M. D. Kaiser, *Yale University*

Background:

Touch enables us to navigate not only the physical, but also the social world, and plays a vital role in early development and social interactions. Recently, neuroscientists have begun to study 'affective' or social touch which has been linked to a class of slow-conducting, unmyelinated nerves, CT afferents, present only in the hairy skin of mammals, including humans. Microneurography studies have shown that CT-optimal stroking speeds range from 1-10 cm/s and pleasantness ratings for this slow, gentle touch follow the same pattern. Such touch is reminiscent of that seen in social interactions, and several key nodes of the 'social brain' have recently been found to be involved in processing such touch. Sensory issues are often present in children with Autism Spectrum Disorder (ASD) and some of the social brain regions implicated in processing affective touch are known to be disrupted in ASD. Further, some of these regions, including the posterior superior temporal sulcus (pSTS), have been shown to exhibit a varied response to visual social stimuli as a function of the observer's autistic traits. Notably, autistic traits are present and normally distributed in the general population.

Objectives:

We sought to examine the relationship between individual differences in autistic traits and the neural response to CT-optimal, affective touch. In addition, we investigated the relationship between autistic traits and self-reported social touch preferences.

Methods:

During an fMRI scan, nineteen healthy adults received alternating blocks of slow (CT-optimal) and fast (non-optimal) brushing to the forearm. Participant also completed the Autism-Spectrum Quotient (AQ) and the Social Touch Questionnaire (STQ).

Results:

Relative to fast touch, the slow touch activated contralateral insula, pSTS, medial prefrontal cortex (mPFC), orbitofrontal cortex (OFC), and amygdala. Connectivity analyses revealed co-activation of the mPFC, insula and amygdala during slow touch. Participants' autistic traits negatively correlated with the response to slow touch in the OFC and pSTS. There was also a positive correlation between AQ and STQ scores, indicating that individuals with more autistic traits had less of a preference for social touch.

Conclusions:

The current study revealed that brain responses to affective touch vary as a function of individual's autistic traits, illustrating a tight coupling of social function and social perception, beyond the visual domain, in typical adults. Participants with more autistic traits showed a diminished response to slow, affective touch in social brain regions, raising the question of whether or not processing deficits of affective touch, processed by the CT-system, are evident in individuals with ASD.

106.058 58 Neural Representations of Personality Traits in Autism: An Investigation of Individual Differences. A. Mizuno*[1], D. L. Williams[2], T. A. Keller[1] and M. A. Just[1], (1)*Center for Cognitive Brain Imaging, Carnegie Mellon University*, (2)*Duquesne University*

Background: Autism is a spectrum disorder because of its pervasive symptoms expressed in a broad range of severity and functioning; however, neural underpinnings of symptomatic heterogeneity among individuals with autism have not been understood.

Objectives: This study aims to assess the underlying neural basis of personality traits among individuals with high-functioning autism in comparison with controls by employing the NEO Five-Factor Model (NEO-FFM; Costa & McCrae, 1992) in an fMRI study. An investigation of personality traits will allow us to address individual differences among adults with autism.

Methods: Participants are 15 adults with high-functioning autism and 17 control adults. In the fMRI scanner, participants made judgments about their own personality traits by characterizing levels of Neuroticism and Conscientiousness from the NEO.

Results: Behavioral responses revealed that individuals with autism reported higher-level Neuroticism and lower-level of Conscientiousness compared to individuals in the control group. During the judgments of Neuroticism, the participants with autism showed reduced activation in the medial prefrontal cortex and medial temporal regions, as well as increased activation in the middle cingulated cortex. During the judgments of Conscientiousness, the participants with autism showed increased activation in the dorsolateral prefrontal cortex.

Conclusions: Results suggested that idiosyncrasies of autism could be characterized in self-report and neural representations of personality traits. The neural regions in which individuals with autism exhibited atypical activations while judging their own personality traits of Neuroticism and Conscientiousness have been previously identified as having significant associations with the gray matter volume in healthy adults (De Young et al., 2010). Understanding the neural basis of inter-individual variability may promote customized interventions, which suit for individuals' unique needs and level of functioning.

106.059 59 Temperament and Sensitivity for Social and Non-Social Reward in Adolescents with Autism Spectrum Disorders. L. Poustka*, C. Bach, F. Nees, S. Steiner, D. Brandeis and T. Banaschewski, *Central Institute of Mental Health*

Background:

Individuals with ASD were found to manifest activation abnormalities in brain regions involved in reward processing such as amygdala, orbito-frontal cortex and anterior cingulate (Bachavalier & Loveland,2006). Moreover, reduced neural responses to social rewards in children with ASD were demonstrated in regions associated with reward processing (Scott- Van Zeeland et al., 2010). On the other hand, personality dimensions are thought to reflect constitutionally based individual differences in reactivity and self-regulation, which influence the ways in which individuals respond to environmental changes. Temperament dimensions like eg. reward dependence (RD) were found to be related to regions that are involved in processing primary rewards (Lebreton et la., 2009). Recent studies on temperament dimensions in ASD found RD to be significantly decreased in both children and adults with ASD (Poustka et al., 2011; Anckarsäter et al., 2006).

Objectives:

To address the question of the relationship of temperament dimensions and brain responses to different magnitudes of social and non -social reward in ASD.

Methods:

15 male adolescents with ASD and 15 typically developing controls, matched for age and IQ , participated in an fMRI study using two similar incentive delay tasks winning either money (monetary incentive delay task, MID) or social feedback (social incentive delay task, SID) . Both tasks consist of three conditions, 22 trials each. Potential gain depended on participants ability to hit a button in time whenever the cued target symbol appeared on the screen. Task difficulty was standardized to a hit rate of nearly 66% for all participants by adjusting target duration to individual reaction time. Temperament was assessed using Cloninger´s Junior Temperament and Character Inventory (JTCI

Results:

We hypothesize that our findings will have an impact on a better understanding of the relationship of personality dimension as well as motivational aspects in ASD. These aspects are crucial for problems with self- and socially motivated behaviour and social interaction observed in ASD.

Conclusions:

Results might illustrate the importance of considering individual variability in constructs like temperament, which influence both adaptive functioning in children with ASD as well as possible success of intervention strategies.

106.060 60 Correlates of Complex Imitation Fidelity to Patterns of BOLD Signal Generated During An fMRI Study of Simple Imitation. L. Braadbaart*, J. H. G. Williams and G. D. Waiter, *University of Aberdeen*

Background:

Imitation is a method wherein we learn actions by seeing others perform them, and consequently replicate these actions to make them our own. This social learning is likely to be a crucial aspect of our social cognitive development. Research shows that, although they can imitate, people with autism perform less well on certain tests of imitation. It is therefore important to identify the factors that determine between-subject variability in imitation fidelity. Whilst a significant amount of research has explored the broad neural substrate of imitation, little is known about the role of individual differences, and the brain areas that might predict whether people are good or poor at imitation.

Objectives:

To address the issue, our study sought to determine where variable patterns of BOLD signal, generated whilst performing a simple imitation task, predicted performance on a demanding imitation task conducted outside the scanner. The specific objectives were:

a) To obtain objective measures of performance from a complex imitation task

b) To obtain measures of BOLD correlates of neural activity on a goal-directed action imitation and observation task

c) To see the influence of between-subject variability in imitation fidelity on BOLD activation

Methods:

15 participants were recruited to perform fMRI and behavioural tasks. Inside the MRI-scanner, participants were instructed to imitate different grips on a handle, or to simply watch someone or a circle moving the handle. Outside the scanner, participants were given a touchscreen-laptop with stylus and instructed to first look at a video of a model drawing a shape using the same apparatus, and then to imitate that drawing, matching the model in speed, size and shape. There were 45 different drawings in total. The speeds and path lengths of these drawings were compared to those of the model, resulting in individual drawing speed and size measures of accuracy, precision and error in imitation fidelity. We then tested for correlations between these behavioural measures and BOLD signal during simple imitation.

Results:

Activity in the 'Imitate' BOLD-contrast correlated negatively with accuracy for path length in left postcentral parietal lobe and with speed in right ventromedial frontal gyrus and anterior parietal lobe. The gradient of change of participant's speed of action in relation to that of the model correlated negatively with Imitation-related activity in left medial frontal gyrus, bilateral insula and cerebellum, right intraparietal sulcus and thalamus. Error for speed correlated positively with Imitate in left posterior cingulate and intraparietal sulcus.

Conclusions:

Greater skill in performing a demanding imitation task outside the scanner was associated with less BOLD activity in brain areas thought to serve imitation during a simple imitation task. We suggest that this reflects better adaptation of these areas to the function of imitation. Additionally, different measures of imitation fidelity corresponded to different activation patterns, suggesting that various aspects of imitation rely differentially on a range of functions that may include action representation and feedback sensitivity.

106.061 61 Different Brain Responses to Different Actions: A New Paradigm to Study Action Comprehension in Autism. F. Riva*, K. A. Pelphrey, D. Z. Bolling and B. C. Vander Wyk, *Yale University*

Background:

The ability to comprehend actions, which is crucial to successful social interactions, is dysfunctional in Autism Spectrum Disorders (ASD). Investigating neural mechanisms underlying this ability is, therefore, of great importance. Previous studies exploring this topic have in some way neglected the social dimension of this ability, using non-social actions as stimuli (e.g. grasping) and passive observations as experimental tasks.

Objectives:

We aimed at investigating brain basis of action understanding in adults and children with and without autism developing a semi-naturalistic paradigm. Using functional magnetic resonance imaging (fMRI), we compared brain activations elicited by actions directed to the participants or requesting a response with actions not demanding a response or directed to another person.

Methods:

The current experiment consisted of a ball tossing game depicted in a series of interactive video clips. Two players performed two kinds of actions: gesturing for a ball (Bid action) or a simple up-and-down arm motion (Motion, control action). Players were turned either toward the subjects (Toward conditions) or to each other (Away conditions, control). In the -Toward conditions participants were instructed to throw the ball, pressing a button, to a player of their choice. The experiment used an event-related design with participants viewing 24 trials of each condition (Bid-toward, Motion-toward, Bid-away, and Motion-away).

Results:

Data from 8 TD (typically developing) adults contrasting Bid-toward to Motion-toward conditions revealed an activation of the right Superior Temporal Sulcus (STS), a brain region underlying action goal understanding. This difference was not evident between the -Away conditions. Furthermore, the interaction of the type of action with the direction of the players resulted in a significant activation of the right Precentral Gyrus (BA6) only between the -Toward conditions. This area belongs to the putative MNS (Mirror Neuron System) that is supposed to participate in action comprehension processes through a resonance automatic mechanism. These data suggest that being the target of a bidding action and not just a passive viewer prompted a deeper processing of action stimuli, enabling the brain to differentiate between distinct actions otherwise processed as the same.

Conclusions:

Having established this paradigm in TD adults, we are now running samples of children with and without autism. Previous studies investigating neural basis of action understanding have shown a diminished activation in STS and in the MNS in children with autism, suggesting these brain structures underpin their difficulties in action comprehension. Hence, we expect STS and Precentral Gyrus will be generally less activated in autistic than in TD children brain. However,

considering the results on TD adults, we expect this paradigm will provide more detailed data on the neural activations subserving action comprehension in children with ASD.

106.062 62 Understanding the "How" and "Why" of Actions in Autism Spectrum Disorders: The Role of Mirroring and Mentalizing Systems. L. Libero*[1], F. de Lange[2] and R. K. Kana[1], (1)*University of Alabama at Birmingham*, (2)*Radboud University Nijmegen*

Background: Human beings are often engaged in interpreting the means (*how*) and intent (*why*) of others' actions. It has been proposed that understanding the intention of others' actions is accomplished by means of an automatic motoric simulation (Gallese and Goldman, 1998), possibly mediated by mirror neuron system (MNS) activity in the ventral premotor cortex and inferior parietal lobule (Rizzolatti et al., 1998; Gallese et al., 2004). In contrast to this, others argue that mentalizing recruits regions outside the motor system, such as the temporoparietal junction (TPJ), superior temporal sulcus (STS), and medial prefrontal cortex (MPFC) (Saxe, 2006; Frith & Frith, 2003). Recently, it has been found that these two systems may be complementary in understanding actions (de Lange et al., 2008). While impairments in both systems have been reported separately in people with autism spectrum disorders (ASD), to our knowledge, they have not been investigated in conjunction. The present study addresses the validity of mirroring and mentalizing hypotheses in autism in understanding the means and intent of actions.

Objectives: The main objective of this functional MRI study was to investigate the nature of mirror neuron and mentalizing system response to interpreting the *how* and *why* of actions in high-functioning adults with ASD.

Methods: fMRI data was acquired from 5 high-functioning adults with ASD and 5 typically developing controls (data collection in progress) while they made action and intention judgments about a series of static images of a model using household objects (adapted from de Lange et al., 2008). The participants' task was to view the model's action and determine whether the means (how the action was carried out) or intent (the model's goal) of the action was ordinary or unusual. The stimuli were presented in blocked design and the data were acquired on a Siemens 3T scanner and analyzed using SPM8.

Results: The results are as follows: 1) ASD participants showed significantly reduced response in bilateral TPJ and left inferior frontal gyrus (IFG), relative to controls, while inferring the model's intent; 2) While detecting unusual means the ASD group activated significantly lesser, relative to controls, in bilateral IFG and left angular gyrus; but showed greater response in right supramarginal, bilateral supplementary motor, and right superior MPFC; and 3) Paired samples t-tests on the behavioral data determined no significant differences between the groups for accuracy and reaction time for all experimental conditions.

Conclusions: Our finding of TPJ and IFG activation in controls for inferring the model's goal underscores the complementary roles of the mirror neuron and mentalizing networks for inferring intentions. That the means condition also activates the IFG in controls is suggestive of the role of the IFG for the simulation of actions and intentions, whereas the TPJ is likely additionally recruited for interpretation of the intentions. Despite finding no behavioral differences between autism participants and controls, our participants with autism showed reduced response in these regions while processing the intent of actions, indicating a possible use of an alternate cortical route in individuals with autism when interpreting others' actions.

106.063 63 An fMRI Study of Observing Communicative and Directive Actions in High-Functioning Autism. T. J. Perkins*[1], J. A. McGillivray[2], R. Bittar[3], D. Flanagan[4] and M. A. Stokes[2], (1), (2)*Deakin University*, (3)*Precision neurosurgery*, (4)*Melbourne Brain Centre*

Background: Deficits in the mirror neuron system (neurons which respond to executed *and* observed actions) have been linked to HFA. Despite support for this theory diminishing (cf. Dinstein, 2008), it is believed mirror neurons may contribute to the difficulty autistic subjects have understanding the actions of others. To date, only an unpublished dissertation by Montgomery (2007) has investigated mirror neuron deficits in *communicative* gestures (i.e. a waving hand), and no research has investigated *directive* hand gestures (i.e. a pointing hand) in an autistic sample. Directive hand actions may be important

due to the deficit in joint attention (the ability to co-ordinate attention between another person and an object) which pervades all autism spectrum disorders.

Objectives: Using fMRI, the present study compared age-matched typically developing (TD) subjects to HFA subjects. Subjects were required to attentively observe four different video tasks while in the fMRI. The first and second tasks utilized robust measures of mirror neuron activity which were hand-object interactions (i.e. a person picking up a mango) and hand-mouth interactions (i.e. a person bringing a banana to their mouth). The third and fourth tasks utilized communicative gestures (i.e. a waving hand) and directive actions (i.e. a hand motioning to stop). This study hypothesized that HFA subjects would demonstrate *reduced* activity in mirror neuron regions in all tasks by comparison to TDs.

Methods: Subjects with a confirmed diagnosis of HFA were compared to TDs (*N*=12 males in each group). All subjects were screened with tests on IQ, executive function, adaptive behavior, developmental history, and the AQ. Further, an assessment was made by a clinical psychologist as to each subject's diagnosis or lack of one. Subjects were placed in the fMRI (3 Tesla) where they observed the four different mirror neuron tasks. Following data collection and pre-processing, a blood-oxygen-level-dependent (BOLD) analysis was performed to compare activity between HFAs and TDs in mirror neuron regions (inferior frontal gyrus & inferior parietal lobule).

Results: Data analysis is only preliminary at present; however, HFA subjects have a reduced BOLD response in the inferior frontal gyrus by comparison to TD subjects. In TDs, BOLD activity in the inferior frontal gyrus is stronger for the robust mirror neuron tasks (hand and mouth) than for the social tasks (social and communicative). In HFA subjects the pattern of activity is less clear. Preliminary analyses suggest a small amount of activity in the inferior frontal gyrus for the robust tasks, but activity is near absent in the social and communicative tasks.

Conclusions: On the basis of preliminary analyses this research appears to support the literature that mirror neurons regions are less active in HFA subjects by comparison to TD individuals. Of particular interest, mirror neuron activity seems to be particularly reduced for communicative and directive actions.

106.064 64 A Functional MRI Study of Imitation and the Mirror Neuron System in ASD. S. Carrington* and A. J. Bailey, *University of Oxford*

Background: The mirror neuron (MN) theory of ASD posits that impairments in language, empathy, Theory of Mind and imitation are related to a deficit in the observation-execution matching mechanism afforded by the MN system (e.g. Oberman et al., 2005). Nevertheless, only a limited number of studies have investigated the neurobiological underpinnings of this theory. In the human brain regions with 'mirror' properties include the inferior frontal gyrus (IFG/ventral premotor cortex), the inferior parietal lobe (IPL), and to a lesser extent temporal and sensorimotor regions. Both electrophysiological (e.g. Oberman et al., 2005) and functional MRI (e.g. Williams et al., 2005) studies have indicated reduced mirror -like activity in ASD. Moreover, it has been suggested that altered functional connectivity may contribute to the dysfunction of the 'mirror' system (e.g. Perkins et al., 2010; Williams et al., 2005).

Objectives: To extend previous findings of reduced mirror-like activity in ASD using a carefully controlled imitation paradigm and functional connectivity analyses.

Methods: Behavioural and fMRI data were acquired from 21 TD individuals and 20 individuals with ASD. Imitation was tested using a paradigm based on the task developed by Iacoboni et al., (1999). The original paradigm included three conditions, 1) imitation, 2) imitation with symbolic cue and 3) symbolically-cued action (Symbol-Static). New stimuli were created for each condition and an additional condition was developed to better control for observed biological motion during symbolically-cued action (Symbol-Bio). Furthermore, participants were required to count target events during observation conditions.

Results: Analysis of behavioural data revealed no significant group differences in either imitative or symbolically-cued action or in the control task included in the observation conditions. Imitation evoked significantly increased activity relative to symbolically-cued action in the anterior IPL in both

groups, although there were subtle group differences in the pattern of activity. Nevertheless, the observation of action alone did not evoke significant activity in the anterior IPL in either group, suggesting that it could not be considered as a prototypical 'mirror' area. There was no evidence of mirror-like activity in the IFG. The concurrent observation and execution of incongruent actions (Symbol-Bio) evoked patterns of activity indicative of inhibitory modulation affecting lateral occipitotemporal and sensorimotor regions. This effect was less pronounced in the ASD group. Psychophysiological interaction analyses indicated increased interaction between right lateral occipitotemporal regions and both posterior and anterior 'mirror' regions in TD individuals during imitation compared with Symbol-Static. In individuals with ASD, however, increased interaction was observed between the left lateral occipitotemporal region and the left IPL in the uncorrected data.

Conclusions: The most likely candidate 'mirror' region identified in the current study was the anterior IPL. Nevertheless, this region was not a prototypical 'mirror' area, nor was there activity in the anterior 'mirror' area. Subtle group differences were particularly apparent in functional connectivity analyses, consistent with the theory that altered connectivity may contribute to 'mirror' system dysfunction in ASD. The incidental findings indicative of laterality effects and inhibitory modulation will be discussed.

106.065 65 "I See What You're Saying." An fMRI Study of Speech-Gesture Integration in Autism and Typical Development. S. Lee*[1], M. Melnick[2] and L. Bennetto[2], (1)*University of Rochester School of Medicine & Dentistry*, (2)*University of Rochester*

Background: Evidence suggests that non-verbal cues facilitate language comprehension and specific neural networks underlie our ability to integrate cues from multiple sensory modalities. Specifically, regions within the posterior division of the superior temporal gyrus/sulcus (pSTS) have been implicated in the integration of visual and auditory linguistic cues. Converging lines of work have also demonstrated that individuals with autism have difficulty integrating verbal and nonverbal information. However, little is known about the neural network subserving audiovisual (AV) integration in individuals with autism.

Objectives: In the current study, we used fMRI to characterize the neural network subserving speech-gesture integration in children with high functioning autism and children with typical development. In particular, we designed experiments to assess multimodal (i.e., speech and gesture) integration in the context of language comprehension. Furthermore, we examined the relationship between multimodal language processing and social functioning abilities.

Methods: Seventeen boys with autism spectrum disorder (ASD; ages 8-15) and 20 typically developing (TD) boys (ages 7-15) participated in this study. All participants were right-handed, native English speakers with normal hearing and visual acuity. In each of three conditions, participants were presented with a description of a shape followed by two pictures, and instructed to select the target shape using a button-box response system. The three conditions varied on whether the shape was described using speech (audio-only), gesture (video-only), or simultaneous speech and gesture (AV). EPI gradient echo sequences were acquired over 30 axial slices (TR=3.0s, TE=30ms, FOV=256mm, 4mm slices), and a MP-Rage high-resolution sagittal T1 structural image (TR=2.53s, TE=3.44ms, FOV=256mm, flip angle=7) was acquired for registration. Pre-processing and analyses of data were conducted using FSL.

Results: Analysis of behavioral data demonstrated that there were no significant differences in accuracy either across conditions, or between groups. Consistent with previously reported findings in typical adults, both TD and ASD groups demonstrated widespread activation of a network including auditory and visual cortices, frontoparietal regions, and in particular, pSTS in response to AV stimulation. For the TD group, direct comparison of the AV versus the two unimodal conditions yielded signal enhancement in pSTS and occipital cortex. The same contrast in the ASD group, however, showed exclusively occipital cortex enhancement. Moreover, the severity of social deficit in the ASD group was inversely associated with pSTS activity such that increased social impairment was associated with diminished BOLD signal in pSTS.

Conclusions: These results are consistent with prior evidence of pSTS involvement in speech-gesture integration in healthy adults, and demonstrate that pSTS operates as part of a dynamic network for AV integration by mid-childhood. Of particular interest, we demonstrated preservation of some functional response in pSTS of children with autism, despite significant differences in the pattern of network enhancement during AV integration. Overall, this study sheds light on the neural network subserving social communication, and demonstrates changes in network function associated with ASD. Differences in the development of a network for AV integration may play an important role in the development of social communication deficits characteristic of autism.

106.066 66 The Neural Basis of Action Understanding in Autism and Typical Development. J. Pokorny*[1], N. V. Hatt[2], S. J. Rogers[3] and S. M. Rivera[2], (1)*The M.I.N.D. Institute, University of California at Davis Medical Center*, (2)*University of California, Davis*, (3)*UC Davis M.I.N.D. Institute*

Background:

In a social species, it is critical to understand the actions and intentions of others during interactions. In typically developing (TD) individuals, there are two neural systems that support action understanding of others: lower level motor simulation in the mirror system, and higher-level intention understanding in the mentalizing system. The fronto-parietal mirror system is active during both the observation and execution of motor actions (Molenberghs et al., 2011). The mentalizing system is engaged when reflecting about the desires or intentions of others (Blakemore et al., 2007), or when observing implausible actions (Buccino et al., 2007). These systems are rarely concurrently active, each working to support different aspects of action and intention understanding (Van Overwalle & Baetens, 2009). Individuals with autism spectrum disorders (ASD) generally have difficulty with understanding the actions and intentions of others (Happe & Frith, 1996; Williams et al., 2004). We sought to examine these systems in adolescents with and without ASD while they observed different types of actions (eating vs. placing). We examined differences in the neural responses when observing actions that differed in their motivation and intention – picking up an object to eat it or to place it elsewhere.

Objectives:

We examined the neural basis of action and intention understanding in ASD and TD using fMRI when observing eating and placing action sequences.

Methods:

Functional neuroimaging was obtained from age and gender matched children (aged 8-17 years) who were either TD or diagnosed with ASD. Participants passively viewed 4-second videos of conventional and unconventional eating or placing actions while functional images were acquired.

Results:

In the TD group, there was more activity in the mPFC, part of the mentalizing system, during the observation of eating than during placing. In ASD, no areas showed significantly greater activity during observation of eating compared to placing. While observing placing actions, greater than eating, both groups showed more activation in superior parietal areas, which is consistent with this area coding goal directed arm movements, as placing actions involved more arm movement than did eating. Additionally, in the ASD group there was greater activation to placing actions compared to eating in ventral premotor (vPM) cortex and the inferior parietal lobule, areas of the mirror system. Between the ASD and TD groups, the ASD group had significantly greater activity to placing then eating actions in vPM, along the STS, and in an area of the mPFC that is involved in mentalizing processes.

Conclusions:

The fMRI results suggest that the groups find different actions more salient, as areas of the mentalizing system were more active for eating in the TD group and for placing in the ASD group. Unexpectedly, the ASD group appeared to engage more mirror activation when observing placing actions, suggesting they are better able to simulate placing an object rather than eating. This may be related to individuals with ASD being preoccupied with objects and directing less attention

toward other people and the actions they are performing, particularly those that are self-directed.

Brain Imaging: fMRI-Social Cognition and Emotion Perception Program

107 Brain Imaging: Resting State fcfMRI and Structural Imaging

Structural MRI, DTI, and Spectroscopy, MEG and resting state functional connectivity analyses

107.067 67 Aberrant White Matter Development Underlies Atypical Visual Orienting At 6 Months in Prodromal Autism. J. T. Elison*[1], S. Paterson[2], J. J. Wolff[3], T. Handler[4], K. Botteron[5], R. T. Schultz[2], J. Piven[6] and I. B. I. S. Network[7], (1)*California Institute of Technology*, (2)*Children's Hospital of Philadelphia*, (3)*University of North Carolina at Chapel Hill*, (4)*Washington University*, (5)*Washington University School of Medicine*, (6)*University of North Carolina, Chapel Hill (UNC-CH)*, (7)*Autism Center of Excellence*

Background: Many of the early behavioral markers associated with ASD implicate developmental impairments in flexibly allocating attentional resources to salient or biologically relevant information in the environment (e.g., orienting to name, responding to bids for joint attention, spontaneous gaze to faces and making eye contact). We reasoned that a domain-general deficit in selective visual orienting during a developmental period that requires flexible and efficient selective visual attention to support social information processing could constrain typical experience-dependent specialization with social information, and thereby contribute to the emergence of behavioral markers related to ASD symptoms.

Objectives: In the current study, we sought to examine whether infants who go on to develop ASD symptoms show different patterns of visual orienting at 6 months of age when compared to low-risk infants and genetic high-risk infants who do not develop ASD symptoms. If so, does the organizational integrity of white matter explain atypical visual orienting?

Methods: We used risk status and ADOS scores at 24 months to form three discrete groups; genetic low-risk or typically developing infants (hereafter LR, n = 37), genetic high-risk infants who do not meet ADOS criteria for an ASD at 24 months (hereafter HR-, n = 28), and infants who meet ADOS classification for an ASD at 24 months (hereafter ASD, n = 14). At 6 months of age, visual orienting data was extracted from a gap/overlap paradigm and imaging data was extracted from a Diffusion Tensor Imaging sequence. The three groups did not significantly differ in age (p = 0.297), nonverbal developmental level (p = 0.789), or number of valid gap (p = 0.306) or overlap trials (p = 0.148) completed.

Results: A disease specific pattern emerged for the overlap latencies such that the ASD group showed longer latencies than both the HR- (p = 0.013) and the LR group (p = 0.038), who were statistically equivalent. The data revealed a disease continuum model in gap latencies such that the ASD group showed significantly longer latencies than the LR group, but the HR- group did not significantly differ from the LR or ASD groups and their latencies fell at an intermediate position between LR and ASD (e.g., ASD > HR- > LR). We found that the organizational integrity of white matter (RD) in the splenium moderated the association between risk status and visual orienting (overlap latencies, as per the disease specific finding above). The results revealed a disordinal interaction, $F(2, 65) = 3.35$, p = .041, such that latencies in the overlap condition were not related to white matter integrity in the ASD group, whereas the association between overlap latencies and splenium RD among LR infants was quite strong.

Conclusions: These findings suggest that patterns of visual orienting at 6 months differentiate infants who go on to develop characteristics of ASD at 24 months from LR infants and HR infants who do not develop ASD symptoms, and that microstructural integrity of the splenium is putatively involved in this process.

107.068 68 Functional MRI Endophenotypes of Autism. M. D. Spencer*[1], R. J. Holt[1], L. R. Chura[1], J. Suckling[2], A. J. Calder[3], E. T. Bullmore[2] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*Brain Mapping Unit, University of Cambridge*, (3)*MRC Cognition and Brain Sciences Unit*

Background: Siblings of individuals with autism have over 20 times the population risk of autism. Evidence of comparable, but less marked, cognitive and social communication deficits

in siblings suggests a role for these traits in the search for biomarkers of familial risk. However, no neuroimaging biomarkers of familial risk have been identified to date.

Objectives: We aimed to examine functional magnetic resonance imaging (fMRI) data from teenagers with autism (n=40), their unaffected siblings (n=40) and controls with no family history of autism (n=40), to identify candidate biomarkers of familial risk for autism. We aimed to contrast the three groups in order to separate fMRI abnormalities associated with autism itself as compared to those associated with the familial risk for autism in the broader phenotype.

Methods: All participants with autism were assessed as positive on the Autism Diagnostic Observation Schedule - Generic and the Autism Diagnostic Interview - Revised. All participants were aged 12-18 years, with IQ≥70. All participants were scanned on the same 3T unit and completed fMRI tasks including an implicit facial emotion processing task using emotional faces from a standard battery.

Results: We found that the neural response to facial expression of emotion differs between unaffected siblings and controls with no family history of autism. Strikingly, the fMRI response to happy versus neutral faces was significantly reduced in unaffected siblings compared with controls within a number of brain areas implicated in empathy and face processing, including the right (p=0.002) and left (p=0.005) temporal poles and the right middle (p=0.004) and left posterior (p=0.016) superior temporal sulci. The response in unaffected siblings did not differ significantly from the response in autism.

Conclusions: These findings suggest that an atypical implicit response to facial expression of emotion may form the basis of impaired emotional reactivity in autism and in the broader autism phenotype in relatives. These results indicate that the fMRI response to facial expression of emotion is a marker of familial risk for autism and a functional neuroimaging endophenotype for autism, and may offer far-reaching insights into the etiology of autism.

107.069 69 Dual-Boot MRI for Multi-Site and Longitudinal Studies of Autism Under Stable Conditions. T. E. Conturo*[1], A. R. McMichael[1], O. El-Ghazzawy[1], S. G. Kim[2] and D. Purdy[3], (1)*Washington University School of Medicine*, (2)*University of Pittsburgh*, (3)*Siemens Medical Solutions*

Background: MRI studies of autism typically span years, may be longitudinal, and may involve multiple institutions. To reduce variability, a stable scanning environment across time and sites is essential. However, changes in scanner software can be frequent. MRI vendors provide software changes nearly annually, which can provide new scanning routines, but can also change existing routines and prevent operation of custom procedures. Conflicts can arise between changing-versus-maintaining scanner software. Changing software is typically desired by clinicians (diagnosis does not require stability); vendors (minimizing supported software levels); and some researchers who want to begin new studies. Maintaining software is typically desired by researchers who have ongoing studies or use custom procedures.

Objectives: These competing needs could be met by "dual booting", where the operator chooses the software level for booting the scanner. However, dual-booting is not commercially available on any FDA-approved MRI scanner. While dual-booting is done in the factory during software development, it is unclear whether an entire installed scanner can be seamlessly switched between two software environments. We aimed to develop dual-booting at a second scanning site to expand enrollment in our studies of autism and other disorders, while preserving ongoing longitudinal studies.

Methods: We devised procedures to dual-boot a Siemens 3T Allegra scanner at a second site (Pittsburgh; va30 software) to match the primary site (St.Louis; va25 software). The scanner has a host computer (running the scanner) and an imager computer (reconstructing images). Host and imager hardware/software differ between environments. To preserve scanning conditions, we used separate computers for va25 booting. The original va25 computers were recovered/tested at the second site, and rebuilt by replacing missing/unreliable components. We reinstalled all original va25 firmware/software, and moved the single-user license dongle from va30 to va25 host computer. After the stand-alone va25 host/imager were running, we plugged them into a network

switch and set internal/external IP addresses. All communication errors resolved upon rebooting. We then connected the va25 computers to the scanner network by switching all cabling between va30/va25 computers, and then powering up the scanner. The va25 computers and all electronics booted up in the va25 environment, without errors.

Results: After booting under va25, we tuned the scanner using vendor procedures, storing tune settings on the va25 host. All performance specifications were met. Autism scan protocols ran seamlessly without modification, and image quality was excellent. The full switching procedure (scanner power-off, computer switching, scanner rebooting) takes only 13-15 minutes, during which the participant can be taken out of the scanner and the next participant prepared. For ongoing longitudinal studies, the scanner is run under va30 (using va30 tuning settings) to maintain those study conditions.

Conclusions: A dual-boot MRI environment can be used with longitudinal/multi-site autism studies to stabilize scanning conditions. Such studies are crucial to understanding brain developmental trajectory and biological heterogeneity in autism, which require long-term stability and large sample sizes. Setting up dual-booting requires a site willing to take risks/provide access; motivated/experienced investigators; available prior computers/software/manuals; and minimal scanner hardware changes.

Funding: MH090494; NS052470; AS03799; BC073839.

107.070 70 Atypical Brain Responses to Illusory Auditory Pitch in Children with Autism. J. Brock* and B. W. Johnson, *Macquarie University*

Background:

Atypical auditory perception is widely reported in association with autism. Previous studies of neurotypical children and adults using electro- and magnetoencephalography (MEG) have identified an event-related brain response, termed the Object Related Negativity (ORN), occurring 200-300 ms after stimulus onset, which is related to the grouping of the acoustic input into separate auditory objects.

Objectives:

In the current study, we recorded the brain responses of children with autism to dichotic pitch stimuli, in which inter-aural timing differences result in the illusory perception of a pitch sound spatially segregated from a carrier white noise. We hypothesized that the ORN would be diminished in autism, reflecting a failure of auditory object formation.

Methods:

Participants were ten 8- to 12-year-old children with autism and ten age-matched typically developing children. Control stimuli were 500 ms, 70 dB white noise presented binaurally. Pitch stimuli were identical apart from a 0.5 ms inter-aural timing difference in a narrow frequency band centred at 600 Hz. Participants viewed a movie while ignoring the auditory stimuli. Brain responses were recorded using 160 channel whole-head MEG and projected onto sources in bilateral auditory cortex.

Results:

Typically developing children demonstrated the expected difference between Control and Pitch stimuli from around 250 milliseconds onwards. While there was a trend in this direction in the ASD group, the effect of stimulus was non-significant, perhaps reflecting somewhat noisier data. Strikingly, however, the ASD group showed a marked difference in responses to Pitch and Control stimuli at around 50 ms, which was not present in the control group.

Conclusions:

Amongst children with autism, brain responses were sensitive to the presence of the illusory pitch from as early as 50 ms. This differential response was absent amongst typically developing children and is also absent in other populations (typical adults, children with dyslexia) we have tested. The increased sensitivity of the auditory cortex response in autism may be related to reports of enhanced pitch discrimination in individuals with autism using behavioural paradigms. Ongoing time-frequency analysis of these data may provide further insights into the neural mechanisms of pitch processing in autism.

107.071 71 A MEG Investigation of Phonological Processing in Autism. L. B. Wilson*[1], E. Slason[1], B. E. Pasko[1], K. L. McFadden[1], S. Hepburn[2] and D. C. Rojas[1], (1)*University of Colorado Denver, Anschutz Medical Campus*, (2)*University of Colorado / JFK Partners*

Background: Deficits involving phonology, one of six proposed core broad autism traits, are observed in a large subset of children with autism and have been reported in two samples of proband parents. Despite this, no neuroimaging studies have investigated phonological processing in individuals with autism or their first-degree relatives.

Objectives: Magnetoencephalography (MEG) was utilized to investigate the neurobiology of phonological processing in adults with autism as well as parents of individuals with autism. The aim of the present study was to examine the presence of phonological processing deficits in individuals with autism as well as unaffected first-degree relatives in order to provide evidence in favor of or against the inclusion of phonological processing deficits as a core trait of the broad autism phenotype (BAP).

Methods: Sixteen parents of a child with autism, thirteen adults with autism and seventeen controls performed a phonological priming task while undergoing whole-cortex MEG. The task consisted of four prime-target word conditions including homophones (e.g., PAUSE-paws) and related stimuli. Primes were presented below perceptual threshold (i.e., 30ms). Subjects, who were not informed that stimuli consisted of word pairs, performed a lexical decision task (i.e., is it a word or a nonword?) on all lowercase targets.

Results: In our priming condition that placed heavier demands on phonological decoding skills, adults with autism exhibited reduced evoked gamma band activity relative to both parents and controls in the left supramarginal gyrus (SMG). Reductions in evoked gamma activity were also observed in adults with autism for unprimed relative to primed stimuli in the left SMG relative to the control group and in the right SMG relative to the parent group. Furthermore for unprimed relative to primed stimuli, reductions in induced gamma activity were observed in adults with autism relative to the parent group in the left inferior frontal gyrus. No differences in evoked or induced gamma activity were observed between the parent and control groups.

Conclusions: These results are consistent with phonological processing deficits in individuals with autism. However, the present results do not strongly implicate phonological deficits in the parent group. While greater frontal activity in the parent group may be indicative of compensatory processes, our results suggest that phonological processing deficits are not a core component of the BAP.

107.072 72 Abnormal Lateralization of Auditory Magnetic Fields Evoked by Clicks In Autism Spectrum Disorders (ASD). E. V. Orekhova[1], A. V. Butorina[2], M. M. Tsetlin[2], S. I. Novikova[2], M. Elam[3] and T. A. Stroganova*[4], (1)*University of Gothenburg*, (2)*MEG Center, Moscow State University of Psychology and Education*, (3)*Sahlgrenska University Hospital*, (4)*Moscow State University of Psychology and Education*

Background: Rightward lateralization for processing of sounds with sharp ramps, such as clicks, has been previously reported in adults and may relate to functional specialization of the right hemisphere (RH) for certain types of information processing, such as rapid, global detection of stimulation and spatial attention. We have previously found rightward lateralization of the N1c(Tb) component of auditory evoked responses to clicks in typically developing children (TDC). Such lateralization was absent in children with autism, who had reduced N1c in the RH. We proposed that this finding reflects abnormal functioning of the RH networks responsible for arousal and initial orienting that, in turn, could affect later stages of information processing in autism.

Objectives: We sought to localize brain sources of the abnormal reaction to clicks in ASD using MEG. We also tested the hypothesis that these auditory processing abnormalities correlate with severity of autism or contribute to sensory difficulties observed in the majority of ASD individuals.

Methods: MEG and structural MRIs were obtained in 14 ASD children aged 8-13 years and 15 age-matched TDC. Presence of sensory abnormalities was assessed with Sensory Profile. Parents also answered questionnaire concerning autism symptoms during the first years of life,

including sensory behavioral abnormalities. Children watched a movie while passively listening to clicks presented either binaurally or monaurally in pairs, with 1 sec ISI within a pair and 8-10 sec ISIs between the pairs. We applied distributed source modeling using minimal norm estimate (MNE) and defined regions of interest (ROIs) in the vicinity of the auditory cortex where significant activation was observed in a majority of subjects. MNE current timecourses in the ROIs were analyzed.

Results: In both groups the most prominent component of the auditory field response was P100m at approx. 100 ms. The amplitude of P100m was significantly higher in response to binaural, then monaural clicks and only in response to binaural clicks the P100m was detected in all subjects. Therefore, only binaural responses were analyzed. P100m strongly decreased upon stimulus repetition in both groups. In control subjects the P100m was right-lateralized, while no lateralization was evident in ASD children, who had tendency ($p=0.06$) for P100m reduction in the right hemisphere. After correction for IQ, the RH reduction of P100m correlated with greater severity of autism, assessed by child version of the Autism Quotient. Moreover, greater leftward lateralization of P100m in ASD was associated with greater severity of sensory abnormalities assessed by Sensory Profile, as well as with severely abnormal auditory behavior during the 1st year of life.

Conclusions: The P100m is thought to originate from thalamo-cortical input to infragranular cortical layers (Eggermont&Ponton, Acta Otolaryngol 2003; 123:249–52). Its reduction in the RH in ASD children suggests disturbance of RH thalamo-cortical afferents or their cortical targets that in turn may contribute to abnormal arousal and attention orienting in ASD. The correlation between sensory abnormalities and atypical leftward P100m suggests that a shift of activation balance to the left hemisphere 'non-optimal' for the initial orienting, may contribute to bizarre sensory behaviors in ASD.

107.073 73 An MEG Study of High-Frequency Brain Oscillations in Autism and First-Degree Relatives During Picture Naming. I. Buard*[1], E. Kronberg[2], S. J. Rogers[3], S. Hepburn[4] and D. C. Rojas[2], (1)*University of Colorado-Anschutz Medical Campus School of Medicine*, (2)*University of Colorado Denver, Anschutz Medical Campus*, (3)*UC Davis M.I.N.D. Institute*, (4)*University of Colorado / JFK Partners*

Background:

Fusiform gyrus (FG) hypoactivity has been reported in individuals with Autism Spectrum Disorders (ASD), and it is still unknown whether this is an inheritable abnormality. Because of the importance of face processing to successful social functioning, the FG has been extensively studied as being a part of the visual system specialized in facial recognition, also called Fusiform Face Area. However, other functions have been attributed to the FG, such as its role in language processing (e.g., the visual word form area). High-frequencies brain activities, such as gamma oscillations, have been demonstrated to be abnormal in the visual and auditory cortices of people with ASD. We have also established that these deficits are seen in adult first-degree relatives, suggesting that such impairment constitutes an autism endophenotype.

Objectives:

To compare high-frequency gamma brain oscillations in the FG of control participants to patients with autism and first-degree relative of persons with ASD during a picture naming task.

Methods:

Participants were 12 persons with ASD, 16 parents of an autism child and 35 controls. Whole-head MEG recordings were acquired during a picture naming task, in which subjects were asked to subvocalize names of objects presented on a screen. Virtual sensors were created in the fusiform gyrus from source analyses of the MEG data (SPM8) and oscillatory activity between 5 and 120 Hz was analyzed across a 1 second window using wavelet-based time-frequency methods. Measures of evoked power and phase-locking factor (PLF) were derived for each subject. Mass univariate, non-parametric statistical analyses were performed across the entire time-frequency space and corrected for multiple comparisons using cluster size metrics, $p < .05$.

Results:

Whereas there was no significant difference among groups within the low-gamma (40Hz) oscillations (or any frequency below ~60-70 Hz), PLF showed significant reduction at high-gamma frequencies (around 80Hz) between 160 and 600 msec after stimulus presentation in both the parent and autism groups, relative to control subjects.

Conclusions:

These findings support the known impaired activation of the FG in autism but also suggests that the high gamma-band range may be important for higher cognitive functions that are mediated by FG activation. The presence of the finding in parents suggests that the previously described gamma-band ASD endophenotype may be relevant to higher order visual object processing and possibly to aspects of language function.

107.074 74 An MEG Study of Inhibition in Adolescents with Autism Spectrum Disorders. S. Varatharajah*[1], H. Qureshi[2], E. W. Pang[2], M. J. Taylor[3] and E. Anagnostou[1], (1)*Holland Bloorview Kids Rehabilitation Hospital*, (2)*The Hospital for Sick Children*, (3)*University of Toronto*

Background: Self-control depends upon cognitive processes such as response inhibition, which is the ability to withhold a prepotent, or competing, response. Inhibition enhances adaptive functioning (Halperin et al. 1994), which is necessary for both social interactions and cognitive flexibility. As impairments in social functioning and the presence of restricted or repetitive behaviour (DSM-IV) are core criteria of an autism spectrum disorder (ASD) diagnosis, the study of inhibition is critical in this clinical population. Furthermore, inhibition undergoes considerable development during the adolescent years and understanding the deficits in this process in ASD may help inform interventions.

Objectives: To determine spatial and temporal aspects of neural processing associated with response inhibition task in adolescents with ASD using magnetoencephalography (MEG).

Methods: Whole-head MEG data were acquired from 10 teenagers with an ASD diagnosis (ages 13.3 to 17.9; mean age 15.7) (8 males; 2 females); and 10 age and gender matched control teenagers (mean age 15.8). Individuals with ASD (with an IQ above 80) met criteria specified by the Autism Diagnostic Observation Schedule-Generic (ADOS-G) and the Autism Diagnostic Interview Revised (ADI-R). Subjects performed a visual go/no-go task that required participants to press a button to 'go' stimuli or withhold their response (no-go) if an "x" was overlaid on the visual stimuli. The experimental condition consisted of 33% no-go trials and tested the ability to withhold a prepotent tendency to respond, whereas the baseline condition consisted of 66% no-go trials. The baseline condition was subtracted from the inhibition condition and then the MEG data were averaged. Principal component analysis (PCA) was then applied to these data, examining the within-group variance of task related brain activity. As well, beamformer analyses were applied to the data to localize brain activation, co-registered to each participant's anatomical MRI scan.

Results: Our preliminary analyses revealed a greater overall global field power (GFP) for controls in comparison to the ASD group. Beamformer analyses revealed activation in the right middle frontal gyrus in a time window of 210 to 250 ms in only the control group when thresholded to 95% of peak activation. A virtual sensor placed in the right middle frontal gyrus displayed peak activity in controls during a 200 to 250 ms time window, but no comparable activity in the ASD group.

Conclusions: The lower overall power measured during the inhibition task in the ASD group compared to controls may be due to a lack of synchronization in neural firing within the ASD group. Our preliminary analyses also indicate a greater activation of the right middle frontal gyrus in typical teenagers in comparison to teenagers with ASD. Inhibition in healthy adults is commonly associated with activation of the right frontal lobe. Thus, it appears that typically developing teenagers are perhaps utilizing the appropriate functional network responsible for inhibition, whereas adolescents with autism are not.

107.075 75 Impact of Methodological Variables on Functional Connectivity MRI Findings for Autism Spectrum

Disorders. A. Nair*[1], C. L. Keown[2], M. C. Datko[2], B. Keehn[3], P. Shih[4] and R. A. Muller[5], (1)*San Diego State University / University of California, San Diego*, (2)*Brain Development Imaging Lab, San Diego State University*, (3)*Children's Hospital Boston/Harvard Medical School*, (4)*Neuroscience Department, Brown University*, (5)*San Diego State University*

Background: Growing evidence suggests that ASD is not a localized brain disorder, but a disorder involving multiple functional networks. Neuroimaging studies of ASD have increasingly focused on connectivity. A large number of functional connectivity (fcMRI) studies have reported network underconnectivity in individuals with ASD. However, there are notable inconsistencies in empirical findings, with some studies reporting overconnectivity in ASD. While some of these inconsistencies can be attributed to the heterogeneity of the disorder, methodological factors may also play a crucial role in differential fcMRI outcomes.

Objectives: To examine how fcMRI results in three ASD data sets may be impacted by methodological variables : temporal filtering, removal of task-related effects, potential group bias in the selection of seeds and regions of interest (ROIs), and whole brain vs. restriction to ROIs in field of view [FOV].

Methods: Three different data sets were used for this comparison: two task-related fMRI data sets for visual search and attention, and one resting-state data set (RS). All MRI data were acquired on a 3T GE scanner with 8-channel head coil. Participants were adolescents with ASD, and matched typically developing (TD) adolescents. All preprocessing and analyses were performed using AFNI. For the task-related data, two pipelines were tested. The first pipeline included high-pass filtering (>.008), whole brain FOV, as well as network of interest FOV. The second pipeline included the following variables band-pass filtering (.008<*f*<.08), task-regression using a general linear model, and whole brain FOV. Additionally for both pipelines, selection of seeds was based on activation findings for (i.) TD group only, (ii.) ASD group only, and (iii.) both groups combined. For the RS data, the first pipeline was the same as for task-related data. The second pipeline only consisted of band-pass filtering and whole brain field of view. Selection of seeds for RS data was based on the default mode network reported in the literature for TD individuals.

Results: Findings suggested that high-pass filtering yielded stronger group differences than low-pass filtering. Also, task-related pipelines yielded stronger group differences compared to task-regressed ones. With regards to seed selection, seeds based on TD activation (attention task) or on TD literature (RS dataset) were associated with underconnectivity findings in the ASD group, whereas such findings were diminished when seeds were derived from ASD group activation or from activation for both groups combined. For the visual search task, there was evidence in the opposite direction, with the ASD group showing greater connectivity compared to TD group. Finally, FCMRI findings were also affected by FOV. Specifically, greater group differences were found in whole brain versus the network of interest FOV, for all three data sets.

Conclusions: Findings suggest methodological variables substantially affect group differences detected in fcMRI analyses. While there is no clear assumption about the superiority of one approach over another, full disclosure their implications appears crucial in functional connectivity studies when inferences about 'underconnectivity' or 'overconnectivity' in ASD are made. Combining different methodological approaches may be commendable in future studies for a more comprehensive understanding of connectivity in ASD.

107.076 76 MEG Measures of Inhibition in Adults with Autism Spectrum Disorders. S. Varatharajah*[1], H. Qureshi[2], K. A. R. Doyle-Thomas[1], J. Vidal[2], M. Batty[3], E. W. Pang[2], E. Anagnostou[1] and M. J. Taylor[4], (1)*Holland Bloorview Kids Rehabilitation Hospital*, (2)*The Hospital for Sick Children*, (3)*INSERM U930*, (4)*University of Toronto*

Background: Self-control depends upon cognitive processes such as response inhibition, which is the ability to withhold a dominant response. Poor inhibitory control is seen in autism spectrum disorders (ASD), and can have serious social ramifications. There have been conflicting results pertaining to the brain networks involved in inhibition in ASD.

Objectives: To determine the spatial and temporal aspects of neural processing associated with inhibition in adults with and without ASD using magnetoencephalography (MEG).

Methods: Whole-head MEG data were obtained from 20 adults (ages 20-34): 10 (8 males; 2 females) with ASD diagnoses from clinicians and 10 healthy controls matched on age and gender. IQ scores were obtained. Subjects performed a go/no-go task that required participants to press a button to visual 'go' stimuli or withhold their response (no-go) if an "x" was superimposed on the stimuli. The experimental condition consisted of 33% no-go trials and tested the ability to withhold a prepotent tendency to respond. The control condition consisted of 66% no-go trials, thus not producing a prepotent tendency to respond. Data were analysed with independent component analysis and trials with artefacts were removed. The control condition was then subtracted from the experimental condition and principal component analysis (PCA) applied to the averaged data, to assess differences between groups for the no-go trials in the two conditions (which did or did not require inhibition). Beamformer analyses were also run on the data, within the time windows determined by analysis of the sensor data, to locate the brain regions activated during inhibition.

Results: Measurements of global field power (GFP) showed a broad peak for both the control and ASD groups between 200ms – 300ms, with lower amplitudes in the ASD group. PCA analyses revealed significant peak activation between 212ms and 228ms for the control group and between 220ms and 262ms for the ASD group. In control adults, significant activity was found with beamformer analyses in the right inferior frontal gyrus (IFG) that peaked around 223ms on the source time course. For adults with ASD activation in the IFG did not pass threshold.

Conclusions: These preliminary results suggest a delay in the neural processing associated with response inhibition as well as a lower activation of the IFG, in adults with ASD; past research has also found IFG activity associated with inhibition in healthy adults. These findings also provide insight into the neural mechanisms that underlie inhibition in individuals with ASD.

107.077 77 Functional Connectivity in ASD with Pharmacological Modulation of the Beta-Adrenergic System. J. P. Hegarty*[1], A. Narayanan[2], C. White[2], A. Abduljalil[2], P. Schmalbrock[2], B. J. Ferguson[1], C. R. McKinley[1] and D. Q. Beversdorf[3], (1)*University of Missouri, Columbia*, (2)*The Ohio State University*, (3)*University of Missouri*

Background: Current behavioral interventions for autism focus on increasing quality of life and language development whereas pharmacological interventions are directed at managing the secondary manifestations such as anxiety and repetitive and obsessive behaviors. Pharmacological research directed at the core features of autism is limited. We have previously shown that propranolol, a beta-adrenergic antagonist, improved verbal problem solving in typically developing controls as well as people with autism. Current theories suggest that autism may be due to decreased network flexibility within cortical regions important for information processing, and we believe the previously noted propranolol effects may be due to increased flexibility within language networks. Functional magnetic resonance imaging, fMRI, allows for the measurement of a potential correlate of network flexibility, functional connectivity. We therefore wish to determine fcMRI alterations during language-based tasks when propranolol is administered.

Objectives: Our objective was to examine the potential mechanism of the beneficial effects of a currently available pharmacotherapeutic agent, propranolol, on the core features of autism by assessing functional connectivity using fMRI.

Methods: We examined a pilot sample of individuals with autism during administration of propranolol, nadolol, and placebo. Nadolol provides a control for general vascular effects on BOLD fcMRI since nadolol is a beta-adrenergic antagonist but does not cross the blood brain barrier. After drug administration, subjects were placed in a 3T magnetic resonance scanner at Ohio State University and asked to complete a cognitive flexibility task, the compound remote associates (CRA), and two verbal fluency tasks, one based on letters and the other based on categories. Structural T1-weighted images were acquired using a T1 weighted 3D FFE pulse sequence (TR=25 ms; TE=3.6 ms; 64 axial slices; 2.2 mm thick). BOLD contrast functional scans were acquired using a gradient echo EPI sequence (TR=3 s; TE=35 ms; 35 axial slices, 4mm thick; $\alpha = 90°$). *A priori* regions of interest, ROIs, were used to extract region-specific activation in the

inferior frontal cortex, fusiform gyrus, middle temporal gyrus, and posterior parietal cortex. Correlations between pairs of ROIs were computed by calculating the correlation coefficient between the time series for each ROI pair and then standardized using Fischer's Z-transformation.

Results: There was a significant effect of drug such that functional connectivity was significantly higher for propranolol trials compared to nadolol and placebo, which did not appear to significantly differ from each other. These results were most robust for the CRA task.

Conclusions: Although this is preliminary data, we begin to show the cognitive benefits of propranolol in autism may be due to increased network flexibility due to alterations of beta-adrenergic mechanisms. Theses alterations seem to be most beneficial for more difficult compared to easier tasks. Better understanding of the effects of the beta-adrenergic system on language processing, especially in the autism population, and modulation of the beta-adrenergic system pharamacologically could lead to development of additional treatments for the core features of autism. Additional research is required to fully understand these alterations and determine possible biomarkers, such as genetic status, of who may benefit most from beta-adrenergic intervention.

107.078 78 Increased Connectivity in Children with Autism Spectrum Disorders: Evidence Consistent with Poor Network Segregation. B. Yerys*[1], D. N. Abrams[2], E. M. Gordon[3], R. Weinblatt[2], K. F. Jankowksi[4], J. F. Strang[2], L. Kenworthy[2], R. T. Schultz[5], C. J. Vaidya[3] and W. D. Gaillard[6], (1)*The Children's Hospital of Philadelphia*, (2)*Children's National Medical Center*, (3)*Georgetown University*, (4)*University of Oregon*, (5)*Children's Hospital of Philadelphia*, (6)*Childrens National Medical Center*

Background: The default mode network (DMN) has generated interest in the study of brain function in individuals with autism spectrum disorders (ASD) because of its purported role in self-reflection, an impaired ability in ASD. Adult and mostly adolescent samples with ASD reportedly have lower activity correlations (i.e., functional connectivity) between the DMN posterior hub, Posterior Cingulate Cortex (PCC), and other regions in the DMN (e.g., ventral medial prefrontal cortex (vMPFC) and angular gyrus). These studies limited their analyses to DMN regions only; this approach limits the ability to observe cross-network connectivity. These studies have also not examined connectivity in early school-age children. Given that brain development in ASD is characterized by an atypical developmental trajectory, it is crucial to examine functional networks during childhood.

Objectives: To examine whole brain functional connectivity in data from two key nodes in the DMN (PCC) in children with ASD.

Methods: Forty children participated in this study. The ASD group (n=18) and the typically developing control (TDC) group (n=22) were matched on age (all *p*-values>0.33). Children completed a 5 minute resting state sequence on a 3T Siemens Trio with TIM, with the following parameters: TR=2000; TE=31ms; 90° flip angle; FOV=256x256mm; 3mm in-plane resolution with a 2.7mm slice thickness (0.3 mm gap); 43 slices with interleaved acquisition. The 150 volumes were slicetime corrected, realigned, normalized, and smoothed in SPM8. The 150 volumes were then bandpass filtered in FSL from 0.1>x>.01, and volumes with excessive motion were eliminated (up to 30) based on recent evidence that excessive head motion creates systematic correlations. All children had <30 volumes of excessive motion so we removed the initial volumes until all children were left with 120 volumes total. Finally, the regressor of interest (PCC) and nuisance regressors (White Matter signal, Cerebrospinal Fluid, and all 6 motion parameters) were extracted and included in a fixed effects model for individual participants with the whole brain, except the cerebellum due to incomplete coverage. Individual t-test maps generated with PCC seed were then submitted into a two-group t-test.

Results: There were no regions which showed increased connectivity in TDCs, but we found increased connectivity between the ASD group's PCC seed and the anterior portion of the left inferior frontal gyrus and left insula/superior temporal sulcus at p<0.005, k=137 (alphasim cluster correction for multiple comparisons at p<0.05). Follow-up analyses using a secondary DMN seed (ventral medial prefrontal cortex) converged with findings from the PCC.

Conclusions: The present findings suggest that children with ASD may be characterized by patterns of increased connectivity between some networks. Our whole brain approach afforded the opportunity to observe correlations with non-DMN regions, and this increased connectivity with non-DMN regions suggests poor network segregation in childhood ASD. This poor segregation at rest may contribute to difficulties with proper coordination of a network during task-based activities, and thus drive the observed lower correlations (i.e., underconnectivity) often reported during task-based functional connectivity. Future research is needed to determine whether functional connectivity differences at rest are predictive of functional connectivity differences during task.

107.079 79 Lack of Evidence for Neural Underconnectivity in High-Functioning Adults with Autism. D. P. Kennedy*, J. M. Tyszka, L. K. Paul and R. Adolphs, *California Institute of Technology*

Background: It is now widely believed that autism is a disorder of connectivity. Numerous studies have found altered white matter structure, suggestive of connectivity abnormalities, and studies examining the functional interactions between brain regions have generally found reduced correlation (i.e., *functional connectivity*) in autism. However, the majority of evidence for functional underconnectivity in autism comes from task-based functional imaging experiments, and so differences in task-related factors (e.g., performance, attention, etc.) might account for this apparent group difference. An alternative approach is to examine the intrinsic dynamics of functional coupling between brain regions during the resting-state (i.e., in the absence of specific task demands).

Objectives: To examine the underconnectivity hypothesis of autism across the whole brain during the resting state.

Methods: Resting-state fMRI data were acquired from 19 adults with high-functioning autism and 20 matched controls. Data were preprocessed using conventional corrections (transient signal, motion, slice timing, B0 unwarping, detrending), and nuisance signals were removed by automated independent component filtering. Two complementary whole-brain approaches were used to examine resting-state functional connectivity: (1) a data-driven method using dual regression of a group level Independent Component Analysis (ICA), in order to identify and compare specific functional networks at the individual and group levels; and (2) a pairwise correlation method using probabilistically-defined anatomic regions of interest covering the entire brain.

Results: In both methods, the resting-state connectivity maps were strikingly similar between autism and control groups, both in terms of spatial organization and inter-regional temporal correlation. No group differences in interregional correlations survived false discovery rate correction ($q < 0.05$). These results were found to be robust across various preprocessing conditions, including regression of global signal. Similarly, no inter-group differences were observed in the dual regression of the group-level ICA. Only one other study has examined whole-brain resting-state functional connectivity in autism, and they found that groups were distinguishable based on measures of connectivity (Anderson et al., 2011). However, their analysis was quite different from that of the present study, in that it employed a machine learning approach focused on group classification, and so our studies may not be directly comparable.

Conclusions: These results challenge the underconnectivity theory of autism. The lack of a group difference may be a consequence of examining intrinsic functional connectivity during a resting-state, as opposed to during task-driven experimental paradigms. It may also be a consequence of sample size, though equivalent and even smaller sample sizes have identified group differences, mainly in the default mode network. Additional replication studies in a larger sample and that include younger children with autism are warranted.

107.080 80 Local Functional Connectivity in ASD Is Reduced, Not Increased. S. Khan[1], A. Gramfort[1], N. Shetty[1], J. M. Moran[2], S. M. Lee[2], J. D. E. Gabrieli[2], B. M. Joseph[3], H. Tager-Flusberg[3], M. R. Herbert[1], M. S. Hämäläinen[1] and T. Kenet*[1], (1)*Massachusetts General Hospital*, (2)*Massachusetts Institute of Technology*, (3)*Boston University*

Background: The hypothesis that long-range functional connectivity (FC) is reduced in ASD while local FC is increased is widely accepted. While a large body of evidence supports the hypothesis of reduced long-range FC in ASD, there is no neurophysiological evidence in support of

increased local FC in ASD. The nature of local neurophysiological interactions in ASD thus remains an important open question.

Objectives: A relatively new finding about neuronal oscillations is that different frequencies in the brain are often coupled locally, where "local" refers to a functionally defined brain region. This cross-frequency coupling (CFC) reflects local FC as mediated by neural entrainment across different frequency bands, and has been shown to play an important functional role in cognitive cortical processes. Our objective was to measure CFC in the cortex in order to determine whether local FC as mediated by CFC is normal, reduced, or increased in ASD. We hypothesized that CFC would be decreased in ASD individuals relative to typically developing (TD) individuals.

Methods: We tested our hypothesis using magnetoencephalography (MEG), a non-invasive method that combines millisecond time resolution with good spatial resolution. We focused on face processing, a paradigm that taps into the core social deficits of ASD, and in which abnormalities in long-range FC in ASD are well documented. We recorded MEG data from 17 male participants ages 14-20 with ASD, and 20 TD participants matched by age, IQ, gender, and handedness, while they viewed houses and neutral, fearful, and angry faces. We mapped the MEG data onto the cortex, identified the fusiform face area (FFA) for each participant, and computed the individual levels of CFC inside the FFA for each condition.

Results: During viewing of houses, both groups showed similar levels of CFC between alpha phase and low-gamma amplitude. During viewing of faces, alpha phase to low-gamma CFC increased in the TD group, and strong CFC between alpha phase and high gamma amplitude also emerged. In the ASD group, CFC during viewing of faces was identical to CFC during viewing of houses; i.e., no increase in CFC was observed. Furthermore, we found that local CFC measures were correlated with long-range FC measures of coherence between the FFA and three contralateral cortical regions. Finally, we found that these neurophysiological measures were predictive of whether a participant belonged to the ASD group and of ASD severity.

Conclusions: This is the first direct neurophysiological study of local FC in ASD. Failure to increase CFC in the ASD group during a task that elicited a large increase in CFC in the TD group meant that local FC in the ASD group was reduced relative to the TD group. This is also the first study to find a link between local and long-range FC measures. This means that the two processes are dependent on one another, and studying them in unison is crucial in order to understand the neural substrates of ASD. Finally, the correlation of these neurophysiological measures with ASD diagnosis and severity makes them potential biomarkers for ASD.

107.081 81 The Brain Connectome: A Multimodal Study of Discordant Monozygotic Autism Twins. K. Mevel*[1], P. Fransson[1], P. Lichtenstein[1], H. Anckarsäter[2], H. Forssberg[1] and S. Bölte[1], (1)*Karolinska Institute*, (2)*University of Gothenburg*

Background: Unraveling the relative contributions of genetics and environment remains difficult in Autism Spectrum Disorders (ASD). Comparison of monozygotic (MZ) twins discordant for ASD appears to be a promising lead. However, studies investigating such a population are still scarce, limited to small samples and/or to isolated brain measures. According to this, the sensitivity of such investigations could be improved in two ways. First, control samples have to be extended from typically developed MZ twins to pairs concordant for ASD and discordant for other mental disorders. Second, as proposed in the Human Connectome Project, the cerebral pathways of ASD could be highlighted while combining anatomical and functional measures of brain connectivity.

Objectives: As a part of a comprehensive twin project (Roots of Autism Twin Study Sweden "RATSS") including (epi-)genetics, immunology, environmental, and behavioral assessments, to explore brain anatomical and functional connectivity within and between the different categories of MZ twins listed above.

Methods: The project presented here has started in the late summer 2011 and is still in progress. Up to 140 pairs of MZ twins aged from 9 to 19 years old will be recruited for this project. All of them have been screened for ASD and comorbidities in a previous study and are categorized according to the followings: 50 pairs discordant for ASD and three control samples matched for age, sex, IQ and

socioeconomics - 30 pairs concordant for ASD, 30 pairs concordant for other mental disorders and 30 pairs typically developed of MZ twins. As for the neuroimaging assessment, twins undergo MRI anatomical and functional examinations using a 3T GE scanner. This includes one structural T1, one resting state functional MRI (rsfMRI; cross fixing) and two High Angular Diffusion Imaging (HARDI) sequences with 8 b0 images, 60 directions and b=1000 or b=3000 s/mm^2. As recommended when following a brain connectome analysis pipeline, datasets will be preprocessed to get covariance matrices for each twin in both modalities, i.e. HARDI and rsfMRI. Based on statistical inferences between measures in parcellated regions of the brain, these matrices provide an exhaustive and easy-understanding quantification of interregional brain connectivity. These covariance measures will be not only compared between twins but also between groups.

Results: To date, 8 pairs of MZ twins have been included, among which one is discordant for ASD. Taking into account the low statistical power allowed by this small sample size, no quantitative results can be provided here. However, 20 more pairs will be included until May 2012, which should be enough for the authors to show preliminary results during the IMFAR congress.

Conclusions: Unraveling the respective influence of genetics and environment is currently challenging ASD research. For the first time, MZ twins discordant for these disorders will be compared to different control samples using a multimodal approach. While mapping exhaustive brain connectivity in these groups, we should be able to access complex information about ASD mechanisms that have not been highlighted yet.

107.082 82 Autism Risk Allele in PLAUR Is Associated with Reduced Structural Connectivity in ASD. D. Beck-Pancer*[1], J. D. Rudie[1], L. M. Hernandez[2], E. M. Kilroy[2], P. M. Thompson[1], P. Levitt[3], D. H. Geschwind[1], S. Y. Bookheimer[1] and M. Dapretto[1], (1)*University of California, Los Angeles*, (2)*Brain Mapping Center, University of California, Los Angeles*, (3)*Keck School of Medicine, University of Southern California*

Background: Multiple genes in the MET receptor tyrosine kinase (*MET*) signaling pathway have been linked to autism spectrum disorder (ASD) susceptibility (Campbell, 2008); however, the mechanisms by which variation in these genes predispose individuals to ASD remains unclear. We recently found that a common functional variant in *MET* (rs1858830) is related to reductions in structural and functional connectivity in ASD (Rudie et al, Under Review), in line with previous studies characterizing ASD as a disorder marked by structural and functional underconnectivity (Schipul, 2011). Urokinase plasminogen activator receptor (*PLAUR*) cleaves hepatocyte growth factor, which binds the *MET* receptor and activates downstream signaling of multiple processes including axon formation and synaptogenesis. A common functional variant in PLAUR (rs344781) was found to be associated with ASD and there was also evidence of a gene-gene interaction between the *MET* and *PLAUR* variants such that individuals with both risk alleles were more likely to be diagnosed with ASD (Campbell 2008).

Objectives: While studies have begun to investigate the role of *PLAUR* in mouse models (Eagleson et al., 2011), the effect of this common variant using *in vivo* neuroimaging has yet to be examined. Therefore, we sought to explore whether the common autism risk variant in *PLAUR* impacts structural connectivity in individuals with ASD.

Methods: Forty-nine children with ASD and 39 typically developing (TD) controls matched for gender, age, and IQ were genotyped for *PLAUR* (rs344781) and underwent a 32 direction Diffusion Tensor Imaging (DTI) scan in a 3T scanner. White matter integrity was measured by quantifying fractional anisotropy (FA) across major white matter tracts using FSL's Tract Based Spatial Statistics.

Results: When examining the main effect of the *PLAUR* risk allele on FA collapsed across ASD and TD groups, *PLAUR* risk was associated with lower FA in several white matter tracts including the splenium of the corpus callosum and the thalamic radiations. Furthermore, when stratifying the risk groups by diagnostic status (TD and ASD), we found that the *PLAUR* risk allele impacted more tracts in ASD individuals.

Conclusions: Similar to what we previously observed for the *MET* risk allele, we found that carriers of the *PLAUR* risk allele exhibited reductions in structural connectivity, and that this effect was more pronounced in individuals with ASD. Our results suggest that multiple genetic risk factors in the MET signaling pathway may predispose to ASD by negatively affecting structural brain connectivity. An imaging genetics approach that utilizes genetic information in conjunction with brain based measures promises to shed new light on the neurobiological underpinnings of complex neuropsychiatric disorders and ultimately inform the development of targeted interventions.

107.083 83 A Cerebral Spectrum From Autism to Dyslexia: Determining Cortical Surface Complexity Utilizing Spherical Harmonics. M. F. Casanova, M. Nitzken, E. L. Williams*, A. E. Switala and A. S. El-Baz, *University of Louisville*

Background: Autism and dyslexia occupy extremes of a neuroanatomical distribution. While autism exhibits characteristics indicative of increased neocortical progenitor proliferation, including increased density of minicolumns, increased gyrification, decrease in gyral window size, reduced corpus callosal volume, and enhanced radiate white matter volume, dyslexia presents with the opposite phenotype, including reduced minicolumnar density and gyral complexity, greater gyral window size, and increased corpus callosal volume.

Objectives: Based upon this evidence, we have utilized spherical harmonics (SH), a set of complex functions defined on the unit sphere, in order to measure cortical surface complexity in autism and dyslexia so that we may further explore this spectrum distribution.

Methods:

Raw data comprised T1-weighted MRI of the brains of 13 individuals with autism (aged 8 y–38 y, mean 22.5 y), 16 with dyslexia (aged 18 y–40 y, mean 28.2 y), and 31 neurotypical comparison participants within the same age range. All participants were male. Triangular mesh representations of the cerebral cortical surface in scanner-based, RAS coordinate system were mapped to the unit sphere using an attraction-repulsion algorithm. Mesh topology was preserved, so that the transformed meshes triangulated the sphere. This mapping defined three scalar functions on the sphere: $R(\theta, \varphi)$, $A(\theta, \varphi)$, and $S(\theta, \varphi)$, each of which was represented as an SH series. Truncating the series at a particular maximum SH degree L_{max} provides an approximation to the cortical surface that incorporates greater detail as L_{max} is increased. We computed a shape index, s, for each surface by summing the truncation error as L_{max} ranged from 1 to 65, inclusive.

Results: As predicted by our theoretical model, the shape index varied significantly by diagnostic category. Autism exhibited a greater level of surface complexity, mean $s = 279$ (95 % confidence interval [255, 305]), dyslexia presented within the lower ranges of our three groups, mean s = 99.5 (95 % confidence interval [91.8, 108]), while controls occupied the median ranges, mean s = 181 (95 % confidence interval [171, 192]).

Conclusions: When utilizing SH to measure overall surface complexity of the brain, autism and dyslexia display two extremes of a single distribution, while controls occupy an intermediate range between the two. Autism and dyslexia occupy similar diametric positions when measuring other aspects of corticalization. Together, this evidence supports our theory of a cerebral spectrum, one in which autism and dyslexia illustrate its two phenotypic extremes.

107.084 84 ASD Geometric Responders: Toward a Biologically Meaningful Subgroup. S. Marinero*, K. Campbell, S. Solso, R. Hazin, E. Courchesne and K. Pierce, *University of California, San Diego*

Background: Autism (ASD) is a heterogeneous disorder both biologically and clinically and the search for biologically meaningful subgroups is essential. Using eye tracking technology, we previously identified a subgroup of children with autism (i.e., 39% of the ASD sample) that preferred to visually fixate on dynamic geometric images rather than dynamic social images. This subgroup of “geometric responders” (GEO), was not identified in DD or TD contrast groups who each preferred social images (SOC). This unique visual attention preference should, in theory, be mediated by an equally unique feature of the ASD brain. The cerebellum, long known to be abnormal in autism (Courchesne 1987) has

been shown to display overgrowth during the first years of life (Webb 2009) followed by reduced volumes during later development (Hallahan 2009). As a structure highly involved in attention, it is ideally suited to examine relationships with performance on the "geometric preference test."

Objectives: This study had 3 primary objectives: 1) to examine similarities and differences in cerebellar volumes between ASD GEO and ASD SOC subgroups; 2) to examine the degree that cerebellar gray matter (GM), white (WM), or overall (GM+WM) volume is associated with visual preference for geometric images and 3) to compare cerebellar volumes between ASD GEO and TD.

Methods: Ninety seven toddlers (63 ASD, 34 TD), ranging in age between 21-48 months participated in both the geometric preference test as well as a sleep MRI scan. Based on fixation times recorded with a Tobii T120, 27 ASD toddlers were classified as GEO (i.e., fixation times > 50% viewing geometric images), whereas the remaining 36 ASD toddlers and all TD toddlers were classified as SOC (i.e., fixation times > 50% viewing social images). Structural MRIs were acquired using a standard T1-weighted 3D protocol on a GE 1.5 T scanner. FSL was used to calculate brain volumes.

Results: Directly comparing the two ASD subgroups revealed significantly larger left and right cerebellar GM as well as overall cerebellar volume ($p=0.001$, $p=0.05$, and $p=0.004$) in ASD GEO toddlers relative to ASD SOC toddlers. Moreover, there was a non-significant trend for ASD GEO toddlers to have a greater total brain volume ($p=0.05$). The degree of cerebellar enlaragement was also positively correlated with percent fixation time towards geometric images ($r=.30$). Moreover, there was a trend towards right cerebellar enlargement in GEO relative to TD ($p=0.08$). In contrast, ASD SOC toddlers, had significantly smaller left and right cerebellar GM ($p=0.05$, $p=0.03$) and a significantly smaller overall cerebellum volume ($p=0.03$) relative to TD.

Conclusions: Children with autism often delight in examining everyday visual repetition, such as the spinning of a fan or a car wheel. Here we present data suggesting that a subgroup of children who display a preference for geometric repetition have distinctly different neuroanatomical profiles, namely increased cerebellar gray matter, than ASD toddlers who do not display this preference. Our data shows, for the first time, that the cerebellum may be centrally involved in mediating a visual preference for repetition in a clearly definable subgroup of ASD toddlers.

107.085 85 Cortical Morphology and Links to Resting-State Oscillatory Activity in Autism Spectrum Disorders. L. Cornew*, T. P. L. Roberts, J. McDaniel and J. C. Edgar, *Children's Hospital of Philadelphia*

Background: Our laboratory recently reported that children with autism spectrum disorders (ASD) exhibit increased resting-state alpha power in temporal and parietal regions, with greater alpha activity associated with greater symptom severity (SRS score). Other recent work has shown reduced cortical thickness (CT) in temporal and parietal regions in adults with ASD. Both alpha activity and CT have been postulated to depend on the structural and functional integrity of cortical columns.

Objectives: The present study examined CT in children with ASD and investigated CT as a potential anatomical correlate of increased resting state alpha activity. It was hypothesized that compared to typically developing controls, children with ASD would exhibit reduced CT, primarily in temporal and parietal regions. In addition, analyses in the ASD group probed associations between CT and resting-state alpha power.

Methods: Participants were medication-free 6- to 14-year-old children (20 with ASD, 20 controls). These children were a sub-sample from our previous magnetoencephalography (MEG) study who also completed a 3T structural MRI scan. MEG eyes-closed resting state data were processed by projecting each individual's raw surface activity into source space with a regional source model and applying a Fast Fourier Transform to artifact-free two-second epochs of the continuous data at each of 15 regional sources. Individual spectra were averaged and alpha (8-12 Hz) power quantified. Structural MRI provided T1-weighted images and, using Freesurfer, CT measures were obtained. Whole-brain general linear model (GLM) group analyses of CT were corrected for multiple comparisons and cluster-wise probabilities computed to indicate the likelihood that a given cluster appeared by chance.

Results: Analyses revealed reduced CT in the ASD group in a left frontal region that included portions of the superior and middle frontal gyri (cluster-wise probability = .01) as well as in left and right temporal and parietal regions (all cluster-wise probabilities = .0001). Temporal and parietal regions included bilaterally the superior temporal sulcus, portions of superior, middle, and inferior temporal gyri, and the inferior parietal lobule. CT was also reduced in the ASD group in the left fusiform and parahippocampal gyri, and left temporal pole. Regression analyses in the ASD group revealed associations between increased alpha power in temporal and parietal regional sources and reduced CT in bilateral portions of the superior temporal gyrus, inferior parietal lobule, and precuneus, as well as left superior temporal sulcus and right fusiform gyrus.

Conclusions: Results demonstrated reduced CT in children with ASD, particularly in bilateral temporal and parietal regions. CT reductions were associated with increased alpha power, suggesting a link between atypical brain structure and function in ASD. The regions exhibiting reduced CT and increased alpha power overlap with regions implicated in social processing and default-mode network activity, in which aberrant activation patterns have been observed in ASD. Thus, present findings may point to a common dysfunction in cortical circuitry underlying multiple neural abnormalities in ASD.

107.086 86 Neuroanatomical Correlates of Cognitive Flexibility in Adolescents with Autism and the Broader Phenotype. R. J. Holt*[1], L. R. Chura[1], A. M. Dean[2], S. Baron-Cohen[1] and M. D. Spencer[1], (1)*Autism Research Centre, University of Cambridge*, (2)*University of Cambridge*

Background:

Autism is associated with impairment in some aspects of executive function. Conflicting reports concern whether subtle or related deficits are present in their unaffected first degree relatives. Structural and functional brain imaging correlates of executive function have been identified and found to differ in individuals with autism.

Objectives:

To explore differences in cognitive flexibility in adolescents with autism and their siblings compared to controls. Structural brain imaging correlates of executive function were investigated and compared between the groups.

Methods:

40 adolescents with autism, 40 of their unaffected siblings, and 40 typically developing controls completed an intra-dimensional/ extra-dimensional shift task (ID/ED), a test of set-shifting ability. Structural MRI data was acquired which was analysed using the multivariate analysis partial least squares (PLS). This was further followed by a permutation test of familial variation of the MRI markers.

Results:

Significant differences in performance were found between the autism and control groups on the ID/ED (p =.003), at the highest level of difficulty. Significant differences in performance on these measures were not apparent between the siblings and controls. PLS identified a grey matter system associated with set-shifting performance. Further analysis revealed significant correlation between grey matter volume in this system and performance on the ID/ED task; however this was only true for the control group. Variation in grey matter volume within this system was significantly more alike between related sibling pairs compared to randomly permutated sibling pairs, as determined by the familial permutation test (p=0.008).

Conclusions:

Impairments in set-shifting were found in individuals with autism. In contrast, set-shifting ability was intact in unaffected siblings. Set-shifting per se therefore does not qualify as a cognitive endophenotype for autism. We found an association between brain structure and cognitive flexibility in the control group, an association that was not apparent in the autism group. This suggests that the structure to function relationship evident in controls is disrupted in autism. Grey matter volume within this system was found to be heritable between autism and sibling groups which could be further explored for its value as a candidate endophenotype for autism.

107.087 87 Decreased Gray Matter in Orbitofrontal and Superior Temporal Areas in Autism: A Voxel-Based Morphometry Study. A. J. Rozsa*, L. Libero, H. D. Deshpande, M. Morris and R. K. Kana, *University of Alabama at Birmingham*

Background: Despite the abundance of studies examining brain anatomy in autism spectrum disorders (ASD), a biomarker for the disorder has been rather elusive. Of late, some studies have proposed structures, such as the superior temporal sulcus, as an endophenotype that can predict the severity of autism symptoms (Kaiser et al., 2010). Similarly, some other studies have found gray and white matter abnormalities in orbitofrontal cortex (OFC) to have a negative correlation with social behavior in ASD (Girgis et al., 2006; Rojas et al., 2006). The current study is an attempt to examine structural integrity of these two *social brain* structures, and possibly relate our findings to underlying connections, to developmental trajectory, and to symptom severity in ASD.

Objectives: The objective of our study is to determine if gray and white matter composition of the *social brain*, specifically the superior temporal cortex (STC) and OFC, can provide clues to potential neural signatures of ASD.

Methods: Structural images were acquired from ten high-functioning adults with ASD and ten typically developing control participants (data collection in progress). To obtain region-based measures of gray and white matter volumes, participants' T1-weighted structural scans were segmented using FreeSurfer 5.1 (Fischl& Dale, 2000). All measurements were normalized to cortical, total, and hemispheric gray and white matter to adjust for individual differences in brain anatomy. We calculated the gray and white matter volumes of different areas in the *social brain* (amygdala, STC, OFC, insula, inferior frontal gyrus, medial prefrontal cortex, and anterior cingulate cortex). Simple regression analyses were used to assess the predictive relationship between ASD symptoms (measured by the Autism Quotient) and social brain area volumes.

Results: The main results are as follows: 1) Participants with ASD had significantly reduced gray matter, relative to controls, in two areas of the social brain: STC and lateral OFC (STC: $t(18)=2.07$, $p=0.05$; OFC: $t(18)=2.39$, $p=0.02$). However, volumes of the other previously mentioned social brain regions were not significantly different between the two groups. 2) Our ASD group had significantly reduced total white matter ($t(18)=2.27$, $p=0.03$), as well as reduced left and right hemisphere white matter relative to control participants (Left: $t(18)=2.31$, $p=0.03$; Right: $t(18)=2.21$, $p=0.04$); 3) A simple regression analysis revealed that greater AQ scores marginally predicted reduced OFC volume ($\beta=-0.46$, $t(18)=-1.91$, $p=0.07$).

Conclusions: These results support previous studies of anatomical alterations in the ASD brain, specifically the OFC (Salmond, et al., 2003). Although the STC was consistently smaller in volume in the ASD group, we did not find any significant relationship between this and symptom severity in ASD. While the evidence for an endophenotype may be mixed at this point, our findings may suggest the OFC and STC as potential targets for future research in ASD. We also plan to examine the developmental trajectory of brain organization in ASD by comparing data of children and adults with ASD. Finally, our finding of reduced total white matter in the ASD group may impact functional and anatomical cortical connectivity (Kana, Libero, & Moore, 2011).

107.088 88 Mapping Cortical Anatomy in Young Children with Autism Using Surface Based Morphometry. A. Raznahan*[1], R. Lenroot[2], A. Thurm[1], M. Gozzi[1], A. Hanley[1], S. J. Spence[3], S. Swedo[1] and J. Giedd[1], (1)*National Institute of Mental Health*, (2)*University of New South Wales*, (3)*Childrens Hospital Boston*

Background: Aberrant cortical development during early childhood is thought to be an important component of autism pathophysiology. However, the challenges of measuring brain anatomy *in-vivo* during early childhood have limited the number of studies comparing cortical anatomy between individuals with autism and typically developing controls (TDCs) during this critical developmental window. Moreover very few studies have examined indices other than global and lobar cortical volume.

Objectives: To present initial structural neuroimaging findings from a new cohort of young children with autism using surface-based methods for cortical morphometry that (i)

directly measure the two biologically distinct sub-components of cortical volume - cortical thickness and surface area and (ii) map cortical thickness at high spatially resolution throughout the cortical sheet.

Methods: This was a cross-sectional case control neuroimaging study conducted in a Federal clinical research institute. We included 75 male children with autism and 33 typically developing male controls aged 2 through 6 years. Primary outcome measures of interest were (i) Global and lobar cortical volume, thickness and surface area, and (ii) cortical thickness at ~80,000 points.

Results: Children with autism showed age-related global cortical volume excesses relative to TDCs, which were driven by attenuation of age-related cortical thickness reduction relative to TDCs. These thickness-driven volume excesses were apparent in all lobes, but uniquely compounded in frontal lobes by an exaggerated age-related surface area increase in children with autism relative to TDCs. Fine-mapping group differences in cortical thickness identified disruptions of cortical anatomy in autism that were already localized at an early age to regions involved in the processing of language, biological movement and social information, as well as to executive prefrontal systems involved in behavioral regulation.

Conclusions: Our findings (i) parse cortical volume abnormalities in autism into more biologically tractable sub-components, and (ii) show that disease mechanisms in autism can already produce targeted disruption of cortical anatomy by early childhood.

107.089 89 Preliminary Findings From a Longitudinal Examination of Brain Volume From 6 to 24 Months in Infants At High Familial Risk for Autism. H. C. Hazlett*[1], H. Gu[2], M. Styner[3], D. L. Collins[4], V. Fonov[4], G. Gerig[5], K. Botteron[6], S. R. Dager[7], S. Paterson[8], R. T. Schultz[9], A. C. Evans[4], J. Piven[10] and I. B. I. S. Network[11], (1)*University of North Carolina at Chapel Hill*, (2)*University of North Carolina*, (3)*UNC*, (4)*Montreal Neurological Institute*, (5)*University of Utah*, (6)*Washington University School of Medicine*, (7)*University of Washington*, (8)*Children's Hospital of Philadelphia*, (9)*University of Pennsylvania*, (10)*University of North Carolina, Chapel Hill (UNC-CH)*, (11)*Autism Center of Excellence*

Background: Multiple lines of converging evidence from post-mortem, magnetic resonance imaging, and head circumference studies have documented brain and head size enlargement in autism spectrum disorder (ASD). This brain enlargement has been observed as early as age 2. Data from longitudinal head circumference studies as well as behavioral studies of infant siblings at high risk for autism suggest that key developmental changes associated with ASD may occur in the first year of life.

Objectives: We sought to characterize trajectories of early brain growth in infants at high familial risk for autism. We examined longitudinal brain volumes using structural MRI data from a large sample of 6 month olds at high risk for autism and typically-developing controls with follow-up scans at ages 12 and 24 months.

Methods: Imaging data was obtained from all four IBIS data collection sites. Data collection included a battery of behavioral and developmental assessments and structural MRI and DTI scans obtained on a 3T Siemens scanner. This longitudinal study is currently ongoing, so we are reporting on preliminary findings from the longitudinal data we have collected thus far. Brain volume measures were performed on 112 high-risk and 17 low-risk controls infants at age 24 months who had previous scan data at 6 and/or 12 months of age. Brain measures at 6 months included intracranial volume (ICV), total brain volume (TBV), cerebrum, cerebellum, and head circumference. At ages 12 and 24 months, we were also able to examine the tissue volume of the cortical lobes (frontal, temporal, parietal, occipital) as well as cortical surface area and thickness. Statistical analyses included covariates such as gender, site, body size (length), and age at scan.

Results: Scores on the ADOS-G were used to classify children in the HR group. There were 31 HR infants who fell on the autism spectrum (ASD+) and 71 infants who did not meet ASD criteria. To account for body size differences in evaluation for brain growth, we calculated normative age for body size based on The WHO Child Growth Standards (boy). We compared the group differences in brain growth rate in relation to normative

body growth, and found an increased rate of total brain volume (TBV) growth in male HR infants who are classified as ASD+ at 24 months compared to the non-spectrum HR infants and low-risk controls. This pattern of increased growth rate between 6 – 24 months was also seen for gray and white matter volumes.

Conclusions: The preliminary results from this ongoing study suggest the presence of an increased rate of brain volume between ages 6 to 24 months in infants at high-risk for autism who fall on the autism spectrum at age 24 months. These findings suggest that early differences in brain growth emerge in the first two years of life and raise the optimistic possibility that there is a window of opportunity where early postnatal intervention, during a period of tremendous brain plasticity, may have an important impact on the later emergence of autistic behavior.

107.090 90 Cortical Thickness in Adults with Autism. P. C. Regener*[1], L. S. McKay[2], D. R. Simmons[1], P. McAleer[1], D. Marjoram[1], J. Piggot[3] and F. E. Pollick[1], (1)*University of Glasgow*, (2)*Netherlands Institute for Neuroscience*, (3)*University of Dundee*

Background:

Grey matter (GM) volume and cortical thickness (CT) have been shown to correlate with performance and expertise on a number of tasks in typically developed individuals (e.g., Maguire et al., 2003). In people with ASDs it has been suggested that GM abnormalities are linked to behavioural deficits (Hadjikhani et al., 2006). Structural magnetic resonance imaging (MRI) studies have revealed various different patterns of CT/GM volume in adults and adolescents with ASDs, predominantly finding decreases on both measures in areas of the frontal, parietal and temporal lobe (e.g., Scheel et al., 2011; Toal et al., 2010). However, increases in CT/GM volume in areas across the brain have also been reported (e.g., Hyde et al., 2010).

Objectives:

Despite being a more reliable measure of underlying GM thickness (Kim et al., 2005), studies on CT in people with ASDs are underrepresented in the literature. Our objective was to utilise new semi-automatic cortical thickness analysis (CTA) tools in BrainVoyager QX (Goebel et al., 2006), which have not yet been applied to whole brain CT measurements in a group with ASDs and a matched control group.

Methods:

Participants: 10 males with ASDs and 10 age, sex and IQ-matched controls (McKay et al. 2011).Data Collection: Sagittal T1-weighted anatomical images were obtained using a Siemens 3T Tim Trio MRI scanner (Parameters -T1 weighted MPRAGE sequence; TR = 1900ms, TE = 2.52ms, TI = 900ms with a flip angle = 9°; 192 slices; resolution = 1 mm^3; FOV = 256.

Data Processing: White matter (WM)/GM border and the GM/cerebrospinal fluid (CSF) border was extracted for each brain using the advanced segmentation tools in BrainVoyager QX. From these, individual CT maps were calculated for each subject. Reconstructed surfaces of the GM/WM boundary for each hemisphere were aligned using cortex-based alignment (CBA) in order to better account for anatomical variability across all brains. The CT maps were then transformed from volume space into each subject's corresponding surface space.

Analysis: Independent between groups t-tests were carried out using the CT of each subject at every vertex on the surface. Cluster size threshold estimation was used to control for multiple comparisons.

Results:

The analysis revealed that males with ASDs had significantly reduced CT bilaterally in the fusiform gyrus, in the left precentral sulcus and in the right postcentral sulcus, superior temporal sulcus, posterior cingulate, uncus and parahippocampal gyrus. There were no areas found to have significantly increased CT in the ASD group. These results are in line with previous studies reporting reduced CT/GM volumes in people with ASDs.

Conclusions:

The regions found to have reduced CT in the ASD group, namely the fusiform gyrus, posterior cingulate, and posterior

temporal lobe, have been implicated in social cognition (Adolphs, 2001; Redcay, 2008). Similarly, the fusiform gyrus, precentral and postcentral sulcus have been linked to face and emotional face processing (Kanwisher et al., 1999; Adolphs et al., 1996). As such, the reduced CT found in these regions may correspond to functional abnormalities in the aforementioned domains in individuals with ASDs.

107.091 91 Self-Injurious Behaviours Are Associated with Alterations in the Somatosensory System in Children and Adolescents with Autism Spectrum Disorders: A Multimodal Brain Imaging Study. E. G. Duerden*[1], S. W. Roberts[2], J. Villafuerte[1], M. M. Chakravarty[3], K. M. Mak-Fan[1], J. P. Lerch[2] and M. J. Taylor[1], (1)*Hospital for Sick Children*, (2)*The Hospital for Sick Children*, (3)*Kimel Family Translational Imaging-Genetics Laboratory, Research Imaging Centre, Centre for Addiction and Mental Health*

Background: Children with autism spectrum disorders (ASD) commonly perform behaviours that are self-injurious, often in the absence of reporting pain. Previous research suggests that altered pain sensitivity is associated with morphological changes in somatosensory and limbic cortices. Self-injurious behaviours are reported to result in alterations in the structure and organization of the temporal lobes in adults with ASD. However, the effect of self-injurious behaviour on cortical development in children with ASD remains unknown.

Objectives: To determine the relation between grey/white matter structural changes and self-injurious behaviours in children and adolescents with ASD.

Methods: We studied 28 children and adolescents (mean age=10.34 ±2.5 yrs; range: 6-15yrs; 25 males) who carried a clinical diagnosis of ASD. Participants were verbal and high functioning (IQ=104; sd=18.27). Self -injury was assessed using a standardized parental questionnaire. Each participant underwent diffusion tensor imaging (DTI) and T1-weighted magnetic resonance imaging at 1.5 Telsa (T). Cortical thickness analysis was performed on the anatomical images using the CIVET pipeline; based on *a priori* hypotheses, regions-of-interest were drawn over the bilateral somatosensory, cingulate, and medial temporal lobe cortices. Volumes of thalamic nuclei were extracted using non-linear alignment of a histological atlas. Tract-based spatial statistics were used to assess changes in Fractional Anisotropy (FA) using the DTI data set followed by whole brain tractography.

Results: Self-injury scores negatively correlated with thickness in the right superior parietal lobule (p=0.001). A directed search in the left primary somatosensory cortex (SI) also revealed a significant negative correlation with self-injury scores (p=0.006). Volumetric analyses revealed that the left ventroposterior (VP) nucleus was negatively correlated with higher self-injury scores (R=-0.53, p=0.005). Based on these findings we extracted the FA values, a measure of white matter fibre integrity, based on a tract based region of interest analysis between SI and the VP nucleus and found that children who engaged in self injury had significantly higher FA values in the left hemisphere (F=5, p=0.04).

Conclusions: Cortical volume and thickness in primary and association somatosensory brain areas were lower in ASD children with increased self injury, suggesting that alterations in somatosensory brain regions, and the underlying white matter pathways, could serve as a biomarker for disrupted brain development in children with ASD who self injure. Future research will focus on the relation among altered brain morphology, self-injury and atypical pain perception commonly seen in this population.

107.092 92 The Effect of Age and Symptom Severity On Brain Surface Area In Autism Spectrum Disorders. K. A. R. Doyle-Thomas*[1], A. Kushki[2], E. G. Duerden[3], M. J. Taylor[3], J. P. Lerch[4], L. V. Soorya[5], A. T. Wang[5], J. Fan[5] and E. Anagnostou[2], (1)*Bloorview Research Institute*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*Hospital for Sick Children*, (4)*The Hospital for Sick Children*, (5)*Mount Sinai School of Medicine*

Background: Grey matter volume (GMV) abnormalities have been reported in individuals with Autism Spectrum Disorders (ASD) (Courchesne 2010). However, what determinants of GMV contribute to these atypicalities is still unknown. Cortical thickness and surface area are both components of GMV that capture distinct neurobiological processes (for reviews see Anagnostou and Taylor, 2011; Raznahan et al., 2010). Atypical development of cortical thickness in a number of brain regions in people with ASD have previously been found (Wallace et al.,

2010; Raznahan et al., 2010; Mak-Fan et al., 2011), with some atypicalities related to social impairment (Hardan et al., 2009; Hadjikhani et al., 2006).

Objectives: To examine the developmental trajectory of surface area (the other determinant of grey matter volume) in ASD and determine if abnormalities are related to symptomatology.

Methods: High-resolution anatomical Magnetic Resonance Imaging (MRI) scans from 53 individuals with (n=29) and without (n=24) ASD between the ages of 7 and 39 (ASD mean age=22 ±8 years; 22 males; control mean age = 21±9 years; 18 males) were included in this analysis. ASD participants carried a clinical diagnosis, according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) and their diagnoses were confirmed using the Autism Diagnostic Observational Schedule (ADOS) and the Autism Diagnostic Interview - Revised (ADI-R). All participants had an IQ>70 as estimated by the Wechsler Intelligence Scale for Children-fourth edition (WISC-IV) or the Wechsler Adult Intelligence Scale-fourth edition (WAIS-IV). Surface area was estimated for the whole brain, each cortical lobe, the para-splenium, the parahippocampal gyrus, the anterior cingulate cortex (ACC) and the insula cortex based on surface-to-surface deformations (Lyttelton et al., 2007; Boucher et al., 2009). Effects of age, group and symptomatology on surface area were examined using regression analyses.

Results: At a significance level of 0.05, an age x group interaction was found for surface areas in the right ACC (p=0.04) and the right para-splenium (p=0.02). In the ASD group, a significant relation was observed between ADI-R scores and surface area in the right insula (p=0.03), with more severe social impairment related to increased surface area in this region. These results however did not survive adjustments for multiple comparisons.

Conclusions: The findings of the present study suggest potential regions of interest for future investigations on the development of surface area in ASD. The right ACC and insula are both brain regions implicated in social function and are key areas of functional impairment in ASD. Atypical surface morphometry in these regions may indicate a neurobiological contributor to social impairment observed in ASD. Indeed, these results suggest that abnormalities in the insula may be associated with social symptom severity. In a previous study (Doyle-Thomas et al., *under revision*), atypical cortical thickness was found in the ACC and collectively, these findings may suggest general abnormalities in GMV in this brain region. This raises the question of whether atypical development in components of GMV in social brain areas may be an intermediate phenotype that may be explored further for neurobiological and potential treatment research.

107.093 93 Abnormal Brain Surface Morphology and Gyrification Pattern in Children with Autism Spectrum Provides Clues to Prenatal Onset. G. Fung*[1], S. E. Chua[1], P. Chan[2], K. Yu[1], C. Wong[1], C. Tang[1], A. Lam[2], P. L. Khong[1], H. Mak[1], C. Cheung[1] and G. M. McAlonan[1], (1)*University of Hong Kong*, (2)*Hospital Authority*

Background:
Cortical complexity can be described by the pial surface and gyrification, a process which begins prior to birth. In normal development, the period critical for the emergence of cortical convolutions is between 26 to 36 weeks of gestational age, ie the third trimester of pregnancy (Chi, Dooling, & Gilles, 1977); during this time the cortical surface area increases considerably, resulting in an increase of grey matter volume. Earlier investigations indicated greater folding in frontal regions in autism (Harden et al., 2004), whereas others have reported sulcal abnormalities in the parietal regions (Nordahl et al., 2007). However using one dimension to understand cortical folding provides limited explanation of cortical complexity. The present study examines the developmental trajectory of cortical gyrification using four cortical dimensions in a group of children with autism spectrum disorders (ASD) and typically developing controls over a 6–17 year range.

Objectives:
The present study examined: 1) gyrification differences in ASD compared to controls across four cortical dimensions: surface area, cortical thickness, sulcal depth and curvature; and 2) age-related differences in gyrification in each group.

Methods:
Thirty five T1-weighted MPRAGE images were acquired from

6-17 year old children with ASD (n=17) and typically developing controls (n=18). Parental consent was obtained and the study was approved by the Hong Kong West Cluster Institutional Review Board. Both groups were matched in age and all children attended mainstream schools. We employed a surface-based approach using the Freesurfer software and a general linear model was computed to derive regional differences in each of the four dimensions. A correlation analysis of age-gyrification pattern was conducted in each group separately.

Results:
There were significant group differences in the right parietal regions. Compared to controls, the right parietal region in the autism group had smaller surface area, but greater cortical thickness, larger sulcal depth and gyral curvature. The right posterior cingulate in the autism group had smaller sulcal depth and gyral curvature despite no differences in the surface area and cortical thickness. Correlation analyses indicated right parietal surface area increased with age in ASD but decreased with age in controls whereas cortical thickness measures did not change with age in ASD, but increased in the control group.

Conclusions:
Our study examines the surface brain morphology across development in children with autism. Preliminary findings confirm cortical abnormalities occur primarily in the parietal regions and posterior cingulate in the right hemisphere. Since sucli and gyri in these regions first emerge at around 24 to 27 gestation week and the gyrification pattern remains relatively constant from postnatal into childhood (White et al., 2010), the differences we observe may have origins during this period of prenatal life. Age-related differences in our cohort suggest dysmaturation of gyrification in the parietal and cingulate regions in the autism group is dynamic and persistent.

107.094 94 Age-Related Differences in Optic Nerve Geometry in Autism Spectrum – a Potential Imaging Marker?. C. Cheung[1], C. P. W. Tsang[1], G. Fung[1], S. E. Chua[1] and G. M. McAlonan*[2], (1)*University of Hong Kong*, (2)*Institute of Psychiatry, King's College London*

Background: Brain maturation in autism is aberrant. In early life, brain volumes enlarge, particularly in amygdala. However, by adolescence there is generally no overall volume difference relative to age-matched controls, although complex regional anatomical changes persist.

Objectives: With an eye to early diagnosis and multi-centre application, we explored MRI measurements which would not rely upon scanner hardware or intensity based image processing methods. We developed a routine to map the optic chiasm and its branches in T1 scans to extract measurements of: optic angle, anterior extension of the optic nerve (a), and posterior extension of optic nerve (b).

Methods: A balanced sample of 30 boys with autism spectrum disorders and 30 typically developing age- and verbalIQ-matched controls had T1 scans available for analysis. Parents gave informed consent for the scanning protocol approved by the Hong Kong West Cluster Institutional Review Board. T1 images were screened for rotational tilt due to 'roll' or 'pitch' in sagittal and coronal planes. A transformation matrix quantifying the tilt angle for each image was constructed and realignment achieved using SPM2 software (Wellcome Department of Imaging Neuroscience, London (http://www.fil.ion.ucl.ac.uk). A reverse transformation was applied to the image to adjust tilt. The re-aligned image was resliced to generate isotropic 1x1x1 mm voxel dimensions. Using ITKsnap software the optic nerves were traced from the tip of the orbit where the optic nerves are not surrounded by the extraocular muscles to the last slice where the optic tracts are visible before entering the brain thalamic substance. Data were imported into Matlab and a measurement kernal established to calculate the anterior distance from optic chiasm forward (a), back (b) and optic angle.

Results: There were no group differences in cranial volumes. In a multivariate general linear model with age as a covariate, for dependent variable 'a', there was a significant main effect of age ($F = 5.22$, $p = 0.026$) and Group and Group x age interaction approached significance ($F = 3.71$, $p = 0.058$), ($F = 5.22$, $p = 0.026$) respectively. Correlation analysis revealed a strong positive correlation between age and anterior distance in the autism group only ($r = 0.54$, $p = 0.002$) and this correlation was significantly different from controls ($Z = -2.03$, $p = 0.02$). Thus, the anterior distance from the optic chiasm in the autism group is shortened compared to controls prior to

12years, then expands beyond controls in adolescence. In contrast the posterior distance from optic chiasm back towards thalamus tended to be greater in young children with asd but smaller in adolescents compared to controls but this was not statistically significant.

Conclusions: We are currently examining replication datasets. If this finding proves robust, we will extend our study to examine optic nerve geometry in younger children with autism and test the hypothesis that anterior distance from optic chiasm is markedly shorter in younger children with autism. The hope is that this observation may hold potential as an early imaging marker to help identify at risk infants.

107.095 95 Imaging Radial Cortical Anisotropy to Measure Microstructure of the Cortex in Autism: A Novel Method for the Detection of Early Brain Changes. R. M. McKavanagh and S. A. Chance*, *University of Oxford*

Background: Theories of autism have hypothesised early developmental brain over-growth, altered cortical micro-circuitry with excessive packing of minicolumns, and loss of inhibitory architecture. The differences in micro-circuitry relate to differences in cognition, for example, altered social cognition appears to be linked to differences in fusiform face processing cortex. Minicolumn structure has also been associated with hemispheric asymmetry of language function. However, seeking to explain altered cognitive functions such as face processing and language at the microscopic scale is a challenge given the current limits of brain imaging. For much of its history MRI has been concerned with the detection of volumetric differences but the cortex is not an undifferentiated, homogenous network; it consists of multiple, columnar, structural units that may constitute micro-circuits. Past studies have shown that developmental changes in DTI signal (radial cortical anisotropy) appear to correspond to the developmental expansion of these micro-circuits. Our studies of post-mortem histology have revealed a cortical signature, based on multi-regional comparison that is sensitive to early signs of pathology.

Objectives: We report here on a novel application of diffusion tensor imaging (DTI) to cerebral cortex for comparison with measurements of microstructure in post-mortem brains.

Methods: Structural MRIs, including diffusion weighted images, were acquired from a series of post-mortem human brains. The tissue collection comprised brains donated by controls (4 subjects) and two neurological/psychiatric conditions: ASD (4 subjects) and multiple sclerosis (MS) (9 subjects). The scanning protocol requires long scans with sequences devised specifically for fixed post-mortem tissue broadly as described in Miller et al (2011). The analysis of radial cortical anisotropy used the novel 'CHIPS' software developed for the purpose (FMRIB, Oxford, UK). After scanning, tissue samples were dissected from several regions and cryosectioned to provide Nissl stained slides for minicolumn estimation. The minicolumn analysis was similar to that described in Chance et al (2011) and provided data on minicolumn centre-to-centre spacing.

Results: Multi-region comparisons typically indicated wide spacing of minicolumns in prefrontal cortex, intermediate spacing in temporal lobe auditory association cortex (including the planum temporale which has been associated with language asymmetry) and narrow spacing in primary auditory and visual cortices. Diffusion measures of the cortex from the CHIPS analysis were significantly correlated with the minicolumn centre-to-centre spacing across both primary visual and prefrontal regions, providing an MRI index of minicolumn organisation in human brain.

Conclusions: Validation of this technique raises the prospect of measurement of (i) much more subtle cortical changes than current volumetric methods, and (ii) brain region differentiation at the microstructural level. Successful translation of this technique to *in vivo* imaging will aid detection and assessment of autism and other disorders.
References: Miller et al. *Neuroimage* 57(1):167-81 (2011). Chance et al. *Cerebral Cortex* 21(8):1870-8 (2011)

107.096 96 Analysis of High Quality Diffusion Tensor Imaging in Young Children with Autism. L. Walker[1], M. Gozzi[2], A. Thurm[2], B. Behseta[2], R. Lenroot[3], S. Swedo[2] and C. Pierpaoli*[4], (1)*USUHS*, (2)*National Institutes of Health - National Institute of Mental Health*, (3)*University of New South Wales*, (4)*PPITS/STBB/NICHD/NIH*

Background: Diffusion tensor imaging (DTI) shows promise for studying potential structural abnormalities in the brains of

autistic children. The most consistent finding in the literature is reduced fractional anisotropy (FA) and increased mean diffusivity (Trace(D)) in autistic subjects compared to healthy subjects. However, regional distribution of the abnormalities is inconsistent across studies. Some of this heterogeneity may be due to small sample sizes, which might obscure meaningful between-group differences that fail to reach the threshold set for statistical significance. Further, the magnitude of the reported changes is small, rendering them vulnerable to the effects of minor confounds.

Objectives: To investigate the brains of autistic children as compared to age and gender matched typically developing children using high quality DTI data, and to create average brains of each group, reporting the regional magnitude of differences in various DTI metrics.

Methods: 39 children, 2.2 – 8.7 years, mean 4.6 ± 1.7 years, 28 male, who met DSM-IV criteria for autism and 39 age and gender matched typically developing children, 2.0 – 8.1 years, mean 4.7 ± 1.8 years, 26 male, were scanned on a 1.5T GE scanner. DTI data consisted of 60 b=1100s/mm^2, 10 b=300s/mm^2 and 10 b=0s/mm^2 volumes at 2.5mm isotropic resolution. Data was preprocessed using TORTOISE to correct for motion and distortions. Tensor based registration (DTITK) was used to create an average brain for the population for voxelwise analysis of DTI metrics including FA, Trace(D), radial diffusivity (RD) and axial diffusivity (AD). Average tensor derived metrics were computed for the autistic and typically developing children separately. Directionally encoded color maps were visually assessed, and subtraction maps were computed for all metrics. Traditional TBSS analysis was also performed on all metrics.

Results: TBSS analysis showed a reduction in FA in autistic children compared to typically developing children in many white matter regions, including the cerebellum, genu, splenium and body of the corpus callosum, brain stem, posterior limb of the internal capsule, superior frontal and temporal parietal regions. Trace(D) was greater in autistic compared to typically developing children in most white matter regions, but only in the posterior half of the brain. AD and RD results mimicked Trace(D). Subtraction of average maps showed very small magnitude differences, e.g. FA difference in genu of the corpus callosum is less than 1%, and Trace(D) in the splenium of the corpus callosum is about 1%.

Conclusions: The general trend of decreased FA and increased Trace(D) in autistic subjects is consistent with previously reported studies. However, the distribution of the abnormal regions adds to the heterogeneity of the existing inconsistencies in the literature. Further, the magnitude of the differences is small and may reflect between-group differences that are not related to brain anatomy. For example, the anterior-posterior gradient of Trace(D) we observed may be the result of a small difference in subject motion between groups. While DTI is promising as a method for revealing anatomic abnormalities in autism, caution must be exercised in interpreting between-group differences. Replication of published findings is a crucial first step.

107.097 97 Associations Between White Matter Integrity and Anxiety Symptoms in Children with Autism Spectrum Disorders. L. E. Bradstreet*, H. Eavani, L. Berry, I. Giserman, R. T. Schultz and J. D. Herrington, *Children's Hospital of Philadelphia*

Background: Anxiety symptoms are highly prevalent among individuals with autism spectrum disorders (ASD). However, there are almost no studies to date on the neurobiology of anxiety symptoms in ASD, despite the theoretical overlap between “social” and “emotional” brain structures and networks. Recent studies on the core diagnostic symptoms of ASD have identified abnormalities in white matter (WM) tracts in individuals with ASD; some of these tracts are associated with limbic structures (e.g., uncinate fasciculus and cingulum). As current neuroscience research on anxiety disorders among typically developing individuals emphasizes the modulation of amygdala by prefrontal cortex, tracts connecting these areas may prove important in understanding the etiology of anxiety symptoms in ASD.

Objectives: The purpose of this project is to test the hypothesis that anxiety symptoms in children with ASD are associated with the structural integrity of WM tracts connecting two key emotion regulation structures: amygdala and ventral prefrontal cortex (vPFC).

Methods: Diffusion tensor imaging (DTI) data were collected on 94 well-characterized children with ASD between the ages of 6-18 years (*M* = 12.4, *SD* = 3.1). Diagnoses for children with ASD were established by expert clinicians using gold standard assessments (i.e., Autism Diagnostic Observation Schedule and Autism Diagnostic Interview – Revised). All participants also received the Differential Ability Scales 2nd Edition (DAS-II). Parent report measures of the core symptoms of ASD (i.e., Social Responsiveness Scale [SRS] and Social Communications Questionnaire [SCQ]) were also collected. Anxiety symptoms were measured using the parent version of the Screen for Child Anxiety Related Emotional Disorders (SCARED). Diffusion-weighted imaging data were acquired using a 30-direction imaging sequence (80 axial slices, voxel size 2 mm isotropic, TR/TE=11000/75 ms, b=1000 s/mm^2). For the main analyses, multiple regression models were used to predict standard per-voxel estimates of WM integrity (i.e., fractional anisotropy [FA]). The resulting statistical maps were controlled for family-wise error (FWE, corrected $p < .05$) via the application of a per-voxel statistical threshold ($p < .005$) and size thresholds derived from Monte Carlo simulations (i.e., a small volume correction). Post-hoc analyses were performed on average FA scores within each of the significant clusters.

Results: The separation anxiety subscale of the SCARED was significantly negatively correlated with WM integrity on separate, bilateral portions of the cingulum immediately adjacent to amygdala and immediately above cingulate cortex (correlations ranged from -.32 to -.38). Post-hoc analyses indicated that these correlations remained statistically significant after controlling for variance associated with questionnaire measures of core ASD symptoms (SRS and SCQ total scores) and age.

Conclusions: The present data indicate that anxiety symptoms in ASD may be related to abnormalities in pathways connecting amygdala to vPFC. The emphasis on separation anxiety in these data likely reflects the salience of this form of anxiety for children with ASD in this age group: dependence on caregivers is typically prominent, and interactions with strangers are often aversive. Future research on this topic will benefit from a more detailed assessment of anxiety symptoms in ASD samples.

107.098 98 Correlation Between Gyral Window and Corpus Callosum: An MRI Study. B. A. Dombroski*, A. E. Switala, A. S. El-Baz and M. F. Casanova, *University of Louisville*

Background: In a previous study conducted by our lab comparing 14 male autistic individuals and 28 matched controls, the size of the gyral window directly correlated to the size of the corpus callosum. In our present study, we sought to increase our confidence in using gyral window and corpus callosum measurements as a biomarker in autism by validating our earlier findings using a new series of control subjects and identifying a normative range of measure. We investigated the measurements of and the relationship between the gyral window and corpus callosum in over 400 subjects ranging from ages 4.8 to 22.3, from the NIH Pediatric MRI data repository for normative developmental studies, the largest non-bias, multi-center, demographically balanced longitudinal study to date.

Objectives: This study seeks to identify normative measurements of and the relationship between the gyral window and corpus callosum in control subjects in relation to age and gender during normal brain development.

Methods: Using Release 4.0 of the NIH Pediatric MRI Data Repository for normative developmental studies, we identified the normalized gyral window depth by segmenting all gyral white matter by lobe using the parameters established by the NIH. A Euclidean distance map (EDM) of gyral white matter was constructed using MatLab. Measurement of gyral shape was identified by calculating the d tilde of each segment. The size of the d tilde correlates to the amount of gyrification in which the smaller the d tilde, the greater the gyrification; likewise, the larger the d tide, the lesser the gyrification. Following the same methods in our previous study, the displacement of the corpus callosum was then calculated and the relationship between gyral window and interhemispheric communication was analyzed separately using linear regression of gyral window with respect to corpus callosum displacement.

Results: Gyral window measurements indicated that gyrification increased with age in both males and females in

the frontal, temporal and parietal lobes and decreased with age in both males and females in the occipital lobe. There was no significant age difference between male and female groups overall, but there was significant dependence of gyral window upon age, lobe, hemisphere, age*sex, age*lobe, and age*hemisphere. There was evidence of a concomitant relationship between changes in gyral window measurements and corpus callosum.

Conclusions: Results of this study provide a normative range for gyral window and corpus callosum measurements that can be used to distinguish variations in growth patterns that will allow us to accurately diagnose neurodevelopmental disorders such as autism through non-invasive MRI.

107.099 99 Investigating Superficial White Matter Connections Using Diffusion Tensor Tractography. S. H. Ameis*[1], C. Rockel[2], T. Cunningham[2], F. Liu[2], N. Law[2], R. J. Schachar[2] and D. Mabbott[2], (1)*The Hospital for Sick Children, University of Toronto*, (2)*The Hospital for Sick Children*

Background: Neurological function is sub-served by large-scale neural networks, comprised of short and long-range white matter fibres that link neighbouring and geographically distant grey matter regions. In Autism Spectrum Disorders (ASD), underconnectivity of long-range white matter connections, and over-connectivity of short-range white matter connections has been postulated to contribute to illness symptoms. Diffusion tensor imaging (DTI) tractography, enabling virtual reconstruction and microstructural characterization of white matter tracts, has been used extensively to map typical development of long-range white matter connectivity, facilitating examination for long-range underconnectivity in ASD. As yet, the typical development of short-range white matter connections remains unknown, hampering comparisons with ASD, and investigation for structural signs of short-range overconnectivity in this disorder.

Objectives: Here, we undertook DTI tractography of short and long-range white matter connections in typically developing children and adolescents for the first time to test the feasibility of short-range white matter examination *in vivo* using DTI.

Methods: DTI scans were acquired for 19 typically developing children and adolescents (11 males; 9 females; age range 6-15 years; mean = 10 ± 2.5 years) using a 1.5 T MRI scanner. For short-range white matter tract reconstruction, a standardized lobar mask was used to create frontal, parietal, temporal and occipital lobe regions of interest. Probabilistic tractography was undertaken to reconstruct white matter remaining within discrete lobar regions, representing intra-lobar, short-range, white matter connections. For long-range white matter tract examination, seed masks from a standardized tractography template were used to reconstruct the cingulum bundle, inferior longitudinal, inferior fronto-occipital, arcuate, and uncinate fasciculi. Fractional anisotropy (FA), mean diffusivity (MD), axial (AxD) and radial diffusivity (RxD) values were calculated for white matter reconstructions. Bivariate correlation matrices for short and long-range white matter diffusion measures and age were examined.

Results: Correlations for age and white matter tract diffusion measures were significant for short-range white matter connections within the left temporal lobe for FA ($r = 0.64$, $p = 0.003$), and RxD ($r = 0.57$; 0.009), and left parietal lobe (FA: $r = 0.57$, $p = 0.009$). A significant correlation was also found between age and left arcuate fasiculus RxD ($r = 0.58$, $p = 0.01$).

Conclusions: Our work indicates that short and long-range white matter connections are undergoing microstructural changes between childhood and adolescence that may reflect increased coherence and continued myelination of underlying white matter pathways. Results indicating the presence of developmental change in left temporal and left parietal short-range white matter, as well as the left arcuate fasciculus, may point to changes in local and distributed connectivity across the left hemisphere language processing network between childhood and adolescence. Our results support the feasibility of undertaking DTI examination of short-range white matter connections in developing children, paving the way for interrogation of the short-range overconnectivity theory in ASD.

107.100 100 Atypical Relation Between Age and Measures of White Matter Diffusivity in Children with An Autism Spectrum Disorder (ASD). K. M. Mak-Fan*[1], D. J.

Morris[2], J. Vidal[3], E. Anagnostou[4], W. Roberts[3] and M. J. Taylor[5], (1)*University of Toronto*, (2)*SickKids Hospital*, (3)*The Hospital for Sick Children*, (4)*Holland Bloorview Kids Rehabilitation Hospital*, (5)*Hospital for Sick Children*

Background: Recent research suggests that brain growth follows an abnormal trajectory in children with autism spectrum disorders (ASD), which may specifically affect white matter development and connectivity.

Objectives: To examine changes in diffusivity with age within defined white matter tracts in a group of typically developing children and a group of children with an ASD, aged 6 to 14 years.

Methods: Participants were 23 children diagnosed with ASD (4 female, mean age = 11.07 years, range 6-14) and 23 age- and gender-matched typically developing control children (4 female, mean age = 11.13 years, range 6-14). Subjects were scanned on a GE 1.5 T magnetic resonance imaging (MRI) scanner with an 8-channel array head coil. Diffusion tensor images were acquired using a single-shot spin echo planar imaging sequence with 35 non-collinear directions (b-value of 1000 s/mm2), and 3 non diffusion-weighted volumes. Slices were 3 mm thick, oriented parallel to the anterior commissure – posterior commissure (AC-PC) axis of the subject. In-plane resolution was 2.5 mm × 2.5 mm. Image processing was performed using a combination of FSL, AFNI, RESTORE and Camino software packages. All volumes were registered to one of the non-diffusion weighted volumes using an affine transformation (FLIRT) to correct for motion and residual eddy current effects. From the estimated diffusion tensor, fractional anisotropy (FA), mean diffusivity (MD), longitudinal (Dmax = first eigenvalue) and radial diffusivity (Drad = average of second and third eigenvalues) were calculated. To perform a group analysis, all FA maps were aligned to the JHU-ICBM DTI-81 FA template (included in FSL) using non-linear registration (FNIRT). The same warp was applied to MD, Dmax and Drad maps. Data were blurred by a 3 mm full-width half-max Gaussian kernel. In each subject, average values for FA, Dmax, Drad, and MD were computed for major fibre tracts in the brain, as defined in the JHU-ICBM DTI-81 white matter atlas.

Results: Age by group interactions were observed in frontal, long distant, interhemispheric and posterior tracts, for longitudinal, radial and mean diffusivity but not for fractional anisotropy. In all cases, these three measures of diffusivity decreased with age in the typically developing group, but showed little or no change in the ASD group. It is important to note, that if the data had been analysed without taking into account age, no group differences would have been found.

Conclusions: These findings support the hypothesis of an abnormal developmental trajectory of white matter in the ASD population, which could have profound effects on the development of neural connectivity, and contribute to atypical cognitive development in these children. The results also underline the critical importance of considering age in the analyses of this neurodevelopmental disorder.

107.101 101 Longitudinal DTI of the Corpus Callosum in Individuals with Autism Spectrum Disorder: Differences in Fractional Anisotropy.

A. Alexander*[1], B. G. Travers[2], N. Adluru[1], N. Lange[3], C. Ennis[1], P. T. Fletcher[4], M. B. DuBray[4], A. Froehlich[4] and J. E. Lainhart[4], (1)*University of Wisconsin*, (2)*University of Wisconsin-Madison*, (3)*Harvard University*, (4)*University of Utah*

Background: The corpus callosum is a white matter structure that enables efficient communication between the left and right hemispheres of the brain. Fractional anisotropy (FA) is a measure obtained through diffusion tensor imaging that is thought to indicate the fiber coherence of white matter tracts. Multiple cross-sectional studies have found evidence for decreased FA in the corpus callosum in persons with ASD (Alexander et al., 2007; Jou et al., 2011; Kumar et al., 2010; Shukla et al., 2010; 2011). However, to our knowledge, no study has longitudinally investigated FA of the corpus callosum in persons with ASD compared to typically developing controls (TDC).

Objectives: The present study longitudinally investigated FA of the corpus callosum in persons with ASD compared to TDC's. We predicted that individuals with ASD would show decreased FA across the corpus callosum. Additionally, we predicted that symptoms of ASD may relate to corpus callosum FA.

Methods: Participants received DTI scans at three time-points across a 5-year period of time (DW, single-shot, spin-echo EPI, *b*=1000, 12 non-collinear directions, 4 averages). Forty-seven TDC's and 100 individuals with ASD were scanned during at least one time point (most being scanned at all three time points). Diagnostic groups were matched on age (TDC: 17.60±9.15; ASD: 17.58±6.85, range: 3.39-47.12 years, p = .99). The Social Responsiveness Scale (SRS) was administered to the majority of participants at both Time 1 and 2.

Results: We conducted a linear mixed effects model using a restricted maximum likelihood fit. Mean FA of the corpus callosum was modeled as a function of participant's age, diagnosis, and corpus callosum size (covariate), keeping participant as a random-effects variable. There was not a significant effect for age, but there was a significant group difference in FA (p < .001), such that the group with ASD appeared to have lower mean FA of the corpus callosum compared to TDC's above and beyond the effect of corpus callosum size. Correlations between mean FA of the corpus callosum and SRS Time 1 and Time 2 scores within the ASD group were not significant (p>.20), but became significant with the addition of the TDC group.

Conclusions: Consistent with the findings of prior cross-sectional investigations, the present longitudinal results found that individuals with ASD have decreased FA in the corpus callosum white matter tracts compared to individuals with typical development. This decrease in FA may be indicative of less white matter fiber coherence in person with ASD. Contrary to our hypotheses, ASD symptom severity (as measured by the SRS) was not related to corpus callosum FA in the ASD group, although this relation did become significant with the addition of the group with typical development. Future analyses will be conducted to examine other measures of white matter integrity in this longitudinal dataset, such as mean diffusivity, axial diffusivity, and radial diffusivity.

107.102 102 Structural White Matter Abnormalities in Children and Adolescents with High-Functioning Autism Spectrum Disorders. C. Cullell*[1], M. Rosa[2], O. Puig[2], V. Sánchez[2], L. Lázaro[2] and R. Calvo[2], (1)*CIBERSAM*, (2)*Hospital Clínic de Barcelona*

Background: The etiopathogenesis of autism spectrum disorders (ASD) still remains to be clarified, but imaging studies indicate that brain structure anomalies play an important role (Brambilla et al, 2003; Courchesne et al, 2007; Minshew et al, 2007). Previous studies yielded abnormalities in different white matter (WM) regions (Bonilla et al, 2008; Waiter et al, 2005) but others failed to found structural differences in ASD children or adolescents compared to neurotypically developing children (Mengotti et al, 2011; Poutska et al, 2011). So, decreased and increased WM volumes have been reported in some VBM studies (analysis corrected) in high-functioning ASD children. More recently, a wide meta-analysis provided also evidence for deficits of WM in this region, among others, and most significantly increases in WM in different regions (Radua et al, 2011). But there is still a lack of knowledge about the meaning of those changes. Preliminary results of a large structural and functional study in HF-ASD children are presented.

Objectives: The aim of the present study is analyzed the nature of structural differences in HF-ASD patients.

Methods: **Subjects**: Participants were 22 HF-ASD children (mean age=13.00, SD=3.05; 21 male, 1 girl) and 12 healthy comparison controls (mean age=10.81, SD=2.72; 11 male, 1 girl). Both samples were balanced for age, gender and IQ. All patients fulfilled ASD criteria on DSM-IV and ICD-10 and ASD diagnosis were confirmed with the Autism Disorder Interview (ADI-R). Inclusion criteria included an IQ above 70 in all participants. **Procedures**: The MRI scannig protocol consisted of a 3D structural using a T1-weighted MPRAGE sequence (acquisition plane:sagital, TR:2300ms, TE:2.98ms, voxel size: 1x1x1mm3) New segmentation, DARTEL normalisation, smooth (10mm gaussian kernel) and whole-brain voxelwise analyses of GM and WM were carried out using SPM8. Age, gender and total intracranial volume were used as nuisance variables, and statistical threshold criteria was set at p<0.05 corrected for multiple comparison FWE (Family Wise Error correction).

Results: Compared to controls, HF-ASD participants showed decreased WM volume in Cingulate Gyrus in Right Frontal Lobe (MNI space coordinates (mm)=[15 20 40], p(FWE)=0.040 peak-level, T=5.25 and cluster size=741). These coordinates were quoted in Talairach Daemon Labels atlas and JHU White-Matter Tractography Atlas using FSL (FMRIB Software Library, Oxford, UK). No areas of significantly increased white matter volume were found and there were no significant differences in GM volume between controls and ASD patients.

Conclusions: In our study, HF-ASD children showed WM decreased volume in the medial right frontal lobe, in cingulated gyrus. These results are consistent with those reported in previous studies. Abnormalities of WM in HF-ASD are probably responsible for some of the clinical features of ASD. Moreover, medial regions of the right frontal lobe have been consistently linked to neuropsychological deficits in ASD. Our results failed to find differences in GM, but our sample could be small enough to detect such differences.

107.103 103 DSM Through the Looking Glass: Corpus Callosum Volume in High-Functioning Autism and Asperger Syndrome. L. R. Chura*[1], D. L. Floris[2], R. J. Holt[1], S. Baron-Cohen[1] and M. D. Spencer[1], (1)*Autism Research Centre, University of Cambridge*, (2)*University of Cambridge*

Background:

Mounting evidence suggests that the corpus callosum (CC) may be central to understanding the pathophysiology of autism spectrum conditions. As the largest white matter tract in the brain, the CC mediates the interhemispheric communication underpinning higher cognitive functioning. Subsections of the callosum have been shown to vary dramatically in quantitative characteristics of axon density, size, and degree of myelination (LaMantia and Rakic, 1990). Discrepancies remain, however, as to which subregions of the CC are affected in autism (Brambilla et al., 2003), and the question as to whether CC volume differs between individuals with High-Functioning Autism (HFA) and Asperger Syndrome (AS) remains unanswered. This question has particular relevance in the context of the proposed changes within DSM-V that will consolidate HFA and AS into one diagnostic category of Autism Spectrum Disorder.

Objectives:

(1) To acquire a robust sample of CC volumetric measurements in male adolescents with HFA and AS; (2) to correlate volumetric differences in the CC with Autism Diagnostic Interview (ADI-R) clinical measures and task performance on an executive function measure; and (3) to test for volumetric differences in the CC in DSM-IV subgroups of HFA and AS.

Methods:

High-resolution structural magnetic resonance images of the brain were obtained on a cohort of adolescent males (12-18 years) with HFA (n=19), AS (n=16), and typically developing controls (n=20). The CC was partitioned into the seven functional subregions according to the Witelson method (Witelson, 1989) and traced in midsagittal and parasagittal sections using Analyze software. 100% of the dataset was traced by two independent raters blinded to group identity (intraclass correlation = 0.98), and all values were averaged. The CANTAB (Cambridge Neuropsychological Test Automated Battery) 'Stockings of Cambridge' task was administered to all participants as a measure of planning ability.

Results:

Structural neuroimaging data include CC subregion and total CC volume measurements relative to global white matter. Significant differences were observed between HFA and controls that were not present in AS subjects. Total CC volume was increased in HFA compared to controls (p=0.016), as was the volume of the anterior (p=0.008) and posterior midbody (p=0.016). Volume of the CC rostrum volume was significantly correlated with ADI-R clinical symptomatology in the AS cohort, notably on communication (p=0.005, R=0.684) and restricted, repetitive and stereotyped behavior (p=0.018, R=0.600) subdomains. The volume of the genu was correlated at trend level (p=0.052) with performance on the Stockings of Cambridge task.

Conclusions:

Significant differences in CC subregion size were found between HFA and controls, but not between AS and controls. This has implications for our understanding of cognitive deficits associated with autism spectrum conditions and for the proposed DSM-V changes.

107.104 104 Is Myelin Content Altered In Young Adults with Autism?. J. Zinkstok[1], S. Kolind[2], V. D'Almeida*[2], A. Shahidiani[2], S. C. Williams[2], D. G. Murphy[3] and S. C. Deoni[2], (1)*Institute of Psychiatry, King's College London*, (2)*Centre for Neuroimaging Sciences, King's College London*, (3)*King's College London, Institute of Psychiatry*

Background:

There is increasing evidence that autism is associated with abnormal white matter development and impaired 'connectivity' of neural systems. Brain connectivity is mediated by myelinated axons, which may be altered or abnormal in autism. However, to date, no study has directly investigated brain myelin content of autistic individuals in vivo.

Objectives:

The primary objective of this study is to elucidate differences in myelin content in typical and autistic brains. The ultimate aim is to improve our understanding of the underlying neurobiology of autism using non-invasive magnetic resonance imaging (MRI) techniques,

Methods:

Using a new myelin-specific magnetic resonance imaging technique, termed mcDESPOT, brain myelin content was compared between 14 young adults with autism, and 14 matched controls. Relationships between myelin content and clinical symptom severity within the autistic group (measured by the Autism Diagnostic Instrument, ADI-R); and the severity of autistic traits in both cases and controls, using the Autism Quotient (AQ).

Results:

Individuals with autism demonstrated a highly significant ($p < 0.0017$) reduction in myelin content in numerous brain regions and white matter tracts. Affected regions included the frontal, temporal, parietal and occipital lobes. White matter tracts most affected included the corpus callosum; the uncinate and posterior segments bilaterally; left inferior occipitofrontal tract and cerebellar peduncle, arcuate fasiculus and inferior and superior longitudinal fasciculi; and the right anterior segment. Further, within autistic individuals, worse interaction score on the ADI-R was significantly related to reduced myelin content in the frontal lobe; genu of the corpus callosum; and the right internal capsule, optic radiation, uncinate, inferior frontal occipital fasciculus and cingulum. Additionally, increased autistic traits in both cases and controls were significantly related to reduced myelin content of the left cerebellar; genu of the corpus callosum; and left temporal lobe white matter.

Conclusions:

Individuals with autism have significantly reduced myelin content in numerous brain regions and white matter tracts. We also provide preliminary evidence that reduced brain myelin content is associated with worsened social development in autistic individuals, and increased autistic traits in both cases and controls.

107.105 105 Macrocephalic Individuals with Autism Have Increased White Matter Whereas Normocephalic Individuals with Autism Exhibit Preserved Volumes. R. J. Jou*, K. A. DeBenedictis, D. M. DePedro, I. Y. Murphy and K. A. Pelphrey, *Yale University, Child Study Center*

Background: A large variety of neuroanatomical abnormalities have been reported in the autism research literature. Two consistently reported abnormalities include larger head sizes (macrocephaly) and abnormal brain volumes, especially increases in white matter volume. While these anomalies may represent key pathological features of the disorder, the relationship between macrocephaly and brain volume remains unclear.

Objectives: The present study was conducted to assess the relationship between groups of macrocephalic individuals with autism (MacA), normocephalic individuals with autism (NorA),

and typically developing controls without macrocephaly (TDC).

Methods: All participants were right-handed boys (N = 48) who were participants in the Simons Simplex Collection project. The MacA group consisted of individuals with autism with a head circumference greater than the 97th percentile for age and gender (mean age = 11.3 ±3.4 years). The NorA group consisted of normocephalic individuals with autism (mean age = 10.0 ±3.7 years). The TDC group consisted of normocephalic, non-affected siblings of individuals with autism (mean age = 15.0 ±2.0 years). Notably, the broad autism phenotype was absent in all TDC individuals. MRI scanning was performed at 3-Tesla. In conjunction with a standard single-channel head coil, high-resolution, whole-brain structural MRI for study of neuroanatomy was performed with a sagittal 1-cubic mm Magnetization Prepared Rapid Gradient Echo (MPRAGE) sequence. Structural MRI data was processed and analyzed using the FreeSurfer image analysis suite which consists of automated tools for reconstruction of the brain from high-resolution MRI data, facilitating the accurate and precise quantification of regional white matter volumes. Subcortical gray matter (subGM) as well as left and right hemisphere cortical gray (corGM) and total white matter (totWM) volumes were measured directly by the FreeSurfer program with manual correction as needed. These volumes were entered into the Statistical Package for the Social Sciences (SPSS), and comparisons of volumes between groups were conducted using multivariate analysis of covariance (MANCOVA). The protected Fisher's Least Significant Difference (LSD) test was implemented to address multiple comparisons.

Results: MANCOVA was performed controlling for age, cognitive functioning, and intracranial volume and revealed significant group differences in left and right totWM only. When MacA was compared to NorA and TDC on left totWM, significant volumetric increases were observed ($p = 0.010$ and 0.015, respectively). Significant volumetric increases were also noted when MacA was compared to NorA and TDC on right totWM ($p = 0.016$ and 0.008, respectively). While not reaching statistical significance, the NorA group exhibited smaller left and right totWM when compared to the TDC group.

Conclusions: This study supports neuroanatomical differences in the pathobiology of autism between macrocephalic and normocephalic individuals with the disorder. Individuals with autism and macrocephaly may have increased white matter volume, whereas affected normocephalic individuals may have preserved white matter volume. These data suggest a biological basis for the observation that individuals with both autism and macrocephaly are more severely affected by the developmental disability.

107.106 106 Glutamate Dysfunction in the Basal Ganglia of Autism Spectrum Disorders : An MRS Study. Y. Yoshihara*[1], G. Sugihara[1], A. Ishizuka[2], H. Yogo[2], K. Nakamura[1], T. Sugiyama[1], K. Matsumoto[1], K. J. Tsuchiya[1], K. Suzuki[1], N. Takei[1], M. Tsujii[3] and N. Mori[1], (1)*Hamamatsu University School of Medicine*, (2)*Department of Radiology, Koujin Hospital*, (3)*Chukyo University*

Background: Glutamate (Glu), the major excitatory neurotransmitter, is highly concentrated throughout the brain and is crucial to neuronal plasticity and the maintenance of cognitive functioning. The concentration of Glu in the human brain can be quantified with a technique of Proton Magnetic Resonance Spectroscopy (MRS). There are only a few MRS studies in relation to autism or autism spectrum disorders (ASD) with conflicting results. It is thus unclear whether abnormality in Glu plays a pathophysiological role in the condition.

Objectives: We aimed to examine Glu and other metabolites abnormalities in the brain (the cerebellar vermis, the right prefrontal cortex white matter, the right hippocampal-amygdala complex and the right basal ganglia) of individuals with ASD using the proton MRS

Methods: Twenty four (six females) individuals with ASD (age, mean ± SD; 26.0 ± 3.8 years) and 25 (six females) controls (age; 26.1 ± 3.5) were recruited. All the participants were right-handed. All the subjects with ASD were diagnosed based on the Autism Diagnostic Interview (ADI-R) and the Autism

Diagnostic Observation Schedule (ADOS) in addition to DSM-IV criteria. The mean ± SD score of ADIR social, communication and repetitive behavior for the ASD was 20.6 ± 5.8, 15.1 ± 4.5 and 4.4 ± 2.6, respectively. The mean ± SD ADOS score of social, communication and repetitive behavior was 8.9 ± 2.5, 4.9 ± 2.2 and 0.8 ± 1.0, respectively. IQ was assessed with the Wechsler Abbreviated Scale of Intelligence (WASI). There was no significant difference in full IQ between the ASD (88.8 ± 19.1) and control (96.8 ± 14.1) groups. Four ASD participants received medication and two ASD participants smoked at assessment. As for MRI data, all participants were scanned using a 3-T GE Signa System. As Volumes of interest (VOIs), we selected four brain regions, i.e. the cerebellar vermis, the right prefrontal cortex white matter, the right hippocampal-amygdala complex and the right basal ganglia. We employed the point resolved spectroscopy (PRESS) spectrum [TE=35, TR=3000 and NEX=128] for data acquisition. The metabolites examined were myo-inositol (mI), choline (Cho), creatine (Cr), glutamate (Glu), glutamate+glutamine (Glx) and N-acetylaspartate (NAA) and the concentration of CSF within the VOI was controlled for. Data analysis was performed by the software of SPM5 and FSL.

Results: The level of Glu in the right basal ganglia in the ASD group was significantly decreased (p =0.03) compared with that of the control group. Even if medicated individuals and smokers among the ASD were excluded from the analysis, the level of Glu in the right basal ganglia in individuals with ASD remained significant (p =0.04). Other metabolites did not differ between the two groups. Glu levels in the basal ganglia were not correlated with symptom severity.

Conclusions: We found a reduction of glutamate in the basal ganglia in individuals with ASD. Glutamate dysfunction in the basal ganglia may be associated with ASD.

107.107 107 Glutamate / Glutamine in the Basal Ganglia Is Associated with Executive Function and Communication Impairments in Autism: A [1H]MRS Study.

J. Horder*[1], M. A. Mendez[1], T. J. Lavender[1], S. Maltezos[2], C. M. Murphy[3], C. Ecker[4], E. Daly[1] and D. G. Murphy[1], (1)*Institute of Psychiatry, King's College London*, (2)*The Maudsley Hospital*, (3)*King's College London, Institute of Psychiatry*, (4)*Institute of Psychiatry*

Background: It has been suggested that dysfunction in glutamatergic neurotransmission may occur in Autism Spectrum Disorder (ASD). Glutamate is the brain's primary excitatory neurotransmitter. However, few studies have measured brain glutamate in adults with ASD and related variation in glutamate to clinical phenotype. We previously [Lavender et al 2009 IMFAR poster, manuscript in preparation] reported that individuals with an ASD had reduced n-acetyl aspartate (NAA) and glutamate/glutamine (Glx) in the basal ganglia, as measured using proton magnetic resonance spectroscopy, [1H]MRS. However, it is not known whether these results are associated with particular symptoms of autism.

Objectives: We examined the correlation between basal ganglia glutamate/glutamine (Glx) concentration and clinical symptoms in terms of the three domains of the ADI-R diagnostic interview: Social impairment, Communication and language, and Repetitive interests and behaviours. We also measured executive function using the Zoo Task from the BADS neuropsychological battery since deficits in executive functioning are common in ASD(Hume et al. 2009) and interventions to improve executive functioning increase social independence (Hume et al. 2009).

Methods: We studied 31 adults with an ASD (4 female) diagnosed using ICD-10 criteria and the ADI-R interview. All participants had a normal range IQ > 70. The BADS Zoo Task, a measure of planning and problem-solving, involves designing a route through a fictional zoo, with the goal of visiting different exhibits, while adhering to a number of rules. [1H]MRS spectra were acquired on a 1.5T GE HDx MRI scanner (GE Medical Systems, Milwaukee, WI, USA). Single voxel spectra were acquired with a PRESS sequence with repetition time TR=3000ms, echo time TE=30 ms. Data were analyzed using LCModel software. MRS voxels were positioned in left medial parietal lobe (20x20x20 mm3), left dorsolateral prefrontal cortex (DLPFC) (16x24x20 mm3), and left basal ganglia (20x20x15 mm3) including parts of the caudate and putamen. T-tests showed no significant differences in the voxel ratios of grey matter to white matter

between affected and control groups. As the results of the Zoo task were discrete (possible scores are 0,1,2,3, and 4), we used the nonparametric Spearman's rank coefficient of correlation.

Results: Basal ganglia concentration of Glx concentration was significantly negatively correlated with scores on the ADI-R Communication scale. Lower i.e. more abnormal Glx was associated with greater communication impairment (r = -0.439, p = 0.020). On the Zoo task, there was likewise a negative correlation with basal ganglia Glx. The Spearman's rank coefficient, rho=0.595 p=0.009 indicating a significant positive correlation between planning performance on the Zoo task, and basal ganglia combined glutamate/glutamine ("Glx") levels. Lower i.e. more abnormal Glx was associated with worse executive function. By contrast, neither Social nor Repetitive symptom domains were correlated with basal ganglia Glx and no symptoms were correlated with Glx in dlPFC or parietal cortex (all p values >0.18). Zoo task performance was not correlated with Glx in the dlPFC (p=0.47) or parietal cortex (p=0.62).

Conclusions: Both executive functioning and communication and language impairment in ASD are associated with reduced basal ganglia glutamate/glutamine function.

107.108 108 Altered Development of Striatal Structures Is Involved In Autistic Behaviour. M. Langen*, H. Nederveen, D. Bos, S. Noordermeer, H. van Engeland and S. Durston, *Rudolf Magnus Institute of Neuroscience, University Medical Center Utrecht*

Background: Repetitive, rigid and stereotyped behaviours are core features of autism and it has been suggested that they result from differences in the anatomy of striatum. In addition, studies of brain changes in autism have indicated that the time course of brain development rather than the outcome seems to be most disturbed. However, most of the studies investigating striatal differences in autism are cross-sectional, limiting inferences on development.

Objectives: Therefore, in this study, we (1) investigate brain development, and especially development of striatal structures in autism, using a longitudinal design; (2) examine the relationship of striatal development with repetitive behaviour.

Methods: We acquired sMRI scans from 68 individuals (35 subjects with autism, 33 matched controls). Each individual was scanned twice, with a mean scan interval time of 2.4 years. Mean age was 9.9 at time 1 and 12.3 at time 2. An automated image processing pipeline was used to determine volumes of total brain, grey and white matter, cerebellum and lateral ventricles. Striatal structures were traced manually. Multivariate analyses of variance were used to investigate differences in brain development between diagnostic groups. To examine the relationship with behaviour, correlations between changes in brain volume and measures of repetitive and stereotyped behaviour were calculated.

Results: Our results show differences in the developmental pattern for striatal structures: growth rate of these structures was increased in the autism group in comparison to controls. Effects were most robust for caudate nucleus. Results were not accounted for by overall changes in brain growth, or scan processing differences. Second, the increased rate of striatal growth was related to measurements of repetitive behaviour: faster growth was correlated with more severe behaviour.

Conclusions: These findings substantiate the involvement of striatum in the aetiology of autism and provide further evidence of the significance of altered trajectories of brain development in this disorder.

107.109 109 Linking GABA to Tactile Function in ASD: A Pilot Magnetic Resonance Spectroscopy (MRS) Study. D. J. McGonigle*[1], L. White[2], N. Puts[2], R. Kent[2], S. Carrington[2], M. Tommerdahl[3], R. Edden[4], K. Singh[2], D. Jones[2] and S. R. Leekam[2], (1)*Schools of Biosciences/Psychology, Cardiff University*, (2)*Cardiff University*, (3)*University of North Carolina*, (4)*John Hopkins University*

Background: Sensory processing difficulties are a prevalent but poorly understood aspect of the behavioural presentation of Autism Spectrum Disorder (ASD). Recent work from post-mortem and animal studies suggests that a deficit in cortical inhibitory transmission may underlie and explain some aspects of these symptoms. To date, however, no research

has yet substantiated this proposal by demonstrating that neurobiological measures of cortical inhibitory deficits are connected to sensory symptoms observed behaviourally. In this study we combine tactile psychophysics and non-invasive measurements of the inhibitory neurotransmitter GABA (using Magnetic Resonance Spectroscopy; MRS) to measure and quantify aspects of atypical touch sensitivity in ASD.

Objectives: This pilot study investigates two hypotheses: (1) The performance of participants with ASD on a tactile discrimination task will not be affected by the presence of a prior adapting stimulus – a task thought to be crucially reliant on localized cortical-cortical interactions mediated by GABAergic transmission (Tannan et al., 2008) (2) ASD participants will have decreased levels of GABA metabolites in sensorimotor cortex as measured using MRS.

Methods: 8 individuals with a diagnosis of ASD and 8 neurotypicals (NT) participated in a combined neuroimaging and tactile perceptual assessment paradigm (all participants were male and right-handed). The study was approved by the Cardiff University School of Psychology ethics committee, and informed consent was obtained for all participants. *Behavioral:* A two alternative forced-choice (2AFC) tracking protocol was used to evaluate the amplitude discriminative capacity of each participant. Suprathreshold vibrotactile stimuli (480ms; 25Hz) were simultaneously delivered to fingertips of LD2/3, and amplitude thresholds were compared between groups during both adapting and non-adapting conditions. *Neuroimaging*: Edited MRS measurements of GABA were made in a (3x3x3) cm^3 'sensorimotor' volume centred on the right motor hand knob. All scanning was carried out on a GE Signa HDx 3T MRI scanner, using an 8-element head coil for receive and the body coil for transmit. GABA concentration in 'institutional units' was quantified from the ratio of the integral of the edited GABA signal (determined by fitting to a Gaussian model) to the integral of the unsuppressed water signal from the same volume.

Results: We observed a significant increase (*$p<0.05$)* in vibrotactile amplitude threshold in NTs with adaptation. No change in thresholds with adaption was found in our ASD group, similar to previous reports. Our neuroimaging data showed a difference in GABA concentration in sensorimotor cortex between groups which approached significance, with GABA concentration in our ASD group being lower, (*$p=0.07$*).

Conclusions: Our preliminary behavioural results replicate previous findings, and when taken with our MRS findings we interpret our data to be consistent with the presence of reduced GABAergic-mediated inhibition in this population.

107.110 110 Reduced Auditory Cortical GABA Concentration in ASD and First Degree Relatives. D. C. Rojas*, S. E. Steinmetz, D. Singel, S. Hepburn and M. Brown, *University of Colorado Denver, Anschutz Medical Campus*

Background:

One emerging perspective on the pathophysiology of Autism Spectrum Disorders (ASD) is the excitation/inhibition imbalance (EI) theory, which proposes that relatively high ratios of excitatory to inhibitory neuronal processes could explain some portion of the ASD phenotype. Evidence for inhibitory deficits converges from a variety of methods and has been of interest for some time, and is supported by a significant body of evidence, including changes in receptor expression. Messenger RNA levels of glutamate decarboxylase (GAD), the enzyme that converts glutamate to GABA, is reduced in ASD, suggestive of corresponding changes in GABA. To date, there has only been a single study of GABA in ASD using MRS methods, which reported that GABA concentration was lower in the frontal lobe in ASD.

Objectives:

Our current study was aimed at the auditory cortex, where we have previously reported electrophysiological abnormalities in gamma-band oscillations in ASD suggestive of changes in EI. We were also interested in whether results would extend to first-degree relatives of persons with ASD, and predicting lower GABA levels in relatives because we have seen changes in EI balance our gamma-band studies of relatives.

Methods:

GABA levels were determined from the left superior temporal gyrus for 9 ASD participants, 12 siblings of persons with ASD (SIB), 11 parents of persons with ASD (pASD) and 11 healthy

controls (HC). A MEGAPRESS spectral editing sequence was used, optimized for GABA detection, with edit-on and edit-off frames interleaved, for a total of 512 acquisitions (256 edit-on and 256 edit-off frames), on a GE 3T HDx scanner with TR/TE= 2500ms/70ms. Edit-on and edit-off frames for each acquisition were separated, reconstructed, and fitted using SAGE (GE Healthcare). The processed edit-off spectra were subtracted from the edit-on spectra to produce the GABA spectra. The GABA peak area was divided by the area of the creatine peak in the edit-off spectra to produce the GABA/Cr ratio.

Results:

The GABA/Cr ratio was entered into a one-way ANCOVA with group as the independent variable. Age was the single covariate chosen because it was significantly correlated with the dependent measure. The main effect of group was significant, $F(3,38) = 3.51$, $p < .02$. Post-hoc LSD analyses revealed the following significant differences in GABA/Cr ratios: HC > ASD ($p = .02$), HC > pASD ($p = .04$), and HC > SIB ($p = .038$).

Conclusions:

The significantly reduced auditory cortex GABA in the ASD group provides support for the hypothesis of GABAergic inhibitory deficits in ASD, consistent with one earlier report of GABA reduction in the frontal lobe in ASD. The fact that reductions were also present in the two groups of 1st degree relatives suggests that the GABA reduction may be heritable as well, and could be used as an endophenotype in future ASD studies. Although these data provide support for the inhibitory side of EI theory, future studies should include both MEGAPRESS and short-echo PRESS measurement of glutamate from the same voxels in participants.

Cell Biology Program
108 Cell Biology

108.111 111 The Therapeutic Effect of Memantine Through the Stimulation of Synapse Formation and Dendritic Spine Maturation in Autism and Fragile X Syndrome.
H. Wei[1], M. Malik*[2], C. Dobkin[1], A. Sheikh[1], W. T. Brown[1] and X. Li[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*New York State Institute for Basic Research in Developmental Disabilities*

Background: Although the pathogenic mechanisms that underlie autism are not well understood, there is evidence showing that metabotropic and ionotropic glutamate receptors are hyper-stimulated and the GABAergic system is hypo-stimulated in autism. Memantine is an uncompetitive antagonist of NMDA receptors and is widely prescribed for treatment of Alzheimer's disease treatment. Recently, it has been shown to improve language function, social behavior, and self-stimulatory behaviors of some autistic subjects. However the mechanism by which memantine exerts its effect remains to be elucidated.

Objectives: The aim of this study is to determine the possible mechanism through which memantine exerts its therapeutic effects on autism.

Methods: C57BL/6 fragile X mice was derived from C57BL/6-129 hybrid mice carrying the *Fmr1* knockout mutation. Cerebellar granule cells (CGCs) were prepared from wild type (WT) and *Fmr1* knockout (KO) 5-6 day postnatal pups. When required, the CGCs were treated for 72 h with memantine (Sun Pharma) at a concentration of 100 μM. Cell adhesion assay and cell migration assay were carried out to examine the adhesion and migration properties of CGCs. The expression of synaptic vesicle proteins was tested using the fluorescence staining. The DiI labeling was used to outline dendritic spines in pyramidal neurons.

Results: In this study, we used cultured cerebellar granule neural cells (CGCs) from *Fmr1* knockout (KO) mice, a mouse model for fragile X syndrome (FXS) and syndromic autism, to examine the effects of memantine on dendritic spine development and synapse formation. Our results show that the maturation of dendritic spines is delayed in *Fmr1*-KO CGCs. We also detected reduced excitatory synapse formation in *Fmr1*-KO CGCs. Memantine treatment of *Fmr1*-KO CGCs promoted cell adhesion properties. Memantine also stimulated the development of mushroom-shaped mature dendritic spines and rescued dendritic spine defects in *Fmr1*-KO CGCs. Furthermore, we demonstrated that memantine

treatment promoted synapse formation and restored the reduced excitatory synapses in *Fmr1*-KO CGCs.

Conclusions: These findings suggest that memantine may exert its therapeutic capacity though a stimulatory effect on dendritic spines maturation and excitatory synapse formation, as well as promoting adhesion of CGCs.

108.112 112 Correlation Between Hepatocyte Growth Factor (HGF) and GABA Plasma Levels in Autistic Children. A. J. Russo*, *Health Research Institute*

Background: There is much support for the role of GABA in the etiology of autism. Recent research has shown that hepatocyte growth factor (HGF) modulates GABAergic inhibition and seizure susceptibility.

Objectives: To assess plasma levels of HGF, GABA, as well as symptom severity, in autistic children and neurotypical controls.

Methods: Plasma from 59 autistic children and 29 neurotypical controls was assessed for HGF and GABA concentration using ELISAs. Symptom severity was measured in these autistic individuals and compared to HGF and GABA concentrations.

Results: We previously reported that autistic children had significantly decreased levels of HGF. In this study, the same autistic children had significantly increased plasma levels of GABA ($p=0.002$) and decreased HGF levels correlated with these increased GABA levels ($r=0.3$; $p=0.05$). GABA levels correlated with increasing hyperactivity ($r=0.4$; $p=0.01$) and impulsivity ($r=0.3$; $p=0.04$) severity.

Conclusions: These results suggest an association between HGF and GABA levels in autistic children and suggest that plasma GABA levels are related to hyperactivity in autistic children.

108.113 113 Heavy Metal Exposures As a Risk Factor for Autism in Oman. M. I. Waly*[1], Y. M. Al-Farsi[1], A. Ali[1], M. Al-Sharbati[1], M. M. Al-Khaduri[1], A. Ouhtit[1], M. Al-Shafaee[1], O. A. Al-Farsi[1] and R. Deth[2], (1)*Sultan Qaboos University*, (2)*Northeastern University*

Background:

Several studies have reported a positive association between environmental insults (such as heavy metals exposure) and the increased risk of autism spectrum disorder (ASD) in developed nations. The investigated heavy metals include; aluminum, cadmium, lead and mercury. The prevalence of autism spectrum disorder (ASD) is on the increase in Oman and there was no such studies which have reported about the impact of various environmental factors as a global cause of autism among Omani autistic children.

Objectives:

The present study examined the potential exposure of Omani autistic children to heavy metals toxicity.

Materials and Methods:

A case-control study that included 40 children with ASD and 40 their age and gender matched normal children (control). Hair samples were collected and analysed for aluminum, cadmium, lead and mercury concentrations. The mothers of autistic children were interviewed to report about the exposure of their children to various risk factors such as, vaccinations, exposure to paint, smoking, pesticides use, cooking utensils and seafood consumption.

Results:

ASD children and their age and gender matched controls did not show any detectable differences in the levels of aluminium, cadmium, lead and mercury in the assayed hair samples. It was found that 89% of the ASD children were consuming more than 2 servings of seafood per week versus 53% of control children. There was no socio-demographic or environmental exposure differences between all the children participated in this study.

Conclusions:

Heavy metals exposure was not found to be associated with the increased risk of ASD in Oman. Further studies are however needed to investigate the prenatal and postnatal exposure to heavy metals toxicity and its associated physical symptoms among mothers and their autistic children.

108.114 114 The Oxytocin Agonist WAY267464 Is Also A Potent Vasopressin 1A Antagonist. C. Grundschober*, C. Risterucci, T. Mueggler, B. Biemans, C. Bissantz, S. Belli, M. Schmitt and P. Schnider, *F. Hoffmann-La Roche*

Background: Intranasal and intravenous (i.v.) administration of oxytocin improves autism symptoms in adults and adolescent autistic subjects. Due to the short half-life of the oxytocin peptide in blood and cerebrospinal fluid, it would be highly useful to identify a brain penetrant small molecule oxytocin receptor agonist for the treatment of autism. Such a potential compound, WAY267464, was described by Ring et al (2009) as a specific oxytocin receptor agonist, with more than 100 fold selectivity against the related V1a, V1b and V2 vasopressin receptors. In vivo the compound reversed stimulant-induced pre-pulse inhibition and had anxiolytic activity after intraperitoneal administration.

Objectives: To profile the in vitro activity of the compound and confirm its affinity for the oxytocin receptor and selectivity against related receptors. We also investigated the pharmacokinetic profile of WAY267464 in rats after i.v. and oral administration.

Methods: WAY267464 was synthetized in-house and profiled in radioligand binding as well as calcium flux functional assays (FLIPR) using recombinant cell lines stably expressing the human or rodent oxytocin or vasopressin receptors.

Results: Using FLIPR, we confirm that WAY267464 is a human oxytocin receptor agonist with EC50= 44 nM +/- 20 and 77% efficacy compared to the maximum effect of oxytocin (EC50= 3nM, 100% efficacy). This is in line with the values reported by Ring et al (2009) on the human oxytocin receptor (EC50= 61nM, 87% efficacy). Surprisingly we find that WAY267464 is also a potent antagonist on the human V1a (binding Ki= 73nM, functional Kb= 78 nM) as well as mouse V1a receptor (binding Ki= 278 nM, functional Kb= 97 nM).
In vivo pharmacokinetic analysis showed that the compound has fast clearance after intravenous administration and poor brain penetration.

Conclusions: In order to dissect the contribution of the oxytocinergic or vasopressinergic system to autism and social behavior in general, it is important to have selective tool compounds available. WAY267464 is described as a selective oxytocin agonist, but we found that it is also a potent human and mouse vasopressin V1a receptor antagonist. This may affect the interpretation of behavioral results obtained with WAY267464.

108.115 115 Spontaneous Integration of Human DNA Fragments Into Host Genomes. K. Koyama* and T. A. Deisher, *Sound Choice Pharmaceutical Institute*

Background:

A trio of recent publications in the journal NEURON reports the presence of hundreds of diverse de novo gene mutations indicating that autism spectrum disorder (ASD) may be a disease of genomic instability, with a significant environmental component. Altered double strand break formation and repair pathways (DSB) may be a commonality among the diverse genetic mutations that have been documented in ASD. US birthyear changepoints in AD are apparent in 1980, 1988 and 1996, coinciding with the switch to or introduction of childhood vaccines contaminated with human endogenous retrovirus K (HERVK) and human fetal DNA fragments. The HERVK and human fetal DNA contaminants could contribute to the genomic instability of ASD demonstrated by de novo mutations.

Objectives:

Human fetal DNA introduced with vaccines may be taken up via cellular DNA uptake receptors or may spontaneously penetrate cell membranes that have become permeable during inflammatory reactions. This foreign DNA could be integrated into the host genome during double strand break repair. In this study we demonstrate foreign DNA uptake in human cells and genomic integration by incubating the cells with Cy3-labeled human Cot1 (placental) DNA fragments.

Methods:

Human Cot1 DNA labeled with Cy3 was incubated with human cell lines for 24-48 hours. Suspension cell lines included U937 (monocytic leukemia) and HL-60 (promyelocytic leukemia), loosely adherent NCCIT (teratocarcinoma), and adherent cell lines were HFF1 (human foreskin fibroblast), BE

(2)-C (neuroblastoma), M059J and M059K (glioblastoma). Cy3 labeled DNA uptake was viewed under fluorescent microscope. Genomic DNA was purified from U937 cells, and the amount of Cy3 labeled human cot1 DNA was calculated from the relative fluorescent unit (RFU) of Cy3 in the U937 DNA measured using spectrofluorimetry.

Results:

Spontaneous cellular and nuclear DNA uptake was evident in HFF1 and U937. Spontaneous cellular uptake was seen in NCCIT. DNA uptake in BE (2)-C, M059J, and M059K was not measurable because of high auto fluorescence of the cells. No Cy3 signal was observed in HL-60. The amount of labeled Cy3 human Cot1 DNA incorporation in U937 genomic DNA was 0.0111 +/- 0.0034pg (n=12) per cell in 24 hours, which was approximately 0.167% of total U937 genomic DNA.

Table: DNA uptake in Various Cell lines

	Spontaneous Cellular uptake	Spontaneous Nuclear uptake	Genomic DNA incorporation	Cellular Uptake With Permeabilization
HFF1	Yes	Yes	ND	Yes
NCCIT	Yes	ND	ND	ND
BE(2)-C	No	No	No	No
M059K	No	No	No	No
M059J	No	No	No	No
U937	Yes	Yes	Yes	Yes
HL60	No	No	No	No

Conclusions:

This study demonstrates that primitive short DNA fragments (50-300 bp) are spontaneously taken up by HFF-1, U937 and NCCIT cells and inserted into the genome of the monocytic leukemia cell line U937. Hence, vaccines containing residual HERVK and human fetal DNA fragments may contribute to the genomic instability observed in ASD.

108.116 116 qRT-PCR-Based Assessment of Redox and Methylation Cycle Gene Expression in Autism. M. S. Trivedi*[1], N. Hodgson[1], S. Al Mughairy[1], M. Kesir[1], D. Feingold[1], M. I. Waly[2], Y. Alfarsi[2] and R. Deth[1], (1)*Northeastern University*, (2)*Sultan Qaboos University*

Background:

Studies from laboratories across the world have described the occurrence of significant alterations in the level of redox/methylation metabolites in autistic patients, indicating that these pathways are central contributors to autism spectrum disorders (ASDs). However, to date no studies have evaluated the dynamic regulation of enzymes involved in these pathways at the transcriptional level. Changes in mRNA levels might be related to the alterations of metabolic biomarkers and may represent adaptive responses to the oxidative stress (decreased GSH/GSSG) and reduced methylation capacity (decreased SAM/SAH) observed in autistic patients.

Objectives: The purpose of this study is to evaluate the transcriptional status of enzymes involved in redox/methylation and transsulfuration pathways using a qPCR assay. Such measurements may prove useful for the clinical diagnosis of ASD

Methods:

*Blood samples:*Blood samples were obtained from autistic and non autistic controls (n=40) in PAXgene tubes™ according to an IRB-approved protocol.

*Isolation of the RNA:*RNA was isolated using the PAXgene Blood RNA extraction ® kit. cDNA was synthesized using the First Strand cDNA synthesis® kit from Roche.

qRT-PCR: qRT-PCR was performed in a 96 well plate using a Roche LightCycler® 480. 5 µL of cDNA template, primers, SYBR Green I Master®, and dH20 in a final volume of 20 µL

was used. Thermal parameters included, incubation for 5 min at 95°C, 45 cycles of 95°C for 10 sec, 60°C for 20 sec and 72°C for 30 sec, followed by a single cycle of 95ºC for 5 sec, 1 min at 65ºC and 97ºC for the melting curve, followed by cooling at 40ºC for 90 sec. Data was analyzed using the Roche relative quantification method and normalized to GAPDH.

Results:

Our preliminary results indicate increased expression several redox/methylation genes in autistic subjects, including EAAT3, the transporter responsible for the uptake of cysteine. Cysteine is the rate limiting precursor for GSH synthesis, and GSH levels are significantly decreased in autistic subjects. In addition, mRNA levels of the folate and vitamin B12-dependent enzyme methionine synthase were increased approximately 2-fold. Methionine synthase regulates levels of methionine and homocysteine, and both these metabolites have been reported to be decreased in autistic patients. Lastly, a significant increase in mRNA levels of the retrotransposon LINE-1 was also observed, an indicator of decreased DNA methylation.

Conclusions:

These preliminary results show that abnormal levels of metabolites in the redox and methylation pathways are associated with altered transcriptional levels of key enzymes, as monitored in blood samples from autistic patients. These mRNA changes could potentially be useful a clinical marker for ASD. Follow up studies will utilize a focused qRT-PCR array to assess all the enzymes involved in the redox, methylation and transsulfuration pathways. Alterations observed at the transcriptional level, along with intracellular thiol data, will be incorporated into a mathematical model of the relevant pathways, developed using the Simbiology toolbox from MATLAB. This model will allow dynamic simulation of redox and methylation pathways in neurons, including the changes that accompany autism.

108.117 117 Effects of Prenatal and Postnatal Sex Steroid Hormones on the Development of Autistic Traits in Children At 18-24 Months of Age. B. Auyeung*[1], J. Ahluwalia[2], L. Thomson[2], K. Taylor[2], G. Hackett[2] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*Cambridge University Hospitals NHS Foundation Trust*

Background: It has been suggested that autism may be an extreme manifestation of specific (but not all) male-typical traits, both in terms of cognition and neuroanatomy. Studies of prenatal exposure to sex steroid hormones during critical periods of development are related to specific (but not all) sexually dimorphic aspects of cognition and behaviour. However, it is not known whether postnatal exposure to these hormones has a similar effect. The critical periods for sexual differentiation of the brain are thought to be when sex differences in serum levels of sex steroids (e.g., testosterone) are highest. During human development, there is a prenatal surge in testosterone at around weeks 8-24 of gestation and a postnatal (neonatal) surge is also thought to occur shortly after birth when the child reaches 3-4 months of age.

Objectives: To examine how prenatal and postnatal sex steroid hormone levels are associated with individual differences in autistic traits in 18-24 month old children.

Methods: Fetal testosterone (fT) and fetal estradiol (fE) levels were measured in amniotic fluid using radioimmunoassay from pregnant women following routine second-trimester amniocentesis in n=129 toddlers. Saliva samples were collected from a subset of these children (n=35) when they reached 3-4 months of age. Salivary samples were assayed (without separation or extraction) for neonatal testosterone (nT) levels using commercially available immunoassay protocols. When the children reached 18-24 months of age, mothers were asked to complete the Quantitative Checklist for Autism in Toddlers (Q-CHAT), a measure which has been shown to be effective in detecting the presence of autistic traits.

Results: fT levels were positively associated with scores on the Q-CHAT. For the smaller subset of children for which nT was measured, nT levels showed no significant sex differences and no relationships with FT levels or with Q-CHAT scores. The same subset retained the relationship between fT levels and Q-CHAT scores, despite the smaller sample size.

Conclusions: These findings are consistent with the hypothesis that prenatal (but not postnatal) androgen exposure

(coinciding with a critical phase in sexual differentiation of the brain) is associated with the development of autistic traits in 18-24 month old toddlers. The present results should be followed up in a larger sample to examine whether individuals with clinical diagnoses of autism had elevated levels of fT .

108.118 118 Understanding Autism: How a Single Mutation Contributes to the Autism Phenotype. A. Chiocchetti*[1], D. Haslinger[2], J. Kellermann[3], R. Waltes[4], F. Poustka[4], J. W. Bauer[5], C. M. Freitag[4], H. Hintner[5], F. Lottspeich[3], S. Wiemann[1], L. Breitenbach-Koller[2] and S. M. Klauck[1], (1)*German Cancer Research Center (DKFZ)*, (2)*Paris-Lodron University*, (3)*Max Planck Institute for Biochemistry*, (4)*Goethe-University*, (5)*Paracelsus Medical University*

Background:

Autism spectrum disorders (ASD) present with a high genetic heterogeneity, and so far no single gene could be directly associated to ASD etiology. Genome wide association studies remained unsuccessful so far. Screening of candidate genes showed that 6-10% of ASD patients carry mutations in genes linked to neurogenesis and synaptic plasticity. However, the pathomechanisms underlying ASD remain unclear. Recently discovered mutations in the ribosomal protein L10 gene (RPL10) provided a new hint towards an altered translational capacity.

Objectives:

To further understand the contribution of an RPL10 mutation at protein level we used 2-dimensional differential-in-gel-electrophoresis (2D-DIGE) on lymphoblastoid cell lines (LCLs). Putative candidates were analyzed using tandem mass-spectrometry.

Methods:

We compared cell lines carrying the RPL10 mutations with non-mutant allele carriers and a set of 10 ASD patients, not harbouring any RPL10 mutation, with 10 random controls. Validation of differentially regulated proteins was performed on mRNA and overall protein expression level applying RT-PCR and Western Blot methods.

Results:

Candidates differentially expressed due to a mutation in the RPL10 gene were associated to the same functional pathways deregulated in cell lines derived from ASD patients. These proteins were mainly related to oxidative phosphorylation and energy metabolism as well as control of mRNA and protein stability. Validation of these results showed that the alteration is mainly taking place at translational levels and suggested also alterations of yet uncharacterized post-translational modifications. Furthermore we observed a variant protein expression level in the ASD samples which in some candidates correlated with a variant mRNA expression level. Overall, the differential protein patterns identified in the LCLs from autistic patients in comparison to LCLs from controls may result from both quantitative (expression level) and qualitative (post-translational modifications) changes in translation.

Conclusions:

The RPL10 mutations contribute to the molecular phenotype observed in the ASD derived cell lines by altering functionally related mechanisms. The identified candidates seem to be altered not only quantitatively, but also by a change in post-translational modifications. A further characterization of these modifications is needed. The association of the identified pathomechanisms to ASD is in agreement with already known candidate pathways. Therefore, we provide evidence that lymphoblastoid cell lines could serve as a tool to characterize the impact of a single mutation in a complex disorder.

108.119 119 Autism in Oman: Nutritional Deficiencies in Vitamin B12 and Folate Associated with Gender-Specific Abnormalities in Serum Thiol Levels. N. Hodgson[1], R. Deth*[1], M. I. Waly[2] and Y. Alfarsi[2], (1)*Northeastern University*, (2)*Sultan Qaboos University*

Background: Environmental factors (xenobiotics) appear to be largely responsible for increasing autism rates in the U.S., but nutritional factors may play a larger role in less developed countries such as Oman. The synthesis of glutathione (GSH) by sulfur metabolism plays a central role in the detoxification of many xenobiotics, and several studies have reported significantly lower plasma levels of GSH, in association with oxidative stress in autistic subjects. The folate and vitamin

B12-dependent enzyme methionine synthase is a key redox switch, whose activity determines the balance between methylation activity and GSH synthesis through the re-routing of sulfur metabolites.

Objectives: To evaluate the nutritional status of autistic children in Oman, particularly with regard to folate and vitamin B12, and to correlate nutrient levels with metabolites in redox and methylation pathways.

Methods: We studied 20 male and 20 female autistic children in Oman, and examined dietary intake and serum levels of folate and vitamin B12. We then measured serum levels of sulfur metabolites, including cysteine, cysteine, cystathionine, reduced and oxidized GSH, homocysteine, homocysteine, methionine, S-adenosylhomocysteine (SAH) and S-adenosylmethionine (SAM).

Results: We found evidence of malnutrition and lower folate and vitamin B12 intake in both male and female autistic subjects vs. controls. Lower intake was reflected as a significant decrease in serum B12 and folate levels. Notably, control levels of folate and vitamin B12 were low in comparison to values for the U.S. In combined autistic subjects, serum levels of cysteine, homocysteine and SAH were increased, and GSH was decreased vs. controls. A comparison of male vs. female subjects revealed several significant differences. Serum levels of homocysteine and SAH were increased in male autistic subjects vs. male controls, while cysteine and GSH were decreased. However, the serum level of cysteine was increased in female autistic patients vs. female controls. Serum levels of cysteine and GSH were increased in autistic females vs. autistic males, while oxidized GSH (GSSG), homocysteine, and SAH were decreased. There were no differences in any of the sulfur metabolites between control males and females.

Conclusions: We found differences in thiol metabolism and oxidative stress in Omani autistic children, similar to the findings of other studies. However, the presence of low B12 and folate levels indicates that the oxidative stress was largely due to a nutritional deficiency, which is not the case for autism in the U.S. Thus, a common metabolic abnormality (oxidative stress) is associated with autism of different origins. Further, our data shows gender specific differences in thiol metabolite levels among autistic subjects, with males showing a greater deficit in GSH and a higher level of oxidative stress. These differences could be essential to understanding the gender bias of autism diagnosis rates.

108.120 120 IL-6 Elevation in Brain Causes Neural Circuitry Imbalance and Mediates Autism-Like Behavior. X. Li*[1], H. Wei[1], K. Chadman[1], D. McCloskey[2], A. Sheikh[1], M. Malik[3] and W. T. Brown[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*College of Staten Island/CUNY*, (3)*New York State Institute for Basic Research in Developmental Disabilities*

Background: Autism is a severe neurodevelopmental disorder characterized by problems in communication, social skills, and repetitive behavior. Abnormal immune responses have been suggested to be associated with autism. Cytokines including IL-6, IL-8, IL-12, IL-1β, TNF-α, IFN-γ, TGF-β1 and MCP-1 were reported to be increased in the blood, brain, or cerebrospinal fluid of autistic subjects. Elevated IL-6 is the most consistent finding in autism. However, the mechanisms of how IL-6 being involved in the pathogenesis of autism are poorly understood.

Objectives: The aims of this study are to determine 1) whether IL-6 overexpression in the brain cause autism-like behavior and 2) the possible mechanism through which IL-6 overexpression may lead to the development of autism.

Methods: A mouse model of stably over-expressing IL-6 in brain was developed by injecting adenovirus encoding GFP IL-6 fusion protein into the cerebral lateral ventricles of P0.5 mice. A set of behavior tests was carried out to investigate the behavior in IL-6-over-expressed mice. The expression of synaptic vesicle proteins was tested using the fluorescence staining. The DiI labeling was used to outline dendritic spines in pyramidal neurons. The synaptic function was measured with extracellular field excitatory post-synaptic potentials recordings in CA1 area of the hippocampus in acute slices.

Results: We showed for the first time that elevation of IL-6 in the mouse brain produced certain autistic features, including impaired cognitive abilities, deficits in learning, abnormal

anxiety-like traits and habituation, as well as decreased social interactions in older mice. To investigate how IL-6 elevation leads to the development of autistic phenotype, we detected that an IL-6 elevation resulted in increased excitatory synaptic formations and a decreased number of inhibitory synapses. IL-6 elevation produced an increase in the length of dendritic spines and also stimulated the formation of mushroom-shaped dendritic spines. In addition, we demonstrated that IL-6 elevation reduced postexcitatory inhibition in the mouse hippocampus.

Conclusions: An abnormal elevation of IL-6 in the brain could lead to the development of autism phenotype through its impairments in synaptic plasticity and neural circuitry stability.

108.121 121 Identification of Transcriptional Targets of RORA, a Novel Candidate Gene for Autism Spectrum Disorder. T. Sarachana* and V. W. Hu, *The George Washington University*

Background: Autism spectrum disorder is biased towards males by a ratio of at least 4:1 with no clear understanding of whether or how the sex hormones may play a role in ASD susceptibility. Recently, we have identified the nuclear hormone receptor *RORA* (retinoic acid-related orphan receptor-alpha) as a novel candidate gene for ASD. Our independent cohort studies using lymphoblastoid cell lines, BA9/10 prefrontal cortical tissues, and cerebellar tissues have consistently demonstrated the reduction of RORA transcript and protein levels in individuals with ASD. Moreover, we have further shown that transcription of this gene is oppositely regulated by the sex hormones; that is, estrogen enhances *RORA* expression through estrogen receptor alpha whereas androgen suppresses *RORA* expression through androgen receptor. These findings suggest that *RORA* may be a key gene contributing to the sex bias of ASD and support *RORA* as a good candidate gene for the disorder. Although studies in mice have demonstrated that *RORA* is involved in ASD-related biological functions, including neuronal differentiation, cerebellar development, protection of neurons against oxidative stress, and regulation of circadian rhythm, little is known about transcriptional targets of *RORA*, particularly in human tissues.

Objectives: To comprehensively identify direct transcriptional targets of *RORA* in human neuronal cells using high-throughput whole-genome promoter analysis. Here we focus on *RORA1* which is the major isoform of *RORA* in the brain.

Methods: Chromatin was isolated from the human neuronal cell line SH-SY5Y and immunoprecipitated (IP) using anti-RORA1 or IgG antibody. DNA was purified from the IP chromatin and used for microarray analysis (ChIP-on-chip) using Affymetrix's Genechip Human Promoter 1.0R Arrays (n = 3 for specific and nonspecific IgG), each of which comprises over 4.6 million probes tiled through over 25,500 human promoter regions. Probes significantly enriched in RORA1-IP DNA were identified using Partek software. Selected potential targets of *RORA1* were then further validated by chromatin immunoprecipitation, followed by qPCR (ChIP-qPCR) analysis. To further demonstrate that reduction of *RORA1* expression could lead to aberrant transcription of novel RORA1 targets, we also conducted shRNA-mediated knockdown of *RORA1* and performed RT-qPCR analysis to determine expression of selected *RORA1* targets in *RORA1*-deficient neuronal cells. Biological networks and functions associated with RORA1 transcriptional targets were predicted using Ingenuity Pathway Analysis (IPA) and Pathway Studio 7 programs.

Results: The ChIP-on-chip analysis revealed that as many as 1,338 probes corresponding to promoter regions of 1,274 genes across the human genome were significantly enriched in RORA1-IP DNA (p-value < 0.05; log2 ratio > 0.3). Among these potential targets were genes known to have biological functions negatively impacted in ASD, including neuronal adhesion and survival, synaptogenesis, as well as development of cortex and cerebellum. ChIP-qPCR analysis confirmed binding of RORA1 to promoter regions of selected potential targets, including *A2BP1, NLGN1, HSD17B10,* and *NTRK2*. Knockdown of *RORA1* in human neuronal cells resulted in reduction of expression of these genes.

Conclusions: These findings indicate that RORA1 transcriptionally regulates a number of downstream targets, including *A2BP1, NLGN1, HSD17B10*, and *NTRK2*, all of which are known to have biological functions associated with ASD.

108.124 124 Neuroligin Has Cell-Autonomous As Well As Cell-Non-Autonomous Functions In C. Elegans. J. B. Rand*, G. P. Mullen, E. A. Mathews and J. W. Hunter, *Oklahoma Medical Research Foundation*

Background: Neuroligins are postsynaptic adhesion proteins originally identified by their binding to presynaptic neurexins. Recent studies suggest that neuroligins function primarily in the maturation and/or maintenance of synapses. There are four neuroligin genes in humans, and mutations in the genes encoding neuroligin-3 and neuroligin-4 are associated with autism spectrum disorders (ASDs) in some families. We had previously examined the expression, localization and biological functions of neuroligin in a simple model organism, the nematode *Caenorhabditis elegans*. *C. elegans* has a single neuroligin gene (*nlg-1*), and we had shown that *nlg-1* null mutants are viable and are not deficient in any major motor functions. However, they are defective in a subset of sensory behaviors and sensory processing. *nlg-1* mutants are also hypersensitive to oxidative stress (*i.e.*, exposure to paraquat); this is an unexpected phenotype for a synaptic mutant. Like many other stress-sensitive mutants, *nlg-1* mutants also have a reduced lifespan and an increased level of oxidative protein damage (Hunter *et al.*, 2010). All of these mutant phenotypes are rescued by transgenic expression of mammalian neuroligin (human neuroligin-4 or rat neuroligin-1). The *C. elegans* and mammalian neuroligins, therefore, appear to be functionally equivalent (including having the ability to prevent or counteract oxidative stress).

Objectives: To analyze the contribution of neuroligin to normal function of specific neurons and of known behavioral circuits in *C. elegans*.

Methods: Using standard methods, we engineered a set of constructs in which the *nlg-1* cDNA was driven by several different promoters, each of which was specific for a small subset of neurons. We then expressed these constructs as stable transgenes in *nlg-1* null mutants, and we compared the behaviors and toxin sensitivity of the transgenic animals to wild-type animals and to *nlg-1* mutants lacking the transgenes.

Results: Neuroligin is normally expressed in approximately ~20% of *C. elegans* neurons, including the pair of AIY interneurons. AIY cells receive direct synaptic input from different types of sensory neurons (*e.g.*, chemosensory, thermosensory, nociceptive), and have been shown to play an important role in the integration of sensory information. We find that expressing neuroligin only in the AIY interneurons is sufficient to rescue all of the sensory deficits as well as the elevated oxidative stress present in *nlg-1* mutants. In addition, we find that expressing neuroligin ectopically in neurons which do not normally express this protein can also rescue mutant phenotypes.

Conclusions: It is both noteworthy and surprising that expression of NLG-1 in only the two AIY neurons is sufficient to rescue all of the mutant phenotypes we examined. Equally noteworthy and surprising is the phenotypic rescue observed when the only neuroligin in the animal is in cells that normally do not express neuroligin - clearly a non-cell-autonomous effect.

108.125 125 Differential Immune Response to the Environmental Toxicant, BDE-49 in Chidlren with Autism Spectrum Disorders. M. D. Eloi*[1], D. Zhou[2], R. Boyce[1], X. Yang[2], I. N. Pessah[3] and J. Van de Water[4], (1)*University of California, Davis*, (2)*School of Medicine, Department of Public Health, Division of Biostatistics, University of California, Davis*, (3)*University of California at Davis, M.I.N.D. Institute*, (4)*University of California, Davis, MIND Institute*

Background: Divergent findings from genetic studies support gene-by- environment interactions as a key contributing factor in autism spectrum disorders (ASD). Several environmental agents have been shown to influence the immune system, including the persistent organic environmental pollutants, polybrominated diphenyl ethers (PBDEs). These toxicants may furthermore interfere with normal endocrine, immune and/or neural development. A recent study demonstrated the impact of *ex vivo* exposure to a PBDE congener, BDE-47, on innate immune function in children with ASD. In another study, in comparison with BDE-47 and congener with a lower body burden, BDE-49, was shown to be extremely neurotoxic to cortical neurons *in vitro* (Kim, et al., 2011). In addition, various

animal model studies indicate there is a sex-specific difference in the response to PBDE exposure.

Objectives: This study sought to evaluate the differential effects of *ex vivo* exposure to a more potent PBDE congener, BDE-49, on immune function in peripheral blood mononuclear cells (PBMCs) isolated from children ages 2-5 yrs with ASD (ASD= 31, M=33, F=8) and compared with age-matched typically developing controls (TD= 53, M=44, F=10).

Methods: Isolated PBMCs were exposed *ex vivo* for 4 hours to 250 nM, 50 nM BDE-49, or DMSO as a vehicle control, prior to challenge with bacterial lipopolysaccharide (LPS), an innate immune cell activator, or the T cell mitogen, phytohemagglutin A (PHA). After exposure for 48 hrs, cytokine and chemokine levels from cell supernatants were analyzed via a 21-multiplex bead-based assay.

Results: Preliminary results indicate that when adjusted for child's sex for both subject groups, BDE-49 exposure at 250nM had an increase effect on the adaptive and innate immune response for production of inflammatory cytokines such as IFN-gamma, IL-1a, and the chemokines MIP-1a, MIP-1b and MCP-1. When diagnosis was taken into account, *ex vivo* exposure of PBMCs to BDE-49 at 250nM resulted in a differential immune response in children with ASD compared to TD. Activation of T cells from children with ASD exposed to 250nM BDE-49 resulted in a significant decrease for the production of MIP-1b and IL-1a compared to TD. In activated monocytes/macrophages there was a significant decrease for the production of MIP-1b.

Conclusions: *Ex vivo* exposure of PBMCs from a pediatric population to BDE-49 had global effects on the production of certain cytokines and chemokines, regardless of diagnosis. Of particular interest, there was a differential effect of BDE-49 exposure on PBMC from children with ASD compared to the TD controls for some cytokines and, in particular, the chemokine, MIP-1b which has been shown to be elevated in Alzheimer brain tissue. These findings may aid in a better understanding of the interplay between immunological and environmental factors and their combined role in the etiology of autism.

108.126 126 Immune Dysfunction in Fragile X Syndrome and Autism. M. Careaga*[1], K. Basuta[2], F. Tassone[3] and P. Ashwood[2], (1)*Department of Medical Microbiology and Immunology Univ. California Davis, Davis, CA*, (2)*University of California, Davis, MIND Institute*, (3)*University of California Davis School of Medicine*

Background: Fragile X Syndrome (FXS) is the leading cause of inheritable intellectual disability in male children, and is predominantly caused by a single gene mutation resulting in expanded trinucleotide CGG-repeats within the 5' untranslated region of the fragile X mental retardation (FMR1) gene. Although prevalence estimates vary across studies, it is estimated that 30-70% of children with FXS meet the criteria for autism spectrum disorder (ASD). Reports have suggested the presence of immune dysregulation in FXS, and previous analysis of peripheral cytokines levels in the blood of children with FXS suggest a similar immune dysregulation to that reported in children with ASD.

Objectives: In order to ascertain if immune dysregulation is present in children with FXS, dynamic cellular responses to immune stimulation were determined.

Methods: Peripheral blood mononuclear cells (PBMC) were isolated over a histopaque gradient from male children with FXS (n=11) and from male age-matched typically developing (TD) controls (n=7). PBMC were cultured for 48 hours in RPMI media supplemented with 10% fetal bovine serum with or without phytohaemagglutinin (PHA; 8 ug/mL) to stimulate the adaptive immune response. Supernatants were harvested and cytokine levels assessed using Luminex multiplexing technology.

Results: Children with FXS displayed an altered response following immune challenge compared with TD controls. Following stimulation with PHA a profile of T_H1 associated cytokines, such as IFNγ, and IL-12 were significantly decreased in FXS subjects relative to TD controls ($p < 0.03$). In contrast, T_H2 associated cytokine profiles, in particular IL-13, were elevated. The skew towards a T_H2 profile was further verified by comparing the ratio (IL-13/INFγ) of T_H2 vs. T_H1 cytokines and was significantly increased in FXS subjects (3.9 ± 1.8; mean ± SEM) compared with TD controls (0.5 ± 0.4; p

< 0.04). Of note FXS subjects with ASD showed a less pronounced skewing (0.78 ± 0.4; n=5) than those with FXS alone (5.6 ± 2.6; n=6).

Conclusions: These findings suggest that dynamic cellular responses in children with FXS exhibit a skew towards a T_H2 cytokine profile when compared with controls. These findings support previous observations of T_H2 cytokines profiles in the plasma of children with FXS. Further evaluation of T_H2 cytokine profiles in FXS is warranted to delineate immune alteration in FXS with and without the occurrence of ASD in this disorder.

108.127 127 Implications of Altered Brain DeiodinaseType 2 (D2) Expresion in Animal Models and Postmortem Human Brains Derived From ASD Donors. E. M. Sajdel-Sulkowska*[1], A. Khan[2] and A. M. Zavacki[2], (1)*Harvard Medical School/ BWH*, (2)*HMS/BWH*

Background:

It has been hypothesized that ASD pathology is associated with exposure to environmental neurotoxicants including heavy metals. We have previously shown that perinatal exposure to Et-Hg in SHR rats results in increased cerebellar oxidative stress marker 3-nitrotyrosine (3-NT), decreased deiodinase Type 2 (D2) suggesting local decrease in thyroid hormone (TH) levels, and aberrant expression of specific TH-regulated genes. We have also shown increased oxidative stress in postmortem human brain samples derived from ASD donors.

Objectives:

The objective of this study was to evaluate the hypothesis that inhibition of local brain D2 expression brought about by exposure to heavy metals may be also altered in ASD, resulting in local brain TH deficiency and aberrant gene expression. Specifically, the objectives were: (1) to compare TH-regulated gene expression between brain samples derived from control and Et-Hg exposed rats; (2) to examine changes in D2 expression in brain samples derived from control and ASD donors; (3) to determine whether TH-regulated gene expression differs between brain samples derived from control and ASD donors.

Methods:

To assess oxidative stress, 3-NT was measured in brain homogenates by an ELISA method. D2 activity was measured in the brain homogenates by quantifying ^{125}I release from a ^{125}I labeled T4 tracer. Gene expression was measured using a Quantitative Real-Time PCR (qRT PCR) real-time PCR.

Results:

We observed a significant decrease in D2 expression (61.9%) in brains derived from Et-Hg-exposed male but not in female rat pups; these decrease was associated with upregulation of SWAP(~80%) and Odf4 (~50%) genes in brains of exposed male but not female pups. Analysis of human postmortem samples confirmed an increase in 3-NT and showed a trend towards decreased D2 expression (19%) in brains derived from ASD donors.

Conclusions:

The neurotoxic effects of perinatal exposure to heavy metals in rats are associated with decreased deiodinase Type 2 (D2) expression suggestive of decreased local brain T3 levels. Altered local brain TH levels affect expression of specific genes regulated by TH; these effects are brain region and sex specific. Preliminary data suggest similar changes in postmortem brain samples derived from ASD donors. Altered expression of brain TH-dependent genes during the perinatal period may impact neurodevelopment and contribute to ASD pathology.

108.128 128 The Implications of Prostaglandin E2-Wnt Signaling Pathway Interaction in Autism. C. Wong*, H. Li and D. A. Crawford, *York University*

Background: Exposure to various environmental factors, including infectious and chemical agents, during pregnancy may result in abnormal lipid metabolism and increase the risk of developing Autism Spectrum Disorders (ASDs). Prostaglandin E_2 (PGE_2) is a lipid signaling molecule derived from membrane fatty acids that acts through four EP receptor subtypes, EP1 to EP4. PGE_2 has an important role in brain development and function. Recent studies show an elevated level of prostaglandin metabolites in individuals with autism. Prenatal exposure to a drug misoprostol, a prostaglandin E analogue, during pregnancy has also been linked to ASDs.

Our previous studies provided evidence that PGE_2 and misoprostol can elevate calcium amplitude in neuronal growth cones and reduce neurite extensions in a dose-dependent manner. Moreover, literature suggests a cooperative regulation between prostaglandin signaling and early developmental pathways such as Wingless (Wnt). Overall, the existing literature and our previous data strongly suggest that PGE_2 signaling may play a contributing role in the etiology of ASDs.

Objectives : Our study aimed to determine whether changes in PGE_2 levels affect the function of embryonic neural cell function, to investigate the potential cross-talk between PGE_2 and Wnt signaling pathways, and to elucidate how these molecules may cause abnormal neuronal development.

Methods : Mouse neuroectodermal (NE-4C) stem cells were used as an *in vitro* experimental model. The study was conducted on undifferentiated NE-4C cells and cells differentiated into neurons and astrocytes. Cells were treated with various concentrations of PGE_2 or misoprostol to determine the effects on gene and protein expression, as well as cell behaviour. Quantitative real-time PCR was used to measure mRNA expression with SYBR Green reagent or Custom TaqMan® Array Plates. Protein analysis was completed using western blot technique. Cell behaviour such as cell movement and growth measurements was recorded using Nikon Eclipse Ti-E microscope with a specialized object tracking module.

Results : We show that the EP receptor expression changed between undifferentiated and differentiated cells. Relative to undifferentiated NE-4C cells, neurons had a decrease in EP1 and an increase in EP3β and EP3γ expression. Similarly, astrocytes had a decrease in EP1 but an increase in EP3α and EP4 expression. This could indicate that committed and uncommitted cells respond differently to PGE_2. PGE_2 concentration-dependent treatment also regulated the level of EP3α,β,γ and EP4 receptor expression suggesting that exposure to varying doses of PGE_2 could result in differential downstream effects. Interestingly, we also determined that PGE_2 treatment modifies the expression of various Wnt-dependent target genes. Furthermore, PGE_2 appeared to attenuate Wnt-dependent cell behaviour by modifying average velocity, path length, distance, and cell division.

Conclusions : These results indicated that PGE_2 may regulate neuronal stem cell function via activation of EP receptors in a dose-dependent manner and that it may interfere with other key developmental pathways such as the Wnt signaling pathway. This study expands our knowledge of the important role PGE_2 signaling may have in the developing nervous system and its potential contribution to the pathology of ASDs.

108.129 129 Maternal Inflammation Increases the Number of Basal Forebrain Cholinergic Neurons and Alters Neuregulin-1 Expression in the Hippocampus. L. Pratt*[1], L. Ni[2] and G. M. Jonakait[2], (1)*Rutgers University-Newark*, (2)*New Jersey Institute of Technology*

Background: Alterations within the cholinergic basal forebrain are implicated in autistic spectrum disorders and schizophrenia. In the rodent basal forebrain the differentiation of cholinergic neurons from bipotential precursors occurs during midgestation. These neurons then project axons to the hippocampus where they form synapses perinatally. Several genetic susceptibility factors for both autism and schizophrenia are associated with synaptogenesis and synapse signaling. An alteration in cholinergic development could affect the transcription and/or protein expression of key synaptic molecules in the hippocampus. Maternal inflammation is recognized as contributing to neurodevelopmental disorders. Moreover, our lab has found that a cocktail of factors from inflamed brain microglia produces excess cholinergic neuron development in vitro.

Objectives: Experiments were designed to determine whether prenatal maternal infection alters cholinergic differentiation in the fetal basal forebrain and whether there is an accompanying change in expression of specific synapse-related molecules in the perinatal hippocampus. Molecules examined were Shank3, Neuregulin-1 (NRG1), α7 nicotinic acetylcholine receptor (α7nAChR), NMDA receptor (NMDAR), the sodium-potassium chloride transporter (NKCC1) and the potassium chloride co-transporter (KCC2).

Methods: The viral mimic polyinosinic-polycytidylic acid was administered to pregnant mice at embryonic day 12.5 (E12.5) to produce maternal inflammation. The activity of choline acetyltransferase (ChAT), the enzyme responsible for acetylcholine biosynthesis was measured in basal forebrain. Transgenic mice expressing enhanced green fluorescent protein (EGFP) along with ChAT and under control of the ChAT promoter were used to assess the number of cholinergic neurons in the basal forebrain. GFP+ cells were randomly and systematically sampled with 3D counting frames using Stereo Investigator Stereology software (MBF Bioscience). Real-time polymerase chain reaction (RT-PCR) quantified the relative mRNA transcript levels of synaptic molecules and western blot with antibody to NRG1 detected protein and revealed molecular weights of isoforms.

Results: Following maternal poly (I:C) administration, a modest but significant increase in ChAT activity is seen at embryonic day 16.5 (E16.5), E18.5 and postnatal day 1 (P1) in the basal forebrain. Meanwhile the number of ChAT+ cells in the basal forebrain increases at E16.5 and more than doubles at P1. In the P1 hippocampus of offspring of dams injected with poly (I:C) message levels of Shank-3, α7nAChR, NMDAR, NKCC1 and KCC2 do not differ from controls While there was no difference in total message level of NRG1 between pups from poly (I:C)-treated and control dams, RT-PCR revealed two distinct transcripts. One was predominant in control samples and the other predominant in offspring of treated moms. Western blot with αNRG1 revealed the existence of several neuregulin-1 isoforms. All control samples contained a strong band between 75 and 100 kDa that was greatly reduced in all poly (I:C) samples. This band corresponds to reported molecular weights for type III neuregulin-1.

Conclusions: Maternal immune activation results in increased ChAT activity and greater numbers of cholinergic neurons in the fetal basal forebrain. In addition there is an associated reduction in protein expression of type III neuregulin-1 in the hippocampus of P1 offspring of dams injected with poly (I:C).

108.130 130 Developmental Expression of Neuroligin and Neurexin mRNAs in the Fragile X Mouse. J. Lai*, S. Jacobs, L. Doering and J. A. Foster, *McMaster University*

Background: Fragile X Syndrome is one of the most well known genetic causes of autism or autism-related behaviours. Up to 25% of Fragile X patients are diagnosed with autism and 2% to 6% of autism patients have Fragile X. This neurodevelopmental disorder is caused by silencing of the *FMR1* gene, located on the X chromosome, that leads to dysregulation of mRNA translation. Recent research has focused attention on synapse structure and function as a primary contributor to the development of fragile X and autism spectrum disorders. Neuroligins (NLGNs) and neurexins (NRXNs) are trans-synaptic cell adhesion molecules that are important for synapse maturation. We have previously examined neuroligin expression in the adult *fmr1-/-* mouse, the mouse model of Fragile X Syndrome. Our data showed male-specific increase of NLGN1 mRNA in the *fmr1-/-* somatosensory cortex (S1) and hippocampus (HIP). Changes in the timing and level of expression of these synaptic genes during postnatal development may influence the establishment of a balanced neural circuit and affect the architecture of the brain network.

Objectives: The objective of this study is to examine the developmental expression profile of neuroligin and neurexin mRNA in the *fmr1-/-* mouse.

Methods: Our target genes include known mouse genes NLGN1, 2, 3, and 4 and NRXN1, 2 and 3. *In situ* hybridization is employed to examine temporal and spatial patterns of these target genes during postnatal development in wildtype (FVB.129P2(B6)) and *fmr1-/-* (FVB.129P2(B6)-Fmr1tm1Cgr) mice.

Results: NLGN1 – Patterns of expression for NLGN1 were similar in WT and *fmr1-/-* mice. Expression levels were highest at postnatal day (P) 7 in both the HIP and S1 and decreased over time. NLGN2 – WT mice showed increasing expression of NLGN2 mRNA over the first 3 weeks, with peak expression at P21, followed by a decrease over the next 2 weeks. *Fmr1-/-* mice showed altered expression of NLGN2 mRNA in the CA1 region of the hippocampus, while remaining brain regions were similar to WT patterns. NLGN3 – NLGN3

mRNA expression increased in WT mice over the first 2 weeks and then was reduced across brain regions by P21. Interestingly, sexual dimorphic expression of NLGN3 mRNA was observed in dentate gyrus in WT mice. In addition, altered expression patterns at P14 and P21 were present in both male and female *fmr1-/-* mice.

Conclusions: Transient changes in neuroligin gene expression are observed during the window of synaptic maturation in *fmr1-/-* mice. Ongoing analysis will extend this work to include neuroligin 4 and the neurexin mRNAs. This research will further our understanding of the shared neurobiology between autism and Fragile X Syndrome.

Genetics Program

109 Genetics and Genomics

109.131 131 The Broader Autism Phenotype in Simplex and Multiplex Families. J. Gerdts*[1], R. Bernier[1], K. Ankenman[1] and G. Dawson[2], (1)*University of Washington*, (2)*Autism Speaks, UNC Chapel Hill*

Background: Non-inherited genetic mutations are particular risk factors in single incidence, or simplex, autism spectrum disorder (ASD) families compared to multiplex ASD families. Behavioral genetic studies examining the broader autism phenotype (BAP) document increased presence of BAP traits in multiplex ASD parents and siblings compared to simplex first-degree relatives.

Objectives: To compare the BAP in simplex and multiplex ASD families.

Methods: Mothers, fathers, and siblings from 87 multiplex and 41 simplex ASD families were assessed using the Broader Phenotype Autism Symptom Scale (BPASS). The BPASS is a semi-structured interview intended to assess ASD-related traits in four domains: Social Interest, Expressiveness, Conversational Skills, and Flexibility/Restricted Interests. It combines information from self- and parent- report using clinical interview questions as well as direct observation. Multiplex families were recruited from participants in a CPEA network funded genetics study of autism and simplex families were recruited from the Simons Simplex Collection.

Results: Significant differences were found in mean levels of social interest between simplex and multiplex mothers, $t(123) = -2.51$, $p = .01$, Cohen's $d = 0.48$, and fathers, $t(109) = -2.15$, $p = .03$, Cohen's $d = 0.42$, with a trend in differences observed in siblings, $t(96) = -1.81$, $p = .07$, Cohen's $d = 0.38$. Simplex family members showed increased social interest across the three groups. Simplex mothers were significantly more expressive in their use of nonverbal communication compared to multiplex mothers, $p = .006$, as were simplex fathers, $p = .006$, and siblings, $p < .001$. Conversational skills were also improved in simplex fathers, $p = .04$, and siblings, $p = .008$, compared to multiplex fathers and siblings. A significantly lower percentage of simplex family members were rated as having low to very low social interest compared to multiplex family members , $X^2(1, N = 334) = 14.42$, $p < .001$. Simplex siblings showed significantly lower rigidity and intense interests compared to multiplex siblings, $t(96) = -2.30$, $p = .02$, Cohen's $d = 0.48$, and were less often rated as having impairing repetitive behaviors compared to multiplex siblings, 5% versus 21%, $X^2(1, N = 98) = 5.10$, $p = .02$. Simplex mothers and fathers did not differ in their flexibility and range of interests from multiplex mothers and fathers.

Conclusions: The decreased number and intensity of BAP traits observed in parents and siblings within simplex families provide behavioral support to findings of increased de novo genetic events not shared by other family members since ASD-related behavioral traits were shared less frequently in simplex compared to multiplex families. Thus, these behaviorally based findings suggest that the types of genetic causes of ASD may vary between single-incidence and multiple-incidence families and that multiplex family members are more vulnerable to ASD symptoms given shared genetic variance.

109.132 132 Understanding Parents' Opinions about Clinical Genetic Testing in ASD. J. Parr*, *Newcastle University*

Background: The American College of Medical Genetics recently suggested microarray testing should be a first tier investigation for children with ASD. However, genetic testing in ASD is contentious; some people believe testing is helpful, whilst others have major concerns about the potential clinical implications and applications. Little is known about whether

parents would want testing for themselves and their children if it were available.

Objectives: To understand parents' opinions about clinical genetic testing for themselves and their children with ASD

Methods: In North East England, approximately 65% of children with ASD and their families are included on the Daslne regional research database (http://daslne.org/). In February 2011, parents were sent a survey that focussed on knowledge about ASD and genetics, and opinions about clinical genetic testing; the survey was designed by experienced ASD clinical academics (members of the AGP), a clinical geneticist, experts in social policy and ethics, and a parent of a child with ASD, who also runs the regional branch of the National Autistic Society. Paper surveys were sent by post to both parents in each family, with mechanisms for separate completion and return. An online survey link was included on the paper version. Reminders were sent to non respondents.

Results: Responses were received from 377 parents (264 mothers and 113 fathers, from 293 families). The ASD characteristics of the children of responders and non responders were very similar.

Most parents overestimated their chance of having another child with an ASD; 43% of parents reported that having a child with ASD had affected their decision to have more children. If it were available, 77% said they would like their child with ASD to be tested for 'genes that caused ASD'. Parents were asked if their child was found to have a gene that caused ASD, whether they would like testing themselves – 78% said yes. Parents were asked hypothetical questions about prenatal testing, and testing during pregnancy. If it was available, 54% of parents would like to be tested for 'ASD genes' before having another child. 40% of parents thought that if it was possible to test a baby during pregnancy, to see what their chances of having ASD were, this should be available; 24% would not want this, and 36% were unsure. Parents of children with less well developed language skills were more likely to want testing. Parents written responses to survey questions revealed a very broad range of opinions about testing.

Conclusions: This is the largest survey of its kind to date, and many parents were positive about genetic testing; however, opinions varied considerably. Genetic testing of ASD families will increase over the next few years; opinions about whether clinical genetic testing should be available will influence its impact.

109.133 133 A Role for UBE3A in Structural Plasticity During the Critical Period of Neocortical Development. P. A. McCoy* and B. D. Philpot, *UNC*

Background: Ubiquitin-protein ligase E3A (UBE3A, also called E6-AP) is a HECT domain ubiquitin ligase that is encoded for by the *UBE3A* gene. In many regions of the CNS, *UBE3A* undergoes neuronal-specific paternal imprinting, meaning that *UBE3A* is expressed from only the maternal allele. Changes in the gene dosage of *UBE3A* are strongly linked to neurodevelopmental disorders such that increased gene dosage of maternal *UBE3A* has been strongly implicated in autism, while loss-of-function of maternal *UBE3A* causes the severe mental retardation disorder Angelman syndrome (AS), also an autism spectrum disorder. Both disorders are characterized by functionally severe intellectual and developmental delays, lack of speech, epilepsy, movement disorders, and other behavioral deficits. Interestingly, abnormal dendritic spine numbers and morphology have been observed in *Ube3a*-deficient mice, as well as in human patients postmortem tissue, suggesting that cognitive impairments associated with AS may arise from deficits in structural synaptic plasticity. Consistent with this idea, UBE3A has been shown to be necessary for experience-dependent wiring of the neocortex during the sensory critical period where there is robust structural and electrophysiological synaptic plasticity.

Objectives: To determine Ube3a's role in the structural plasticity of synapses during the experience-driven formation of neuronal circuits.

Methods: We performed *in vivo* 2-photon time-lapse imaging of visual cortical neurons, expressing a Thy-1 driven GFP reporter, in maternally *Ube3a*-deficient ($Ube3a^{m-/p+}$) AS model mice and wildtype (WT) littermates during the critical period of development (P21-30).

Results: General spine density analysis confirmed previous reports that loss of UBE3A results in a decrease in spine number. To determine if this is due to a decrease in spine formation or an increase in spine elimination, blind analysis of these rates as well as the rate of spine turnover is ongoing.

Conclusions: Cognitive impairments associated with AS could arise due to an altered rate of spine turnover as a consequence of deficits in spine dynamics during the critical period for neocortical maturation. This model can be used to determine how changes in structural plasticity are affected by loss of UBE3A during development and may be used to determine the efficacy of potential AS treatments for functional recovery.

109.134 134 Blood Gene Expression Differences Between Autism Spectrum Disorders and Other Types of Developmental Delay. S. Letovsky*[1], M. E. Causey[1], C. Proulx[1], J. Skoletsky[1] and I. Hertz-Picciotto[2], (1)*SynapDx Corporation*, (2)*University of California Davis*

Background:

There is a need for objective biomarkers to assist clinicians with the diagnosis of childhood neurodevelopmental disorders. A number of investigators have reported changes in blood gene expression associated with autism spectrum disorders; a recent paper by Voineagu [1] reviews this literature.

Objectives:

The aim of this study was to assess whether blood gene expression could provide a biomarker to distinguish children on the autism spectrum from children with other conditions that might present in the same clinical setting.

Methods:

We used Affymetrix U133plus2.0 gene expression microarrays to profile blood samples from 235 subjects from the CHARGE (CHildhood Autism Risks from Genetics and the Environment, [2]) Study. 103 of these subjects were diagnosed as being on the autism spectrum (ASD) based on ADI-R and ADOS scores. Of the remaining subjects, 83 had been referred for evaluation for developmental delay and found not to be on the autism spectrum (NAR, for non-autism referred); this group included 16 found to be typically developing on evaluation. An additional group of 49 subjects were recruited as typically developing controls (TD). Individual genes were evaluated for differential expression by t-test between the different pairs of groups, and between each group and the other two.

Results:

Although initial evaluations showed no significant differences between the groups, after adjustment for sample and process variables, including batch effects, and removal of the largest principal components to account for unknown masking variables, a significant excess of differentially expressed genes compared to random class label permutations was observed. The largest differences were observed between the ASD and NAR groups. 5-fold cross-validated machine learning using a radial basis support vector machine classifier yielded an AUC of .67 for distinguishing between these two groups.

Conclusions:

These results provide support for further research and larger studies to determine whether gene expression differences can be informative for differentiating autism spectrum disorders from other forms of developmental delay. Planned followup studies include increasing the sample sizes and use of RNASeq for expression profiling.

[1] Voineagu, I., Gene expression studies in autism: Moving from the genome to the transcriptome and beyond, Neurobiol. Dis. (2011), doi:10.1016/j.nbd.2011.07.017

[2] Hertz-Picciotto I, Croen L, Hansen R, Jones C, Pessah IN (2006). The CHARGE Study: An epidemiologic investigation of genetic and environmental factors contributing to autism. Environ Health Persp 114(7):1119-1125. http://www.ehponline.org/members/2006/8483/8483.pdf

109.135 135 De Novo Point Mutations, Revealed by Whole-Exome Sequencing, Are Strongly Associated with Autism Spectrum Disorders. S. J. Sanders*[1] and M. W.

State[2], (1)*Yale University*, (2)*Yale University School of Medicine*

Background: Multiple studies have confirmed the contribution of rare variations in chromosomal structure to the risk for Autism Spectrum Disorders (ASD). Large, multigenic *de novo* copy number variations (CNVs) have been found in 5-10% of probands from families with only a single affected individual, carrying markedly greater risks than those associated with common genetic polymorphisms. However, the overall contribution of *de novo* single nucleotide variants (SNVs) to ASD remains to be characterized.

Objectives: To assess the frequency and distribution of *de novo* single nucleotide variants (SNVs) in ASD affected individuals and in their unaffected siblings; to determine if *de novo* SNVs carry risk for ASD; and to identify specific disease associated *de novo* SNVs.

Methods: Whole-exome sequencing was performed on 872 individuals in 224 families selected from the Simons Simplex Collection (SSC). These were made up of 200 quartet families (father, mother, probands with ASD and unaffected sibling) and 24 trio families (father, mother and proband). De novo variants were predicted from the sequencing data and confirmed by PCR and Sanger sequencing.

Results: We found that *de novo*, non-synonymous SNVs are significantly more common in probands than in unaffected siblings (p=0.01; OR=1.88; 95%CI: 1.08-3.28). This difference is more significant when we consider only those non-synonymous mutations present in brain-expressed genes (p=0.006; OR=2.15; CI: 1.10-4.20). In probands we estimate that at least 19% of all *de novo* SNVs, 41% of non-synonymous *de novo* SNVs in brain-expressed genes and 77% of nonsense/splice site mutations in brain-expressed genes carry risk for ASD. Based on the *de novo* mutation rate observed in unaffected siblings, we demonstrate that the observation of multiple independent *de novo* non-synonymous SNVs in the same brain-expressed gene among unrelated probands can reliably differentiate risk alleles from neutral substitutions. In the current study, among a total of 279 identified *de novo* coding mutations, there is only a single instance in probands, and none in siblings, in which two independent nonsense substitutions disrupt the same gene, *SCN2A (Sodium Channel, Voltage-Gated, Type II, Alpha Subunit)*, a result that is unlikely by chance (p=0.01).

Conclusions: In simplex families *de novo* SNVs carry risk for ASD. This risk is most readily apparent for non-synonymous variants and in brain-expressed genes. Specific mutations can be associated with ASD by virtue of multiple observations from different samples in the same gene and this approach offers a clear route to identify multiple ASD risk-associated genes in larger cohorts.

109.136 136 Blood-Based Gene Expression Signatures of Autistic Infants and Toddlers. S. J. Glatt*[1], M. T. Tsuang[2], M. E. Winn[3], S. D. Chandler[2], M. Collins[2], L. Lopez[2], M. Weinfeld[4], C. Carter[2], N. Schork[5], K. Pierce[2] and E. Courchesne[2], (1)*SUNY Upstate Medical University*, (2)*University of California, San Diego*, (3)*University of California San Diego*, (4)*University of California, San Diego, UCSD Autism Center of Excellence*, (5)*The Scripps Translational Research Institute*

Background: Autism spectrum disorders (**ASDs**) are highly heritable, involve early brain overgrowth, and exhibit clinical onset during the first years of life.

Objectives: ASD-risk biomarkers expressed early in life could significantly impact diagnosis and treatment, but no transcriptome-wide biomarker classifiers derived from fresh blood samples from autistic children have yet emerged.

Methods: Using a community-based, prospective, longitudinal method, we identified infants and toddlers at-risk for ASDs (autistic disorder and pervasive developmental disorder), language delay (**LD**), or global developmental delay (**DD**), as well as two groups of typically developing (**TD**) comparison children. Diagnoses were confirmed *via* longitudinal follow-up. Each child's mRNA expression profile in peripheral blood mononuclear cells (**PBMCs**) was determined by microarray.

Results: 61 potential ASD biomarkers were discovered in one half of the sample and used to build a classifier with high diagnostic accuracy for sorting the subjects in the remaining half of the sample.

Conclusions: The mRNA expression abnormalities reliably observed in PBMCs, which are safely and easily assayed in babies, offer the first potential peripheral blood-based early biomarker of risk for autism in infants and toddlers; future work should verify these biomarkers and evaluate if they may also serve as indirect indices of deviant molecular neural mechanisms in autism.

109.137 137 Common SNPs, Rare CNVs... and the Expression Network Between?. Y. Cheng[1], K. Tsang[1], E. Frank[1] and L. A. Weiss*[2], (1)*UCSF*, (2)*UCSF Department of Psychiatry, Institute for Human Genetics*

Background: Recent genetic studies in common, complex heritable disease like autism spectrum disorders have met success in two arenas: geneticists like to divide differences among individuals into 'common polymorphisms' and 'rare variants', and often argue about which kind of variation will be more important in disease risk. Both kinds of results provide challenges to direct translation into neurobiological understanding of autism, as they rarely reveal easily interpretable protein-coding mutations. Common polymorphism association signals often fall in noncoding sequences or between genes, and rare variants in autism have primarily been large deletions and duplications including many brain-expressed genes.

Objectives: I will describe an approach to 'pathway' definition using gene expression data that can unite a number of autism-implicated common polymorphisms and rare variants into a network with functional implications.

Methods: In a previous genome wide association study (GWAS), significant association with autism was detected near the *SEMA5A* gene, which has also shown evidence for reduced expression in autism (Weiss *et al*, 2009). Here we have used public expression and genetic data in controls to define eQTLs and master regulators for *SEMA5A* expression in lymphoblast cell lines. We have gone on to test for SNP association and CNV association in autism datasets within these putative expression networks using set-based approaches. Further, we have used RNAi knock-down techniques in lymphoblast cell lines to functionally validate the genetic-expression networks we have identified.

Results: We have identified SNP association in one large autism GWAS dataset. We have identified CNV association in 4 autism datasets. We also show cellular expression data for human lymphoblast cell lines.

Conclusions: Our approach of defining an expression regulatory pathway for a SNP-associated candidate gene has revealed additional common, and now rare, variants associated with autism and may provide a framework for identifying which rare CNVs are likely to contribute to autism risk.

109.138 138 Genetic Abnormalities in Adults with Autism Spectrum Disorders. G. Stobbe*, F. Hisama, L. Hudgings, O. Thompson and R. Wu, *University of Washington*

Background:

Autism Spectrum Disorder (ASD) is a condition impacting individuals lifelong and results in needs across a variety of domains. Genetic factors contribute significantly to the development of ASD. The diagnostic yield of clinical genetic testing in children with ASD is as high as 17-21%. Genetic test abnormalities can influence medical treatment and health screening for ASD individuals, while also influencing family planning for these individuals and their siblings. Despite the benefits as well as the impact of ASD on society, no study has been conducted of genetic abnormalities in ASD adults.

In our experience, the majority of ASD adults have either never had genetic testing or the testing was done long ago and did not benefit from the increased yield of modern genetic testing utilizing comparative genomic hybridization (CGH) techniques. Therefore, the prevalence of genetic abnormalities in adults with ASD is unknown.

Recently, a study of adults with intellectual disability (ID) revealed a prevalence of genetic abnormalities higher than predicted by pediatric studies of ID. It is hypothesized that this higher yield reflects a tendency to test adults with more severe ID, thus increasing the percentage of individuals with abnormalities.

Objectives:

The primary objective is to determine the prevalence of clinical genetic test abnormalities in ASD adults.

A secondary objective is to describe characteristics of the genetic abnormalities as well as physical and demographic features of individuals with these genetic abnormalities as compared to those without genetic abnormalities.

Methods:

All ASD adults age 18 and over seen in the UW Adult Genetics Clinic between July 1, 2009, and March 30, 2012, will be offered to participate. Currently, this includes approximately 35 subjects with an estimated 40-50 subjects total at the time of final analysis. Both retrospective and prospective chart analysis will be conducted depending on the time the patient was seen in the clinic. Data abstracted will include age, sex, ASD diagnostic subtype, genetic test results, imaging results, EEG results, neuropsychological test results, physical exam features, medical history, medications, family history, developmental history, and social demographics such as level of education, employment status, and living situation. Clinical and demographic features will be compared between individuals with genetic abnormalities versus those without.

Results:

We hypothesize a greater prevalence in detecting genetic abnormalities as compared to similar studies in ASD children, as we would predict testing of adults focuses on a more severely impacted subgroup. We also hypothesize a greater prevalence of genetic abnormalities in ASD individuals with abnormal physical exam features and more severe functional deficits.

Conclusions:

The importance of this study is in providing information to help guide clinicians in decision-making regarding genetic testing for adults with ASD. The large sample size will allow clinicians to better understand expected test results in adults with ASD and the clinical and demographic features associated with these genetic test abnormalities.

109.139 139 The CNV Module of AutDB: A New Resource for the Clinical Genetics of Autism Spectrum Disorders. E. Larsen* and S. B. Basu, *MindSpec Inc.*

Background: The advent of increasingly sensitive genome-wide scanning arrays has led to the discovery of numerous submicroscopic chromosomal deletions and duplications, more commonly known as copy number variants (CNVs), throughout the human genome. CNVs are considered to be one of the leading genetic causes of neuropsychiatric disorders, with an estimated 10-20% of autism spectrum disorder (ASD) cases resulting from the presence of one or more CNVs in an affected individual. A number of recurring CNVs with some degree in prevalence in autistic populations have been identified; however, the pathogenic relevance of the vast majority of CNVs identified in autistic cases remains unclear. The necessity of determining and prioritizing potentially pathogenic CNVs in individuals with ASD is of great importance, as chromosomal microarray (CMA) screening of autistic individuals is increasingly being used to identify CNVs that confer at least some degree of risk of disease. This information will be essential in the interpretation of genetic screening results in newborns and the subsequent identification of potentially at-risk individuals before the onset of disease.

Objectives: The CNV module of the autism genetic database AutDB (http://mindspec.org/autdb.html) has been designed to function as an online resource for the ASD research community and consists of detailed annotations of published scientific reports in which one or more CNVs have been identified in an ASD population cohort. In order to determine the global risk conferred by a given CNV in individuals with ASD, we performed a critical assessment of CNVs that were observed in ASD cohorts across multiple published reports in the CNV module database using a range of mathematical, statistical, and bioinformatics analyses.

Methods: We prioritized CNV loci from these published reports based upon a number of criteria, including the number of studies in which a CNV was observed at that locus, the frequency of a CNV at that locus within ASD and control populations, the gene content of the CNV, and the mechanism of CNV inheritance.

Results: While a number of previously characterized recurring CNV loci were among the highest ranking loci, a number of less well-characterized loci were also identified that warrant further investigation.

Conclusions: We anticipate that the CNV module of AutDB will be a valuable resource for the clinical genetics of autism spectrum disorders.

109.140 140 The Human Gene Module of AutDB: A Gene Reference Resource for Autism Research. T. Wadkins* and S. B. Basu, *MindSpec Inc.*

Background: A strong genetic component underlying ASD has been firmly established from various lines of studies. Genomic advances have led to the identification of hundreds of ASD candidate genes. Recently, submicroscopic copy number variations (CNVs) were also strongly associated with ASD. Furthermore, ASD is consistently associated with a number of specific genetic disorders caused by a single gene mutation, such as Fragile X Syndrome. The high genetic heterogeneity of ASD poses an enormous challenge for understanding its etiology. For this reason, we have developed an autism gene database, AutDB, for ongoing curation of genes linked to the disorder. AutDB is a disease-specific database model which curates information for all known ASD-linked genes ranging from monogenic to risk-conferring candidates. Candidate genes are richly annotated for their relevance to autism and range of molecular functions. In this manner, AutDB serves as an up-to-date, annotated resource of ASD candidate genes which provides a bioinformatics framework for understanding the pathogenesis of ASD.

Objectives: The human gene module of the autism genetic database AutDB has been designed to function as an online resource for the ASD research community and consists of detailed annotations of published scientific reports in which one or more genes have been identified in patients with ASD. We describe the design and integration of the database as well as describe generation of enriched reference profile.

Methods: We generated a functional and expression profile using bioinformatics tools such as DAVID and Bioconductor using data from the human gene module of AutDB which was then used to screen the genome to generate potential ASD candidate genes.

Results: While a number of previously strongly associated genes were identified from the screen, we also identified a number of novel putative ASD risk genes which should be prioritized for future research.

Conclusions: We anticipate that the human gene module of AutDB will be a valuable resource for autism research as it allows for large scale systematic analysis to help solve some of the complexities of a heterogeneous disorder like ASD.

109.141 141 Evaluation of GABA(A) Receptor (GABAA-R) Subunits Polymorphisms in An Argentinean Population of Autism Spectrum Disorders (ASD). C. V. Sesarini*[1], A. R. Cajal[1], L. Costa[1], M. Naymark[2], M. García Coto[3], R. C. Pallia[2], G. E. Agosta[2], N. Grañana[4] and P. F. Argibay[1], (1)*Instituto de Ciencias Básicas y Medicina Experimental (ICBME), Hospital Italiano de Buenos Aires*, (2)*Hospital Italiano de Buenos Aires*, (3)*Centro de Investigaciones del Desarrollo Psiconeurológico (CIDEP)*, (4)*Hospital Carlos G Durand*

Background: Some forms of ASD may be associated with disproportionate high level of excitation (weak inhibition) in neural circuits. More excitable cortex is more poorly functionally differentiated and would lead to broad-ranging abnormalities in cognition and motor control. Moreover, 'noisy' (hyperexcitable) cortex is inherently unstable and susceptible to epilepsy.

ASDs can be conceptualized as a genetic dysfunction that disrupts development and function of brain circuits mediating social cognition and language. Disconnection between different cerebral modulus, as result of congenital disturbance of cerebral development, could lead to altered information processing. The neocortical architecture is organized in minicolumns of functionally-related glutamatergic and GABAergic neurons processing together thalamic input. GABAergic neurons participate in controlling functional integrity and segregation in minicolumns providing lateral inhibition of activity coming from bordering ones. Polymorphisms in $GABA_A$-R subunits have been associated

with epilepsy. Indeed, GABAergic abnormalities have been involved in ASD.

Objectives: To evaluate polymorphisms in $GABA_A$-R subunits genes in Argentine ASD patients versus healthy controls.

Methods: 136 ASD (DSM-IV) and 104 controls were included. Eighteen SNPs were genotyped in $GABA_A$-R subunits: α1 (GABRA1), β3 (GABRB3), δ (GABRD), γ2 (GABRG2) through PCR-RFLP and DNA-sequencing. Allele and genotype frequencies, HWE and LD were analysed using UNPHASED 3.1 and SNPStats; and chromatograms using DNASTAR Lasergene. Restriction enzymes' (VspI-rs4906902, BstUI-rs20317, NcoI-lis-289-met) products were visualized on 3% agarose gel.

Results: Eleven polymorphisms studied (GABRA1: ala-322-asp; GABRB3: rs57294806; GABRD: glu-177-ala, rs6688232, rs3795278, rs3795279, arg-220-his, rs34122464, rs75981360; and GABRG2: lis-289-met, rs17855004) were not observed in controls or ASD patients.

No significant differences in allele and genotype frequencies ($p>0.05$) were observed between patients and controls for SNPs in GABRB3: rs3212337, rs3212338, rs4906902, rs20317; GABRD: rs41307846, novel rs140480490: -/C; and GABRG2: rs211037; both populations in HWE ($p>0.05$). SNPs in GABRB3 were in LD ($p<0.05$), but not polymorphisms in GABRD ($p>0.05$). Worth noting, rs41307846-GABRD and rs211037-GABRG2 were in LD ($p=0.0187$). Remaining combinations were not in LD ($p>0.05$). No significant difference between cases and control was found in the haplotype study. Although to mention, haplotypes AA- (rs3212337, rs4906902, no-C insertion: rs140480490), ATA- (rs3212337, rs3212338, rs4906902, no-C insertion rs140480490) and AAC- (rs3212337, rs4906902, rs20317, no-C insertion rs140480490) showed marginal significant association with ASD ($p<0.075$).

No significant difference between sexes was observed ($p> 0.05$).

Conclusions: Eleven SNP analysed, and described elsewhere, in GABRA1, GABRB3, GABRD and GABRG2 were not present in our Argentinean population (neither patients nor controls), not contributing to the ASD phenotype. Although the rest of the polymorphisms studied did not show significant association with ASD individuals, haplotype results in GABRB3 and GABRD should be taken into consideration for further studies. Clinical data from patients (clinical and cognitive symptoms associated with loss of cortical GABA-dependent inhibition) and inclusion of more patients will help evaluate whether haplotypes are associated with a subset of ASD with specific clinical and behavioural phenotypes.

This line of research focus on the development of neural circuits and systems that underlie language processing, along with social and affiliate behaviours in an effort to understand at least some forms of ASD.

109.142 142 Screening for Variants in the PTEN Gene in ASD Patients in Saudi Arabia. A. Adi, B. A. Al Tawil, M. Aldosari*, A. Almuslamani, M. Nester, M. Ghannam, B. F. Meyer and N. Al Tassan, *King Faisal Specialist Hospital and Research Center*

Background: Autism Spectrum Disorders (ASD) represents a group of complex developmental disorders characterized by varying degrees of delay or impairment in social interaction (e.g. poor eye contact) and communication with restricted and repetitive/stereotyped patterns. Macrocephaly was observed in ASD patients, where about 80% of ASD patients have a head circumference greater than the 50th percentile, and 20% have a head circumference above the 98th percentile. *PTEN* gene mutations were previously reported in individuals with ASD, mental retardation, developmental delays accompanied by macrocephaly, and to date 24 mutations in patients with ASD and macrocephaly were identified but the exact functional implications of these mutations are not fully investigated.

Objectives: Screen the entire coding region of *PTEN* in ASD patients from multiplex and singleton consanguineous families from Saudi Arabia.

Methods: The diagnosis of ASD was established by two independent evaluations by experienced clinicians utilizing DSM-IV criteria. Children were also evaluated by a multidisciplinary team specialized in evaluating children with ASD. All clinical data including head circumference size were recorded. The entire coding sequence of the *PTEN* gene was

amplified and PCR products were sequenced using Sanger sequencing. Segregation of potential pathogenic variants was also investigated in family members when available.

Results: 48 patients diagnosed with ASD (from 9 multiplex families and 27 singleton cases) were screened for mutations in the *PTEN* gene. Some of these patients had macrocephaly. A total of 15 variants identified in the samples (8 coding and 7 non-coding). Of the coding variants, 4 were previously reported while 4 variants were novel substitution mutations. The non-coding variants were 1 reported and the rest are novel intronic variants.

Conclusions: None of these variants segregated with the phenotype, indicating that they might represent polymorphisms rather than pathogenic mutations. However, we can't rule out the possibility that some of these variants might have an influence on this complex phenotype.

109.143 143 DNA Methylation of the Oxytocin Receptor (OXTR) and Associated Genes in Autism Spectrum Disorder (ASD). D. Butcher*[1], D. Grafodatskaya[1], R. Rajendram[1], S. Goodman[1], Y. Lou[1], C. Zhao[1], S. W. Scherer[2], W. Roberts[1], E. Anagnostou[3] and R. Weksberg[1], (1)*The Hospital for Sick Children*, (2)*The Centre for Applied Genomics, The Hospital for Sick Children*, (3)*Holland Bloorview Kids Rehabilitation Hospital*

Background: Autism spectrum disorders (ASD) are a group of childhood onset neurodevelopmental disorders characterized by problems in social interaction and communication as well as repetitive behaviours. Studies in children with autism have demonstrated lower levels of oxytocin (OXT) in the blood compared to typically developing, age-matched children. It has been suggested that dysfunction of the OXT pathway is associated with features of autism such as repetitive behaviour and impaired social cognition. Treatment of ASD patients with OXT to ameliorate these behaviours has been proposed.

Objectives: Previously a study in a small population reported increased DNA methylation of the oxytocin receptor (OXTR) in lymphocytes of patients with autism. These changes were also demonstrated in post-mortem samples from the temporal cortex of autism patients. Our objective was to determine the DNA methylation pattern of the OXTR promoter and investigate the methylation of genes in both the oxytocin (OXT) and vasopressin (AVP) pathways in a larger cohort of patients with ASD.

Methods: Blood DNA from patients with ASD were sodium bisulfite converted. DNA methylation patterns of genes in the OXT and the AVP pathways were assessed using the Illumina Human Methylation27K microarrays or targeted pyrosequencing. Data was extracted from the microarray data for AVP, OXT, AVPR1A, AVPR1B, AVPR2 and the promoter of OXTR. Methylation of the 5'UTR of OXTR, a region previously described to have altered DNA methylation in ASD and not represented on the microarray, was assessed using quantitative sodium bisulfite pyrosequencing of 8 CpG in a cohort of ASD patients and controls.

Results: Targeted DNA methylation analysis of the 5'-UTR CpG island of OXTR demonstrated no difference in DNA methylation of the region between ASD cases and controls. However, in 8% of the male ASD samples there was an increase in DNA methylation at one of the CpG sites previously reported to have increased methylation in association with ASD. There was no statistical DNA methylation difference in AVP, OXT, AVPR1A, AVPR1B, AVPR2 or the promoter of OXTR between cases and controls.

Conclusions: DNA methylation alterations in the OXT pathway may be relevant to both ASD phenotype and treatment options. Methylation of OXTR could be an important modulator of response to oxytocin (OXT) treatment in which case the methylation pattern of OXTR could be a useful tool in determining the appropriateness of OXT treatment for individual patients.

109.144 144 Disclosing Results of Autism Genomic Testing–Systematic Review and Applying Its Results to Clinical Practice. B. Chung*[1], D. Cheuk[2], M. Tang[3], E. Lau[3], Y. K. Chan[3] and Y. L. Lau[4], (1)*The Univeristy of Hong Kong*, (2)*Queeh Mary Hospital*, (3)*Tsan Yuk Hospital*, (4)*The University of Hong Kong*

Background: An 8-year old patient with Asperger syndrome and multiple medical problems participated in an array CGH research project. A 94kb paternally-inherited 1q42.2 duplication was detected. This region includes *DISC1* (Disrupted in schizophrenia 1) gene and its duplication has been reported in 2 brothers with autism and healthy otherwise (*Clin Genet 2010:77; 389-394*). *DISC1* is an interesting gene associated to schizophrenia, bipolar disorder and autism, however the interpretation of causality is difficult for such a rare variant in neuropsychiatric illness and poses a challenge in the result disclosure.

Objectives: We aimed to determine opinions from the available literature about: 1. whether individual genomic research results should be disclosed to participants; 2. what types of results should be disclosed; and 3. what factors affect these decisions.

Methods: We performed a systematic review with comprehensive search of MEDLINE and EMBASE for quantitative and qualitative studies on the opinions of researchers and participants, in the context of autism genomic research. We included only English publications. Papers presenting ethical arguments alone were excluded.

Results: We identified 2 quantitative and 1 qualitative studies. The 2 quantitative surveys involved only researchers (N=168) or participants (N=158) with response rates of 40% and 41% respectively. The qualitative study involved both (23 researchers and 34 participants) and the response rate was not stated. Almost all (97%) participants wished to obtain individual research results, whether favorable or not, irrespective of whether they would act upon the results. Majority of researchers (80%) agreed that clinically significant findings should be disclosed, while those of uncertain significance should not be reported (85%). "Clinical significance" depends on whether the genetic finding is robust, well-replicated, or incidental. Researchers with clinical interpretive role or capability to explain the results are more inclined to disclose. Integrating the opinions of both parties, the qualitative study found that report ability is related to perceived meaning to participants, evidentiary standards, and epistemological commitments regarding the role of genetics in autism and concluded that disclosure standards remained context-specific and not universal.

Conclusions: Our systematic review provides limited guidance on genomic research disclosure and the meaning of "clinical significance" remains subjective and poorly defined. All included studies are susceptible to response bias and selection bias limiting validity and generalizability. Based on our understanding of the family's wish prior to informed consent, we chose to disclose the finding with detailed genetic counseling, emphasizing the scarcity of evidence to support the apparent clinical significance of the *DISC1* duplication. The father of the participant decided to withdraw from the project, opted not to receive any further information, but still allowed us to report the research findings for the contribution to science. Research with larger samples evaluating different scenarios is needed to guide the decision-making process on result disclosure and to explore the ethical and legal responsibility of researchers. However, the ultimate disclosure standards will be context-specific and require individualized considerations for different participants, given the complexity of the issue.

B Chung and D Cheuk have equal contribution

109.145 145 Using Cluster Analysis to Define Subgroups of Phenotypic Expression for Autism Spectrum Disorders. O. J. Veatch*[1], B. Yaspan[1], N. Schnetz-Boutaud[1], M. A. Pericak-Vance[2] and J. L. Haines[3], (1)*Center for Human Genetics, Vanderbilt University*, (2)*University of Miami*, (3)*Vanderbilt University*

Background:

Previous studies established a strong influence of genomic variation in the etiology of Autism Spectrum Disorders (ASD). While associated genomic regions have been identified, the estimated effect sizes for these regions are small and combined evidence from numerous genetic analyses does not explain the highly heritable nature of the disorder. Disorders diagnosed within the autism spectrum are heterogeneous regarding phenotypic presentation. This wide variability in clinical manifestation is a potential explanation for difficulties in identifying common genetic variation associated with ASD.

Objectives:

We chose to use multivariate clustering to explore ASD phenotype data in an attempt to uncover highly similar genetic sub-groups. Our hypothesis is that by sub-grouping individuals relative to behavioral and clinical exam information our power to detect genes influencing risk for ASD will be greatly increased.

Methods:

For cluster analyses, we included Autism Diagnostic Interview-Revised (ADI-R) scores, Autism Diagnostic Observation Schedule (ADOS) scores, Vineland Adaptive Behavior Scale (VABS) scores and head circumference measures for 1,689 affected individuals from Caucasian families in the Autism Genetic Research Exchange dataset**.** Weights were assigned to each measure to allow equal contribution of the ADI-R, ADOS, VABS and head circumference in cluster analyses. Seven different clustering methods were evaluated for internal validity and cluster stability while partitioning the dataset into anywhere from 2 to 12 clusters. Kruskal-Wallis equality-of-populations rank tests were subsequently done on untransformed scores to determine the distributional variation of scores between clusters. Cluster validation was also done by permuting phenotype data across individuals 1,000 times, clustering the permuted data and calculating the Hubert-Arabie Adjusted Rand Index to compare clustering of the real data to permuted data. Intra-cluster family structure was evaluated by calculating the odds of individuals being assigned to the same cluster given a familial relationship.

Results:

The best validity and stability scores were for agglomerative clustering with the dataset partitioned into two groups, one cluster with 1,136 individuals and a second cluster with 550 individuals. The agglomerative coefficient was 0.78 indicating strong clustering structure identified in the dataset. The average Hubert-Arabie Adjusted Rand Index when comparing real data results to permuted results was 0.0012 meaning partitioning of real data was significantly better than partitioning permuted data. Kruskal-Wallis results showed that all input variables were significantly different ($p<0.0001$) between the resulting clusters. Examination of the variables indicates that individuals with more severe measures for most variables are placed into the same cluster. The odds ratio determined for family structure within clusters was approximately 1.42 ($p<0.0001$) suggesting it more likely for related individuals to cluster together than unrelated individuals.

Conclusions:

This approach to ASD gene discovery allows effective evaluation of a broad array of data, enabling more complete phenotype definitions for ASD datasets. The data indicating that related individuals are more likely to be assigned to the same cluster when clustering on phenotype data suggest that clinical variability of ASD is related to underlying genetic variability. Our results suggest that more effective methods of phenotype definition will increase power to detect genetic factors influencing risk for ASD.

109.146 146 Applying Atomistic Modeling to Predict NLGN3 Isoform Binding to Neurexin 1- Beta. N. Doan*[1], T. A. Deisher[1], S. D. Solares[2] and Z. Talebizadeh[3], (1)*Sound Choice Pharmaceutical Institute*, (2)*University of Maryland* , (3)*Children's Mercy Hospital and University of Missouri-Kansas City*

Background:

Neurexins (NRXN) are pre-synaptic proteins that trigger post-synaptic differentiation through neuroligins (NLGN), which in turn trigger pre-synaptic differentiation. Both partners undergo alternative splicing, conferring selectivity for their counter-structures. A point mutation (R451C) in X-linked neuroligin (NLGN3), identified in two brothers with autism spectrum disorders (ASD), leads to endoplasmic reticulum retention of the mutated protein and reduced neurexin binding. However, population screening indicates that NLGN and NRXN mutations are rare among ASD individuals. Talebizadeh et al. recently identified multiple alternatively spliced NLGN3 isoforms. This finding raises an important question as to whether these isoforms have different binding affinity to neurexins.

Objectives:

To perform atomistic simulations to explore the binding interactions of various NLGN3 isoforms with neurexin 1-beta (NRX1β).

Methods:

Exon boundaries of identified NLGN3 variants amplified from lymphoblastoid derived RNAs were verified by DNA sequencing. Predicted protein structures were generated using the I-TASSER software. The published crystal structure of NLGN4X, highly homologous to NLGN3, interacting with NRX1β from the Protein Data Bank and publications was used to determine potential binding residues between all variants of NLGN3 and NRX1β.

Software tools (Co-threading of Protein-Protein complex structures (COTH), Z-DOCK and Rosetta Dock server) were applied to dock each variant of NLGN3 with NRX1β to calculate binding affinities. Stability of docked structures was evaluated using NAMD, a scalable Molecular Dynamics protocol, used to optimize and equilibrate 3D structures of each NLGN3 variant prior to docking with NRX1β.

Results:

Encoded peptides by NLGN3 exons 6, 7 and 8 have direct, salt bridge and polar interactions with NRX1β. Exon 7 encoded peptide is involved in crucial NLGN-NRXN Ca^{2+}-mediated binding. Since the above exons play an important role in binding, splicing out these exons could lead to unfavorable binding energy. This is supported by preliminary docking results obtained with Rosetta, which predict unfavorable binding energy for alternatively spliced NLGN3 isoforms that lack domains coded for by multiple exons.

Conclusions:

Applied atomistic modeling suggests that alternatively spliced NLGN3 isoforms may lead to differences in the calculated binding energy for docking with NRX1β. In particular, isoforms that lack corresponding residues for exons 6, 7 and 8 may exhibit significantly diminished neurexin binding and synaptic differentiation compared with the full length isoform.

109.147 147 Tactile Sensitivity Phenotypes Associated with Variation in the Autism Candidate Gene GABRB3 in Typical Developing Children. T. Tavassoli*[1], B. Auyeung[1], L. Murphy[2], S. Baron-Cohen[1] and B. Chakrabarti[3], (1)*Autism Research Centre, University of Cambridge*, (2)*ARC*, (3)*University of Reading*

Background: Autism Spectrum Conditions (ASC) and autistic traits are highly heritable. Atypical sensory sensitivities are one of the core features of ASC. However little is known about mechanisms underlying normative variability in sensory sensitivity. A recently developed mouse model of autism with a heterozygous *gabrb3* deletion showed increased tactile responsiveness in male mice (DeLorey et al., 2010). No study in humans has examined the role of variability of the *GABRB3* gene on tactile sensitivity. Therefore we conducted two genetic association studies of tactile perception in typically developing children.

Objectives: The aim was to test an association between tactile sensitivity phenotypes (self-report and experimental measurement) and variation in the autism candidate gene *GABRB3*.

Methods: Tactile sensitivity was measured using a sensory questionnaire, the Short Sensory Profile (SSP) (n=87), and experimentally using a touch assessment test (Semmes Weinstein Von Frey Aesthesiometer for Touch Assessment test) (n=39).

Results: Experimentally measured tactile sensitivity thresholds were nominally associated at $p<.05$ to 13 SNPs from *GABRB3*. SSP tactile scores were nominally associated with 6 SNPs.

Conclusions: These are the first human studies to show an association between *GABRB3* and tactile sensitivity measured using a sensory questionnaire and experimentally measured tactile thresholds. This association should be tested in cases of ASC towards a better understanding of the underlying causes of their sensory issues.

109.148 148 Autism Incidence and Association with MECP2 Variants on a Positively-Selected Haplotype in North-Eastern China. X. Zhou*[1], Y. Xu[2], L. J. Wu[1], Q. Ayub[2], C. Tyler-Smith[2] and Y. Xue[2], (1)*Public Health College*

of Harbin Medical University, (2)*Wellcome Trust Genome Campus*

Background: Autism is a developmental disorder characterized by social interaction deficit, language impairment and repetitive behaviours with restricted interests. Its worldwide prevalence varies between 4.2‰ and 12.1‰, with a male: female ratio of 4:1. There is a substantial genetic contribution to autism susceptibility. However, few studies have been carried out in Chinese populations, which account for one-fifth of the world population, and it is unclear to what extent the incidence and genetic susceptibility landscape are similar to those in Western populations.

Objectives: The objectives were to study the general epidemiological features of the autism in North-eastern of China, to replicate the association of rs2734647 in the *MECP2* gene in a Chinese autism cohort collections light of the evolutionary history of this locus.

Methods: A cross-sectional investigation and stratified cluster sampling methods were used in the epidemiological study. ASD cases(n=649) and controls (n=592) from North-eastern China were recruited in the study. A case-control association analysis was used to test the association between *MECP2* rs2734647 and the Chinese Han population. Summary statistics and a likelihood ratio test were used to test the pattern of variation in resequencing data from a ~20kb region of the *MECP2* gene for consistency with neutral evolution in 4 HapMap populations (YRI, LWK, CEU and CHB).

Results: Our epidemiological investigation from North-eastern China showed that the prevalence of autism was 2.27‰, rather lower than other reports. However, the male: female ratio was much higher (7.0:1). We successfully replicated the association of rs2734647 with autism (p=0.039) in our case-control collection from North-eastern China. The protective allele is present at high frequency (>80%) in the HapMap CHB and JPT samples and an evolutionary investigation showed significant departures from a neutral pattern of evolution with the Fay and Wu's H statistic or a likelihood ratio test, indicating that it lies on a haplotype that has been positively selected in East Asian populations.

Conclusions: MECP2 rs2734647 is also associated with autism in Chinese population and the haplotype carrying the derived allele for this variant appears to have been positively selected in early human history, but now contributes to the incidence of autism in China. The SNP which is located in a highly conserved region in the 5' UTR of the gene, could have functional importance.

109.149 149 Dravet Syndrome- Genetic Analysis of SCN1A and PCDH19 Mutations for 17 Chinese Children. V. C. N. Wong*, A. K. Y. Kwong and C. W. Fung, *The University of Hong Kong*

Background: For Dravet syndrome (DS), 80% had mutation in SCN1A gene, which encoded a voltage-gated sodium channel. Recent study demonstrated that 16% of SCN1A-negative patients had mutations in protocadherin-19 (PCDH19) genes.

Objectives: The present study examined the genetic mutations in Chinese DS children and assesses the relationship between mutation and phenotype.

Methods: DNA of 17 DS in The University of Hong Kong was screened for SCN1A mutation using polymerase chain reaction and direct sequencing. SCN1A-negative female patients were then screened for PCDH19 mutation.

Results: For DS, 82% (14/17) had SCN1A mutations-truncating mutations (6), splice site mutations (2) and missense mutations (6). These mutations affected $Na_v1.1$ protein functions by pathogenicity assessments including conservative, SIFT and Align-GVGD analyses. We found a relationship between the type of mutation and the degree of intellectual disability ($p<0.05$), with truncating/ splice site mutations associated with moderate/ severe mental retardation. At the evolution of the disease, 79% (11/14) of DS patients with SCN1A mutations had features which fit into the diagnostic criteria of autism spectrum disorder (ASD). 57% (8/14) had history of vaccination-induced seizures. One of the two female SCN1A-negative patients had PCDH19 mutation.

Conclusions: High percentage of genetic mutations was identified in our Chinese cohort of Dravet Syndrome. Pathogenicity assessment demonstrated that the mutations

were linked to the phenotypes of Dravet syndrome. Our detection of high frequency of ASD (79%) and vaccination-induced encephalopathy (57%) in those DS with SCN1A mutation suggested evaluating ASD with epilepsy or vaccination induced encepalopathic children for any relationship between SCN1A mutations.

109.150 150 Genome-Wide Transcriptome Profiling Reveals the Functional Impact of Rare De Novo CNVs and Recurrent Events At 16p11.2 and 7q11.23 in ASD. R. Luo*[1], S. J. Sanders[2], Y. Tian[3], I. Voineagu[4], N. Huang[5], S. H. Chu[6], L. Klei[7], C. Cai[8], J. K. Lowe[3], J. Ou[4], M. E. Hurles[5], B. Devlin[7], M. W. State[2] and D. H. Geschwind[3], (1), (2)*Yale University School of Medicine*, (3)*University of California, Los Angeles*, (4)*UCLA*, (5)*Wellcome Trust Sanger Institute*, (6)*Carnegie Mellon University*, (7)*University of Pittsburgh School of Medicine*, (8)*University of California Los Angeles*

Background: Autism Spectrum Disorders (ASDs) are defined by a triad of social deficits, language dysfunction, and repetitive behavior or restricted interests. Recent studies have implicated copy number variation (CNV) as a major genetic cause of ASD. However, the functional impact of these variants is largely unexplored.

Objectives: Given that structural variation can be causal in some cases of autism, we reasoned that CNVs would significantly up- or down-regulate the expression of specific genes, and that these changes could be detected by expression arrays. Furthermore we reasoned that recurrent CNVs would result in convergent expression changes, and that these changes would associate with measurable phenotypes.

Methods: We performed functional genomic analyses in lymphoblast cell lines from 439 discordant siblings over 244 Simons Simplex families on Illumina Human Ref8 version2 chip. The distribution of gene expression was analyzed in autistic probands and unaffected sibling populations. Genes that were 2 or 3 standard deviations (SDs) further from average expression levels were deemed potential outliers genes (dysregulated genes). We compared the dysregulated molecular pathways in affected versus unaffected siblings by this outlier analysis. We then integrated the transcriptome profiling with the copy number variations (CNVs) identified in the same population via different statistical analyses including odd ratios, multivariate linear regression. We further explored the functional study of CNVs via analyzing the genes' haploinsufficiency. Also, we examined the relationship between gene expression and head circumference phenotype via multivariable linear regression.

Results: Our results show that outlier genes identified in probands, but not in unaffected siblings, fall into neural-related pathways as development/ neurogenesis/ synaptogenesis ($p = 9.54E-03$), and synaptic cell adhesion ($p = 2.0E-02$). Intersection of the expression data with the CNV data on the same population (Sanders et al. 2011, in press), we demonstrate that outlier genes show significant enrichment within the most pathogenic CNVs (rare de novo CNVs). For rare non-recurrent CNVs not known to be associated with autism, by permutation test, we prioritized deletions at 3q27, 3p13 and 3p26 and duplications at 2p15 and 3q14, all of which show significant enrichment of outlier genes compared to genome background. For recurrent CNVs known to be associated with autism, we demonstrate that dysregulated genes enrich in distinct pathways in 16p11.2 microdeletions, microduplications, and 7q11.23 duplications, which provides a potential molecular explanation of their different penetrance. Our analyses also show that specific genes, including TAOK2, CORO1A, KCTD13 and QPRT within the 16p CNV interval are correlated with differences in head circumference.

Conclusions: This study is the first to provide evidence that pathogenic structural variants lead to transcriptome alterations in ASD at a genome-wide level and demonstrate the utility of this approach for prioritization of genes for further downstream functional analysis subsequent to a whole genome screen.

109.151 151 Global DNA Methylation Changes in Brain Tissues From Individuals with Autism. V. W. Hu*, Y. Hong and M. Xu, *The George Washington University School of Medicine and Health Sciences*

Background: Although epigenetic changes have been proposed to play a role in the etiology of autism, there has been no study to date which has investigated global methylation changes in the brain of individuals with autism.

Objectives: The goal of this study was to identify differentially methylated genes in brain samples from individuals with autism that may be relevant to the neuropathology of autism. To accomplish this, we performed global methylation profiling of post-mortem tissues from the frontal cortex (BA9/10) and cerebellum of 7 and 8 male individuals with autism, respectively, and compared the methylation profiles with that of age- and sex-matched controls.

Methods: Genomic DNA was extracted from the brain tissues using Qiagen's DNeasy columns and protocols. DNA enriched for methylated regions was isolated using Epigentek's Methylamp Methylated DNA Capture (MeDIP) Kit. Affymetrix Human Promoter 1.0R GeneChips were used to analyze differentially methylated promoter regions in the enriched DNA (normalized by input DNA). Partek GS 6.6 beta software was used to analyze the intensities across the promoter regions using the workflow for methylation analyses. The data normalization procedures included adjusting for probe sequence, RMA background correction, quantile normalization, and log(base 2) transformation. Two-way ANOVA was used to determine differences in hybridization to specific probes between the cases and age-matched controls. The MAT (model-based analysis of tiling arrays) peak-seeking algorithm was used to detect enriched regions in the respective brain regions of cases vs. control samples. Multi-experiment Viewer (MeV) software was used for additional statistical analyses. A MAT score cutoff of $\geq |4.0|$ with p-value ≤ 0.05 was used to focus on the most differentially methylated genes for functional and pathway analyses using Ingenuity Pathway Analysis (IPA) network prediction software.

Results: Over 4000 promoter elements representing over 2000 unique genes were found to be differentially methylated in both frontal cortex and cerebellum of individuals with autism relative to the age-matched controls. There was an overlap of 754 differentially methylated genes between the two brain regions, including a number of previously identified autism candidate genes. Pathway analysis of these overlapping genes showed significant enrichment in genes involved in axon guidance, melatonin signaling, semaphorin signaling, and synaptic long term potentiation. Application of Pavlidis template matching to the respective sets of differentially methylated genes further reduced the set of genes to 63 cortical and 96 cerebellar genes whose methylation profiles completely separated cases from controls, as demonstrated by principal components analyses. Among these genes, S-phase kinase-associated protein 2 (SKP2) was found to be differentially methylated in both the frontal cortex and cerebellum. SKP2 is thus identified as a novel autism susceptibility gene which has been shown to be essential for the proliferation and differentiation of neuronal precursor cells.

Conclusions: Our results show global changes in the brain methylome of individuals with autism relative to that of age-matched controls. The differentially methylated genes in the frontal cortex and cerebellum are involved in pathways that are known to be disrupted in autism.

109.152 152 Concentration of Double Strand Break Specification Signatures in Autism Associated Genes. A. Omaiye*[1], N. Doan[2], T. A. Deisher[2] and S. D. Solares[3], (1)*Seattle University*, (2)*Sound Choice Pharmaceutical Institute*, (3)*University of Maryland*

Background:

Study of autism spectrum disorder (ASD) on an individual basis has identified over 350 genes associated with it, and hundreds of diverse de novo deletions and duplications have been identified in up to 10% of simplex ASD, indicating environmental influences on the genetics of ASD. Altered double strand break (DSB) formation and repair pathways may be a commonality among the diverse genetic mutations that have been documented in ASD. Much of what is known about DSB hotspots comes from studies of meiotic recombination (MR). A haplotype map of the human genome has identified specific regions where MR crossover occurs most-readily, termed "MR hotspots", and 41% of these hotspots are associated with a degenerate 13 mer sequence that binds to the hotspot specification protein PRDM9.

Objectives:

To determine the expression of constrained 13 mer sequences and whether they are concentrated in autism associated genes.

Methods:

A list of all autism associated genes (aags) was obtained by combining the AutDB and ACGMap databases. The entire nucleotide sequence of each chromosome was downloaded from UCSC's FTP site, and the exon positions for each of their genes were obtained from UCSC's table browser. Then, meiotic recombination hotspot locations were obtained from the International HapMap Project and were changed from build 35 into build 37 with the UCSC LiftOver tool. An algorithm was written to generate all 1024 specific 13 mer sequences and their reversed complements, and these were then located on the chromosomes and their specific genes using NCBI's stand-alone Blast, version 2.2.24. Multiple overlaying softwares were written to match the 13mer locations from Blast with MR hotspot locations on aags and all genes under chromosomal and exon levels.

Results:

According to AutDB and ACGMap, the X-chromosome has the most aags, while chromosome 21 has the least aags. Chromosome 7 is used to validate results from the X-chromosome and chromosome 21. Hence, the study focuses on those three chromosomes.

The overlaying results show that aags have a higher concentration of MR hotspots, as well as number of constrained 13 mer, in comparison to all genes across each chromosome studied. However, there are consistently more hotspots with at least one 13 mer in all genes as opposed to aags. Results are summarized in the table below.

		% Genes Containing Hotspots	% Hotspots Associated With 13 mer	% Genes Containing 13 mer
X-Chromosome	all genes	14	67	65
	aags	45	39	95
Chromosome 7	all genes	26	77	77
	aags	63	54	97
Chromosome 21	all genes	25	96	69
	aags	100	100	100

Conclusions:

The 13 mer motifs and MR hotspots are more concentrated on aags than total genes on the studied chromosomes. This concentration can potentially increase the risk of faulty DSBs leading to mutations associated with autism. The lower concentration of hotspots containing 13 mers may indicate that DSB formation is potentially regulated by other genetic factors, such as flanking sequences. Further investigation on other factors throughout the whole genome will provide a deeper understanding of DSB formation on aags.

109.153 153 Alternative RNA Splicing in Autism Spectrum Disorders. B. Stamova*[1], Y. Tian[1], C. W. Nordahl[2], M. D. Shen[2], D. G. Amaral[2] and F. R. Sharp[1], (1)*UC Davis, MIND Institute*, (2)*UC Davis M.I.N.D. Institute*

Background: Autism spectrum disorder (ASD) is clinically defined by communication and social impairments and repetitive behaviors. It is heritable, but genetic causes have only been identified for 20% of the cases. Genetic, environmental and gene-by-environment interactions have been proposed to be involved in ASD etiology. RNA-level mechanisms merge effects of both genetics and environment. A major RNA –level mechanism is alternative splicing of pre-mRNA and it has been implicated in a number of diseases.

Objectives: We aimed to identify differences in alternative splicing in blood cells of 2-3.5 year old children with ASD compared to age, gender and race matched typically developing (TD) controls. In addition, we aimed to identify specific signatures of alternatively spliced isoforms in ASD children with normal size frontal lobes (NFL) and with large size frontal lobes (LFL).

Methods: The subjects were recruited through the Autism Phenome Project at the M.I.N.D. Institute. Blood was collected in PAXgene tubes. RNA was processed on Affymetrix Human Exon 1.0 expression arrays. Brain MRI and expression data was available for 30 ASD boys (age= 36.7±5.1 months), of which 20 with NFL and 10 with LFL; and 20 TD boys (age=

36.5±4.5 months). LFL was defined as a mean frontal lobe volume of > two SDs greater than the average frontal lobe volume of matched TD controls. Alternative Splicing Analysis was performed in Partek, using Splicing ANOVA (μ+Group+Exon+(Group x Exon)+ε) ($p<0.005$). Pathway analysis of alternatively spliced genes and differential expression at exon-level resolution was performed in IPA (adjusted $p<0.05$).

Results: 371 genes are predicted to be alternatively spliced in children with ASD compared to TD controls. They were over-represented in monocyte/macrophage-related pathways, such as production of nitric oxide and reactive oxygen species in macrophages and FCγ receptor-mediated phagocytosis in macrophages and monocytes, as well as in xenobiotic metabolism signaling and dendritic cell maturation. A different molecular signature was associated with ASD children based on the size of their frontal lobe. Genes associated with ASD-LFL were over expressed in IP3, apoptosis, Natural Killer cell, monocyte and TNFR1 signaling pathways. Genes associated with ASD-NFL were associated with axonal guidance and BMP receptor (TGF superfamily) pathways.

Conclusions: We provide evidence for altered alternative splicing in blood of ASD children, at a very young age, when ASD becomes evident. The majority belonged to macrophage-related pathways. The macrophage transcriptome is very similar to microglia (brain macrophage), and microglia have been shown to be activated in ASD brain (Morgan et al, 2010). Moreover, we found a significant number (45, $p<1e-04$) of alternatively spliced genes in ASD blood cells, which were also reported to be aberrantly spliced in ASD brain (Voineagu et al, 2011). These overlapping genes provide strong evidence that assessing blood can provide insights into ASD. This is the first study to demonstrate abnormal alternative splicing in the blood of subjects with ASD and at an early age when ASD becomes evident and requires early treatment. The findings can direct searches for environmental causes, treatment and/or prevention and can be used for biomarkers for disease diagnosis.

109.154 154 Case-Control Haplotype Analysis Indicates Association of TPH1 Gene with Autism Spectrum Disorders (ASD) In the Indian Population. A. S. Singh*[1], U. Rajamma[1], S. Sinha[1], A. Chatterjee[1] and S. Ghosh[2], (1)*Manovikas Kendra Rehabilitation and Research Institute for the Handicapped*, (2)*Indian Statistical Institute*

Background: ASD is a childhood complex neurodevelopmental disorder with high heritability in nature. Its prevalence rate is 1 in 91 individuals according to the latest report of 2009, which is much higher in comparison to 1 in 150 individuals as reported earlier in the same year. Platelet hyperserotonemia has been considered as an ASD endophenotype being one of the most consistent findings in ASD research indicating abnormalities in platelet serotonin system among individuals with ASD. Several candidate gene association studies had been carried out in wide number of different populations across the world to finding the genes involve in ASD; but the findings have not been conclusive due to bias results between different populations. Therefore, further investigation with more genetic markers is of absolute importance and TPH1 gene is one of the strong candidate genes for ASD hyperserotonemia, since its protein product tryptophan hydroxylase1 acts as rate limiting enzyme in the peripheral serotonin biosynthesis.

Objectives: Our present study is to investigate if there is any significant change in the TPH1 gene with individuals with ASD in the Indian population through genetic approach and also to compare our findings with the earlier reports.

Methods: 486 subjects comprising 113 trios and 16 duo families with ASD along with 1 single, and 114 ethnically matched healthy controls (without any known neurological abnormalities) from West Bengal, India, were selected. Diagnosis was carried out using DSM-IV criteria while CARS was used for assessment. Genotyping was performed with PCR-RFLP and PCR-DNA sequencing methods to examine four SNP markers rs211106, rs684302, rs623580 and rs10488682. Cocaphase and TDT phase of UNPHASED version 2.404 were used for polulation based case-control as well as family based association tests.

Results: Population based case-control and family based TDT/HHRR analyses do not indicate any risk allele for the disorder. However, case-control haplotype analysis showed

possible involvement of rs211106 and rs684302 (LRS = 14.6; DF = 3; p = 0.0022 and global p = 0.034) which suggest possible link of *TPH1* with ASD.

Conclusions: Our data suggest that *TPH1* is likely to involve in platelet hyperserotonemia of ASD in the Indian population and thereby pathophysiology of the disorder.

109.155 155 Annexins: A Putative Role in the Etiology of ASD. I. C. Conceição*[1], C. Correia[2], I. Sousa[3], A. F. Sequeira[3], B. Oliveira[4], J. Coelho[4], J. Almeida[5], C. Café[5], F. Duque[5], D. Pinto[6], W. Roberts[7], K. Gao[8], J. K. Lowe[9], S. W. Scherer[10], D. H. Geschwind[9], G. Oliveira[5] and A. M. Vicente[2], (1)*Instituto Nacional de Saúde Dr Ricardo Jorge*, (2)*Instituto Nacional de Saúde Dr. Ricardo Jorge*, (3)*Instituto Gulbenkian de Ciência*, (4)*Instituto Nacional de Saúde Dra Ricardo Joge*, (5)*Hospital Pediátrico de Coimbra*, (6)*The Centre for Applied Genomics, The Hospital for Sick Children*, (7)*The Hospital for Sick Children*, (8)*David Geffen School of Medicine, University of California*, (9)*University of California, Los Angeles*, (10)*University of Toronto*

Background: Autism Spectrum Disorders (ASD) have a strong genetic component, with an estimated heritability of over 90%. Recent studies carried out by the Autism Genome Project (AGP) consortium suggest that rare Copy Number Variants (CNV), characterized by submicroscopic chromosomal deletions and duplications, are more frequent in ASD compared to controls, and may play an important role in susceptibility to this disorder.

Objectives: Establishing the relevance of rare potentially pathogenic CNVs for autism susceptibility identified by the AGP whole genome CNV analysis is the major goal of our study.

Methods: We have been characterizing potentially pathogenic rare CNVs identified by the AGP whole genome CNV analysis of 1771 ASD individuals using the Illumina Infinium1M SNP microarray. CNV validation in patients and relatives and characterization of the breakpoints was performed by qPCR and Long-range PCR. Expression analysis was done by RT-PCR. Sanger and 454 Roche sequencing were performed for identification of additional rare variants.

Results: We have identified CNVs in two Annexin genes, namely *ANXA1* and *ANXA7*. A small *in tandem* inherited duplication overlapping *ANXA1* gene at 9q21.13 was identified in 12 patients from 9 families. This duplication involving the 4 last exons of the gene is not present in 8000 European control individuals. The breakpoints were the same for all individuals carrying the duplication, which is probably mediated by a sequence of microhomology of 3 nucleotides identified. In the 3 patients analyzed, there was no change in *ANXA1* expression levels. Coding or splicing variants were not identified in any of the 479 additional individuals screened for the 13 exons of the gene, but three new variants in the 3'UTR were identified in three patients, one of them in a putative miRNA binding site. Additionally, one autistic patient showed a rare *de novo* deletion located at 10q22, and encompassing 14 genes, including *ANXA7*, together with *ZMYND17*, *PPP3CB* and *CAMK2G*, which is absent in 4964 controls of European ancestry with no psychiatric disease history. Accurate breakpoint determination showed that it is smaller than predicted by CNV identification algorithms, including only part of *CAMK2G*, and that a 39 nucleotide addition occurred with the deletion, a mutational mechanism known to occur in this type of chromosomal rearrangement. Expression analysis of *ANXA7*, *ZMYND17* and *PPP3CB* in this patient, in comparison with controls, is ongoing.

Conclusions: Annexin 1 plays an important role in anti-inflammatory response and neuroprotection, and is likely to be an effect on the mTOR pathway (mammalian Target Of Rapamycin), a major regulator of cellular growth in mitotic cells, in which several mutations have been described in autistic individuals. Previous studies identified a genetic association of the *ANXA7*, *PPP3CB* and *ZMYND17* region with schizophrenia, and significant expression alterations in schizophrenic patients. *ANXA7* encodes Annexin7, involved in membrane fusion. *PPP3CB* plays an important role in synaptic plasticity, learning and memory. *ZMYND17* has no known function. Our results suggest that alterations in these genes may be risk factors co-observed in autism and schizophrenia. Additional genetic and functional studies may lead to a better

understanding of the common pathways between these neuropsychiatric disorders.

109.156 156 Identification of Genetic Risk Factors Involved in Autism Spectrum Disorders. C. Sin*, H. Li, C. Wong and D. A. Crawford, *York University*

Background: There have been multiple genes, risk alleles, and copy number variants implicated in the pathology of Autism Spectrum Disorders (ASD). Yet, currently established genetic causes account for only a small percentage of the cases, and a genetic diagnosis for this disorder is not yet possible. Thus, advancing our understanding of ASD requires transcriptomic data, which considers both genetic information and genome function. Gene expression changes resulting from environmental influences can be monitored in the blood. However, a less invasive method of sample collection is of foremost importance considering that the participants of this study are young children. Buccal cells are easily collected with minimal discomfort and present an alternative sample material for biomarker testing. Susceptibility genes and common molecular pathways dysregulated in ASD have been investigated with the application of microarray technology.

Objectives: Our study aimed to identify diagnostic biomarkers for dysregulated metabolic or signaling pathways that may provide insight into the pathology of ASD. Our study also determined if total RNA isolated from buccal mucosa may be used as an alternative tissue source to determine relative gene expression.

Methods: Buccal cell RNA was used for comparing gene expression levels between typically developing children and children with an ASD diagnosis. Total RNA was isolated from cells, reverse transcribed, and amplified. Illumina Human HT-12 v4 Expression BeadChip arrays were used for global gene expression studies. *P* values were corrected using Benjamini and Hochberg False Discovery Rate method. The Database for Annotation, Visualization and Integrated Discovery (DAVID) Bioinformatics Resources was used for additional functional annotation. Statistically significant functions were determined using the Fisher Exact test.

Results: Analyses of significant differentially regulated genes revealed numerous genes that were unanimously upregulated or downregulated among the affected children relative to the typically developing children. The list of differentially regulated genes was enriched with molecules associated with inflammation, regulation of transcription, axonogenesis, and circadian rhythm.

Conclusions: This study demonstrates a non-invasive technique for quantification of human gene expression signatures permitting gene-environment interactions. Our results suggest that RNA from buccal cells can be used to detect differential gene expression between typically developing and affected children. The results support the notion that various genetic factors underlie the development of ASD, and that these factors can be converging at, or diverging from, central networks. The findings of this study enabled the identification of genetic biomarkers underlying brain development and other physiological symptoms associated with ASD.

109.157 157 Association of Gain of DNA Methylation At the Arylsulfatase A Gene Promoter with Autism Spectrum Disorders. D. Grafodatskaya*[1], R. Rajendram[1], Y. Lou[1], D. Butcher[1], L. Senman[1], C. Windpassinger[2], W. Roberts[1], S. W. Scherer[3] and R. Weksberg[1], (1)*The Hospital for Sick Children*, (2)*Medical University of Graz*, (3)*The Centre for Applied Genomics, The Hospital for Sick Children*

Background: Epigenetics refers to heritable changes in gene expression occurring without altered DNA sequence. A role for epigenetics in ASD etiology is suggested by known genetic and environmental risk factors. However, the role of epigenetics alterations in ASD remain largely unexplored.

Objectives: The objectives of this study were to assess the role of epigenetic alterations in ASD in blood, a clinically accessible tissue. DNA methylation, defined as addition of methyl group to the cytosine residues at CpG dinucleotidesis is the best studied form of epigenetic regulation, and was chosen for the genome-wide analyses.

Methods: Genome-wide DNA methylation was assessed in 12 ASD samples and 12 controls at ~27,000 CpG sites using methylation microarray. Pyrosequencing was used for targeted validation and replication.

Results: We hypothesized that, similar to genetic variants, common and rare epigenetic variants contribute to the ASD phenotype. To test these possibilities we have undertook two statistical approaches. Using Mann-Whitney U test with correction for multiple testing we have identified only one ASD-associated epigenetic common variant, a 7 % gain of DNA methylation in the promoter of the natural cytotoxicity triggering receptor 1 (*NCR1)* gene. To identify rare variants in ASD cases, we selected CpG sites with DNA methylation changes of at least 10% compared to controls. Using this rare variant approach we identified 7 CpGs with loss and 5 CpGs with gain in ASD vs controls. Further, in order to assess the relevance of DNA methylation changes identified in blood to brain, we have compared DNA methylation levels at 13 CpG sites referred above to 150 brain samples of neurologically normal individuals run on the same microarray platform (Gibbs et al. 2010). To narrow the list of candidates we selected genes with: 1) similar levels of DNA methylation in blood and brain in controls, and 2) no outliers in the brain similar to the outliers levels in ASD blood. Only two rare variants with gain of DNA methylstion at CpG sites within promoters of arylsulfatase A *(ARSA*) and phosphatidylcholine transfer protein (*PCTP)* genes survived the brain comparison. The *ARSA* gene is located within the region of 22q13.3 deletion syndrome characterized by developmental delay, and frequent autistic features, it is also adjacent to *SHANK3*, a known ASD susceptibility gene. Therefore, we have further assessed DNA methylation in six CpG sites of the *ARSA* promoter in 66 ASD cases and 70 controls of matched (European) ethnicity using targeted pyrosequencing. We analyzed data for each CpG site individually using a Chi Square test and set the cutoff at the maximum DNAm level in controls. We observed a statistically significant increase of DNA methylation in two CpG s within the assay (CpG#4 (4 ASD cases with gain of DNA methylation) and CpG#6 (5 ASD cases with gain of DNA methylation).

Conclusions: Our data support a role for epigenetic variants in ASD etiology and the feasibility of identifying the epigenetic variants in clinically accessible tissues such as blood

109.158 158 Styles of Participation in the Simons Simplex Collection and Ethical Implications of Genetics Research. J. S. Singh*, *Georgia Institute of Technology*

Background:

The Simons Simplex Collection is a study to establish a permanent repository of genetic samples from 2000 families, each of which has one child affected with an Autism Spectrum Disorder (ASD). The collection consists of blood samples from the biological parents, one unaffected and affected child, and detailed phenotypic information about the affected child using standardized diagnostic instruments. There are thirteen clinical collection sites throughout the United States and Canada and the samples are stored in a central repository, which scientists may request for use in their own experiments. Although scientists are beginning to utilize this data, central to this database and missing from the discourse on genetics research are the parents and families who participate. This study considers parents who participate in the SSC and what their narratives can tell us about their motivations to be part of a genetic database and the potential ethical implications of participating in genetics research.

Objectives:

The objectives of this research were to identify the various processes by which parents participate in the Simons Simplex Collection. Based on the identification of different "styles of participation," this paper identifies the ethical implications that arise when families of ASD participate in genetics research.

Methods:

This paper is based on in-depth semi-structured interviews with parents who participated in the SSC (N=15). Each interview lasted from 1-2 hours, was tape recorded, transcribed, and coded for major themes using grounded theory methods.

Results:

Expanding on the framework proposed by Haimes & Whong-Barr (2004), who describe the notion of participation and decision-making around genetic databases as a "highly varied social process, with multiple meanings" (p.57), three "styles of participation" were identified in parents who participated in the Simons Simplex Collection: 1) the "active participant" who is willing to help in any way; 2) the "cost/benefit participant" who

balances the cost to themselves to the greater collective good; and 3) the "eager participant" who participates based on their need for what is being offered through the study. Based on these various "styles of participation", which are tied to their motivations to participate, various ethical implications became apparent, including: 1) the lack of knowledge about the SSC study goals and objectives; 2) the vulnerability of parents who need a diagnostic evaluation; 3) the lengthy time to return evaluations and limited follow-up; and 4) the expectations of research, including obtaining genetics research results.

Conclusions:

In this study various styles of participation were identified for parents who participated in the Simons Simplex Collection. These styles of participation were tied to their desire to help their child in any way possible, their altruism of helping families in the future, and the need for a diagnostic evaluation. By considering these perspectives, the social and moral contexts within which parents of children diagnosed with an ASD come to participate in genetics research implies a wider concept of engagement and a level of participation that highlight the contextual issues not often considered in current bioethical frameworks.

109.159 159 Relationship Between the CNTNAP2 Gene Variant and Cognitive and Behavioral Flexibility in Children with Autism Spectrum Disorders. A. C. Sharber*[1], L. Kenworthy[1], J. Strang[1], D. N. Abrams[1], J. M. Devaney[1] and B. Yerys[2], (1)*Children's National Medical Center*, (2)*The Children's Hospital of Philadelphia*

Background: Restricted, repetitive behaviors and interests (RRBI) symptoms are core to autism spectrum disorder (ASD), particularly higher-order RRBI, which are related to cognitive and behavioral inflexibility. However, identifying risk genetic variation associated with these behaviors has been difficult. A limitation of previous studies is the use of the ADI as the sole basis of phenotypic information. The ADI has only a few items addressing higher order RRBI symptoms and does not provide continuous data. This qualitative phenotypic data provides considerably less power to identify gene-behavior associations than quantitative data. The Behavior Rating Inventory of Executive Function (BRIEF) is a standardized instrument that provides quantitative measurement of cognitive and behavioral flexibility. Contactin associated protein-like 2 (*CNTNAP2*) has been linked to social communication symptoms in ASD, and recent genetic expression analyses suggest that *CNTNAP2* is also expressed in regions responsible for flexible behavior. No studies to date have examined the relationship between *CNTNAP2* and inflexible behaviors in ASD.

Objectives: Examine the relationship between the single nucleotide polymorphism (SNP) in the *CNTNAP2* gene (rs2710102) and higher-order RRBI characteristics as assessed by the BRIEF, Flexibility Questionnaire (FQ), and the compulsive domain from the Repetitive Behavior Scale-Revised (RBS-R) in children with ASD.

Methods: In our preliminary analyses, we have examined 45 children with ASD (80% male; mean age =10.06 years (SD=1.80); mean full scale IQ=107.40 (SD=19.94)). Diagnosis was confirmed with the ADI-R and ADOS (ADI Social interaction mean=20.34 (SD=5.19), Verbal mean=16.33 (SD=4.43), Nonverbal mean=8.79 (SD=3.27), RRBI mean=5.80 (SD=2.66); ADOS, Communication and social interaction total=11.99 (SD=4.63)). Children were also assessed using the BRIEF (Shift domain mean T-score=68.49, SD=13.43), the FQ (total raw score mean=65.21, SD=20.20), and the RBS-R (compulsive domain severity raw score mean=2.84, SD=3.01). Children provided saliva samples for genetic testing on the *CNTNAP2* gene, and parents rated probands on the three phenotypic measures. A Spearman's rho correlation, univariate ANOVA, and Cohen's *d* were used to explore the relationship of *CNTNAP2* ASD risk allele presence (G) and RRBI behaviors.

Results: Preliminary results showed a significant Spearman's rho correlation between increasing risk alleles (0,1,2) and difficulties on the Shift scale ($rho(N=45)=0.31$, $p<0.05$). The homozygous non-risk allele group (AA) had the lowest (least impaired) means across all three flexibility measures (Shift scale M=59.86, SD=6.03; FQ Total=52.25, SD=24.24, compulsive scale M=1.88, SD=1.81), the heterozygote (AG/GA) had higher scores (Shift scale M=68.58, SD=15.615; FQ Total=59.68, SD=20.25, compulsive scale M=2.58, SD=2.57), and the homozygous high risk allele group (GG) had the highest scores (Shift scale M=73.17, SD=10.308; FQ

Total=68.06, SD=16.611, compulsive scale M=3.11, SD=3.58). The two homozygous groups had medium-to-large effects for differences in flexibility measures (Cohen's *d* ranged from 0.46 to 0.99), and the preliminary ANOVA's yielded marginal findings for the BRIEF.

Conclusions: We find preliminary evidence of an association between *CNTNAP2* genetic variation and scores on continuous measures of cognitive and behavioral flexibility, supporting the hypothesis that the risk allele for a SNP in the *CNTNAP2* gene may relate to higher parent ratings of RRBI behaviors. Further research between RRBI symptoms and this *CNTNAP2* SNP is warranted.

109.160 160 Parents' Opinions about Clinical Genetic Testing in ASD. J. Parr*[1], A. Hames[1], R. Alegbo[1], A. Henderson[2], D. Garland[3], T. Finch[4] and J. McLaughlin[5], (1)*Institute of Neuroscience, Newcastle University*, (2)*Northern Genetics Service, Newcastle Upon Tyne NHS Foundation Trust*, (3)*Newcastle Autism Resource Centre, National Autistic Society*, (4)*Institute of Health and Society, Newcastle University*, (5)*Policy, Ethics and Life Sciences Research Centre, Newcastle University*

Background: The American College of Medical Genetics recently suggested microarray testing should be a first tier investigation for children with ASD. However, genetic testing in ASD is contentious; some people believe testing is helpful, whilst others have major concerns about the potential clinical implications and applications. Little is known about whether parents would want testing for themselves and their children if it were available.

Objectives: To understand parents' opinions about clinical genetic testing for themselves and their children with ASD

Methods: In North East England, approximately 65% of children with ASD and their families are included on the Dasl[n]e regional research database (http://daslne.org/). In February 2011, parents were sent a survey that focussed on knowledge about ASD and genetics, and opinions about clinical genetic testing; the survey was designed by experienced ASD clinical academics (members of the AGP), a clinical geneticist, experts in sociology and ethics, and a parent of a child with ASD, who also runs the regional branch of the National Autistic Society. Paper surveys were sent by post to both parents in each family, with mechanisms for separate completion and return. An online survey link was included on the paper version. Reminders were sent to non respondents.

Results: Responses were received from 377 parents (264 mothers and 113 fathers, from 293 families). The ASD characteristics of the children of responders and non responders were very similar. Most parents overestimated their chance of having another child with an ASD; 43% of parents reported that having a child with ASD had affected their decision on whether to have more children. If it were available, 77% said they would like their child with ASD to be tested for 'genes that caused ASD'. Parents were asked if their child was found to have a gene that caused ASD, whether they would like testing themselves – 78% said yes. Parents were asked hypothetical questions about prenatal testing, and testing during pregnancy. If it was available, 54% of parents would like to be tested for 'ASD genes' before having another child. 40% of parents thought that if it was possible to test a baby during pregnancy, to see what their chances of having ASD were, this should be available; 24% would not want this, and 36% were unsure. Parents of children with less well developed language skills were more likely to want testing. Parents written responses to survey questions revealed a very broad range of opinions about testing.

Conclusions: This is the largest survey of its kind to date, and many parents were positive about genetic testing; however, opinions varied considerably. These data show there is a need to engage with families' views, understandings and concerns as the testing moves into clinical practice. Genetic testing of ASD families will increase over the next few years; opinions about whether clinical genetic testing should be available will influence how people respond to their availability.

109.161 161 An Item-Level Approach to Genome-Wide Association of Autism Spectrum Disorders. J. J. Connolly*[1], J. Glessner[2] and H. Hakonarson[2],

(1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background: In recent years, efforts to understand the genetic basis of autism spectrum disorders (ASDs) have moved forward considerably. However, progress has been hampered somewhat by the genetic complexity and heterogeneity of the disorders. A potentially productive strategy for reducing this complexity is to target endophenotypes, simpler biologically-based measures that may involve fewer genes and constitute a more homogenous sample.

Objectives: In this study, we tackle this complexity by selecting individual items from the Autism Diagnostic Interview-Revised, Autism Diagnostic Observation Schedule, and Social Responsiveness Scale for genome-wide association analysis, each of which is treated as a potential endophenotype.

Methods: We conducted a genome-wide association study (GWAS) of 2,165 participants from the Autism Genetic Resource Exchange, and a replication sample of participants from the 1,231 Autism Genome Project, with the aim of identifying genes that correlate with individual items from these three instruments.

Results: A number of genes known to be involved in neurodevelopment were shown to correlate significantly with selected assessment items. These include *NELL1* (faints/fits/blackouts), *NOS2A* (loss of motor skills), and *MPN2* (functional play with objects).

Conclusions: These findings may help prioritize study design and directions for future genomic efforts and suggest that certain discrete variables may help to define potential ASD sub-types.

109.162 162 Identification of DNA Methylation Alterations in Children with Autism Spectrum Disorders Conceived Using Assisted Reproduction. R. Rajendram*[1], D. Grafodatskaya[2], L. Senman[2], W. Roberts[2], S. W. Scherer[3] and R. Weksberg[2], (1), (2)*The Hospital for Sick Children*, (3)*The Centre for Applied Genomics, The Hospital for Sick Children*

Background: The use of fertility treatments has not been associated with significant risks to child health. Subfertility and fertility treatments (FT) have been associated with an increased risk of rare imprinting disorders such as Beckwith-Wiedemann and Angelman syndromes. The increased risk for these syndromes has been attributed to aberrant DNA methylation at imprinting centers. Increased rates of methylation alterations at imprinting centers have also been reported in animal models of FT. Recently, an increased risk of Autism Spectrum Disorders (ASD) in children conceived by subfertile couples and/or FT has been reported in some studies but not others.

Objectives: To assess whether aberrant methylation marks could be, at least in part, responsible for the ASD phenotype in patients conceived using fertility treatments (FT).

Methods: DNA from blood samples of controls (N=12), and ASD patients conceived with FT (N=12) or without FT (N=12) were run on the Illumina HumanMethylation27 microarray. To assess global DNA methylation the Mann-Whitney U test was used to compare the mean methylation of all probes between groups and also compared after dividing the probes into bins of 10% methylation intervals. For targeted analysis the Mann-Whitney U test with FDR was used to compare the average beta methylation values of ASD-FT samples against controls. A stringent novel individual analysis was used to generate a list of genes with significantly increased variance. At least one sample in each ASD group was required to have a 17% DNA methylation difference greater or less than the average of controls.

Results: The global analysis identified a statistically significant reduction in methylation was observed in the ASD-FT group compared to either controls (p=0.006) or the ASD group (p=0.015). A statistically significant increase in number of probes was observed in the 0-0.1 bin within the ASD-FT group compared to controls (p=0.001) and the ASD group (p=0.007). A statistically significant decrease in the number of probes was observed in the 0.1-0.2 bin in the ASD-FT group compared to controls (p=0.005) and to ASD group (p=0.008). Statistical analysis for targeted DNA methylation variants did not reveal any significant changes. In the targeted analysis, 17 and 84 genes were respectively identified in the ASD and ASD-FT groups, suggesting higher variability in DNA methylation in ASD-FT group. The gene list was compared to a list of known

imprinted genes, and a loss of DNA methylation was observed at two CpG sites in a CpG island associated with the imprinted gene DIRAS3 in ASD-FT, but not in the ASD group.

Conclusions: We found a global loss of DNA methylation at CpG sites with reduced levels of methylation in the ASD-FT group. Our data also suggest higher levels of methylation variability in ASD-FT compared to the ASD group conceived without fertility treatments. These data provide an opportunity to study the role of DNA methylation dysregulation in ASD susceptibility.

109.163 163 Advanced Maternal Age and Autism Spectrum Disorders (ASDs): The Role of Covert Mosaicism, Uniparental Disomy, and DNA Methylation in the Etiology of ASDs. E. R. Berko*[1], F. Beren[2], M. Suzuki[1], S. Molholm[1], J. J. Foxe[1], R. W. Marion[1] and J. M. Greally[1], (1)*Albert Einstein College of Medicine*, (2)*Stern College for Women of Yeshiva University*

Background: Recent reports have demonstrated the correlation between increasing rates of autism prevalence and advanced parental age, suggesting that mechanisms involved in pathology of the aging germline may contribute to the etiology of Autism Spectrum Disorders (ASDs). While the effects of paternal age, namely higher rates of mutation and copy number variation in offspring, have indeed been linked to ASDs, no study has determined the potential role of maternal age. We propose that maternal non-disjunction and resulting aneuploidy, as well as tissue specific epigenetic changes, could cause ASDs and remain undetected. Since most aneuploidies are lethal embryonically, surviving offspring often undergo a "rescue" event that restores normal chromosome number. Depending on when an aneuploidy rescue occurs and which chromosome is lost, offspring exhibit either covert mosaic aneuploidy in sub-populations of cells or heterodisomic uniparental disomy (UPD). These defects are unlikely to be detected by current genetic approaches that utilize cultured blood, a tissue that demonstrates low or absent levels of aneuploidy in mosaic individuals. While baseline rates of covert mosaicism in the general population are unknown, recent studies have demonstrated that up to 50% of IVF-generated embryos possess a chromosomal aneuploidy in some cells. Additionally, epigenetic modifications can become dysregulated during aging, and may therefore induce subtle epigenetic differences that could contribute to ASDs.

Objectives:

1. To determine if the prevalence of UPD and mosaicism in children with ASDs born to mothers 35 and older is higher than control, typically developing children born to mothers in the same age range.

2. To study the epigenetic differences in CG methylation in children with ASDs born to older mothers versus control, typically developing children born to mothers 35 and older.

Methods: For this study, we have assembled a unique, culturally diverse patient cohort of typically developing children and children with ASDs born to mothers 35 and older. We collected DNA from the subjects' buccal epithelium, a tissue of the same embryonic ectodermal lineage as neurons; a recent study of mosaic trisomy proved buccal epithelium to be a better predictor of brain chromosomal status than blood. To detect mosaic trisomy and UPD we are employing SNP arrays, and have optimized a computational approach to accurately discover these events. We are concurrently analyzing the same buccal epithelial samples using methylation arrays to study potential DNA methylation differences in these populations, as buccal cells may serve as better indicators of brain tissue methylation status.

Results: We are currently completing the molecular assays on our entire patient cohort and are expecting completed results in the next 2-3 months.

Conclusions: The discovery of higher rates of mosaicism, UPD, or epigenetic dysregulation in our ASD cohort will significantly enhance our understanding of the etiology of ASDs, especially in the population of older mothers. The results may also help better direct therapeutic interventions in affected children with an ASD attributed to one of these genetic or epigenetic events.

109.164 164 Autism, Obesity, and mTOR: Are There Any Connections?. Z. Talebizadeh* and M. Miralles,

Children's Mercy Hospital and University of Missouri-Kansas City

Background: Numerous susceptibility genes and chromosomal abnormalities have been associated with autism spectrum disorders (ASD), but most discoveries either fail to be replicated or account for a small effect. Inconclusive results could in part be a reflection of heterogeneous phenotype and indicate the need to employ strategies that identify more homogeneous groups of ASD subjects. Autism might be accompanied with other symptoms. These associated symptoms have been used in subject stratification for linkage and association studies resulting in valuable discoveries. Herein, the central point of our model is based on the concept that obesity might be a co-occurring condition in autism. Recently, there have been suggestive reports for a higher rate of obesity in autism. Overall, there is a paucity of data describing the prevalence of obesity in autism and the limited number of studies conducted did not include medication history. It is not clear if the suggested higher rate of obesity is related to psychotropic medication side effects or to the disorder itself. However, in-depth literatures search suggests that indeed some scientific merit can be found that backs up the potential link between autism and obesity; one such scenario can be found for the mTOR pathway. Implications in the mTOR pathway (composed of two complexes called mTORC1 and mTORC2) have been independently associated with autism and obesity. It has also been reported that rapamycin administration, an inhibitor of mTORC1, will improve autistic-like behaviors observed in mice models for two mTOR genes (Pten and Tsc). These lines of evidence prompted us to systematically evaluate the potential role of mTOR in relation to autistic subjects' obesity status.

Objectives: To assess the possible relationship between autism and obesity, we evaluated the expression level of mTOR-related genes in autistic subjects with and without obesity.

Methods: Subjects were ascertained from the Autism Genetics Resource Exchange (AGRE). Obesity status was determined using Body Mass Index percentiles. PCR arrays, including the mTOR genes, were conducted on lymphoblastoid cell line-derived RNA from 16 AGRE subjects.

Results: Despite the small sample size in this pilot study, differential expression was detected for several mTOR-related genes in autism-obese group compared with autism-non obese group. Interestingly, two genes with reported connections to both autism and fat metabolism, i.e. EIF4E and PIK3CG, were seen among the differentially expressed genes in the obese group.

Conclusions: This is the first targeted research study to evaluate the expression level of mTOR-related genes taking into consideration the obesity status of autistic subjects. Our pilot study demonstrates that autistic subjects with obesity may represent a more homogeneous subset of this highly heterogeneous population. Applying such a stratification method may provide a way to better understand underlying genetic mechanism in a subset of autistic subjects with a co-occurring obesity. Our study introduces a novel, practical, and effective method to connect different lines of phenotypic and genomic data in unraveling the etiology of this highly heterogeneous neurodevelopmental disorder.

109.165 165 Subgroup Analyses Suggest Interplay of Rare and Common Variants In the Etiology of Autism. M. W. Marquardt*, T. N. Takahashi and J. H. Miles, *University of Missouri - Thompson Center for Autism and Neurodevelopmental Disorders*

Background:

Autism may be caused by cytogenetic & genetic abnormalities including Fragile X, chromosomal aneuploidy and copy number variants (CNVs). Children with these diagnoses often exhibit generalized dysmorphology &/or microcephaly (complex phenotype). Children with no evidence of generalized dysmorphology or microcephaly and no recognized genetic or environmental syndrome are labeled essential or non-syndromic autism. They are reported to have high genetic loading for autism based on family studies showing elevated histories of autism, psychiatric and behavioral disorders. Higher SRS scores in sibs and parents suggests their autism is caused by additive common variants.

Objectives:

Test the hypothesis that some chromosomal, genetic, teratogenic and dysmorphic abnormalities that appear to cause autism may just lower the threshold for expression of the full autism phenotype.

Methods:

Children with classical autistic disorder were classified by identified causes; chromosomal (15 subjects) , clinically significant CNV (15) , genetic or environmental syndrome (9), generalized dysmorphology of unknown cause (66). Remainder (221) were classified as essential autism. All were evaluated through an outpatient autism specialty clinic with medical, developmental and family histories, dysmorphology examinations, chromosomes, FISH &/or microarray, DNA for Fragile X. Diagnosis was by adherence to DSM-IV criteria for autistic disorder with 88% of diagnoses verified by ADOS &/or ADI-R.

Results:

Children with complex autism, defined by dysmorphology, chromosomal aneuploidy or genetic syndromes were clinically different than those with essential autism with higher seizure rates (31% vs 14%, p=0.002), EEG abnormalities (33% vs 23%), and lower mean NVIQ (62 vs 81, p= 0.001). Sib recurrence was lower (5%) in the complex groups compared to the essential group (15%). However, family loading for autism, psychiatric and behavioral disorders did not differ significantly between essential & complex groups. All were significantly higher than in control families. Surprisingly the 15 children identified with CNVs more closely resembled essential autism (no seizures, nl EEGs, higher NVIQs (81), high sex ratio (14:1) and high sib recurrence (13%). But their family histories of autism & related disorders were similar to what is seen in both the essential or complex groups.

Conclusions:

Finding that children with complex autism, essential autism and those with CNVs have comparable family histories of autism, psychiatric and behavioral histories suggests that the genetic disorders that we identify in children with autism are not wholly responsible for their autism phenotype. If identified chromosomal and genetic syndromes were entirely responsible for causing the autism, one would expect family loading to be no higher than in the general population. Finding similar family histories across the groups implies that for most cytogenetic and genetic syndromes identified in children with autism, their causal effect is only partial and may just lower the threshold for the development of autism. The surprising finding that the group with CNVs clinically and genetically resembled those with essential autism suggests that common CNVs identified by current methodology may be more likely to identify autism specific genes than studies of children with complex phenotype autism.

109.166 166 Discovery and Analysis of New Alternatively Spliced Isoforms of Autism Candidate Genes. S. Kang*[1], X. Yang[2], G. N. Lin[1], R. Corominas[1], Y. Shen[3], S. A. Wanamaker[3], S. Tam[2], M. Rodriguez[3], M. Broly[3], J. Sebat[1], K. Salehi-Ashtiani[3], D. E. Hill[3], M. Vidal[3], T. Hao[3] and L. M. Iakoucheva[1], (1)*University of California San Diego*, (2)*Dana-Farber Cancer Institute*, (3)*Harvard Medical School*

Background:

Autism is a neurodevelopmental disorder involving a large number of functionally diverse genes. Currently, it is not completely understood how these genes interact with each other and with a majority of other human genes on a protein level. Even less is known about the influence of alternative splicing (AS) on protein-protein interactions.

Objectives:

Here, we aim at discovering new splice variants of autism candidate genes and at investigating their interaction patterns in the context of an autism protein-protein interaction network (i.e. autism interactome).

Methods:

Our isoform discovery pipeline includes four major steps: (1) Cloning of AS isoforms of 191 autism candidate genes from normal adult and fetal human brain samples; (2) High throughput 454 sequencing of the cloned transcripts; (3) yeast two-hybrid screening to detect interactions of AS isoforms with

~15,000 human ORFs; (4) Analysis of the autism isoform network.

Results:

We have successfully cloned 373 AS isoforms from 124 out of the 191 autism candidate genes (an average of 3.0 isoforms per gene); 226/373 isoforms are newly discovered, i.e. are not present in the public databases. This corresponds to an average of 1.82 new isoforms per gene. By cloning novel isoforms, we were able to increase the isoform space of the autism candidate genes by 29%.

Next, we have built autism candidate genes-centred interactome using a high-throughput yeast two-hybrid system. We have tested 124 autism candidate genes and their 373 isoforms for interactions against ~15,000 human ORFs. We have identified 492 gene-level interactions, which correspond to 638 isoform-level interactions, between 75 autism candidate genes and 272 human proteins. By incorporating isoform interactions into the autism network, we were able to expand the interactome by 50%. The comparison between isoform networks from fetal and adult human brain tissues has demonstrated 45% overlap of interactions, indicating that different patterns of interactions may exist in the developing and adult human brains. In addition, out of 10 hub genes with more than 10 interacting partners, 8 had less than 20% partners shared between the isoforms with the most and the least numbers of interacting partners. This demonstrates the strong influence of alternative splicing on protein-protein interactions.

Conclusions:

Our isoform discovery study has largely increased the isoform space of the autism candidate genes. The biological role of these AS isoforms was systematically investigated by detecting their interaction partners within the autism interactome framework. The splicing interactome demonstrates that interaction partners between different splice isoforms of the same gene are only partially shared, thereby illustrating the immense level of complexity of human interaction networks.

109.167 167 Baseline Physiological Defensiveness: Predicting Severity of Social Responsiveness Scale Scores. T. A. Hassenfeldt*, M. Patriquin and A. Scarpa, *Virginia Tech*

Background:

Children with autism spectrum disorders (ASD) have difficulties modulating social behavior, including eye gaze, vocalizations, and facial affect (American Psychiatric Association, 2000). Children with ASD also demonstrate more physiological “defensiveness” - a mobilized autonomic state at baseline when compared to their typically developing peers (Bal et al., 2010; Van Hecke et al., 2009). The neurobehavioral link between physiological defensiveness and social engagement difficulties has been suggested in the Polyvagal Theory (e.g., Porges, 2007), which specifies neural circuits that promote social communication, mobilization, and immobilization. Unlike typically developing children, who exhibit effective social communication paired with a soothed physiological state, children with ASD demonstrate social engagement difficulties paired with a mobilized/defensive physiological state. We examined the relationship between baseline measures of heart rate variability (HRV; respiratory sinus arrhythmia, RSA; heart period, HP) and social symptoms associated with ASD measured via the Social Responsiveness Scale (SRS; Constantino, 2002).

Objectives:

We predicted that lower baseline RSA (greater heart rate variability) and lower baseline HP (faster heart rate) would be associated with more severe sub-scale and total scores on the SRS.

Methods:

Data were collected from 23 children (18 boys, 5 girls), aged 4 years 3 months to 7 years 9 months (M = 5.72, SD = 1.17) with prior ASD diagnoses. HP data were edited with CardioEdit and CardioBatch (Brain-Body Center, University of Illinois at Chicago; Porges, 1985). Baseline HP data were collected during a neutral 3-minute video with the LifeShirt® heart monitor. Parents completed the SRS, a 65-item questionnaire used to measure severity of ASD symptoms, including the

following sub-scales: social awareness, social information processing, capacity for reciprocal social communication, social anxiety, and autistic preoccupations.

Results:

Due to non-significant RSA findings when participants were not grouped by SRS severity cutoffs, we examined the prediction of RSA and HP when participants were grouped by SRS cutoffs (severe n = 17; mild-moderate n = 6). Age was used as a covariate in all analyses. In the severe group (Mtotal = 84.76; SDtotal = 5.460) lower baseline RSA and lower baseline HP predicted higher SRS total scores, b -2.281, $t(16)$ = -3.424, p = .005 and b= -.042, $t(16)$ = -3.416, p = .005. Lower RSA and lower HP also predicted the autistic mannerisms sub-scale, b= -2.803, $t(16)$ = -3.911, p = .002 and b= -.056, $t(16)$ = -4.643, p < .001. In the mild-moderate group (Mtotal = 70.83; SDtotal = 4.119), total SRS score was not predicted from baseline RSA or HP. Baseline RSA only predicted social information processing in the mild-moderate group, b= -8.831, $t(6)$ = -6.664, p = .007.

Conclusions:

Lower baseline RSA and HP were related to more severe social deficits in children whose SRS total score was in the severe range. Importantly, baseline RSA and HP did not predict total score for children whose SRS total score was in the mild-moderate range. This suggests that physiological defensiveness or activation may be related to severity of social symptoms of ASD in children with SRS total scores in the severe range.

Neuropathology Program

110 Neuropathology

110.168 168 Cortical Organization in the Brains of Autistic Subjects: A Correlation Between Pyramidal Cell Size and Core Minicolumnar Width. M. F. Casanova, A. S. El-Baz* and A. E. Switala, *University of Louisville*

Background: Autism is a condition where both minicolumnar and cell soma size have been described as being smaller than normal.

Objectives: We hypothesize that the smaller cell bodies in autism are not pathological; but rather, a required feature of a law of conservation relating the dimensions of pyramidal cell size and numbers to minicolumnar size.

Methods: Postmortem tissue was obtained from eight donors with autism spectrum disorders and ten neurotypical comparison clients. Digital micrographs were obtained from a single section covering the full cortical depth (lamina II–VI) in each of Brodmann areas 3, 4, 9, 10, 11, 17, 18, 20, 21, 22, 24, 37, 43, 44, 45, and 47. Minicolumnar width w and the cross section of pyramidal cells comprising the minicolumn were estimated using our established computerized image analysis methodology. Pyramidal cell cross section was transformed to the equivalent diameter d_{eq} of a circle with the same area in order to have the same dimensions as w. Statistical analysis used a mixed effects model with d_{eq} as a linear function of w along with Brodmann area and lamina (II–VI) and all interactions between those effects. The intercept of the model was random over individual cases, nested within diagnostic category (autistic or neurotypical).

Results: Average d_{eq} increased with w at a rate of 0.097 ($F_{1,1187}$ = 2417; p < 0.0001), averaging over all lamina and Brodmann areas. The rate of increase is not constant across different brain regions, however ($F_{15,1187}$ = 17.0; p < 0.0001). There was no significant dependence on diagnostic category (χ^2 < 0.0001, p = 0.9995). Mean d_{eq} was 15.3 µm (s.d. 1.9 µm) in autism and 15.6 µm (s.d. 1.5 µm) in comparison clients, while mean w was 44.9 µm (s.d. 4.5 µm) in autism and 46.0 µm (s.d. 4.2 µm) in neurotypical cases.

Conclusions: The resultant phenotype (i.e., smaller cell bodies) engenders a bias that favors short corticocortical connections as opposed to long connections. The fact that a law of conservation apparently mediates cell soma size in autism suggests that this aspect of the described minicolumnopathy occurs within an isolated system thus emphasizing the neurodevelopmental origin of the condition.

110.169 169 Alteration of Astrocyte in the Frontal Cortex of Autistic Subjects. A. M. Sheikh*[1], W. Guang[1], F. Cao[2], A. Yin[2], M. Malik[3], W. T. Brown[4] and X. Li[4], (1)*NY State Institute for Basic Research in Developmental*

Disabilities, (2)*NY State Institute for Basic Research in Developmental Disabilities* , (3)*New York State Institute for Basic Research in Developmental Disabilities*, (4)*New York State Institute for Basic Research in Developmental Disabilities*

Background: The development of the nervous system requires choreographed neuronal migration, axon guidance, target selection, dendritic growth and synapse formation. Proper orchestration of each of these stages of neuronal development requires glia-derived factors. Glial cell types in the CNS include astrocytes, oligodendrocytes, microglia, and chondroitin sulfate proteoglycan NG2–positive cells. Together these cells perform a dynamic range of functions essential for nervous

system development and physiology, from simple trophic support of neurons to wrapping axons to allow for rapid nerve impulse conduction to modulating synaptic connectivity and efficacy. Astrocytes are the most abundant cell type in the brain and they are intimately associated with synapses and govern key steps in synapse formation and plasticity. Recently, a number of studies havesuggested that an abnormal function of glia/astrocytes may play a role in the development of autism.

Objectives: The aim of this study is to determine whether the density and morphology of astrocytes are altered in the brain of autistic subjects.

Methods: Frozen human brain tissues of six autistic subjects (mean age 8.3 ± 3.8 years) and six age-matched normal subjects (mean age 8 ± 3.7 years) were obtained from the NICHD Brain and Tissue Bank for Developmental Disorders. Donors with autism fit the diagnostic criteria of the Diagnostic and Statistical Manual-IV, as confirmed by the Autism Diagnostic Interview-Revised. In this study, Western Blot Analyses, Immunohistochemistry and confocal microscopy studies were used to detect the density and morphology of astrocytes.

Results: In immunohistochemistry studies using anti-GFAP (glial fibrillary acidic protein) antibody, we observed under confocal microscopy that the density of astrocytes were significantly increased in the frontal cortex of autistic subjects as compared with age-matched controls. In addition, we observed that the astrocytes in autistic cortex had significantly decreased branching as compared with controls. However, with western blot analyses, we did not detect significant differences in the protein expression of GFAP in frontal cortex between autistic subjects and the controls.

Conclusions: Our findings suggest that astrocytes are altered in the frontal cortex of autistic subjects and this alteration could affect the function of the astrocytes and consequently the neural synapses formation and plasticity, which may contribute to the pathogenesis of autism.

110.170 170 Comprehensive Analysis of Glial Abnormalities in the Amygdala in Autism. J. T. Morgan*, D. G. Amaral and C. M. Schumann, *UC Davis M.I.N.D. Institute*

Background: The amygdala plays a modulatory role in social and emotional processing, which are core deficits in autism, and has been strongly implicated as structurally and functionally abnormal in the disorder. In a previous postmortem brain tissue study, we reported a reduction in the number of neurons in the amygdala in a cohort of seizure-free, age-matched adolescents and adults with an autism spectrum disorder. Microglia are innate immune effector cells in the brain that when activated carry out an array of functions ranging from phagocytosis of apoptotic neurons to neuroprotection. Increased microglial activation has been found in other brain regions in autism, but microglia have not been assessed in the amygdala. In addition, the other major glial populations, oligodendrocytes, astrocytes, and endothelial cells, have yet to be stereologically assessed for abnormalities in individuals with autism.

Objectives: The primary goal of this study was to comprehensively examine glial cell abnormalities in the amygdala of adolescents and adults with autism. In addition, we wanted to investigate if the reduction in neuron number we previously observed might be related to glial pathology.

Methods: We carried out a comprehensive stereological study of the number of microglia, oligodendrocytes, astrocytes, and endothelial cells in the same defined regions of the amygdala and in the same cases (n = 8 autism, n = 10 control, ranging in age from 10-44 years of age) as the prior stereological study of

neuron number. We also measured microglial cell body size, as somal enlargement is indicative of substantial activation.

Results: We observed significant increases in both the number of microglia and the proportion of large microglial cell bodies in the autism cases, indicative of increased microglial activation; there was marked heterogeneity in the level of activation among the autism cases. A striking reduction of oligodendrocytes was noted in the subgroup of autism cases with pronounced microglial activation, and reduced oligodendrocyte number was significantly correlated with increased microglial cell body size. However, there was no relationship between the increased microglial activation and the reduction in neuron number previously observed in these autism cases.

Conclusions: Increased microglial activation is present in the amygdala of some but not all adult and adolescent subjects with autism. The autism subgroup that displays strong microglial activation may also demonstrate reduced oligodendrocyte number. This may reflect oligodendrocyte susceptibility to factors produced by microglial activation or another perturbation that causes both oligodendrocyte loss and microglial activation. These findings may define a distinct phenotype of autism with multiple related glial abnormalities, and confirm the presence of heterogeneity at the cellular level in autism. We found no association between microglial activation and reduced neuron number, suggesting that microglial activation in autism is not strongly associated with neuron loss as would be expected in a classic neurodegenerative profile such as that in Alzheimer's disease. Additional studies are needed to explore if increased microglial activation and its relationship to reduced oligodendrocyte number is present in children with autism or is a phenomenon that occurs later, during adolescence and adulthood.

110.171 171 Cajal-Retzius Cell Number in Layer I of the Superior Temporal Lobe Is Similar in Autistic and Control Human Brains. E. Ejaz, J. Camacho and V. Martinez Cerdeno*, *University of California, Davis*

Background: Autism is characterized by abnormalities in social interaction, communication, and repetitive interest and behavior. This project investigates whether changes in Cajal-Retzius (CR) cell number is associated with autism. CR cells are located in the marginal zone of the cerebral cortex during development and in layer I of the mature adult cortex. CR cells secrete the protein Reelin (RELN) into the extracellular matrix. A large population of CR cells are thought to die after cortical development but a portion of the CR cells persist into adulthood, where they continue to express RELN. The absence of RELN has been shown to alter cellular migration and results in an inversion of the cortical layers in the developing cerebral cortex. In addition, RELN plays an important role in the regulation of neurotransmission and synaptic plasticity in adults. The *RELN* gene and RELN protein have been implicated in autism. Previous work has reported that the levels of RELN protein and mRNA are significantly reduced in the cerebellum and frontal cortex of autistic brains. In addition, it has been suggested that the *RELN* gene may be one of the loci contributing to the positive linkage between chromosome 7q and autism.

Objectives: Since RELN is produced by CR cells in the adult cerebral cortex, and a decrease in RELN protein has been associated with autism, we hypothesized that the decrease in RELN may be caused by a decrease in the number of CR cells in layer I of the cerebral cortex.

Methods: To test this hypothesis we used unbiased stereological methods to determine the number of CR cells in layer I of the human superior temporal lobe of six autistic and six age-matched control subjects.

Results: We found that the total number and the density of CR cells in layer I of the superior temporal lobe is similar in autistic and control cases.

Conclusions: We conclude that the decreased level of RELN in the human autistic cerebral cortex is not caused by a decrease in the number of Cajal-Retzius cells in layer I of the cerebral cortex.

110.172 172 Benzodiazepine Binding Site and GABA-B Receptor Density in the Cerebellar Cortex, Broca's, and Wernicke's Areas in Individuals with Autism. G. J. Blatt*, C. R. Clancy, S. C. Kern, A. L. Oblak and T. T. Gibbs, *Boston University School of Medicine*

Background: There are widespread abnormalities across brain areas in multiple GABA receptor subtypes in individuals with autism. Two particular types, benzodiazepine (BZ) binding GABAA receptors (GABA-AR) and GABAB receptors (GABA-BR), are reduced in number in the anterior and posterior cingulate cortex and fusiform gyrus. The Crus II region of the cerebellum in autism has the most pronounced decrease in Purkinje cells (PCs) as well as altered GAD65/67 mRNA in PCs and basket cells. There is a paucity of information regarding GABAergic changes in the speech and language areas in autism.

Objectives: To determine whether there are alterations in density of these receptor subtypes in two different regions of the cerebellar cortex: the vermis (centered on lobule VI) and the lateral hemisphere (Crus II), as well as in two cerebral cortical areas for speech and language: Broca's area (BA 44/45) and Wernicke's area (BA 22).

Methods: Age-matched postmortem brain tissue from Crus II (n=17 autism; n=21 control), vermis lobule VI (n=7-9 autism; n=11 control), Broca's area (n=14-15 autism; n=17 controls) and Wernicke's area (n=10-12 autism; n=12-13 control) were processed for ligand binding autoradiography for ^{3}[H]-flunitrazepam (2 nM) labeled GABA-AR and ^{3}[H]-CGP54626 (1.5nM) labeled GABA-BR. Binding density was quantified in the molecular and granular layers in the cerebellum or in the superficial (I-IV) and deep (V-VI) lamina in the cerebral cortical areas.

Results: Significant decreases in the density of BZ binding sites were demonstrated in both the molecular (p=0.0007; two tailed unpaired t-test) and granular layers (p=0.0034) in the Crus II region in the autism group. In contrast, normal density of BZ binding sites was found in vermis lobule VI. Significant reductions in BZ sites were also found in Broca's (p=0.0162 superficial layers; p=0.0004 deep layers) and in Wernicke's areas (p=0.0008 deep layers) but not in superficial layers. All four brain areas contained normal density of GABA-BRs.

Conclusions: Within the cerebellum there are disparate findings indicating that the Crus II region, which receives pronounced frontal cortical inputs via the pons and is reported to contain reduced numbers of PCs in individuals with autism, has markedly reduced density of BZ binding sites on GABA-ARs throughout its layers. In contrast, the vermis, which receives spinocerebellar and other motor inputs, contains normal BZ site density. These findings suggest a selective inhibitory dysfunction in the lateral hemisphere that may affect modulation of frontal cortical-related activity. The decrease in BZ density in both language areas confirms the pervasive GABA-AR disturbances across brain areas in autism. On the other hand, GABA-BR abnormalities are so far limited to specific cerebral cortical areas and do not include Broca's and Wernicke's areas or the cerebellar cortex.

110.173 173 Morphological Analysis of Dendritic Spines on Cortical Pyramidal Cells in ASD. T. A. Avino*, C. Wojcik, A. Mann and J. J. Hutsler, *University of Nevada Reno*

Background:

Dendritic spines function as the primary site for excitatory synaptic contacts on cortical pyramidal cells. Previous research on dendritic spines in autism spectrum disorders (ASD) has shown an increased density of spines on cortical pyramidal cells (Hutsler & Zhang, 2010). Morphological features of spines such as length, width, and the size of the head all have functional significance in neuronal signaling and can be related to spine maturity (Yuste & Majewska, 2000). Given this structure-function relationship, alongside the fact that dendritic spines in Fragile X Syndrome show morphological and density differences compared to neurotypicals, we aim to assess potential alterations to the morphology of dendritic spines in ASD.

Objectives:

The aim of the present study was to assess dendritic spine morphology on cortical pyramidal cells in ASD versus neurotypical subjects. Because spine morphology is relatable to functional significance, alterations in ASD may provide useful information about disrupted inter-neuronal signaling.

Methods:

Post-mortem tissue was acquired from 8 male subjects (4 ASD, 4 neurotypicals). Tissue blocks were taken from the superior temporal gyrus (BA 21), dorsolateral frontal lobes (BA

9), and dorsal parietal lobes (BA 7). The tissue samples were sectioned perpendicular to the gyral axis then stained using a modified Golgi-Kopsch method. Pyramidal cells from cortical layers 2, 3, and 5 were selected at 100x magnification and individual spines were manually analyzed at 1000x magnification on measures of length, thickness, and presence of a head. Data were collected from 5 cells per layer in all 3 regions examined, resulting in approximately 45 cells per case and over 20,000 spines. Synaptic spines were analyzed based on length, distance from the cell body, as well as categorical data (thin versus not thin, head versus no head).

Results:

On average, ASD subjects had longer spines than control subjects. In addition, ASD subjects showed comparable spine lengths in layers 2, 3, and 5 within each region examined, while control subjects' spine length decreased across layers 2, 3, and 5. Finally, ASD subjects showed a significantly lower proportion of spines with heads relative to neurotypical subjects (Odds Ratio = 1.945, $p < .001$).

Conclusions:

These results show that ASD subjects exhibit longer spine lengths compared to neurotypicals. This may indicate a greater proportion of immature spines in the autistic brain. Additionally, the fact that ASD subjects show a lower proportion of spines with a head relative to neurotypical subjects indicates a weakened number of synaptic contacts (Yuste & Majewska, 2000) among dendritic spines on cortical pyramidal cells in the autistic brain. These results provide the first systematic demonstration of cortical spine dysmorphology in autism spectrum disorders.

110.174 174 A Stereological Investigation of Regional Cerebellar Purkinje Cell Densities in Autism: Clues about Direct Gaze and Executive Function Impairments. J. Skefos*[1], T. Yuce[2], K. Enzer[2], E. Levy[2], K. Weed[2] and M. Bauman[1], (1)*Boston University School of Medicine*, (2)*Boston University*

Background: Neuropathological studies within the cerebellum have implicated a decrease in Purkinje cell (PC) density in autism. However, to date, no unbiased quantitative analyses have been performed.

Objectives: Our aim was to quantify Purkinje cells in anatomically- and functionally-defined cerebellar regions, and to compare this data to ADI-R behavioral measures from each case.

Methods: We utilized systematic, random sampling technique to assess PC densities in the postmortem cerebellum obtained from eight subjects diagnosed with autism in comparison to age- and sex-matched controls. Five cerebellar regions of functional relevance to autism symptomatology were investigated. Series of histological slides collected from the entire cerebellum of each case were provided by the Autism Tissue Program as a component of the Brain Atlas Project.

Results: PC densities within Crus I and II were consistantly significantly lower in autism cases. Furthermore, the PC density of the Flocculonodular lobe was significantly lower in individuals with autism that demonstrated poor eye contact as assessed by the ADI-R, and the density of PC's correlated significantly with this measure.

Conclusions: The PC's of Crus I and II have been shown to reciprocally interact with networks in multimodal association cortices as well as frontal cortex underlying executive function, and the Flocculonodular lobe is known to modulate eye movement as well as limbic function. These findings support the hypothesis that cerebellar developmental pathology contributes, at least in part, to the clinical autism phenotype.

110.175 175 Evidence of Oxidative Damage and Inflammation Associated with Low Glutathione Redox Status in the Autism Brain. S. Rose*, S. Melnyk, O. Pavliv, S. Bai, T. G. Nick, R. E. Frye and S. J. James, *University of Arkansas for Medical Sciences*

Background: Despite increasing evidence of oxidative stress in the pathophysiology of autism, the source and functional consequences of oxidative stress are relatively understudied. Oxidative stress and damage occurs when antioxidant defense mechanisms fail to effectively counter endogenous or exogenous sources of reactive oxygen species (ROS).

Glutathione is the primary antioxidant responsible for maintaining the reducing intracellular microenvironment that is essential for normal cellular function and viability. The ratio of reduced to oxidized glutathione (GSH/GSSG) is an established indicator of cellular redox status. A chronic reduction in GSH/GSSG reflects a decrease in antioxidant/detoxification capacity and increased vulnerability to oxidative damage. We recently reported that an increase in oxidative protein and DNA damage was associated with the decrease in intracellular and plasma GSH/GSSG in children with autism suggesting that the reduced antioxidant defense capacity in these children may have functional consequence in terms of overt oxidative damage.

Objectives: The aim of this investigation was to determine whether systemic indicators of oxidative stress are also present in two brain regions reported to be abnormal in autism, cerebellum and BA22. We also sought to determine whether these oxidative stress biomarkers are associated with protein and DNA damage and markers of inflammation and mitochondrial superoxide production.

Methods: Frozen samples of cerebellum and temporal cortex (BA22) from individuals with autism and unaffected controls (n=15 and n=12 per group, respectively) were matched for sex, age, post mortem interval (PMI), mode of death and race. Biomarkers of oxidative stress including reduced glutathione (GSH), oxidized glutathione (GSSG) and glutathione redox/antioxidant capacity (GSH/GSSG) were measured. Biomarkers of oxidative protein damage (3-nitrotyrosine; 3-NT) and oxidative DNA damage (8-oxo-deoxyguanosine; 8-oxo-dG) were also assessed. Functional indicators of oxidative stress included relative levels of 3-chlorotyrosine (3-CT), an established biomarker of inflammation, and reduced aconitase activity, a biomarker of excessive mitochondrial superoxide production. The biomarkers GSH/GSSG, 3-NT and 3-CT were measured by HPLC elution and electrochemical detection while 8-oxo-dG was measured by HPLC/MS. Aconitase activity was measured spectrophotometrically.

Results: Consistent with previous studies on plasma and immune cells, GSH/GSSG was significantly decreased in both autism cerebellum ($p<0.001$) and BA22 ($p<0.001$). Both 3-NT and 3-CT were inversely correlated with GSH/GSSG in both brain regions ($p=0.04$ and $p=0.02$, respectively). Further, 8-oxo-dG was inversely correlated with GSH/GSSG in the cerebellum ($p<0.0001$). Aconitase activity was significantly decreased in autism cerebellum ($p<0.01$) and positively correlated with GSH/GSSG ($p=0.01$).

Conclusions: Overall, the findings of this study support a role for glutathione redox imbalance and oxidative stress in the neuropathology of autism and provide new evidence suggesting that a neuroinflammatory process and excessive mitochondrial superoxide production may promote oxidative damage in the affected brain regions in autism.

110.176 176 Comparative Neuropathology of Lissencephaly with ARX Mutation: Consideration of Neocortical Interneuron Distribution of Various Lissencephalies. M. Itoh*, *National Center of Neurology and Psychiatry*

Background: Lissencephaly usually shows severe mental retardation and occasionally intractable epilepsy. Recently, X-linked lissencephaly with abnormal genitalia (XLAG) is established as one disease entity. XLAG, showing severe neonatal seizure and developmental delay, is a rare disorder caused by mutations in the *aristaless*-related homeobox (*ARX*) gene, located in Xp22.13. *Arx*-null mice for human XLAG model showed loss of tangential migration of GABAergic interneurons. However, GABAergic interneuron distribution of XLAG brain has never been reported.

Objectives: In the present study, we investigated subpopulation of GABAergic interneurons in the brain of an infant with XLAG, who had a nonsense mutation of the *ARX* gene, compared with those of age-matched normal control, Miller-Dieker syndrome (MDS) as a type I lissencephaly, and polymicrogyria of Fukuyama type congenital muscular dystrophy (FCMD) as a type II lissencephaly.

Methods: We used paraffin-embeded brain tissues of two XLAG, three MDS and four FCMD, with an informed consent of their parents and approve of the ethical committee of the institute. We performed immunocytochemistry for interneuron and migration markers.

Results: Glutamic acid decarboxylase (GAD)- and calretinin (CR)-containing cells were significantly very few in the neocortex and, interestingly, located in the white matter and neocortical subventricular zone, while neuropeptide tyrosine and cholecystokinin positive cells were normal. From previous rodent studies, the imbalance of GABAergic interneurons may be derived from the caudal ganglionic eminence tangential migration. Also, in the neocortical subventricular region, the GAD- and CR-containing cells had Mash-1 protein, like a radial migration marker, and nestin protein. On the contrary, MDS showed relative low concentration of GAD-containing cells. FCMD revealed random distribution of these marked cells.

Conclusions: ARX protein controls not only tangential migration of GABAergic interneurons from the ganglionic eminence, but also may serve to induce radial migration from the neocortical subventricular zone. MDS and FCMD also demonstrated abnormal distribution of neocortical interneurons, but those severities are different in each type of lissencephaly.

Neurophysiology Program

111 Neurophysiology I

111.177 177 Basic Information Processing in Children with Autism Spectrum Disorders. G. F. Madsen*[1], N. Bilenberg[1] and B. Oranje[2], (1)*University of Southern Denmark*, (2)*University of Copenhagen*

Background:

Autism Spectrum Disorders (ASD's) are neurodevelopmental disorders characterized by a triad of impairments; qualitative disturbances in social interaction and communication, and restricted behaviour and interests. A growing number of systematic studies report co-occuring psychiatric symptoms and disorders to be common in children with ASD, and from follow up studies we know that a significant number of patients within years after diagnosis develop psychosis or even schizophrenia.The overlap between ASD and schizophrenia has been a matter of intense debate and research, and it is currently being reconsidered in view of emerging evidence about common neurobiological processes in both disorders. It may be appropriate to revisit the possibility that these disorders are related.

In schizophrenic patients the brain's basic processing of auditory information is disturbed, which is reflected in aberrant scores in several psychophysiological paradigms compared to healthy controls, e.g. "Pre-pulse inhibition of the startle reflex" (PPI), "Sensory gating" (P50 suppression) and "Mis-match-negativity" (MMN).

The main objective of this study is to test whether the psychophysiological features that are normally found in schizophrenia are also present in ASD.

Objectives:

- To compare basic auditory information processing in children with ASD and a group of neurotypically developed (NTD) controls.
- To test whether it is possible, on the basis of the psychophysiological outcomes, to differentiate subgroups within the ASD group.
- To compare psychophysiological results from subgroups within the autism spectrum, presenting anxiety and "thought problems", with psychophysiological results from schizophrenic patients described in the literature.

Methods:

This case-control study involves 40 ASD children, 8-12 years old, diagnosed according to DSM-IV-TR criteria and 40 age, gender and IQ matched NTD children. Both groups are tested with a neuropsychological tests battery, and parents to all participants have completed Social-Communication Questionnaire (SCQ) and the Child Behaviour Checklist (CBCL). In addition all participants are testet in a PPI, P50 suppressions and a MMN paradigm.

Results:

We are just about to start analyzing our results and we expect to be able to present preliminary data and results at the conference.

Conclusions:

We hope that this study will generate new insight in the neurocognitive aetiology of ASD, as well as on possible underlying psychophysiological features shared by ASD and schizophrenia.

111.178 178 Sensory Change Detection and Attention in Autism: An EEG and Event-Related Brain Potential Study. M. Zinni*, D. Trauner and J. Townsend, *University of California, San Diego*

Background:

While deficits in social communication are among the most salient symptoms of autism, the underlying source of these deficits may arise from lower-level deficits in perception and/or attention. For example, a child with autism that effectively neglects social interactions could have established such a pattern of social response over the course of development, as a downstream consequence of an early developmental failure to detect and orient to important changes in the sensory environment. While prior studies have established evidence for abnormal orienting responses to novel stimuli in persons with autism, the current study was designed to investigate whether the neural response to a visual, sensory-level change, occurring outside of the focus of attention, differs between children with autism and their typically developing peers. Such a difference would suggest a perceptual-level deficit in the sensory encoding of environmental change.

Objectives:

To determine whether the neural response to the sensory registration of change and/or attentional orienting differs between typically developing children and children diagnosed with autism. We hypothesized that children diagnosed with autism would not readily detect unattended visual environmental changes, and further, that orienting to such changes would be slowed or might not occur at all.

Methods:

Visual sensory-level discrimination was tested passively while the typically developing children (TD) or high-functioning children with autism (HFA) watched a video of their choice. The video was surrounded by a rapidly presented pattern of line gratings of different standard and deviant orientations (45 degree tilt to the right or left of center), appearing in the visual periphery. The visual mismatch event-related brain potential (ERP) was measured as an index of sensory-level stimulus discrimination and elicited by presenting the line patterns, in a randomized manner, in both standard (frequent: 80%) and deviant (infrequent: 20%) orientations. The resulting difference in the ERP response between deviant and standard line orientations was calculated.

Results:

Both the TD and HFA groups elicited a differential response to the deviantly oriented lines. The mismatch ERP response in the TD group occurred as early as the P1 ERP component, becoming statistically significant by 110 ms. In contrast, the mismatch response in the HFA group occurred much later, by 160 ms. These results suggest that the TD group distributed their attention as a gradient on and around the video, resulting in an early, sensory-level discrimination of the lines, while the difference in the HFA group was manifested in a later, orienting response to the unattended stimuli with larger responses to the lines of a deviant orientation.

Conclusions:

Both TD and HFA groups of children discriminate changes in the environment, but the timing differed between the two groups with early sensory-level discrimination occurring in the TD group, but not the HFA group. This observation may help to explain why autistic children often do not respond quickly to commands, and may also provide one explanation for their difficulty with transitions— the additional time required to process sensory information may contribute to a strong stress reaction in situations that require rapid processing of changing information.

111.179 179 Mobile Brain-Body Imaging of ASD Participants During Natural Movement. M. Westerfield*[1], K. Vo[2], D. Lock[1], S. Wee[1], D. Sarma[1], S. Makeig[1] and J. Townsend[1], (1)*University of California, San Diego*, (2)*Chicago Medical School*

Background: Motor dysfunction (e.g., abnormalities of gait, balance, muscle tone, head and eye movement and coordination) is a prominent feature in autism that may be a contributing factor in cognitive and social impairments. Isolating specific underlying mechanisms that lead to a variety of motor impairments (e.g., timing, anticipation) would inform effective intervention that may in turn improve not only motor competence but also behavioral problems that are affected by motor dysfunction. We are currently conducting a first quantitative study of motor function in ASD that relates motor dysfunction to both underlying brain structure and function as well as to behavioral. Central to this study is the ground-breaking mobile brain/body imaging (MoBI) system (Makeig et al., 2009). This novel system uses a combination of cameras and LED emitters for motion capture with simultaneous collection of high-density scalp EEG to quantify the accuracy, coordination, and timing of motor functions and to allow modeling of cortical network function during specific phases of motor operations. Development of analytic methods is critical to the success of this work.

Objectives: The goals of the experiment presented here were 1) to test the feasibility of integrating EEG with motor activity collected during a task in which the participant moved freely around a large room, and 2) to determine the most appropriate analytic methods for these novel multi-modal datasets.

Methods: We recorded 128-channel EEG and 66-sensor motion-capture data from boys between the ages of 13-17 (ASD and typically developing controls). The task, embedded in a simple video game, required participants to walk across a large room in order to reach a cartoon 'alien' projected on a wall. On STRAIGHT trials, the participant could reach the alien by walking straight across the room; on TURN trials the alien would move to one of the adjacent walls requiring the participant to change direction.

Motion-capture data was used to determine the point at which the participant began a turn to follow the alien. EEG data were decomposed using Independent Components Analysis, and activity of individual Independent Components (ICs) was time-locked to the turning time point identified from the motion-capture data. For each IC of interest, we performed time-frequency analyses, and estimated the cortical solution; we also modeled causal relationships between pairs of ICs.

Results: We successfully separated cortical EEG activity from movement-generated artifact. After integrating motion and EEG data, we found the markers best related to task behavior, and used these markers to identify EEG networks associated with that behavior. We identified ICs from two categories: those whose activity was associated with leg/foot movement, and those whose activity was associated with, but more importantly *preceded* the act of turning. Cortical source modeling indicated that these components were located in brain areas consistent with the motor network.

Conclusions: This pilot work established the feasibility of recording and analyzing EEG activity from freely-moving participants. Modeling causal relationships between the various EEG networks revealed interactions that will allow us to differentiate between motor planning and execution.

111.180 180 Neuromodulation Effects on Error Monitoring and Correction Function in Autism Spectrum Disorders. E. M. Sokhadze*, L. L. Sears, G. Sokhadze, A. S. El-Baz and M. F. Casanova, *University of Louisville*

Background: One important executive function known to be compromised in Autism Spectrum Disorders (ASD) is related to response error monitoring and post-error response correction. Reports indicated that children with ASD show reduced error processing and deficient behavioral correction after an error is committed. Error sensitivity can be readily examined by measuring event-related potentials associated with responses to errors: the fronto-central error-related negativity (ERN) and the error-related positivity (Pe). The ERN is a response-locked negative deflection, emerging between 40-150 ms after the onset of an error. Usually this ERN is followed by a positive wave referred to as the Pe potential. It is suggested that the ERN reflects an initial automatic brain response as a result of an error, and the Pe indicates the conscious reflection and comprehension of the error.

Objectives: The goal of our study was to investigate whether behavioral response reaction time (RT), error rate, post-error RT change, ERN, and Pe will show positive changes following 12-week long repetitive TMS (rTMS) in group of high

functioning children with ASD. Considering that in our prior studies we showed reduction in error rate in ASD group following dorsolateral prefrontal cortex (DLPFC) rTMS, we hypothesized that 12 sessions of rTMS bilaterally applied over the DLPFC will result in improvements reflected in RT, ERN and Pe measures.

Methods: Participants with ASD (N=30) were referred by clinical psychologist. Diagnosis was made according to DSM-IV and further ascertained with ADI-R. Then participants were randomly assigned to either active rTMS treatment (N=15) or wait-list (WTL) groups. There were no significant group differences in age, gender, or IQ. EEG was collected using 128 channel system. The task involved recognition of a specific illusory shape, in this case a square or triangle, created by three or four inducer disks. Treatment group received 12 weekly 1 Hz rTMS sessions (150 pulses, 90% of motor threshold), while the WTL subjects were tested twice within 12 weeks.

Results: There were no between group differences in reaction time (RT) nor in rate of commission errors. ERN in TMS group became more negative (by 4.99± 4.35 mV, F=5.07, p=0.03). The number of omission errors in TMS group decreased (t=2.26, p=0.034), and post-error RT became slower (from -22.3 ms to 10.6 ms post-TMS). There were no changes in RT, error rate, post-error RT, nor in ERN/Pe measures in the WTL group.

Conclusions: Our results show significant post-TMS differences in the ERN, as well as behavioral response measures (omission errors, post-error slowing) indicative of improved error monitoring and correction. This executive function is important for ability to correctly evaluate committed error and adjust behavior to prevent from rigid and repetitive actions. Elucidating the neurobiological basis and clinical significance of response monitoring and correction deficits in ASD represents a promising direction for further research. The ERN along with behavioral performance measures can be used as functional outcome measures to assess the effectiveness of rTMS in autism and thus have practical implications.

111.181 181 Resting-State Gamma Power in Young Children with ASD Participating in a Treatment Program. K. A. McEvoy*[1], A. Norona[2] and S. S. Jeste[2], (1)*UCLA*, (2)*UCLA Center for Autism Research and Treatment*

Background: There is growing support for the hypothesis that ASD may reflect altered structural and functional connectivity across large-scale cortical and subcortical networks (see Geschwind & Levitt 2007 for review). Resting-state EEG oscillatory activity, specifically high-frequency activity (gamma: 30-50 Hz), may reflect the aberrant functional connectivity and neural asynchrony contributing to the ASD phenotype and, hence, could serve as an important biomarker of the functional disconnection that likely occurs early during development in children with ASD. A recent study of infants at high-risk for ASD showed that frontal gamma power was reduced in high-risk infants at age 6 months as compared to age-matched, low-risk infants (Bosl et al. 2011). Another relevant study examined the relationship between gamma power and language function in typically developing (TD) children and found that individual differences in frontal resting gamma power were highly correlated with concurrent language and cognitive skills at ages 16, 24, and 36 months (Benasich et al. 2008).

Objectives: Here, we used resting-state EEG to examine high-frequency oscillatory activity in preschool-aged children with ASD and TD, age-matched controls. Children with ASD were enrolled in a 3-month intensive day treatment program, and EEG data was gathered prior to and at the end of treatment. Our objectives were to (a) compare gamma activity in ASD and TD children, (b) investigate change in gamma activity after a treatment program, and (c) examine region differences between the groups of children.

Methods: Resting-state EEG was obtained for 2 minutes while the children were sitting quietly in a dark room, watching a video of bubbles. EEG data were bandpass filtered from 1 to 50 Hz. Segments containing artifacts arising from eye or muscle movements were removed from subsequent analysis. Only subjects with a minimum of 30 seconds of artifact-free data were analyzed. Data was then transformed into the frequency domain using a Fast Fourier Transform. Frontal gamma power was compared between ASD and TD children without. In addition, EEG data prior to treatment was

compared to EEG data after treatment among the children with ASD. Lastly, we examined regional differences in the TD, the pre-treatment ASD children, and the post-treatment ASD children.

Results: We collected adequate data from 11 typically developing children, 17 children with ASD pre-treatment, and 6 children with ASD post-treatment. The data show that pre-treatment ASD children have increased gamma power when compared to TD children, most significantly in the left frontal region (p=.018). Additionally, there was a trend showing a decrease in frontal gamma power from pre-treatment to post-treatment (p=.095).

Conclusions: Our very novel data show that frontal gamma power differentiates children with ASD from TD controls. Furthermore, it appears that frontal gamma activity decreases over the course of the treatment program. These data support the use of resting EEG as a biomarker of diagnosis and treatment outcome. As our sample size increases we will be able to further investigate these preliminary trends and their potential implications for ASD treatment programs.

111.182 182 Neural Correlates of Learning From Social Engagement in Children with ASD. L. Elder*, A. Norona, C. Shimizu and S. S. Jeste, *UCLA Center for Autism Research and Treatment*

Background: Children with autism spectrum disorder (ASD) show less social engagement and, therefore, are less likely to learn from social cues. Social learning represents a challenging cognitive domain to characterize given the somewhat restricted behavioral repertoire of children with ASD. One approach to address this challenge is to inform behavior with quantifiable biomarkers (Gandal, 2010). Electroencephalography (EEG) and event related potentials (ERPs) hold particular promise in this population because they are non-invasive and more feasible than neuroimaging in challenging populations, and they also provide time sensitive information about brain processing (Jeste, 2009). No prior studies have investigated biomarkers for social engagement in children with autism using EEG.

Objectives: To develop an ERP paradigm that captures social learning, with the goal of differentiating social engagement in children with ASD from typically developing children.

Methods: The paradigm consists of a behavioral exposure phase and an ERP test phase. The examiner presents children with 4 visually-matched pairs of toys. Half of the toys are presented in a “non-social” setting, with the examiner wearing a neutral expression and refraining from engaging with toy or child, while the other half of the toys are presented in a “social” setting, with the examiner engaging with the child around the toy. The behavioral component is videotaped and later coded by two independent and reliable raters for variables including: eye contact with examiner, child looking time to toy, spontaneous vocalizations, and degree of social engagement during each trial. The ERP portion immediately follows the exposure phase. Children view a continuous sequence of photographs of the toys in random order. The component of interest is the frontocentral Nc and, specifically, the differentiation of the social and non-social conditions based on Nc mean amplitude.

Results: Four 3-5 year old children with ASD and six typically developing, age matched, children have completed the paradigm thus far. There are significant group differences in the level of social engagement during the behavioral exposure phase, with typically developing children demonstrating more social engagement (t=3.98, p=.004). Preliminary ERP data show that typically developing children differentiate the social and non-social stimuli more than the ASD kids, as quantified by the difference in Nc mean amplitude (4.44 for the typical group, 2.68 for the autism group). Furthermore, mean Nc amplitude shows moderate correlations with behavioral data.

Conclusions: This is the one of the first studies to use EEG as a biomarker for learning from social engagement. Our preliminary data show that neural correlates of learning from social engagement are quantifiable using EEG. Behaviorally, preschoolers with ASD demonstrate less social engagement, and less differentiation between social conditions in the EEG. Future work will include using this paradigm to better characterize individual variability in social engagement in children with ASD and to investigate this variability as predictor of treatment response.

111.183 183 Attentional Mechanisms in Autism Spectrum Disorders and Schizophrenia: An Event-Related Potential Study. C. T. W. M. Vissers*[1], S. Koolen[2], D. J. Chwilla[1] and J. I. M. Egger[1], (1)*Donders Institute for Brain, Cognition and Behaviour, Centre for Cognition, Radboud University Nijmegen*, (2)*Behavioural Science Institute, Radboud University Nijmegen*

Background: Autism spectrum disorders (ASD) and schizophrenia show phenomenological overlap and have been proposed to share a common underlying pathogenesis (King & Lord, 2011). Here we investigate whether both pathologies can be conceptualized as disorders of attention.

Objectives: To examine attentional processing in patients with ASD, patients with schizophrenia and a control group, event-related potentials (ERPs) were recorded in an oddball paradigm. Previously, infrequent stimuli in this paradigm elicit a large positivity (P300). P300 has been proposed as the neural signature of the working memory update of changes in the environment (Donchin & Coles, 1988). Specifically, variations in P300 latency and amplitude have been taken to reflect differences in the degree and quality of attentional mechanisms required to change the mental model of the environment.

Methods: 10 patients with ASD, 10 patients with schizophrenia, and 10 healthy controls were exposed to a visual oddball task (frequent stimulus: large circle; odd stimulus: small circle). All participants were asked to silently count the odd stimuli while ERPs were recorded.

Results: For healthy controls a standard P300 oddball effect was observed. The P300 oddball effect for patients with ASD and schizophrenia was qualitatively different in terms of amplitude, latency or scalp distribution.

Conclusions: P300 results are disussed in terms of structural and functional brain abnormalities associated with ASD and schizophrenia. The present ERP results contribute to the ongoing debate about whether ASD and schizophrenia share a common pathogenesis.

111.184 184 Monitoring in Language Perception in High-Functioning Adults with Autism Spectrum Disorder: Evidence From Event-Related Potentials. S. Koolen*[1], C. T. W. M. Vissers[2], J. I. M. Egger[2] and L. Verhoeven[1], (1)*Behavioural Science Institute, Radboud University Nijmegen*, (2)*Donders Institute for Brain, Cognition and Behaviour, Centre for Cognition, Radboud University Nijmegen*

Background: Individuals with autism spectrum disorder (ASD) often show impaired global (with intact local) language processing performance (e.g., Jolliffe & Baron-Cohen, 1999). Recent psycholinguistic studies suggest that the quality of language perception relies on monitoring, an aspect of executive control (e.g., Van de Meerendonk et al., 2009). Monitoring involves reanalysis of linguistic input in case of conflicting linguistic representations, leading to optimal language comprehension. Event-related potentials can be used to tap the monitoring response online, reflected by the P600 effect. We propose that the problems with global language comprehension in ASD might be explained in terms of increased need for executive control, specifically monitoring.

Objectives: The aim of the present study was to map the inclination of people with and without ASD to monitor global aspects of language, and compare monitoring processes in a simple, single level task to those in a more complex, dual level task.

Methods: Participants were 14 high-functioning adults with ASD and 14 controls. The clinical and control group were matched on gender, age, intelligence and working memory. A dual-task experiment was developed to examine monitoring of global language aspects in a simple and a more complex condition. Participants were instructed to focus on global, syntactic errors in I) a single level condition with attentional focus only on syntactic errors, and II) a dual level condition with attentional focus both on syntactic errors and on orthographic errors. During the experiment ERPs were recorded. We compared the P600 effect to syntactic errors relative to correct sentences in participants with ASD as well as control participants, in the single and the dual level condition.

Results: For people without ASD, a monitoring response (as tapped by the P600 effect) to global errors was found only in the dual level condition. People with ASD, however, showed a monitoring response to global errors in both the single level and the dual level condition.

Conclusions: These ERP findings suggest that people with ASD monitor global aspects of language already under simple circumstances, whereas people without ASD only do so under more complex circumstances. Possibly, for individuals with ASD, global language perception costs more attention, resulting in impaired language comprehension in more complex situations. This would indicate that language problems in ASD might not result from a linguistic dysfunction as such, but from an increased need for executive resources to achieve optimal language comprehension.

111.185 185 Sleep Spindles and K-Complexes: EEG Markers of Poor Sleep in Autism?. S. M. Duplan*[1], M. Chicoine[1], C. Berthiaume[2], E. Chevrier[1], L. Mottron[3] and R. Godbout[1], (1)*Hôpital Rivière-des-Prairies*, (2)*Hopital Riviere-des-Prairies*, (3)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: Sleep recording of adults with Autism Spectrum Disorders (ASD) show signs of poor sleep, including long latencies to sleep onset and frequent nocturnal awakenings. Sleep spindles and K-complexes are EEG phasic events thought to reflect sleep protective mechanisms that inhibit the processing of potentially arousing stimuli.

Objectives: To evaluate sleep protective mechanisms in children and adult autistics through the quantification and scalp distribution of EEG sleep spindles and K-complexes.

Methods: Twenty-nine individuals with ASD (16 adults: 14 M, 2 F, 22.1 ± 1.3 years; 13 boys, 10.7 ± 1.9 years) with normal IQ and a comparison group of 31 typically developed participants (TD; 18 adults: 17 M, 1 F, 21.1 ± 1.0 years; 13 boys, 9.8 ± 2.2 years) were recorded for two consecutive nights in a sleep laboratory. Sleep spindles were recorded in children and adults using a central (C3) and a frontal (Fp1) electrode and visually identified as bursts of EEG activity at 12-14 Hz, lasting 0.5 to 2.0 seconds. K-complexes were scored in adults only, using a 14-electrodes montage and defined as negative-going biphasic waves with sharp onset and smoother offset, lasting 0.5 to 1.5 seconds, with an amplitude of at least 75 µV. Spectral analysis of the EEG 2 seconds before and 2 seconds after K-complexes was performed and spectral power was calculated for delta (0.5-3.5 Hz), theta (4.0-7.5 Hz), alpha (8.0-12.5 Hz) and beta (13.0-30.0 Hz) frequency bands.

Results: Sleep spindles in adults were less in the ASD group than in the TD group at the central (C3), not the frontal (Fp1) electrode. No differences were found in children. K-complexes were significantly less in the adult ASD group compared to the TSD group at the parietal and occipital recording sites. Spectral analysis of the EEG showed, however, that K-complexes were followed in both group by an increase in delta activity.

Conclusions: These data suggest that cortical sleep protective mechanisms are impaired in autism, particularly in centro-posterior regions. The fact that EEG delta activity was increased in both groups following K-complexes suggests that the problem do not reside in the capacity *per se* of EEG events to keep the brain asleep but rather their topographical distribution. More electrodes need to be analyzed in children in order to test the hypothesis of an atypical developmental course.

111.186 186 Auditory Processing and Language Impairment in Children with ASD. S. Yau*[1], B. W. Johnson[2] and J. Brock[2], (1)*Macquarie Centre for Cognitive Science*, (2)*Macquarie University*

Background:

Although auditory processing is commonly found to be atypical in ASD, the precise nature of its relationship to language and communication difficulties in ASD is unclear. Some researchers argue that differences in low-level auditory perception have an early influence on speech perception (Oram Cardy et al 2005), contributing to language impairment in ASD. Others attribute language impairment and communicative deficits in ASD to reduced attention to speech (complex and rapidly changing social) stimuli (Ceponiene et al 2003, Dawson et al 2004, Kuhl et al 2005).

In EEG studies, auditory discrimination and attention is typically measured using an auditory oddball paradigm in which infrequent deviant sounds occur within a train of standard speech or nonspeech sounds. Previously it has been reported that the Mismatch Negativity (MMN), an automatic pre-attentive change detection response, is atypical in ASD. However, the nature of this atypicality is inconsistent across studies with reports of enhanced and diminished, early and delayed responses. A more consistent finding is that the P3a, an index of involuntary attention that follows from the MMN, is diminished in response to speech but not non-speech stimuli in ASD (Lepisto et al 2005, Ceponiene et al 2003).

MEG (magnetoencephalography) offers advantages over EEG in terms of the ability to separate responses from different sources in the brain. In a recent MEG study, Roberts et al (2011) reported delayed MMF (MEG equivalent of MMN) in children with ASD, but did not investigate the P3a.

Objectives:

This study aims to further investigate the neural basis of speech perception and attention in children with ASD using MEG. In particular, we are interested in the MMF, P3a and potential differences between brain responses in left and right hemisphere, and how these differences relate to language ability in ASD.

Methods:

We are currently testing 20 children with ASD and 20 age-matched TD controls using an auditory oddball paradigm. Brain responses to standard and deviant (pitch change) sounds are recorded using 160-channel MEG while the children watch a silent DVD. Speech and Nonspeech stimuli are carefully matched to ensure that any differential responses are not attributable to the acoustic properties of the stimuli.

Results:

Event-Related Beamforming will be used to extract the time series of brain responses to sounds measured from virtual sensors. Results of a pilot study with 4 neurotypical adults using this method indicate multiple bilateral sources in temporo-parietal regions. We will analyse differences in amplitude, and latency of event-related fields between autistic and non-autistic children, and consider individual differences in neuromagnetic responses as a function of performance on tests of language development and social communication.

Conclusions:

The results of this study will provide insights into the relationship between auditory processing and language and communication impairment in ASD. In particular, we will determine whether individual differences in language and communication impairment are best predicted by MMN or P3a responses.

111.187 187 Neural Correlates of Environmental Sound and Emotional Semantic Integration in Children with Autism. J. McCleery*[1], V. Vogel-Farley[2], C. Stefanidou[3], S. Utz[1] and C. A. Nelson[4], (1)*University of Birmingham*, (2)*Children's Hospital Boston*, (3)*School of Psychology, University of Birmingham*, (4)*Children's Hospital Boston/Harvard Medical School*

Background: Previous behavioural and neuroimaging studies have found evidence that children with autism spectrum disorders (ASD) have difficulties with semantic processing, with particular deficits in verbal comprehension. By studying the semantic integration of word and environmental sound information, we recently uncovered evidence that these semantic processing deficits may be specific to the verbal versus nonverbal domain.

Objectives: To examine the semantic integration of environmental sounds compared with the semantic integration of emotional information in faces and voices, in children with autism.

Methods: Participants were fifteen 3- to 6-year old high-functioning children with ASD and fifteen typically developing control children, matched on chronological age, developmental age, and gender. We recorded event-related potentials (ERPs) while the children observed pictures of instruments (drums, guitars) followed shortly by matching and mismatching nonverbal sounds (drum sounds, guitar sounds), and while they observed pictures of emotional faces (happy, fearful) and matching and mismatching voices (happy voice,

fearful voice). Face stimuli were from the MacBrain standardised emotional expression dataset, and emotional voice stimuli (nonsense words "gopper sarla") were shown to be accurate representations of happy and fearful emotional prosody through a comprehensive rating study involving six different emotion types with twelve typically developing adult participants. We analysed two ERP components involved in semantic and cognitive integration, the N400 and the Late Positive Component (LPC).

Results: An analysis of variance (ANOVA) including matching and hemisphere as within-subjects factors and participant group as a between-subjects factor revealed a main effect of match for the LPC component for the environmental sounds condition, whereby the amplitude of this component was larger for mismatching than for matching stimuli ($p < 0.01$). This match/mismatch effect was significant for the ASD group alone ($p = 0.035$), and exhibited a similar but non-significant trend in the control children alone ($p = 0.10$; match x hemisphere $p = 0.09$). No main effects or group interactions were observed for ANOVAs on the environmental sounds N400 component or for either the N400 or LPC component during the emotional face/voice integration condition. Furthermore, neither group exhibited any significant match/mismatch effects for the emotional face/voice integration condition.

Conclusions: From these results, we conclude that the automatic semantic integration of nonverbal, environmental sound information is intact in children with autism. Because neither group of children exhibited semantic integration effects for emotional face/voice pairs, we were unable to assess emotional integration effectively in children with autism in the current study. Future research might use emotional stimuli that come from emotional categories that are more dissimilar to one another, such as happy and disgust faces and voices.

111.188 188 ERP Phase Synchrony in Language Networks Is Highly Correlated with Language and Cognitive Abilities in Autistic and Typical Children. K. M. Martien*[1], H. Bharadwaj[2] and M. R. Herbert[2], (1) *Lurie Center for Autism, Massachusetts General Hospital*, (2)*Massachusetts General Hospital*

Background: The autism spectrum disorders (ASDs) are a heterogeneous group of neurodevelopmental disorders that share a behavioral phenotype classically described as impairment of social communication accompanied by repetitive or stereotyped behaviors. Biological models supported by neuroimaging studies are converging on a biological phenotype shared by these disorders, specifically, altered functional connectivity in and among critical cortical networks. Phase synchrony is a measurement of electrocortical synchronization of oscillatory brain rhythms across neural networks, hypothesized as a mechanism for functional connectivity. Language deficits in autism may be due in part to a failure of integration and synchronization of phonological information across critical language networks. We sought to test the hypothesis that during auditory processing of phonemes, autistics would show decreased functional connectivity between temporal and frontal language networks and that the degree of impaired connectivity would correlate with severity of language impairment.

Objectives: To analyze phase synchrony between activated regions in primary auditory cortex (STG) and defined frontal language networks (Broca's area) during phonemic cortical auditory evoked potentials in age-matched autistic and typical children and compare the phase synchrony to cognitive and language abilities.

Methods: Auditory ERP's in response to a standard phoneme, //ge//, and a deviant, //be//, were recorded from children (ages 5 to 8 yr) with autism spectrum disorders (n = 6) and age-matched typical controls (n = 8) using high-density array nets and 128 channel EEG. Cortical activation in source space derived from the evoked response to the standard phoneme was mapped onto a standard adult whole head model (inflated cortex) for each subject and average maps of the group data were generated for the two groups: ASD and controls. The phase synchrony between the activated auditory cortex (LSTG) and Brodmann's area 45 (Br45) was computed for each subject. The correlation coefficients were calculated for phase synchrony and general cognitive ability (GCA) and verbal cognitive ability (VCA) as measured on the Differential Abilities Scale.

Results: Phase synchrony between regions of activation in LSTG and Br45 for the alpha band after Bonferroni correction was found to show a strong positive correlation with both GCA

and VCA for typical and ASD subjects. Using the Kendall Correlation (tau), phase synchrony to GCA had a correlation of 0.57 and a p value of 0.0052. Specific correlations for other language measures will also be presented. Non-alpha frequency bands failed to show significant correlations.

Conclusions: These results support the view that language impairment in children with ASD is related to impaired functional connectivity between critical language networks. Our ability to demonstrate and quantitate this impairment using EEG underscores the value of this technology for measuring functional biomarkers in behaviorally challenged young children with autism. This methodology will be applied to at risk infants to identify functional language impairment before behavioral correlates are clinically apparent. This technique has the potential to show the failure of the at risk brain to develop compensatory mechanisms during ontogeny and thus could provide an indication for interventions to improve the functional outcome.

111.189 189 Short-Duration Visual Evoked Potentials (VEPs) in Children with ASD. P. M. Weinger*[1], J. Gordon[1], T. Navalta[1], L. V. Soorya[2] and V. Zemon[3], (1)*Hunter College, City University of New York*, (2)*Mount Sinai School of Medicine*, (3)*Yeshiva University*

Background: Previous studies have demonstrated visual deficits in children with autism spectrum disorder (ASD). However, there is a paucity of data on early-stage visual processing in this population. Children with ASD are often difficult to assess on visual tasks, which is reflected by studies that generally target higher functioning children. Visual evoked potentials (VEPs) provide noninvasive, rapid, and reliable measures of neural functions, and therefore, they may eventually be used to identify neural dysfunction, changes in visual processing over time, and to serve as biomarkers for subgroups of children with ASD. Before this advancement in assessment can be achieved, VEP techniques must be modified to facilitate collection of data on children at various levels of functioning.

Objectives: To determine whether a battery of short-duration stimulation and analysis conditions will adequately probe select pathways and mechanisms within the brains of children with ASD and typically developing children.

Methods: Transient and steady-state VEP recordings were obtained from 5 children with ASD and 12 typically developing children using the Neucodia system (VeriSci Corp.). Short-duration stimuli were 3 seconds in duration with 1 second for adaptation and 2 seconds for data collection. Each condition was comprised of 10 runs and synchronized data collection was used. Short-duration recordings were compared to long-duration (60-s) recordings. Visual acuity was measured and ASD diagnoses were determined using the Autism Diagnostic Observation Schedule (ADOS).

Results: Findings demonstrate that short-duration stimuli, in conjunction with statistical analysis of the brain's responses, can yield sensitive and objective indices of the neural pathways under investigation.

Conclusions: Short-duration (2-s) epochs may be used in place of long-duration (60-s) epochs in order to record VEP responses in children with and without ASD. Short duration stimuli allow for faster data collection while applying rigorous methods for statistical significance. Future studies may apply short-duration VEP techniques to examine underlying neural mechanisms in the visual systems of children with ASD.

111.190 190 Reduced Resting Gamma Power Is Associated with Symptom Severity in Autism. M. E. Villalobos*[1], C. R. Maxwell[1], R. T. Schultz[1], B. Herpertz-Dahlmann[2], K. Konrad[2] and G. Kohls[1], (1)*Children's Hospital of Philadelphia*, (2)*University Hospital Aachen*

Background: In addition to the triad of impairments observed in autism, sensory processing abnormalities have also been reported. Recent studies have suggested that abnormal electroencephalography (EEG) frequency oscillations may indicate impaired sensory processing in psychiatric disorders, including Autism Spectrum Disorders (ASD). Specifically, abnormal oscillations in the gamma frequency band have been found in ASD and proposed as a potential biomarker; however, these findings have been mixed depending on whether evoked versus resting gamma oscillations were examined. While many studies have investigated gamma oscillations in ASD, none have reported an association between gamma and ASD symptom severity. Examining the relationship between the degree of ASD symptomatology and gamma abnormalities may be a first step towards better

understanding the extent to which gamma oscillations function as a potential biomarker in ASD.

Objectives: 1) To investigate resting gamma power in high functioning males with ASD compared to age and IQ matched typically developing controls (TDC) using EEG and 2) to explore associations between the gamma frequency band and ASD symptom severity as measured by the Social Responsiveness Scale (SRS).

Methods: Resting scalp EEG was recorded from 15 boys diagnosed with ASD and 18 typically developing boys (TDC) ranging in age from 9 to 18 years (M=14.5 years, SD=2.8 years). Total gamma power was calculated for 9 electrodes, averaged across frontal (F5, Fz, F6), central (C5, Cz, C6) and parietal (P5, Pz, P6) regions and a repeated measures ANOVA was used to determine significant differences by group and brain region. Groups were matched on age and IQ. Exploratory analyses included Pearson correlations to examine associations between resting gamma power and SRS total across all subjects.

Results: In the gamma frequency band, significant main effects of topography ($p<0.001$) and a topography by subject group (diagnosis) interaction ($p=0.012$) were found. A t-test confirmed that at central electrodes, resting gamma power was reduced in ASD compared to TDC ($p =0.014$). Exploratory analyses yielded a significant negative correlation between gamma power at central electrodes and the SRS total (Pearson $r = -0.4$; $p = 0.021$).

Conclusions: To our knowledge, this is the first study to report an association between abnormal power oscillations in the gamma frequency band and ASD symptom severity. Our findings provide a foundation for future studies to investigate the relationships between physiological measures and ASD symptomatology in order to increase our understanding of the fundamental neural deficits observed in ASD and provide further support of gamma oscillations as a possible biomarker. Future studies should include males and females with lower-functioning ASD relative to other clinical comparison groups (e.g., ADHD) to further elucidate this finding.

111.191 191 Early Processing of Emotional Faces in Children with Autism: An Event-Related Potential Study. M. Batty*[1], E. Meaux[1] and M. J. Taylor[2], (1)*INSERM U930*, (2)*Hospital for Sick Children*

Background: Social deficits are one of the most striking manifestations of autism spectrum disorders (ASDs). Among these social deficits, the recognition and understanding of emotional facial expressions has been widely reported to be affected in ASDs.

Objectives: We investigated emotional face processing in children with and without autism using event related potentials (ERPs).

Methods: High-functioning children with autism (n = 15, mean age = 10.5 ± 3.3 years) completed an implicit emotional task while visual ERPs were recorded. Two groups of typically developing children (chronological age-matched and verbal equivalent age-matched [both n = 15, mean age = 10.51 ±3.2 years and 7.7 ± 3.8 years respectively]) also participated in this study.

Results: The early ERP responses to faces (P1 and N170) were delayed, and the P1 was smaller in children with autism than in typically developing children of the same chronological age, revealing that the first stages of emotional face processing are affected in autism. However, when matched by verbal equivalent age, only P1 amplitude remained affected in autism.

Conclusions: Our results suggest that the emotional and facial processing difficulties in autism could start from atypicalities in visual perceptual processes involving rapid feedback to primary visual areas and subsequent holistic processing.

111.192 192 Auditory Integration As a Neural Marker of Language Disorders in ASD. J. E. Oram Cardy*, R. Nicolson, L. M. D. Archibald, J. Boehm, H. M. Brown, M. E. Stothers, C. McCarthy and E. Kwok, *University of Western Ontario*

Background: Many children with Autism Spectrum Disorder (ASD) have oral language impairments, but the neural basis of these language problems is not well understood. Here, we

considered one candidate marker of language impairment: the ability of the auditory system to integrate information over time. Auditory perception is the outcome of a neural process that integrates acoustic elements over a brief time frame, termed the auditory window of integration (AWI). The smaller the AWI, the better the resolution of the signal. Research has suggested that, like language, the AWI becomes refined (smaller) as children age, and that individuals with impaired language may have an immature (larger) AWI. The relation between AWI and language ability in children with ASD has received limited attention to date.

Objectives: We compared the length of the AWI in children with autism spectrum and/or language disorders to that of their typical peers, in order to explore whether delayed maturation of cortical auditory integration may be associated with language impairment, ASD, or both.

Methods: Participants were 50 children aged 7-10 years in four groups: ASD without language impairment (ALN), ASD with language impairment (ALI), language impairment without ASD (Specific Language Impairment - SLI) and typical development (TD). We used a passive event-related potential (ERP) paradigm to examine the length of the AWI in individual children. A 128-channel EGI system recorded ERPs during binaural stimulus presentation while the child watched a silent movie. Five trails of 225 stimuli each were presented: a single 50ms tone and four tone pairs, each consisting of two 50ms tones separated by one of four gaps (100, 200, 300, and 400ms). The presence or absence of the P1/N2 complex (the neural correlate of distinct tone identification) to the second tone in each child was determined by comparison to the child's waveform generated in response to a single tone, for all four conditions.

Results: The majority of children across all four groups demonstrated neural responses to both tones in the 300 and 400ms gap conditions, and most children failed to demonstrate a second tone response in the 100ms condition. However, the groups differed in the 200ms gap condition. At this presentation rate, significantly fewer children with SLI and ALI (roughly 30% of children in each group) had second tone responses than children with ALN and TD (more than 60% of children in each group), $\chi^2(3, N=50)=9.0, p=.029$.

Conclusions: Results estimated the AWI to fall between 200-300ms in children with SLI and ALI, a less mature, lower resolution than that estimated for children with ALN and TD (which was between 100-200ms). These findings suggest that maturational delays in how the brain processes basic auditory stimuli may contribute to the impairments in understanding and using language found in children with language disorders, both within and outside the context of ASD. In future investigations, this paradigm would be particularly well-suited to explore with much younger and more disabled children, because it is quick, non-invasive, and does not require active judgment or participation.

111.193 193 Electrophysiological Indices of Empathic Response and Their Relation to Autistic Traits. C. E. Mukerji*[1], R. Bernier[2], A. Naples[1], G. Righi[1], D. Perszyk[1], M. Coffman[1] and J. McPartland[1], (1)*Yale Child Study Center*, (2)*University of Washington*

Background:

Empathy is a fundamental social ability affected in ASD and the broader autism phenotype. Empathic response is hypothesized to rely upon a neural perception-action mechanism in the mirror neuron system (MNS) that facilitates motor representation of observed actions and associated autonomic states, prompting affective sharing. Electroencephalography (EEG) studies indicate that MNS activity is indexed by suppression of oscillatory activity in the mu frequency range (8-13 Hz), which is sensitive to the social relevance of observed actions and correlates with trait empathy. Individuals with ASD demonstrate reduced mu suppression to observed actions of unfamiliar others, indicative of attenuated MNS response; consequent dysregulation of empathic response may contribute to difficulties in empathic drive, ability, and overall social function in ASD. Prior work has revealed MNS activity to observed physical pain in typical adults, but MNS response to observed social pain and its relation to autistic traits remains unexplored.

Objectives:

This study aimed to (a) investigate, for the first time, MNS activity elicited by observed social pain relative to observed

physical pain and (b) elucidate the relationship between empathic response and autistic traits. We predicted greater MNS activity (as revealed by EEG mu suppression) to social pain than to physical pain due to the specific role of the MNS in social information processing. Autistic traits were hypothesized to correlate with reduced MNS activity, indicative of attenuated empathic response, to both social and physical pain, with greater reduction in the social pain condition.

Methods:

Participants were 44 typical adults prescreened for levels of subclinical autistic traits (Autism-Spectrum Quotient). EEG was recorded with a 128-electrode Hydrocel Geodesic Sensor net while participants viewed dynamic and static stimuli displaying hands in physically- and socially-painful and painless contexts. Participants viewed identical stimuli under two conditions, while performing an empathic task (rate distress) or a distractor task (count bracelets worn by actors). Mu power (8-13 Hz) was computed over central electrodes at C3 and C4 clusters, and log ratios (empathic attention:distractor condition) were contrasted for physical versus social situations.

Results:

Spectral analyses revealed comparable response in the high mu frequency range (11-13 Hz) to observed physical and social pain; however, mu suppression to painless social scenarios was greater than to painless physical scenarios ($F(1,43)=7.90$, $p=.010$). Autistic traits differentially modulated mu suppression to physical and social scenarios. Analyses in progress examine correlations between power in the theta (4-7 Hz) and alpha (8-13 Hz) frequency ranges during observed social and physical pain and autistic traits.

Conclusions:

Results indicated comparable MNS activation, as revealed by EEG mu attenuation, to observation of both physical and social pain in others; however, in painless conditions, only social scenarios elicited MNS activation. In the absence of salient pain cues, the MNS preferentially activates to social versus nonsocial actions, despite similar patterns of human movement. Subthreshold autistic symptomatology modulates this index of empathic response, demonstrating value as a metric for assessing social function and dysfunction in ASD.

111.194 194 Three Strategies for Prospective Mapping of Neurphysiological Measures on to Behavioural Outcomes. M. Elsabbagh*[1], E. Mercure[2], A. Pickles[3], T. Charman[4], M. H. Johnson[5] and .. BASIS team[6], (1)*McGill University*, (2)*Institute of Cognitive Neuroscience, University College London*, (3)*Institute of Psychiatry, King's College London*, (4)*Institute of Education*, (5)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (6)*Centre for Brain and Cognitive Development, Birkbeck*

Background: It is suggested that neurophysiological measures are more sensitive than behavioral measure in signaling early brain atypicality, which in some infants leads to an autism diagnosis. Notwithstanding the promise of such measures as predictors of clinical outcomes, researchers have also advocated the use of dimensional intermediate phenotypes, viewed as more closely aligned to the genotype than complex clinical characterization. Specifically, measures of quantitative traits associated with ASD are though to be better candidates for gene mapping relative to diagnostic classification. The assumption here is that diagnosed forms of ASD, which are themselves highly variable, are extremes of what is otherwise typical individual variation.

Objectives: We contrast three strategies for mapping of infant brain function measures on to later behavioral outcomes within the same longitudinal cohort. The first strategy is mapping between brain function measures and clinically defined outcomes in toddlerhood. The second and third strategies involve mapping the same infant brain function measures onto emerging atypical or alternatively typical variation in social and communicative skills.

Methods: Participants were from the British Autism Study of Infant Siblings (BASIS). One hundred and four infants (54 high-risk sibs and 50 low-risk controls) were included in the analysis. When aged between 6 and 10 months, ERPs were recorded while the infants viewed dynamic images of females shifting their gaze towards (directed) or away from (averted) the infant. Outcome measures at 2- and 3-years of age included a

range of standardized measures combined with expert clinical judgment to ascertain outcome classification.

Results: Relative to the control group, the high-risk siblings group showed both similarities and differences in the amplitude and latency of components related to gaze processing. Variation in individual infant's ERP response characteristics was correlated with outcome measures irrespective of the strategy used. Different strategies reveal that a range of brain function measures capture complementary aspects of the emerging behavioral phenotype.

Conclusions: As a group, infants at-risk for autism show differences in certain neural components related to the processing of eye gaze. Moreover, individual differences in the infant ERP could be mapped onto behavioral characteristics of the same infants when they reach toddlerhood. The findings help to highlight the potential scientific and clinical utility of infant ERP measures.

The BASIS Team in alphabetical order: Baron-Cohen, S., Bedford, R., Bolton, P., Chandler, S., Fernandes, J., Garwood, H., Gliga, T., Hudry, K., Pasco, G., Tucker, L., Volein, A.

111.195 195 Brain Response to Gaze Contingent Eye-Contact in ASD. A. Naples*, M. Coffman, C. E. Mukerji, J. Wu, L. Mayes and J. McPartland, *Yale Child Study Center*

Background:

Difficulty with interpersonal interactions is a unifying symptom of autism spectrum disorders. Yet, the neuroscientific study of ASD has focused almost exclusively on passive observation of social information. In this way, the interactive element of social behavior, most critical for understanding social function in ASD, has not been addressed. Event related potential (ERP) studies in typical development have examined brain response to dynamic faces, revealing a central P300 marking perception of facial movement. However, neural responses to facial movements that occur contingent to one's own movement in the context of social interaction, such as responsive eye gaze, remain unexplored.

Objectives:

This study investigated electrophysiological brain responses to responsive eye gaze during social interaction. By applying gaze-responsive experimental paradigms recording both brain activity (EEG) and visual behavior (eye-tracking; ET), we sought to elucidate the temporal dynamics of the neural response to shared gaze in ASD.

Methods:

ERPs were recorded from high-functioning children with ASD (IQ > 80) and age, sex, and IQ-matched typical counterparts using a 128 electrode Geodesic Hydrocel Net. ET was recorded from a three camera remote eye-tracking system (SmartEye Pro v5.8) integrated with a stimulus presentation computer and EEG recording. Through co-registered and time-locked ET and EEG, the experimental paradigm was controlled by participant gaze. Trials began with presentation of a centrally presented fixation arrow, followed by a peripherally presented neutral face with mouth and eyes closed. Fixation arrows cued the participants to look either to the mouth or the eyes of the face. Contingent upon participant fixation, the face responded by either opening its eyes or opening its mouth. In this way, we examined four conditions: look to the eyes and eyes open (eyes:eyes), look to the eyes and the mouth opens (eyes:mouth), look to the mouth and the eyes open (mouth:eyes), look to the mouth and the mouth opens (mouth:mouth). ERPs were time-locked to face movement; P300 was extracted at central electrodes.

Results:

In typically developing children, P300 amplitude was enhanced in the eyes:eyes condition (1.7μV) relative to all other conditions (amplitudes range from -.54 to .28μV). Children with ASD did not display differential P300 amplitude across conditions and exhibited attenuated P300 amplitude relative to control participants only in the eyes:eyes condition (difference of 2.11μV).

Conclusions:

We demonstrate, for the first time, an electrophysiological marker of shared gaze; typically developing children display enhanced brain response to observed facial movement only in the context of reciprocated gaze. This index of shared gaze was not observed in children with ASD. Given the critical import of reciprocal eye contact in social development and its primacy in the emergence of autistic symptomatology, we foresee the application of similar gaze-contingent paradigms measuring this neural index of shared as critical for advancing efforts toward early detection of atypical social development.

111.196 196 Developmental Changes in Mu Suppression to Observed and Executed Actions in Autism Spectrum Disorders. L. M. Oberman*[1], J. McCleery[2], E. Hubbard[3], R. Bernier[4], J. R. Wiersema[5], R. Raymaekers[5] and J. A. Pineda[6], (1)*Beth Israel Deaconess Medical Center*, (2)*University of Birmingham*, (3)*Vanderbilt*, (4)*University of Washington*, (5)*Ghent University*, (6)*University of California, San Diego*

Background:

Disruptions in the mirror neuron system (MNS) have been suggested to play a key role in the core social deficits observed in autism spectrum disorders (ASD). However, recent empirical studies have conflicting results with some supporting a dysfunction in this system and others not. These discrepant findings may be accounted for by factors such as population heterogeneity, differences in age of the various samples, lack of power, particular stimuli used etc.

Objectives:

Given the discrepant findings in the literature and the importance both clinically and theoretically to understand factors mediating the functioning or dysfunction of the mirror neuron system in ASD, we conducted a direct exploration of the development of mu rhythm suppression with age in individuals with ASD in ages 6-17 by pooling data across four previously published studies (Oberman et al., 2005; Oberman et al., 2008; Pineda et al., 2008; and Raymaekers et al., 2009).

Methods:

Raw data were obtained with permission from the corresponding authors of four published datasets. All of the studies included in this analysis had almost identical methodology for data collection and analysis. Mu suppression, as indexed by the ratio of mu power over central electrodes (C3 and C4) during action observation or execution divided by mu power during baseline, was calculated for each individual participant. We calculated Pearson correlation coefficients in order to quantify the relationship between mu suppression and age across all subjects as well as for each group individually. Correlation coefficients were also directly compared between the two groups using the calculation for the test of the difference between two independent correlation coefficients (Preacher, 2002) in order to evaluate whether or not the relationship between age and mu suppression differed between the ASD and control groups.

Results:

We found a significant correlation between age and mu suppression in response to the observation of actions, both for individuals with ASD and typical individuals. This relationship was not seen during the execution of actions. Additionally, the strength of the correlation during the observation of actions did not significantly differ between groups.

Conclusions:

These results suggest that developmental changes to the systems underlying mu suppression in response to observation of actions are independent of diagnosis. Additionally, that mu suppression in response to executed actions does not change over the age range from 6 to 17. The results provide evidence against the argument that mirror neuron dysfunction improves with age in individuals with ASD and suggest, instead, that a diagnosis-independent developmental change may be at the root of the correlation of age and mu suppression during the observation of actions.

Neurophysiology Program
112 Neurophysiology II

112.197 197 Ambient Prism Lenses Modulate Spatial Attention in Autism: An Event-Related Potential Study. G. Sokhadze*[1], M. Kaplan[2], S. M. Edelson[3], E. M.

Sokhadze[1], A. S. El-Baz[1], B. A. Dombroski[1] and M. F. Casanova[1], (1)*University of Louisville*, (2)*Center for Visual Management*, (3)*Autism Research Institute*

Background: Autism is a developmental disorder marked by deficits in social interaction, communication, and behavior. One of the less studied deficits in autism is the dysfunction of the ambient visual system, which can affect attention, movement, and visuo-motor coordination. These deficits of the ambient vision may limit the ability to process information regarding gait, posture, movement, speech, and spatial attention.

Objectives: The proposed study aims to understand the abnormal neural and functional mechanisms underlying visual distortion in autism by incorporating neurophysiologic studies, behavioral studies, and qEEG/ERP measurements of spatial attention.

Methods: Individuals with ASD were recruited with the assistance of local autism treatment centers in Louisville. Pre-screening questionnaires were filled out by parents, while evaluation of visual abnormalities related to ambient vision deficits were conducted by Dr. Kaplan. Twenty subjects with autism screened and ambient correcting lenses were selected to match their visual deficits. The final sample consisted of 12 high-functioning ASD individuals (Mean age 13.9±3.0 years) who were able to tolerate EEG recording procedures for the ERP task. In this modified cued Posner spatial attention task, subjects were instructed to press a button to indicate which side of the screen the stimulus "X" appeared. Before the presentation of each stimulus, the subjects were shown a pre-cue (red square). The probability of correctly cued targets was 80%. The task consisted of 2 blocks lasting 10 minutes each, with a "horizontal" block (stimuli centered vertically), and a "diagonal" block (stimuli appeared in the corners). Each subject performed the task with ambient and placebo lenses which did not alter vision, and the order was counterbalanced. The ERP of interest included early (N100, P200) and late (N200, P300) components at frontal, centro-parietal, and occipital areas reflecting spatial attention processes.

Results: Reaction time in prism lenses condition tended to be faster than in placebo lenses condition. Accuracy of responses in lenses vs. placebo condition also showed lower percentage of errors (5.6% vs. 14.2%). Amplitude of the parieto-occipital N100 in horizontal congruent trial was significantly higher (-3.92 vs. -1.37 μV, F=7.79, p=0.012) in prism lens condition. Similar effect was significant for incongruent trials (0.21 μV in placebo vs. -3.33 μV in lenses condition, F1,23=6.40, p=0.021). Amplitude of the P3b during the more difficult diagonal incongruent condition was higher (4.65 vs. 2.05 μV, F=4.57 p=0.045) in ambient prism lenses condition, while latency of P3b was shorter (349.1 ms vs. 380.1 ms, F=7.72 p=0.012).

Conclusions: These ERP effects of wearing ambient prism lenses is indicative of more effective special attentional processing, especially in more complex diagonal incongruent trials. Our pilot study provides preliminary support to utility of wearing prism lenses to correct ambient vision in autism and sensitivity of ERP indices to detect spatial attention improvement. We have found that using prism lenses and comparing the autistic patients performance and ERPs with and without such lenses can be a very informative approach to understand the mechanisms of visual deficits and spatial orienting impairments typical for autism.

112.198 198 EEG Measures of Response to Attentional Network (ANT) Task in Autistic and Neurotypical Individuals. C. Chesnutt, M. Baker*, M. O'Boyle and D. Richman, *Texas Tech University*

Background:

The Attentional Networks Test (ANT) has been widely used to assess the functionality of different brain networks associated with attention (Posner, Fan). A number of studies on children with ADHD and related attention disorders have used the ANT in conjunction with functional MRI (fMRI) to determine differences in attentional network responses within the brain by observing patterns in the BOLD response. A previous study by Mutreja involved administering the ANT to autistic participants and age-matched controls, and showed that autistic children had less sensitivity in processing speed when responding to the incongruent stimuli than neurotypical children (Mutreja). The hypothesis in this research is that mildly autistic

individuals have a higher level of attentional focus and are less likely to be distracted by visual stimuli outside of the area where their visual attention is focused. This study addresses whether the cortical brain areas involved in this process are different or respond differently for autistic individuals.

Objectives:

The objectives of this research were: to determine the EEG power distribution patterns of autistic and neurotypical participants; to compare the power distribution for incongruent and congruent task presentation; and to determine whether there are features within the EEG power that can be used in pattern recognition algorithms for identification of mild to very mild autism.

Methods:

Participants were recruited between the ages of 13 and 18 who were either diagnosed with mild autism or Asperger's (in the case of diagnoses made prior to 2009), and were not verbally impaired. Individuals were diagnosed and/or screened either through the school system or a consulting psychologist. A 64-channel EGI system was used to acquire an EEG of participants while they were taking the ANT, under conditions of congruent, incongruent, and neutral stimuli in a screen room facility that isolated external visual and auditory stimuli. An in-house Matlab algorithm and EEGLAB were used for data processing.

Results:

The EEG power levels were determined for all electrode locations and averaged over the congruent and incongruent tasks (16 trials each) for both autistic subjects and controls. A non-corrected t-test was performed to determine whether there were any significant differences in EEG power levels between the two groups. For the congruent task, one feature was identified that passed the t-test: the EEG power in the alpha band in the right temporal-parietal region. For the incongruent task, seven features were identified that passed the t-test: EEG power in the left frontal-temporal region in the delta, theta, and gamma frequency ranges; in the right temporal region in the alpha, beta, and gamma frequency ranges; and in the left occipital region in the gamma frequency range.

Conclusions:

The results indicate that the brain responses as measured by EEG of autistic and neurotypical participants are similar when performing the ANT with a congruent presentation; while for the incongruent presentation, numerous areas were shown to be different. This result is consistent with the hypothesis that autistic individuals may be less distracted in the presence of incongruent flanker information than neurotypical individuals.

112.199 199 Reduced Transient and Steady-State Auditory Gamma-Band Activity in Children with Autism Spectrum Disorders and Their Unaffected Siblings. K. L. McFadden*[1], S. E. Steinmetz[1], A. S. Moiyadi[1], L. B. Wilson[1], E. Kronberg[1], S. Hepburn[2] and D. C. Rojas[1], (1)*University of Colorado Denver, Anschutz Medical Campus*, (2)*University of Colorado / JFK Partners*

Background: Current diagnoses of autism spectrum disorders (ASD) are based entirely on behavioral observation and caregiver interviews, so the discovery of physiological markers of ASD would provide objective markers of the condition, facilitating further research and treatment. Synchronous neural activity in the gamma range (30-80 Hz) has been shown to be abnormal in individuals with ASD and could be a potential biological marker of ASD. Reduced auditory evoked gamma-band activity and/or reduced gamma-band phase locking factor (PLF) have been found in both children and adults with ASD in response to pure and amplitude-modulated tones. This has also been found in unaffected parents of children with ASD, suggesting potential familiality of these abnormalities. This has not previously been investigated in unaffected siblings of children with ASD.

Objectives: The goal of the current study was to assess transient and steady-state auditory gamma-band responses in children with ASD and their unaffected siblings to determine if gamma-band abnormalities are familial. This would extend previous research finding gamma-band abnormalities in both individuals with ASD and their unaffected parents. If gamma-band abnormalities are familial, both children with ASD and

their unaffected siblings would be expected to exhibit these abnormalities.

Methods: Magnetoencephalography (MEG) recordings were obtained for a group of children with ASD (N=13), their unaffected siblings (N=16) and a group of healthy control children (N=18). Evoked gamma-band power and gamma-band PLF in response to 40 Hz amplitude-modulated sounds were measured for transient and steady-state responses.

Results: The ASD group demonstrated significantly reduced steady-state right hemisphere auditory evoked gamma-band power compared to the control group, $p < .05$ (cluster-wise correction for multiple comparisons). There was also a trend toward both the ASD and sibling groups showing reduced transient and steady-state auditory evoked gamma-band power in left hemisphere compared to the control group (uncorrected $p < .05$). In addition, both the ASD and sibling groups demonstrated a trend toward reduced PLF in both right and left auditory cortex compared to controls (uncorrected $p < .05$).

Conclusions: Children with ASD and their unaffected siblings both showed reduced evoked gamma-band responses and gamma-band PLF compared to controls, which is consistent with previous findings in individuals with ASD and their unaffected parents. These results suggest that the gamma-band abnormalities seen in those with ASD are familial, and that gamma-band activity is a potential biological marker of ASD.

112.200 200 Support Vector Machine (SVM) Analysis of Auditory Oddball Event-Related Potentials (ERP) Classifies Toddlers with and without Early Signs of Autism. A. E. Lane*[1], J. Eldridge[1], K. Harpster[2], S. J. Dennis[1], T. Shahin[1] and M. Belkin[1], (1)*The Ohio State University*, (2)*Cincinnati Children's Hospital Medical Center*

Background:

ERPs have been used to characterize sensory and cognitive function in autism (Jeste & Nelson, 2009; Marco et al, 2011). In particular, differences between children with and without autism have been noted in responses to auditory (speech) oddball paradigms. Recently, attempts have been made to identify biomarkers for autism risk via the sophisticated analysis of complexity in resting state electroencephalogram (EEG) signals of young children with and without risk factors for autism (Bosl et al, 2011). Preliminary findings suggest that the use of multiclass SVM of EEG data is a promising approach to the classification of infants with risk factors for neurodevelopmental disorders. We propose that application of similar analysis techniques on auditory oddball ERP data where known differences exist between autism and non-autism, should be more successful in classifying groups and isolating specific biomarkers.

Objectives:

The purpose of our study was to examine the utility of SVM analysis of auditory oddball ERP data in the classification of toddlers (12-24 months) with and without early signs of autism.

Methods:

Forty-six toddlers (mean age=17.9 months, SD=3.0, 28 males) participated in the study. ERPs were collected using an EGI GES 300 system utilizing a HydroCel 128 Channel Geodesic Sensory Net and Net Amps 300 amplifier. Toddlers completed an auditory oddball paradigm involving phonemes (dae and daa; stimulus duration = 340ms, ISI = 960ms). Stimuli were presented in 4 x blocks of 400 stimuli each lasting approximately 8.5 minutes. Data was processed in Net Station and included: (1) filtering (high-pass=0.1 Hz and low-pass=30Hz), (2) segmentation, (3) artifact detection, (4) bad channel replacement, (5) referencing and (6) baseline correction.

Participants were assessed as showing early signs or no early signs of autism using the Autism Detection in Early Childhood (ADEC; Young, 2007) screening tool. Toddlers scoring between 0-5 were identified as no early signs (N-ES) (n=24) and toddlers scoring a 6 and above were identified as showing early signs (ES) (n=22).

Results: ERP data from 20 ES toddlers and 18 N-ES toddlers was submitted for preliminary analysis to SVM with Gaussian and linear kernels for classification purposes. Feature vectors representative of each child were generated by averaging the

raw time series data from a single channel over all standard and deviant responses in a block. The performance of the classifier was analyzed using leave-one-out cross-validation.

Conclusions:

Preliminary results from our study indicate that SVM analysis of auditory oddball ERP data correctly classified three-quarters of our sample of toddlers with and without early signs of autism. Further analysis of the full dataset using data from multiple channels is expected to strengthen this result. Analysis techniques such as these may be key in isolating subtle differences in sensory and cognitive development associated with autism.

112.201 201 The High Frequency Brain Response to Illusory Contour in Boys with Autism: The Missing Processing Stage?. T. A. Stroganova*[1], E. V. Orekhova[2], M. M. Tsetlin[3] and A. A. Morozov[4], (1)*Moscow State University of Psychology and Education*, (2)*Sahlgrenska University Hospital*, (3)*MEG Center, Moscow State University of Psychology and Education*, (4)*Institute of Radio-Engineering and Electronics*

Background: The atypical visual perception is frequently reported in children with autism Spectrum Disorder (ASD) and has been hypothetically related to the decreased integration of perceptual information (Frith, 1989) or to over-functioning of the lower-order visual areas (Mottron, 2006). We used the high-frequency brain oscillatory response during illusory contour perception as a model for studying the neural dynamic underlying automatic contextual integration of local image feature.

Objectives: This study was designed to determine whether the illusory contour (IC) processing could be reflected in phase-locked gamma and beta band oscillations in typically developing boys (TDB), and whether visual processing abnormalities in boys with ASD would appear in their abnormal gamma band responses to illusory Kanisza figure.

Methods: EEG data were obtained in 23 ASD boys aged 4-7 years and 23 age-matched TDB. The stimuli consists of four symmetrical black inducer discs that were arrange in such a way as to either produce a Kanizsa square illusion (Illusory Contour: 134 trials) or not (Control stimulus: 134 trials). To maintain children's attention on the computer screen the test stimuli were interspersed with the short animation movies. The stimulus duration was 500 ms and inter-stimulus interval varied between 500 ms and 1000 ms. To quantify the power of gamma and beta bands evoked response to the stimulus onset, the complex wavelet transformed data for the respective frequency bands from each single trial were averaged. From this complex average the square modules were taken as a measure of the power of the phase-locked (PL) response. Normalized time courses of PL gamma and beta band responses were analyzed.

Results: We found phase-locked beta and gamma-band activity to be a very strong component of brain response to illusory contour as compared to non-illusory stimulus in both autism and control children. The high-frequency response to IC was, however, qualitatively different in TDB and ASD. In TDB the IC effect has been observed during two time windows of stimulus processing (40-120 and 120-270 ms). As compared to the control stimulus the IC evoked higher gamma band response in the later time window (120-270 ms, *direct IC effect),* but lower gamma response in the earlier window (40-120 ms, *inverted IC effect).* The ASD demonstrated abnormally protracted inverted IC effect, but were lacking the later direct IC effect.

Conclusions: Our results demonstrate that illusory contour response does present in PL gamma oscillation in healthy children and contains two different phases. The earlier phase of inverted IC effect, in the context of literature (Ramsden et al, 2001), may be regarded as a correlate of sensory coding of stimulus features and signaling of illusory lines presence in the contour . The second phase of direct IC effect is most probably associated with perceptual grouping processes related to excitatory feed-back signal from higher-order visual areas subserving shape discrimination (Lamme and Roelfsma, 2000). Children with autism may rely more heavily on the lower-order processing in the primary visual area and are lacking the later stage related to higher-order contour integration process.

112.202 202 Genotype Phenotype Interactions of Epilepsy in Children and Adolescents with Autism Spectrum

Disorders. M. Byrd[1], O. J. Veatch[2], J. Paolicchi[3], J. L. Haines[4] and G. Barnes*[1], (1)*Vanderbilt*, (2)*Center for Human Genetics, Vanderbilt University*, (3)*Vanderbilt University Medical Center*, (4)*Vanderbilt University*

Background: Five to 30% of children with ASD develop epilepsy by twenty years of age. Children with autism and epilepsy have an increased risk of morbidity and mortality. Despite the enormous strides in understanding the molecular pathogenesis of ASD, little is known of the common molecular mechanisms between autism and epilepsy. Genotype phenotype studies of epilepsy and autism would add to the knowledge base regarding the overlap of genomic mechanisms and clinical phenotypes common to these two childhood neurological disorders.

Objectives: This report describes proposed clinical and genotype parameters to aid in identification and evaluation of distinct subgroups of children (250) with Autism Spectrum Disorders (ASD) and epilepsy.

Methods: Systematic comparisons across 12 subgroups divided by genotype and age of first words were performed to identify clinical differences across the spectrum of children with ASD alone versus those with ASD and epilepsy.

Results: Brain growth (head circumference) in ASD and epilepsy may differ significantly from children and adolescents of similar age with ASD alone. Clustering of genomic microarray data by age of first words revealed differences among subgroups in sensory issues, reciprocal social communication, and repetitive behaviors. Putative protein protein interactions networks revealed unique networks involving BMP signaling pathway, acetylcholine synthesis/neurosecretion, and microtubule interactions with the cytoskeleton in ASD/Epilepsy group

Conclusions:

The current data supports the hypothesis that the molecular pathogenesis of ASD and epilepsy is distinct among ASD populations.

112.203 203 Autonomic Responses to Social and Non-Social Reward Among Children with Autism. E. E. Neuhaus*[1], T. P. Beauchaine[2] and R. Bernier[1], (1)*University of Washington*, (2)*Washington State University*

Background: Pervasive social impairments among those with autism spectrum disorders (ASDs) are often construed as stemming from reduced sensitivity to stimuli that are social in nature. Behaviorally, reduced attention to social stimuli (e.g., faces, voices) is among the earliest predictors of a later ASD diagnosis. A corresponding reduction in sensitivity to social stimuli is apparent at the neurobiological level. Individuals with ASDs fail to display selective sensitivity to social stimuli, although the familiarity of stimuli may moderate such effects. Dawson and colleagues (e.g., Dawson et al., 2005) argue that reduced sensitivity to social stimuli results from disrupted reward processing, reflected in behavioral and neurological impairments. However, the effects of reward on physiological functioning in ASD have not previously been tested.

Objectives: We explored the effects of social and monetary reward on autonomic responding among 8- to 12-year-old boys with and without ASDs. Following from the neuroimaging literature, both unfamiliar and familiar social reward conditions were included to explore the potential moderating effect of familiarity. We also examined links between physiological response to reward and social functioning, both parent-reported and observed.

Methods: Participants included 36 boys between the ages of 8 and 12 years. Eighteen children met ADOS, ADI, and clinical criteria for ASD and eighteen were typically-developing children with no history of developmental concerns. Physiological responding was assessed with (1) cardiac pre-ejection period (PEP), a measure of sympathetic cardiac influence that has been linked with reward sensitivity in typically-developing samples; and (2) cardiac respiratory sinus arrhythmia (RSA), a measure of parasympathetic cardiac influence that has been linked with social functioning. Autonomic responding was assessed while participants completed a simple matching task under three conditions of reward (monetary, unfamiliar social, and familiar social) and completed a social interaction task with unfamiliar and familiar partners.

Results: Behaviorally, participants with and without ASDs had slower responses to the task under social versus monetary reward conditions. Participants with ASDs were less accurate than controls in their responses to the task. Autonomically, there were no effects of group or reward type on RSA or PEP reactivity, nor did participants with ASDs differ from controls on baseline PEP values. However, participants with ASDs displayed lower baseline RSA values relative to controls, consistent with hypotheses. Furthermore, baseline RSA was correlated with parent-reported social behavior but not with observational measures of social functioning.

Conclusions: Our findings provide support for parasympathetic deficits among children with ASDs, but not for sympathetic deficits related to reward responding. According to polyvagal theory (e.g., Porges, 2004), parasympathetic deficits suggest reduced flexibility in adapting to changing social demands and argue for further exploration of relations between parasympathetic function and social behavior among individuals with ASDs. With regard to intervention, our findings suggest the need to integrate relationship-based and reinforcement-based strategies in intervention, and to explore the predictive or moderating effects of parasympathetic functioning on treatment outcome.

112.204 204 Regulation of Heart Rate in Adolescence: Relations to Social Anxiety and Intervention Effects. K. Schohl*, B. Dolan, J. S. Karst, A. Meyer, S. Stevens, N. Fritz, C. Gasaway, S. Brockman, G. McDonald, R. Remmel and A. V. Van Hecke, *Marquette University*

Background: Teens with ASD report significantly more social anxiety symptoms than their typically developing peers (Sebastian, Blakemore, & Charman, 2009), which in turn negatively affects their social skills. According to Bellini's (2006) developmental pathway to social anxiety, individuals with AS/HFA present with a temperament that is marked by a high degree of physiological arousal. Level of physiological arousal and its inverse, regulation of the heart via the vagus nerve, can be measured utilizing respiratory sinus arrhythmia (RSA). It has been found that children with ASD have significantly lower levels of RSA than typically developing children (Bal et al., 2010; Ming et al., 2005; Vaughan Van Hecke et al., 2009). Thus, diminished RSA may serve as a foundation from which anxiety stems in social interchange. While there are a handful of studies that have looked at RSA in children with ASD, there is a paucity of studies evaluating regulation of heart rate in adolescents with AS/HFA, as well as the effect that intervention may have on the plasticity of RSA and social anxiety.

Objectives: The objectives of this study were to examine changes in social anxiety as well as regulation of the heart via RSA in teens with AS/HFA who underwent social skills intervention.

Methods: Thirteen adolescents (N = 13) between the ages of 11 to 15 years with ASD participated in the study. The current study conducted a social skills intervention, namely the Program for the Enrichment and Education of Relational Skills (PEERS). PEERS focuses on improving friendship quality and social skills among teens, ages 11-15 years, with higher-functioning ASD (Laugeson et al., 2009). Participants were randomly assigned to one of two conditions, either the Experimental Treatment Group or the Waitlist Control Group. Pre-intervention and post-intervention measures included: (1) usage of a Biopac ambulatory heart rate monitor (Biopac Systems, Inc.: Goleta, CA.), in order to collect teens' baseline heart rate; heart rate data was edited and RSA was computed with the CardioEdit and CardioBatch programs (Porges, Chicago, IL); and (2) the *Social Anxiety Scale-Adolescent* (SAS-A; La Greca & Lopez, 1998), which is a self-report measure that was given to teens.

Results: Preliminary results include available data from the experimental treatment group; ongoing analyses will include additional participants and the waitlist group. Teens' social anxiety significantly decreased from pre- to post-intervention, t (12) = 3.38, p = .005. It was also found that positive change in RSA over the course of the PEERS intervention was marginally associated with less social anxiety at post-intervention, r = -.51, p = .11.

Conclusions: Our results suggest that social anxiety may decrease due to intervention. Initial results suggest that increases in RSA at post-intervention may predict less social anxiety in adolescents with AS/HFA. This finding will be examined further by comparing additional participants in the

experimental treatment group to the waitlist control group. This study has the potential to add to the literature regarding intervention effects on plasticity of social anxiety and regulation of heart rate in teens with ASD.

112.205 205 Emotional Conflict Adaptation in Autism. S. E. White*, W. Ernst, W. A. Worsham and M. South, *Brigham Young University*

Background: Poor performance and error monitoring in individuals with autism spectrum disorders (ASD) may be associated with the repetitive/restricted behaviors characteristic of the disorder (Thakkar et al., 2008; Larson et al., 2011). Difficulties in emotional processing, compounded with poor behavior monitoring, could negatively affect social interactions. Conflict adaptation refers to the adjustment of cognitive resources based on previous-trial conflict. We adapted an emotional conflict adaptation paradigm used in healthy and generalized anxiety adults (Etkin et al., 2010), to study older children and adolescents diagnosed with ASD, with the goal of better understanding the neural processes of conflict adaptation in an emotional context. To our knowledge, this is the first electrophysiological emotional conflict adaptation study in ASD.

Objectives: We sought to elucidate the behavioral and neural mechanisms involved in emotional conflict adaptation within a cohort of ASD and matched control adolescents.

Methods: Participants (ASD *n*=22; TYP *n*=19) matched on age (*M*=14.6) and IQ (*M*=107.9) viewed a series of pictures expressing either happy or fearful emotions. Each picture had either the word "happy" or "fear" overlaid across the face. Expressions and words were combined to create either congruent (e.g., happy expression with "happy") or incongruent (e.g., happy expression with "fear") trials. Three blocks of 149 trials each were viewed, with pictures appearing for 1250 ms and a fixation screen appearing after each picture (mean duration =1200 ms). Participants indicated via button press whether the facial expression was fearful or happy. We mapped out conflict adaptation based on response to previous and current trials (cC=congruent trial preceded by congruent trial, iC=congruent trial preceded by incongruent trial, iI=incongruent trial preceded by incongruent trial, cI=incongruent trial preceded by congruent trial). EEG data was collected using a 128-electrode geodesic sensor net and EGI amplifier system.

Results: For reaction time (RT), there was an expected main effect of current condition type ($p<.001$), with incongruent trials having significantly slower RTs than congruent trials. There was also a significant previous x current trial congruency interaction ($p<.01$), with cC trials having the fastest RT, followed by iC, iI, and cI trials. There was no significant previous trial x current trial x diagnosis interaction. This same pattern was seen for accuracy rates, with significantly lower accuracy rates for incongruent trials ($p<.001$); previous x current trial congruency interactions ($p<.001$) also showed the greatest accuracy for cC, followed by iC, iI, and cI trials. Surprisingly, the N200 ERP waveform showed no significant main effects or interactions. In contrast, the conflict-SP waveform showed a significant main effect for current condition ($p=.006$), with incongruent trials having a greater mean amplitude than congruent trials; and no significant interactions of diagnostic group.

Conclusions: Our behavioral results are similar to our previous study of non-emotion conflict adaptation (Larson et al., in press); however our previous findings of reduced ERP amplitude was not replicated, as both groups showed intact conflict-SP response. We are further investigating the use of the N2 wave for this task in older samples, and recommend further research on conflict adaptation in ASD.

112.206 206 The Long and Short of It: Serotonin Transporter Allele Variants and Emotion Processing in Adults with Autism Spectrum Disorders. S. Faja*[1], S. J. Webb[1], E. M. Wijsman[1], E. H. Aylward[2] and G. Dawson[3], (1)*University of Washington*, (2)*Seattle Children's Research Institute*, (3)*Autism Speaks, UNC Chapel Hill*

Background: The serotonin transporter linked polymorphic region (5-HTTLPR) has 2 common variants: the short allele (S) and long allele (L). Previous work has demonstrated differences in neural and behavioral responses of individuals with at least one S allele to faces with negative emotions including greater activation of the fusiform gryus for fearful faces and faster responses to angry faces. Prior work has also

reported reduced amplitudes in electrophysiological responses to angry faces in comparison to happy and neutral faces among carriers of the S allele.

Objectives: To test the relation between the pattern of electrophysiological neural response to emotional faces in individuals with ASD and neurotypical development based on the 5-HTTLPR allele profile.

Methods: Subjects were 24 adults with ASD, 16 of whom had at least one S allele; and 21 adults with typical development, 17 of whom had at least one S allele. All participants were Caucasian and had Full Scale IQs in the average or above average range. ASD diagnosis was confirmed with the ADOS, ADI-R and DSM-IV-TR. Electrophysiological responses were continuously recorded with high-density EEG as participants viewed static images of faces with fearful, happy, or neutral expressions. The P100, N170, N250 and N400 components were examined in electrodes over the lateral posterior region in the right and left hemisphere.

Results: Similar to previous reports with typically developing individuals, among participants with ASD, there was a significant interaction between allele length (S vs. L) and facial expression for the amplitude of the P100, $F(2,44) = 4.3$, $p = .03$. This interaction was not observed for later components. Given that individuals with the S allele may be more sensitive to stimuli conveying negative emotions, the S carriers in the ASD and TD group were also compared. There were no differences in the pattern of neural responses of S allele carriers with ASD (n=16) versus those with typical development (n=17) across the 4 components examined, though there were main effects of facial emotion. Finally, with S and L carriers combined, comparison of the ASD versus TD groups revealed no diagnostic group by emotion interactions or main effects of group for the 4 components.

Conclusions: These initial findings suggest that serotonin transporter linked polymorphic region (5-HTTLPR) allele length may be a useful way to better understand the individual performance of individuals on the autism spectrum, particularly in early visual attention to emotional information. The use of genetic information may provide meaningful ways to parse the heterogeneity of symptoms.

112.207 207 Dissociation in Autism Between Reading Gaze Direction Versus Mental States From the Eyes. C. Ashwin*[1], A. J. Calder[2] and S. Baron-Cohen[1], (1)*University of Cambridge*, (2)*MRC Cognition and Brain Sciences Unit*

Background: Autism Spectrum Conditions (ASC) are characterized by social and communication difficulties. These include abnormalities in gaze perception and in theory of mind (ToM), including reading other's mental states from their eyes. There have been mixed findings in various tasks of gaze processing to date, with some showing intact ability in ASC and others showing deficits. They may be utilizing strengths in perceptual processing to understand some information from the eyes, however other information from the eyes requires higher-level metarepresentation that is deficient in ASC.

Objectives: To investigate for a dissociation between reading perceptual information about gaze direction versus mental state information from the eyes of others, in adults with and without ASC. Predictions: People with ASC would show deficits in reading mental states from the eyes, but the mechanisms for coding the gaze direction of others would be intact.

Methods: We tested 19 males with ASC, and 19 typical male controls matched for age, handedness, and IQ on two different tests requiring the processing of information from the eyes of others. Reading perceptual states from the eyes was tested using a paradigm where participants performed a baseline gaze perception task, then repeated the task after viewing extreme gaze directed 30 degrees to the left and then to the right. This task typically produces 'gaze adaptation' effects: individuals report that gaze involving small deviations from centre, and that is in the same direction as the extreme gaze, as being centre gaze. In contrast, small deviations of gaze in the opposite direction to the extreme examples are viewed accurately. Reading mental states from the eyes was tested using the 'Reading the Mind in the Eyes' Test, where people determine the mental and emotional states of others using information from the eyes.

Results: Both the control and ASC groups showed the typical gaze adaptation effects, for both the left and right directions.

However, the ASC group showed deficits in reading the mind from the eyes compared to the control group.

Conclusions: These results show a dissociation in ASC involving intact reading of perceptual states about the gaze direction of other's alongside deficits in reading mental states from the eyes. This suggests the neural mechanism coding for the gaze directions of others is intact in ASC. However, information from the eyes is not utilized successfully for higher-level abilities such as mental state attribution, which rely on different mechanisms than computing eye gaze direction.

112.208 208 Impaired Classical Conditioning in Persons with Autism Spectrum Disorder. P. S. Powell*[1], M. E. Crisler[1], L. G. Klinger[2], B. G. Travers[3] and M. R. Klinger[1], (1)*University of Alabama*, (2)*TEACCH, University of North Carolina School of Medicine*, (3)*University of Wisconsin-Madison*

Background:

Research has indicated that individuals with autism spectrum disorder (ASD) have difficulty with implicit or automatic learning. The present study utilized a classical fear conditioning paradigm to examine implicit associative learning (i.e., classical conditioning) in individuals with ASD. Previous studies examining associative learning in ASD have found both intact (Bernier et al., 2004) and impaired learning (Gaigg & Bowler, 2007). However, both studies examined associative learning across modalities; pairing a visual conditioned stimulus (CS) with an auditory unconditioned stimulus (UCS). To date, no study has examined associative learning both across modalities (visual CS with auditory UCS) and within a modality (auditory CS with auditory UCS).

Objectives:

The primary objective of this study was to assess individuals with ASD associative learning across and within modalities. We predicted that if individuals demonstrated impaired learning across modalities, but intact learning within a modality, this would be consistent with functional connectivity theories of ASD. However, if individuals with ASD demonstrated impaired learning both across and within modalities, this would suggest more general associative learning impairments.

Methods:

Fifteen high-functioning young adults diagnosed with ASD and 16 age- and IQ-matched individuals with typical development were presented with both a visual color (CS visual) and an instrument sound (CS auditory) paired with an aversive sound (UCS). Three neutral visual stimuli and three neutral auditory stimuli were also presented. Participants' skin conductance responses (SCRs) were recorded. After 40 trials in which the CS and UCS were paired, we examined whether participants showed elevated SCRs when the UCS (aversive sound) did not follow he CS. This elevation in SCRs provided evidence of learning. Following the conditioning task, an explicit memory test examined awareness of the learning contingences.

Results:

Individuals with typical development displayed greater learning than individuals with ASD across both the visual and auditory conditions, $F(1,29)=7.90$, $p <. 01$. Participants with typical development demonstrated a large learning effect, $F(1,15)=32.13$, $p < .01$, $\eta_p^2=.682$, whereas participants with ASD did not show significant learning, $F(1,14)=2.31$, $p =.15$, $\eta_p^2=.142$. These results suggest individuals with ASD have a general impairment in associative learning. Additionally, a significant interaction between pairing and explicit memory, $F(1,13)=8.13$, $p=.01$,was found for individuals with ASD, but not individuals with typical development suggesting that only those individuals with ASD who explicitly learned the contingencies showed reliable associative learning.

Conclusions:

Results demonstrated impaired learning across both visual and auditory modalities, suggesting that individuals with ASD may have a general impairment in associative learning. Additionally, we found that greater explicit awareness was related to greater associative learning among individuals with ASD. These findings are consistent with the claim that individuals with ASD have impairments in implicit, associative learning and may compensate for these impairments by employing explicit learning strategies. Given the importance

of learning by automatic associations and its ubiquitous role in early learning, our findings provide important evidence for basic learning impairments in autism and the importance for targeting associative learning in early intervention strategies.

112.209 209 Neural Mechanisms of Social and Non-Social Reward and Their Relation to Autistic Traits. A. Cox*, A. Naples, H. Rutherford, M. Coffman, C. E. Mukerji, L. Mayes and J. McPartland, *Yale Child Study Center*

Background: Social and non-social rewards are regarded as important modulators of behaviour. Recent models of autism have highlighted attenuated behavioural responsiveness to social incentives (such as pictures of smiling faces), with social motivation deficit theories suggesting that those with autism do not properly anticipate and appreciate the pleasure of social stimuli. Functional neuroimaging has also highlighted reduced neural responsiveness to social reward in ASD in regions associated with reward processing, which taken together may partially explain the reduced social motivation commonly seen in autism. However, only one study has examined the temporal correlates of social and non-social reward processing in ASD. In an ERP study, Kohls and colleagues (2011) found that compared to typically developing individuals, those with ASD displayed reduced P3 amplitude to reward versus non-reward irrespective of social or non-social reward type, suggesting a general reward processing deficit in autism. Because the P3 component is thought to reflect motivated attention to reward signals, a lower P3 amplitude to reward cues in autism may therefore reflect reduced motivated attention.

Objectives: The current study followed-up this work by investigating the differential effects of social and non-social reward on goal-directed behaviour in young adults using Event-Related Potentials (ERPs), examining modulation of reward sensitivity by level of autistic traits. A specific goal of the study was to improve upon previous operationalisations of social and non-social reward by incorporating more ecologically-valid reward stimuli.

Methods: 40 typically developing young adults were pre-screened with the Autism Spectrum Quotient and Broad Autism Phenotype Questionnaire for high (N=20) or low (N=20) levels of autistic traits. Event-related potentials were recorded with a 128 channel HydroCel Geodesic Sensor Net while subjects performed a cued incentive go/no-go task during simulated observation by a peer. Three identical blocks were administered (with performance indicated by on-screen dots) across three reward conditions: 1) Social reward, positive feedback on performance by the observer (simulated with pre-recorded video); 2) Non-social reward, receipt of candy (also displayed on video); 3) No reward, a video of mosaic pictures. ERPs were time locked to in-task performance cues, and P3 amplitude and latency were extracted across centroparietal leads.

Results: Analyses in progress contrast P3 amplitude and latency using mixed measures ANOVAs with within-subjects factors of reward type (social/non-social/no-reward) and hemisphere (left/right), and a between-subjects factor of autistic traits (high/low). We predict a better performance and larger P3 amplitude for reward trials than no-reward trials, and that compared to those with low autistic traits, those with high levels will display reduced P3 amplitude to reward vs. no-reward, with the largest effect seen for social reward.

Conclusions: Results will shed light on the temporal dynamics of social and non-social reward processing and their relation to autistic traits. The experimental paradigm represents a significant innovation in the study of social and non-social reward, offering a valuable tool currently being applied to individuals with clinical levels of autistic traits. Insight into vulnerabilities in reward processing is critical for understanding social function in ASD as well as interpreting co-morbidities with psychiatric disorders.

112.210 210 Repetitive Transcranial Magnetic Stimulation (rTMS) Modulates Event-Related Potential Indices of Attention in Autism. M. F. Casanova*, J. M. Baruth, L. L. Sears, A. S. El-Baz and E. M. Sokhadze, *University of Louisville*

Background:

Individuals with autism spectrum disorder (ASD) have previously been shown to have significantly augmented and prolonged event-related potential (ERP) responses to irrelevant, visual stimuli compared to controls at both early (e.g., P100) and later stages (e.g., N200, P300) of visual cue

processing and evidence of an overall lack of stimulus discrimination. Abnormally large and indiscriminative cortical responses to sensory stimuli may reflect cortical inhibitory deficits and a disruption in the ratio between cortical excitation and inhibition, resulting in a higher noise and difficulties in filtering out distracter stimuli. Low-frequency (≤1HZ) repetitive transcranial magnetic stimulation (rTMS) has been shown to increase inhibition of stimulated cortex by the activation of inhibitory circuits.

Objectives:

It was our hypothesis that after 12 sessions of low-frequency rTMS applied bilaterally to the dorsolateral prefrontal cortices (DLPFC) in individuals with ASD there would be a significant improvement in ERP indices of selective attention evoked at later (i.e., 300-600 ms) stages of attentional processing as well as an improvement in reaction time and response error rate.

Methods:

We assessed 25 participants with ASD in a visual three-stimuli oddball task using illusory figures before and after 12 sessions of rTMS using a controlled design (25 patients with ASD in active TMS, 20 patients in wait-list group). Participants with ASD (age range 9 to 19 years) were recruited through the Weisskopf Child Evaluation Center (WCEC). Diagnosis was made according to the DSM-IV and further ascertained with the ADI-R. Electroencephalographic (EEG) data were acquired with a 128 channel EGI system. Stimulation in TMS group was done at 1Hz, 90% of motor threshold, weekly with 150 pulses/day.

Results:

Reaction time to targets was not significantly different between groups, however, there was a significant reduction in total error rate as a result of rTMS (t=2.51, p=0.02). This was mainly due to a reduction in omission errors (t= 2.26, p=0.034). We found a significant improvement in both N200 and P300 ERP indices of selective attention as a result of rTMS. A *Stimulus* X *Treatment* interaction reached significance (F=3.42, p=0.037) across both hemispheres indicating a significantly more negative N200 amplitude to target stimuli with significantly less negative amplitudes to non-target stimuli as a result of rTMS. One-way ANOVA analysis revealed a significantly reduced P3b latency to non-target stimuli over the left hemisphere as a result of rTMS (F=4.99, p=0.03). We also found significant reductions in both repetitive behavior and irritability according to clinical and behavioral questionnaires as a result of rTMS.

Conclusions:

This investigation showed that treatment with rTMS significantly improved both N200 and P300 ERP indices of selective attention, reduced response errors to target stimuli, and reduced repetitive behaviors and irritability. We conclude that treatment with low-frequency rTMS significantly improved selective attention and executive functioning in individuals with ASD. Neuromodulation with rTMS should be considered a promising treatment modality targeting some of the core symptoms of ASD.

112.211 211 Functional Rehabilitation of Social Communication in Young Children with Autism: Clinical and Neurobiological Correlates. E. Meaux*, R. Blanc, J. Malvy, C. Barthelemy, J. Martineau and M. Batty, *INSERM U930*

Background:

Based on the neurodevelopemental theory of autism, the exchange and development therapy (EDT) is applied in very young children, when the neural plasticity is greater. The EDT consists in the early and harmonious re-education of the basic neurophysiologic functions; the development of which leads to the development of more complex functions. Previous studies have confirmed the efficiency of the EDT, showing a decrease of the inappropriate behaviours and an increase in cognitive and social abilities. However, the cerebral correlates that underlie these improvements have never been studied.

Objectives:

The aim of the current study was to investigate the evolution of two neurophysiological markers (ocular exploration, electrophysiological responses to face) before and after the EDT and to test whether these are related to clinical improvements.

Methods:

Six children with a diagnosis of autism (ASD) according to the DSM-IV criteria and assessed with ADOS and/or ADI (mean age = 4 years 10 months) were involved in an EDT during two years. Clinical and neurophysiological evaluations were assessed three times during the follow up: before the beginning T0, one year after T1 and two years after T2. Socio-emotional abilities and autistic behaviours were measured using SCEB (Social Cognitive Evaluation Battery; Adrien,2007) and BSE-R (Behavioural Summarized Evaluation scale revised; Barthélémy et al., 1997). Using an eye-tracking method, the visual exploration of face was investigated and visual ERPs (P1, N170) were recorded during an implicit emotional task. A group of typically developing children (TD) matched by chronological age also participated to the eye-tracking and ERPs recordings.

Results:

ASDs displayed strongly abnormal pattern of face exploration (children with ASDs looked less at the eye region compared to TD children) and visual ERPs in response to face (P1 and N170 were delayed and smaller in ASD) confirming that these processes, involved in social adaptation, were affected in our sample at T0. Moreover one year after the beginning of the therapy, improvements are observed in both socio emotional and cognitive area especially in affective relation. During this first year of therapy, the time spent on the eyes increased, suggesting a normalization of the ocular strategy used to explore faces. However, the electrophysiological indices appeared to be affected by the EDT only during the second year. The amplitude of P1 and N170 increased and the topographical analysis revealed a normalization of the N170.

Conclusions:

Both clinical and neurophysiological markers appeared to be affected by the EDT. Although these data are only preliminary, they are very encouraging and suggest an effect of therapy on brain development in agreement with the principles of the EDT.

112.212 212 Low Iron Status and Sleep Disturbance in Children with Autism. R. Lane*[1], A. W. Buckley[2], B. Felt[1], C. Farmer[2], A. Thurm[2] and S. Swedo[2],

(1)*University of Michigan Medical School*, (2)*National Institute of Mental Health*

Background: Providing a well-balanced diet to children with autism can be difficult due to frequently reported restricted eating habits. Many children, and particularly those with autism, do not meet the recommendations for daily iron intake, putting them at risk for iron deficiency (ID) (Herndon, 2009). ID has been linked to sleep disorders such as restless leg syndrome (RLS) and periodic limb movement (PLM) disorder in both children and adults (Gozal, 2009). Children with autism also exhibit higher rates of sleep problems such as bedtime resistance and disrupted sleep patterns (Stores and Wiggs, 2003).

Objectives: The purpose of this study was to assess ID in children with autism, and to determine if lower iron status is correlated with more sleep problems in children with autism, developmental delays or typical development.

Methods: 75 children (54 with autism (AUT), 10 typically developing (TD), 11 with non-autism developmental delay (DD) (mean age=4.5y and mean BMI=16.3), underwent both an overnight electroencephalogram (EEG) recording with electro-oculogram, electrocardiogram, and surface chin and anterior tibialis EMG, and blood sample collection for complete iron studies. A caregiver completed a Children's Sleep Habits Questionnaire (CSHQ) at the time of the overnight study. Blood samples taken within ±3 months of the EEG were frozen and later analyzed for serum ferritin and total iron binding capacity (serum iron, transferrin and %transferrin saturation). A ferritin level below the mean for the study population (<20 ng/ml) or the presence of two or more other low iron indices classified a participant as having "low iron" within the context of this study.

Results: Serum ferritin average over all groups was 20.5 ng/ml ±10.1; there were no significant group differences for any iron measures. There were no significant group or iron status differences for CSHQ subscales - bedtime resistance or sleep disordered breathing. Fifty one percent of AUT parents reported too little sleep on the CSHQ, compared to 21% of TD and DD parents ($p<0.05$). Parent perceptions were supported by the EEG data; the AUT group had significantly less total

sleep time (456±99 min) than either TD (529±56 min) or DD (545±54 min) groups ($p<0.01$). Overall, serum ferritin was positively correlated with sleep restlessness on the CSHQ (0.277, $p<0.05$) and within the AUT group this relationship was sustained at a trend level ($p<0.07$). Using a categorical approach overall, there was a trend for those with low iron status to have a higher PLM index ($p<0.12$) but no within-group differences.

Conclusions: In our sample, the iron status of AUT children was similar to TD and DD children; all had serum ferritin levels in the low normal range. An overall low level and narrow range of iron status values across groups may have limited our ability to detect true group differences in iron status or the relationship to other sleep indices. The relationship of iron status to sleep disorders such as RLS and PLMD deserves further study to determine if this interaction may be different in children with autism.

112.213 213 Sources of Variable Functionality of the Execution/Observation Matching System in ASD. R. Bernier*[1], B. Aaronson[1] and J. McPartland[2], (1)*University of Washington*, (2)*Yale Child Study Center*

Background:

Attenuation of the EEG mu rhythm is reliably observed at central scalp electrodes during both the execution and observation of human motion, reflecting activity in an execution/observation matching system. Disruptions to this mechanism are hypothesized to contribute to social deficits in autism. Discrepant findings have been reported, with some studies reporting atypical activation within the mu range in autism and others demonstrating intact activation. Phenotypic and developmental variability in samples of individuals with ASD studied in this work has been posited to account for these heterogeneous results.

Objectives:

To (a) improve upon prior research by examining activity in the execution/observation matching system in a sample of well characterized children with ASD within a constrained age range and to (b) systematically examine the influence of additional phenotypic characteristics that may contribute to variability in mu attenuation.

Methods:

46 children (23 ASD, 23 TYP) between 5 and 9 years of age observed and executed simple grasping actions while continuous EEG was recorded with a high density EGI sensor net. All ASD children met ADOS, ADI, and clinical criteria. The TYP group consisted of age and gender matched typically developing children without a family history of ASD. EEG mu rhythm was characterized in two ways: 1) Ratio of power during observe and execute conditions over resting baseline in 8-13 Hz band from centrally located electrodes (Bernier et al, 2007); 2) Ratio of power in a 2 Hz band identified as the peak difference between execute and resting baseline for each participant (Muthukumaraswamy et al, 2004). Groups were compared with separate ANOVAs for each mu calculation method, and, within the ASD group, regression analysis was applied to examine relations between phenotypic characteristics (IQ, ADOS scores, and ADI scores) and mu rhythm attenuation. Finally, children failing to demonstrate mu rhythm attenuation were compared to those who did using the above variables.

Results:

The ASD group showed reduced attenuation of the EEG mu rhythm during observation but not execution relative to the TYP group ($p<.05$) in terms of individualized mu rhythm frequencies but not the gross 8-13 Hz band approach. Both parent report (ADI, $p<.05$) and clinician rating (ADOS, $p<.01$) of increased repetitive behaviors predicted decreased mu rhythm attenuation, but IQ, social, and communication domain scores on the ADOS and ADI were unrelated. Attenuation was observed in all TYP children; however a portion of the ASD group (N=5) showed a complete absence of attenuation.

Conclusions:

Independent measures of repetitive behaviors, based on both parent report and clinical observation, were predictive of activation in the execution/observation matching system in children with ASD. Furthermore, while, in general, children with ASD showed relatively decreased activity in this system, a

subset of children with ASD exhibited absolute absence of activity, a pattern not observed in TYP children. Findings offer insight into the heterogeneous results observed in prior work and clarify the importance of evaluating neural phenotypes in the context of well-characterized behavioral phenotypes.

112.214 214 ERP Response to Affective Pictures in Children and Adolescents with Autism Spectrum Disorders. W. A. Worsham*, M. South, P. E. Clayson and M. J. Larson, *Brigham Young University*

Background: Previous research demonstrates that children with autism spectrum disorders (ASD) are typically unresponsive to socio-affective cues such as facial expressions, tone of voice, and emotional subtleties (Grèzes et al., 2009). The neural bases of these deficits remain poorly understood but can be explored utilizing electroencephalogram (EEG) and event-related potentials (ERP) to affective stimuli. The late positive potential (LPP) is an ERP component that reflects facilitated attention directed at emotionally relevant stimuli and has a greater magnitude when individuals view emotionally salient information compared to neutral stimuli (Foti & Hajcak, 2008). The P300 reflects a change in context and motivated attention toward emotionally relevant information (Hajcak, MacNamara & Olvet, 2010). Although children with ASD display impaired social and emotional reciprocity (Bal et al., 2010) the neural correlates of affect recognition have not been thoroughly examined.

Objectives: We investigated the hypothesis that children with ASD will display decreased neural activity relative to typically-developing children when viewing unpleasant affective pictures relative to pleasant or neutral pictures.

Methods: Participants included 29 children and adolescents (3 females) ages 11-16 and diagnosed with an ASD, compared to 21 healthy controls (CON group, 4 females) matched on age (*M* = 14.2 years) and IQ (mean =108). Electroencephalogram data were collected while participants viewed pictures collected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2001) depicting positive, neutral and negative scenes. The participants viewed 13 scenes of each type, presented 4 times each for 2000 ms followed by a fixation point for 500 ms. The P300 was quantified as the mean amplitude from 400ms to 600ms; the LPP was quantified as the mean amplitude from 600ms to 800ms.

Results: A 2-Group x 3-Valence ANOVA on LPP amplitudes revealed a significant main effect of valence with larger amplitudes for pleasant and negative pictures relative to neutral pictures ($p<.05$) but no differences between pleasant and negative valence. There were no significant main effects or interactions as a function of group. Analysis of the P300 showed a trend-level effect for valence and no effects of group or group x valence interaction; pleasant and unpleasant pictures both had higher P300 amplitudes than neutral pictures but showed no differences between each other.

Conclusions: The results indicate that the pictures presented differentiated neural activity to affective picture scenes (i.e., pleasant or unpleasant pictures) relative to neutral pictures, when collapsed across group. There were no between-group differences for diagnosis nor group x condition interactions. Our results indicate that children with ASD process pictures of affective information in a manner similar to that of typically-developing children and do not show decreased attentional bias toward these pictures.

112.215 215 An Investigation Into the Role of the Mirror Neuron System in Facial Emotion Processing in High Functioning Autism Utilizing Transcranial Magnetic Stimulation. K. Young*, T. J. Perkins, D. Kidgell, J. A. McGillivray and M. A. Stokes, *Deakin University*

Background:

Theoretical accounts suggest that the mirror neuron system (MNS) (neurons which respond to executed *and* observed actions) plays an important role in social cognition and thus a deficit in this system may be linked to social difficulties in autism spectrum disorders (ASD). However an important element of social cognition that has not been well examined in the context of the MNS is facial emotion processing. As facial emotion processing involves the ability to identify emotion through the observation of facial expression, this ability may be attributable to the MNS. Automatic processing by MNs may allow for an internal representation of another's facial expression, thus facilitating the understanding of the observed internal state of another (Enticott et al., 2008). Research has

established that viewing emotional faces often elicits spontaneous mimicry in typically developing individuals, thus providing further support for this account. This suggests that difficulties with facial emotion processing in ASDs may in part be due to a dysfunctional MNS, and contribute to difficulties in higher order abilities such as tehory of mind and empathy.

Objectives:

The present study examined whether mirror neuron activation was associated with facial emotion processing in typically developing individuals and in individuals with HFA. Transcranial magnetic stimulation (TMS) was used as it is a non-invasive means of stimulating nerve cells in the motor cortex via the administration of a brief magnetic pulse to the scalp. This pulse produces a motor evoked potential (MEP) in the specific muscle stimulated that can be measured via electromyography. When TMS is delivered during the observation of action within the stimulated muscle, premotor MN activity increases excitability in the motor cortex resulting in enhanced MEP amplitude.

Methods:

Subjects with a diagnosis of HFA were compared to TD individuals (*N*=10 males in each group). Participants were shown a number of emotional facial expressions in the experimental conditions and a number of neutral expressions in the control conditions. During this time, the motor cortex was stimulated using TMS. The effects of the motor cortex stimulation was assessed by recording responses produced in facial muscles specific to the expression presented via electromyography. It was hypothesized that TD individuals would actively engage in facial emotional processing as demonstrated by increased MEP amplitude in emotional conditions compared to neutral conditions. Further, it was also hypothesized that individuals with HFA would demonstrate a lack of facial emotional processing as demonstrated by no difference in MEP amplitude between conditions.

Results:

Although data analysis is only preliminary at present as more HFA data needs to be collected; the results indicate that TD individuals are demonstrating higher MEP amplitude in emotional conditions compared to neutral conditions. In contrast, individuals with HFA are demonstrating no difference in MEP amplitude between conditions.

Conclusions:

On the basis of preliminary analyses this research appears to support the notion that the MNS plays an important role in social cognition and that a dysfunction in this system may provide a neural basis for a number of social cognitive deficits exhibited in individuals with HFA.

112.216 216 Animacy and Intentionality in the Mirror Neuron System in the Broader Autism Phenotype. G. P. Moseley*[1], A. Naples[2], R. Bernier[3], C. E. Mukerji[2], M. Coffman[2], G. Righi[2] and J. McPartland[2], (1) *Yale University*, (2) *Yale Child Study Center*, (3) *University of Washington*

Background: Research in non-human primates first revealed the existence of single neurons activated in response to performance of an action and observation of the same action. Subsequent neuroimaging studies in humans provide strong evidence for a similar action-perception system (APS) in humans. Electrophysiological brain recordings reveal that rhythmic activity in the mu range (8-13 Hz) reflects the synchronous firing of motor neurons at rest, and attenuation of this rhythm in the absence of motor movement is a reliable marker of APS activity. Dysfunction in this neural circuitry has been observed in ASD; individuals with ASD exhibit typical mu attenuation during motor actions but reduced attenuation during action observation. Based on these findings, atypical function of this brain system has been speculated to contribute to the neuropathology of the disorder. Several studies have investigated the modulatory influences of the intentionality of observed actions (i.e., goal-oriented vs. non-goal-oriented actions), as well as the animacy of the performer of the observed action (i.e., human versus humanoid robot), although it remains unclear to what degree and in what direction these factors influence activity in the APS.

Objectives: This study investigated (a) the modulatory influence of intentionality and animacy, as well as (b) the level of autistic traits, on APS activation as revealed by electrophysiological indices.

Methods: 20 typically developing adults participated in this study. Participants were pre-selected for high (H-AQ, N=10) or low (L-AQ, N=10) levels of autistic traits with the Autism Spectrum Quotient. EEG was recorded using a 128 channel HydroCel Geodesic Sensor Net while participants viewed a novel series of short videos displaying four conditions varying performer animacy and intentionality: 1) human hand, goal-directed; 2) human hand, non-goal-directed; 3) robot hand, goal directed; 4) robot hand, non-goal-directed. Mu power (8-13 hz) was computed over central electrodes and log ratios (video stimuli: baseline) were compared between the four conditions.

Results: We predict that, across participants, both animacy and intentionality will modulate APS activity such that Condition 1 > Condition 2 > Condition 3 > Condition 4. We expect that the H-AQ group will exhibit reduced mu attenuation overall and reduced differentiation among conditions, indicating less sensitivity to animacy and intentionality. Though data collection is ongoing, preliminary analyses concord with these predictions.

Conclusions: This is the first study to (a) apply EEG to investigate the effect of animacy and intentionality on mirror neuron activation and to (b) analyze these effects in the context of the broader phenotype of autism. Our novel stimulus set eliminates confounds between familiarity and intentionality; confirmation of predictions will inform our understanding of APS involvement in empathy, theory of mind and in the broader autism phenotype.

Invited Educational Symposium Program
113 Communicating Autism Science
Chair: A. Singer *Autism Science Foundation*

Dissemination of autism research no longer ends with publication in a peer reviewed journal. Media interest in autism science has grown steadily over the past few years and most scientists can now expect to hear from press after publishing research findings. Press and other stakeholders, many of whom write blogs, have also become regular attendees at scientific meetings and conferences. This symposium will teach attendees the best ways to interact with the press and other stakeholders, while still maintaining a commitment to scientific principles and integrity. Attendees will gain specific skills in creating a communications plan around their research, will learn how to work with their university press office, will get actionable tips from media regarding what makes a great interview, and will learn specific techniques for handling challenging questions and presenting potentially controversial findings.

113.001 Media Training 101:. J. E. Rubinstein*, *Rubenstein Associates*

How can you create a communications plan around your research results? What makes research newsworthy? What are the best techniques for sharing news of your research with the press, with parents or with other stakeholders? What three elements should you always include? What should you avoid? What techniques can be used to handle live q&a, curveball questions or hostile questions?

113.002 Working with the Press.

113.003 Communicating Directly with Families and Other Stakeholders. D. Marnane*, *Autism Speaks*

What are families most interested in hearing about? Will everything I share with a family end up on a blog? Is it wise to do an interview with a blogger? What happens when families come to scientific conferences? What is lay language when it comes to families?

113.004 Working with Your Press Office. E. B. Welker*, *Kennedy Krieger Institute*

Your press office wants you to participate in press. That's why there's a press office! When should you get your press office involved? What is their role? How can you work together to achieve the best outcomes? What are the best ways to handle press when your research findings are potentially controversial? How can you work together to approach study participants to answer reporter questions while not violating privacy? How can you be responsive and enthusiastic about press without losing focus on the science?

Treatments: A: Social Skills; School, Teachers Program
114 Large Controlled Trials
Chair: I. M. Smith *Dalhousie University/IWK Health Centre*

These papers present data on large controlled treatment trials.

114.001 Treating Anxiety Disorders in Children with High Functioning Autism Spectrum Disorder: A Controlled Trial. A. M. Chalfant*[1], R. Rapee[2], L. Carroll[3] and H. Lyneham[2], (1)*Annie's Centre*, (2)*Macquarie University, Sydney Australia*, (3)*Children's Hospital Westmead*

Background: Prevalence rates of anxiety symptomatology in children with High Functioning Autism Spectrum Disorder (HFASD) support the argument that anxiety is a core difficulty of many children who suffer with HFASD (e.g., Leyfer et al., 2006; Gillot, Furniss, & Walter, 2001; Muris et al., 1998). Although, manualised Cognitive Behaviour Therapy (CBT) programs have widely demonstrated efficacy among typically developing, anxious children (without intellectual delay) (e.g., Albano, Chorpita, & Barlow, 2003), there is little published literature regarding the direct relevance of CBT models to children with HFASD.

Objectives: To conduct a clinical trial investigating the effectiveness of a manualised CBT program for HFASD children who have a comorbid anxiety disorder.

Methods: Forty-seven children aged 8–13 years (35 boys, 12 girls) were randomly assigned to either the CBT (n = 28) or WL condition (n = 19; offered treatment after the WL period). Participants received a primary anxiety disorder diagnosis on the basis of structured clinical interviews conducted with the both the parent and the child using the Anxiety Disorders Interview Schedule'' (ADIS). The Revised Children's Manifest Anxiety Scale (RCMAS), the Spence Children's Anxiety Scale (SCAS), the Children's Automatic Thoughts Scale (CATS), and the Strengths and Difficulties Questionnaire (SDQ) were also used as self, parent and teacher report measures of anxiety. All measures were administered pre and post treatment. Treatment involved 9 weekly treatment sessions and 3 monthly booster sessions with both the child and the parent.

Results: At post-treatment, the percentage of children who no longer met DSM-IV-TR criteria for a current primary anxiety disorder was significantly more for the CBT condition (20 of 28 children or 71.4%) than for the WL (0 out of 19 children or 0%), x^2 (1, N = 47) = 24.889, p < .05. Comparisons between the two conditions also indicated significant reductions in anxiety symptoms as measured by self report, parent report, and teacher report.

Conclusions: Manualised CBT might be a suitable treatment option for children with HFASD and their families, with the potential for treatment benefits to extend to both the home and school setting. Further investigations could consider which treatment components are most effective for this group and what adaptations to traditional CBT are most beneficial for the learning styles of HFASD children.

114.002 Omega-3 Fatty Acid Supplementation in Children with Autism. L. A. Carpenter*, S. L. Logan, L. B. King, J. Charles, L. DeVane, I. Singh, W. Jenner, C. A. Cheely and J. S. Nicholas, *Medical University of South Carolina*

Background: Omega-3 fatty acids are essential for brain development and function, and may play a role in gene expression. Omega-3 fatty acid supplementation has shown some promise in recent pilot studies in treating associated behavioral problems, particularly hyperactivity, in autism.

Objectives: This double blind placebo controlled trial evaluated the safety and efficacy of omega-3 fatty acid supplementation on hyperactivity and other behaviors in children with autism. The study also investigated whether changes in plasma fatty acid concentration and cytokine markers were associated with behavioral changes in response to treatment.

Methods: Children with ADOS-confirmed autism (n=58) were randomized to receive 12 weeks of omega-3 fatty acid supplementation (625 mg DHA and 875 mg EPA per day) or a soybean oil placebo matched for scent and appearance. Soybean oil provides Omega-6 fatty acids (linoleic acid), but not Omega-3 fatty acids. Plasma fatty acid concentrations and cytokine markers were measured at baseline and again at 12 weeks. Behavioral changes were monitored at three time points (baseline, 6 weeks, and 12 weeks) via the Aberrant Behavior Checklist and PDD-Behavior Inventory. Adverse events and treatment adherence were monitored bi-weekly.

Results: The treatment was well-tolerated by both groups, with no serious adverse events in either group, and no

differences between groups in terms of adverse events or side effects. In the unadjusted analysis, the active treatment group demonstrated a significant increase in DHA and EPA in plasma blood concentrations relative to the control group. Adjusting for baseline behavior scores, age, gender, race, and baseline severity of illness by ANCOVA analysis did not reveal significant differences in hyperactivity for the active treatment and control groups. In addition, ANCOVA analyses also did not reveal significant group differences for other associated behavioral problems in autism (e.g. irritability) or for core symptoms of autism.

Conclusions: Omega-3 fatty acid supplementation appears to be safe and effective in increasing DHA and EPA in plasma blood concentration. This study did not demonstrate improvements in hyperactivity, or in other core or associated symptoms of autism.

114.004 Treatment As Usual and Peer Engagement in Teens with High Functioning Autism. F. Orlich*[1], R. Montague[2], R. Bernier[3], R. Oti[4], C. Kasari[5], C. E. Lord[6] and B. King[7], (1)*University of Washington and Seattle Children's*, (2)*Seattle Children's* , (3)*University of Washington*, (4)*Seattle Children's Hospital and Research Institute*, (5)*University of California, Los Angeles*, (6)*Weill Cornell Medical College*, (7)*University of Washington and Seattle Children's Hospital*

Background: Impairment in the ability to interact socially is the hallmark feature of teens with High Functioning Autism (HFA). Few interventions and supports are available to these adolescents, despite their significant need. As a result, these adolescents are at risk for depression and anxiety, often experiencing marginalization within their peer group and community. Several clinical interventions have been designed to improve social relationships for teens with HFA and typically include a clinic based social skills group composed of teens from different locales who share a diagnosis of ASD. Despite widespread use of this intervention, it has not been found to be effective in changing peer relationships or increasing engagement in the teen's natural environment. Thus, there continues to be a pressing need for effective treatments that improve skills and foster generalization of skills. This muti-site study aims to address this need by examining two school based treatment approaches for teens with ASD: a peer mediated program (ENGAGE) and a more typical social skills group intervention comprised of teens with HFA (TSS).

Objectives: This multi-site study (Orlich, Treatment as usual and peer engagement in teens with High Functioning Autism R01HD65291) examines the effectiveness of two group interventions: a typical social skills intervention (TSS) and a novel peer mediated intervention (ENGAGE) aimed at increasing peer interactions, social competence, affiliation and quality of life in teens with HFA within their natural school environment.

Methods: Adolescents with HFA were randomized at the school level to either the skills only (TSS) or peer mediated (ENGAGE) groups for 8 weeks. All adolescents received pre-, post-, and follow-up assessment. Pre-treatment evaluation included confirmation of diagnosis, measurement of IQ, and assessment of social skills, behavioral adjustment and self esteem. To address social relationships, adolescent self perceptions of friendships and loneliness at school, a social network measure, and observation of teen initiations, responses, and engagement took place at school pre-treatment, end of treatment and at follow up. A total of 72 teens will complete the study by February, 2012.

Results**:** Preliminary data analysis including a repeated measures ANOVA examining intervention type across pre and post assessment points indicated no differences between intervention types but yielded main effects for assessment point on interpersonal relationships by self report ($p<.05$), internalizing behaviors by parent report ($p<.05$), and empathy by teacher report ($p<.01$), indicating that after intervention, participants reported improved interpersonal relationships, parents reported fewer internalizing behaviors, and their teachers reported greater empathy regardless of the type of treatment The finding of improved empathy remained at follow up assessment 3 months later ($p<.01$).

Conclusions**:** Findings from the study suggest that adolescents receiving social skills intervention within the

teens' natural environment of school improved perception of their quality of social relationships, teacher report of empathy, and decreased anxiety and depression as observed by their parents. In contrast to previous studies demonstrating gains in social skills, but limited generalizability, our preliminary findings underscore the positive and generalizable impact of naturalistic, school based, group interventions on social engagement and emotional adjustment in adolescents with HFA.

114.005 Efficacy of the LEAP and TEACCH Comprehensive Treatment Models for Preschoolers with ASD. B. Boyd*[1], K. Hume[2], M. Alessandri[3], A. Gutierrez[3], L. D. Johnson[4], L. A. Sperry[5] and S. L. Odom[6], (1)*University of North Carolina at Chapel Hill*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of Miami*, (4)*University of Minnesota*, (5)*Griffith University*, (6)*University of North Carolina*

Background: TEACCH and LEAP are two comprehensive treatment models (CTMs) with a long-standing history in the field of autism. Yet, researchers are only now beginning to examine their programmatic efficacy (Strain & Bovey, 2011). There is still a critical need to directly compare these CTMs to determine any differential effects as well as for whom and under what circumstances these interventions best work.

Objectives: (1) To compare child and family outcomes for participants in TEACCH, LEAP, and "business-as-usual" (BAU) control classrooms, and (2) To describe child and family characteristics that moderate participant outcomes.

Methods: A rigorous, quasi-experimental study involving n = 75 classrooms (28 BAU, 22 LEAP, 25 TEACCH) and n = 205 children was conducted across four study locations. All study classrooms had to meet stringent inclusion criteria to ensure they were "high quality" classrooms and, for TEACCH and LEAP, they exhibit a high degree of fidelity A battery of measures was collected on children and families across three time points to examine change over time. Prior to data analysis, seven composite variables were derived from the measures to serve as study outcomes. The composite variables were generated using a combination of exploratory and confirmatory factor analytic methods. In addition, longitudinal invariance analysis was used to ensure the composite variables exhibited stable measurement properties across time points. Following empirical confirmation of the composite variables, a series of three data analytic models were fit to the data. The three analysis models were (1) gain score analysis, (2) repeated measures model, and (3) repeated measures model with adaptive centering. Because of the quasi-experimental study design, the data analytic models are of increasing complexity to act as sensitivity checks. Multiple imputation methods were used to address missing data.

Results: Data analysis is still ongoing. However, our current findings based on the gain score analysis only, which reflect change from pre to post-test, reveal no group differences on any composite variables with the exception that children in TEACCH classrooms showed less improvement in sensory and repetitive behaviors (based on teacher report) than children in BAU classrooms ($p=0.0267$). In general, irrespective of program type, children made gains across the school year. However, there are variables that appear to moderate participant response. For example, for the autism severity composite, children with initial lower IQ scores and parents with higher levels of stress made less improvement. Additional discussion of child characteristics that may interact with program type to differentially predict response to intervention will be discussed.

Conclusions: In this study, two historical, widely implemented CTMs and a high quality business as usual program all produced positive results across time. The absence of differential treatment effects suggests that all models were having a significant impact, although one cannot rule out the possibility of maturation. This study raises the issues of the replication of effects for CTMs when the model developer is not involved in conducting the research, and whether having access to a high quality, early intervention program is as beneficial as access to a specific CTM.

114.006 Effectiveness of a Province-Wide Early Intervention Program for Preschoolers with ASD. I. M. Smith*[1], H. E. Flanagan[2], K. Fossum[3], T. Vaillancourt[4] and S. E. Bryson[5], (1), (2)*IWK Health Centre*, (3)*Dalhousie*

University, (4)*University of Ottawa*, (5)*Dalhousie University/IWK Health Centre*

Background: Translation of efficacious early intervention methods into community practice is a challenge in many jurisdictions, especially for publicly funded services. Nova Scotia (NS) implemented a model of relatively low-intensity (15 hours/week) and short duration (1 year) intervention for ASD in 2005 (Bryson et al., 2007). The program employs Pivotal Response Treatment (PRT) as the primary treatment modality, and entails training and in vivo coaching of parents to complement the shorter period of 1:1 intervention by therapists. The primary target of intervention is social communication skills. Initial data for N = 45 suggested positive outcomes after one year of intervention (Smith et al., 2010).

Objectives: To examine key outcomes for a larger cohort of children and families who participated in the PRT-based NS program.

Methods: Participating families were enrolled in the clinical program, with eligibility based only on age under 6 years and a clinical diagnosis of ASD. Research staff conducted independent assessments at baseline, and after 6 and 12 months of intervention. Data from all three timepoints were available for N = 76. Key outcomes (and associated measures) included language (PLS IV), IQ (Merrill-Palmer-Revised Scales), adaptive behaviour (VABS II), behaviour problems (CBCL 1½-5) and autism symptoms (SRS).

Results: Children made meaningful gains in expressive and receptive language age equivalent scores ($p<.001$) and ratio scores ($p < .05$). After one year, 37% and 46% of children experienced greater gains in expressive and receptive language, respectively, than expected for typical development. In addition to better language/communication skills, children experienced large increases in cognitive standard scores ($p<.001$), with an average increase of 13.2 IQ points. After 1 year, 43% scored within the average IQ range, versus 12% at program entry. Children's overall adaptive functioning also improved significantly ($p < .001$), as did child behaviour problems ($p < .05$). However, autism symptoms improved only for a higher-functioning subgroup ($p < .05$).

Conclusions: One-year outcomes for children in this less-intensive program of short-term therapist intervention, combined with parent training in PRT, appear similar to published results for more intensive "traditional" models of EIBI. Substantial effect sizes were obtained for an explicitly targeted outcome (expressive communication), as well as for generalized, collateral improvements (e.g., receptive language, IQ). There is also evidence of differential responsiveness to intervention for children at different levels of initial cognitive functioning. Our next analyses will examine closely this and other factors that predict outcomes in this program.

114.008 Sapropterin As a Treatment for Autistic Disorder: Results of A Randomized, Double-Blind, Placebo-Controlled Trial and An Open Label Extension. C. Klaiman*[1], L. Masaki[2], G. R. Elliott[2] and L. Huffman[2], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*Children's Health Council*

Background: Most studies of biological interventions for autism have focused on symptom reduction, emphasizing behaviors that are thought to be secondary to autism—e.g., self-injurious behavior, aggression, hyperactivity, and OCD components—as opposed to core features. Sapropterin, used to treat tetrahydrobiopterin (BH4)-responsive phenylketonuria, is of interest as a possible treatment of autism. Fernell et al. reported on a pilot study in 6 children ages 3-5 years with autism using 3 mg/kg/day for 3 months. In an open-label design, they found improved social functioning in all subjects. A subsequent report described a double-blind placebo-controlled crossover trial with 12 boys, ages 4-7. The investigators found only small, nonsignificant changes at both 3 and 6 months in total scores on the CARS, but post-hoc analyses revealed significant improvements in social interactions at 6 months. As noted, these and other studies suggested that sapropterin might ameliorate core symptoms of autism at least in younger subjects. However, the studies had notable limitations. We therefore conducted a double-blind study of sapropterin at higher dosage levels that are now feasible with the formulation currently available in the United States.

Objectives: The purpose of this study was to evaluate the efficacy of the approved formulation of sapropterin on the core symptoms of autism in young children.

Methods: This was a double-blind, placebo-controlled, 16-week trial followed by an open-label extension. In the placebo-controlled study, participants were 46 children (3-6 years old) with ASD. The primary outcome measure was the CGI-I Scale; secondary measures assessed social interactions, language, and odd behaviors, as well as side effects. Participants were randomized to 20 mg/kg/day of sapropterin or placebo. Behavioral and safety measures were collected at baseline, 8, and 16 weeks. In the open-label study, participants were 30 children who successfully completed the double-blind placebo-controlled arm of the study. Primary and secondary outcome measures were the same as those used in the placebo-controlled study.

Results: Participants were 83% male, 46% white, and an average age of 60 months; 76% received at least one concurrent complementary medication. At 16-weeks, the placebo (n=23) and sapropterin (n=23) groups showed similar proportions with a CGI-I of 1 (Very Much Improved) (4.5% vs. 0.0%) and 2 (Much Improved) (9.1% vs. 25.0%). Compared to placebo, sapropterin subjects had significant improvement, with moderate effect sizes, in social interaction and expressive language. BH4 was well-tolerated with few side effects. Open-label data is still being collected.

Conclusions: At 16 week, the primary outcome measure of global clinical improvement was not different for active treatment vs. placebo; however, analyses of secondary measures yielded statistically significant differences suggesting that BH4 may enhance development in social interaction and in language in young individuals with an autism spectrum disorder and that it is generally well tolerated even at the relatively high dose used in this study. The open-label extension will help us to determine extended safety profiles as some children will have been on the medication for 8 months. It will also help us discern patterns of improvement and if they plateau with regard to change.

Cognition and Behavior Program

115 Cognition & Behavior: Across the Lifespan
Chair: L. G. Klinger *TEACCH, University of North Carolina School of Medicine*

115.001 Do Alterations in Low-Level Visual and Auditory Processing Co-Occur in Autistic Individuals?. A. A. Simard-Meilleur*[1], A. Bertone[2] and L. Mottron, M.D.[1], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Perceptual Neuroscience Laboratory for Autism and Development (PNLab)*

Background: Multiple behavioural studies have demonstrated enhanced processing of low-level auditory (eg: pitch discrimination) and mid-level visual (eg: pattern detection) information in autism. The enhanced perceptual functioning model proposes that such differences originate from a combination of enhanced bottom-up feed forward flow of perceptual information combined with a superior independence from downward streams in both visual and auditory modalities. At the cortical level, it has been suggested that differences in elementary information processing result from altered local neural connectivity characterized by atypical inhibitory/excitatory lateral interactions. This would result in increased spatial-frequency tuning mediated by mechanisms within primary visual areas in autism (Bertone et al., 2005). This idea has been supported in the visual domain (Keita et al., 2011; Vandenbrouke et al., 2008) and predicts the same type of alteration within the auditory domain. At a physiological level, the minicolumns theory (Casanova et al., 2002) also proposes a superior ability to discriminate low-level information across sensory modalities. Despite these multiple theories and predictions, it remains unknown whether such locally-oriented perception co-occurs in both visual and auditory domains in autism.

Objectives: To establish the prevalence of autistic individuals who present with specific enhanced low-level auditory and visual perceptual abilities, then to determine whether these abilities co-occur in autistics and matched typically developing peers.

Methods: 43 autistics and 38 controls (ages 14 to 35) were tested on three psychophysical tasks: 1) pitch discrimination,

2) contrast discrimination of luminance-defined gratings, and 3) visual spatial frequency (SF) discrimination. Participants were matched at the group level on Raven's Progressive Matrices and analyses controlled for differences in Wechsler FSIQ. All participants had normal or corrected-to-normal visual and auditory acuity.

Results: Although no between-group differences were manifested for contrast and SF sensitivity ($F(1,77)=.332$, $p=.566$ and $F(1,71)=.001$, $p=0.972$ respectively), between-group mean comparisons showed that autistics were significantly more sensitive than controls in detecting small pitch variations ($F(1,64)=18.838$, $p<.001$). A peak prevalence analysis, using a modified t-test (Crawford & Howell, 1998), revealed enhanced pitch and low-level visual sensitivity (≥1 SD control mean) in 33% and in 7% of autistics, respectively. Within autistics with enhanced pitch sensitivity, 58% also displayed a Block Design score significantly above their Wechsler FSIQ.

Regression analyses, incorporating a group X predictor interaction factor, tested for between-group differences. Results showed that pitch sensitivity predicted SF and contrast discrimination thresholds differently for both groups (SF:$p=.024$; Contrast:$p=.011$). Pitch sensitivity was a significant predictor of both SF ($p=.018$ $R^2=.229$) and contrast sensitivity ($p=.006$ $R^2=.227$) in autistics, but not in controls ($p=.702$ $R^2=.005$ and $p=.856$ $R^2=.001$ respectively).

Conclusions: Enhanced pitch sensitivity is present in one third of autistics and is more common in those who display visuo-spatial abilities significantly above what is predicted by their Wechsler FSIQ. More importantly, the results demonstrate a distinct relationship between low-level auditory and visual perception in autism that was not found for control participants. The fact that pitch sensitivity significantly predicts low-level visual abilities in autistics, but not in non-autistics, suggests that atypical perceptual processing across modalities in autism may arise from common underlying mechanisms.

115.002 Rates of Audiovisual Speech Integration Covary with Low-Level Multisensory Temporal Processing in ASD Individuals.

M. T. Wallace*[1], J. K. Siemann[2], B. C. Schneider[2], H. E. Eberly[2], T. G. Woynaroski[1], J. H. Foss-Feig[2], S. M. Camarata[1] and R. A. Stevenson[1], (1)*Vanderbilt University Medical Center*, (2)*Vanderbilt University*

Background: While the diagnostic criteria for ASD include communication impairments, social deficits, and restricted/repetitive behaviors, sensory impairments are frequently reported as well. These sensory deficits are the focus of ongoing research, with the framework that these contribute to the deficits seen in higher-order cognitive function. In the current study we seek to elucidate these links by investigating how temporal deficits in low-level sensory processing, specifically audiovisual integration, are related to measures of speech processing in ASD individuals.

Objectives: Our objective is to assess the relationship between individual's multisensory temporal processing and their ability to perceive an audiovisual speech utterance as a single, unified event. We sought to accomplish this by measuring the temporal binding window (TBW), a probabilistic construct that reflects the interval of time within which two sensory signals may be perceptually bound, and relating this to an audiovisual measure of perceptual fusion of speech utterances. Differences between ASD and typically developed (TD) groups were assessed for each measure.

Methods: Participants included 21 TD adults (18-35), 40 TD (7-17) children, and 24 ASD (6-18) children, matched for IQ, visual, and auditory acuity. Participants completed a simultaneity judgment task where visual flashes and auditory beeps were presented at varying asynchronies from 0-400ms in both auditory-first and visual-first configurations. Participants also completed a McGurk task where they reported their perception to congruent /ba/ and /ga/ utterances and an incongruent condition with an auditory /ba/ presented with a visual /ga/ (the McGurk stimulus). The TBWs for both auditory-first and visual-first conditions were calculated, as where rates of McGurk perception. The relationship between these three measures was then correlationally related within individuals.

Results: In TD adults, the visual-first side of the TBW was significantly narrower than the auditory-first TBW. In addition, only the width of the visual-first portion of the TBW (reflecting

ecologically valid stimuli) was correlated with individuals' rates of McGurk perception, such that Individuals with narrow TBWs were more likely to report the McGurk effect. TD children also showed a narrower visual-first TBW, and again only this visual-first TBW was correlated with rates of McGurk perceptions. ASD children, on the other hand, failed to exhibit an asymmetry in the TBW. Importantly, both the visual-first and the auditory-first TBWs were highly correlated with rates of McGurk perception in the ASD group.

Conclusions: With typical development, the TBW matures to reflect the natural statistics of audiovisual sensory inputs: TD perceptual systems are more tolerant of visual-first inputs. As such, in TD, the temporal processing reflecting such natural perceptions (the visual-first portion of the TBW) is related to our abilities to perceptually bind an incoming auditory and visual signal (the McGurk effect). In ASD individuals, however, this low-level temporal processing is impaired, resulting in a symmetrical TBW. Furthermore, this impairment in low-level temporal processing maps directly onto the ability of these individuals to perceptually fuse speech signals. This suggests that deficits in low-level temporal processes may have a cascading effect, impacting higher-order cognitive functions including, but not limited to, speech communication.

115.003 Postural Stability and Symmetry in Persons with Autism Spectrum Disorder: Relation Between Symptom Severity and Wii Balance Board Performance. B. G. Travers*[1], P. S. Powell[2], L. G. Klinger[3] and M. R. Klinger[2], (1)*University of Wisconsin-Madison*, (2)*University of Alabama*, (3)*TEACCH, University of North Carolina School of Medicine*

Background: Postural stability and postural symmetry are fundamental aspects of motor ability that allow individuals to navigate an environment. Decreased postural stability has been previously reported in persons with ASD (e.g., Fournier et al., 2010; Minshew et al., 2004; Molloy et al., 2000). Nevertheless, it is unclear how postural stability is related to core ASD symptomatology.

Objectives: The present study aimed to examine postural stability (i.e., balance time and degree of waiver) and postural symmetry (i.e., center of balance) during standing postures on a Wii balance board. The present sample only included individuals with ASD and typical development with IQs in the average range to minimize the impact of intellectual disability on findings.

Methods: Twenty-six individuals with ASD and 26 age-and-IQ-matched individuals with typical development (age range 16-30 years) stood on the balance board on one leg or two legs with eyes opened or closed. Participants were timed for how long they could hold each posture. Additionally, postural stability and left-right center of balance were recorded by a Wii balance board connected via Bluetooth to a laptop computer. Balance board data were recorded every 16.7 milliseconds. Past research has demonstrated excellent reliability and validity in using the Wii balance board for research purposes (Clark et al., 2010). Current ASD symptom severity was assessed using the Repetitive Behavior Scale-Revised (RBS-R), and the Social Responsiveness Scale (SRS). Additionally, self-rated empathy was assessed using the Empathy Quotient (EQ).

Results: The results indicated significant group differences during one-legged standing in postural stability (balance time, p =.01, and postural drift, p =.02) but no significant group differences during two-legged standing. Degree of waiver during two-legged standing in the group with ASD was significantly related to current repetitive behaviors (RBS-R), r = +.48, social symptoms (SRS), r = +.54, and empathy (EQ), r = -.49 (i.e., decreased postural stability was associated with more severe symptoms and less empathy). Additionally, current repetitive behavior symptoms were significantly related to postural symmetry during two-legged standing, r = +.46 (i.e., decreased postural symmetry was associated with more severe symptoms).

Conclusions: The present results suggest that postural stability in adolescents and adults with ASD is impaired during one-legged standing relative to that of persons with typical development. This suggests that diagnostic group differences may emerge during more difficult standing postures, even in average-IQ individuals with ASD. Moreover, this is the first study to find that postural stability is significantly related to ASD symptom severity measures, suggesting that postural stability may be intimately intertwined with key ASD symptoms and may

be more central to a diagnosis of ASD than previously thought. The decreased postural stability seen in the group with ASD may be symptomatic of cerebellar or corpus callosum atypicalities, which have been commonly reported in persons with ASD in the past and have been previously linked to symptom severity in ASD. Understanding how postural stability may contribute to the social, communication, and repetitive behaviors of persons with ASD may be an important avenue for future research and intervention development.

115.004 Specificity of Action Model Formation Deficits in Autism and Their Relationship to Social and Motor Impairments. S. H. Mostofsky*, *Kennedy Krieger Institute*

Background: Internal action models, or sensorimotor programs that form the brain basis for a range of skilled behavior and for understanding others' actions, are compromised in autism and may impact social development in affected individuals.

Objectives: Determine the specificity of deficits in action model formation in autism relative to ADHD, and examine this deficit as a putative mechanism underlying social dysfunction in autism.

Methods: Motor adaptation was examined in 23 children with autism and two control groups: 20 TD children and 17 children with ADHD. Participants learned to control a robotic arm while making arm movements in which the robot perturbed their movements by producing a velocity-dependent force field perpendicular to the direction of motion. In this task, the typically developing brain builds an association between self-generated motor commands and the sensory consequences (visual and proprioceptive). The strength of each association can be inferred by how the brain generalizes the learning from the trained movements to novel movements. The training took place in the left workspace (Target 1), and we quantified generalization to novel movements in the right workspace matching the intrinsic coordinates of the arm (Target 3; identical joint rotations as Target 1), and extrinsic coordinates of the task (Target 2; identical hand motion as Target 1). Movements to Targets 2 and 3 were always made in 'error-clamp' trials, in which the robot artificially eliminated movement errors, but allowed for measurement of force output from the hand.

Results: The adaptive learning for Target 1 was indistinguishable across the three groups of subjects (P = 0.44). However, generalization patterns were markedly different ($p<0.001$). Children with autism generalized joint rotations to a greater degree than TD children ($p<0.001$), whereas this generalization was not distinguishable between TD and ADHD ($p=0.29$). The difference between autism and ADHD was close to significant ($p=0.06$); the autism group showed greater generalization of the joint rotation than the ADHD group. These results suggest that children with autism built a motor memory that more strongly relied on proprioceptive coordinates than did TD children (and, to some degree, than did ADHD children). Over-reliance on proprioceptive coordinates in autism was related to impairments in social function on the ADOS-G ($p<.02$) and motor imitation ($p<0.05$) and basic motor control as measured using the PANESS ($p<0.005$).

Conclusions: Findings suggest a specific pattern of altered motor learning associated with autism. When learning a novel movement, children with autism show a bias toward reliance on proprioceptive, rather than visual feedback that was not observed in a clinical control group of children with ADHD. Furthermore, this anomalous pattern of motor learning was found to robustly correlate with measures of social and motor dysfunction, suggesting that compromised action model formation may contribute to impaired development of social (as well as motor) capacity in autism. This line of study can lead to important advances in understanding the neural basis of autism and, critically, can be used to guide effective therapies targeted at improving social, communicative, and motor function.

115.005 Motor Resonance in Adolescents and Adults with Autism Spectrum Disorder. M. R. Klinger*[1], B. G. Travers[2], P. S. Powell[3] and L. G. Klinger[4], (1)*Allied Health, University of North Carolina School of Medicine*, (2)*University of Wisconsin-Madison*, (3)*University of Alabama*, (4)*TEACCH, University of North Carolina School of Medicine*

Background: Motor resonance is motor activation that occurs in the body when one observes or thinks about movement. Motor resonance is thought to assist in automatic imitation, the development of language (e.g., watching others speak helps a person learn to move their mouth to form the words), the development of empathy (e.g., watching others get hurt makes a person automatically flinch), and the development of motor ability (e.g., watching someone ride a bike should help a person ride it later), all of which are impaired in persons with Autism Spectrum Disorder (ASD). The expression of motor resonance is thought to be supported by the Mirror Neuron System. Thus, motor resonance may relate in important ways to the social, language, affective, and motor atypicalities commonly observed in persons with ASD.

Objectives: The present study used social stimuli (e.g., videos of hand movements), nonsocial stimuli (e.g., videos of objects spinning), and language stimuli (e.g., sentences about movement) to examine the presence of motor resonance in individuals with ASD. All of these videos were non-emotional by nature in order to examine possible group differences in motor resonance that was not driven by attention to affective information.

Methods: Twenty-six individuals with ASD and 26 age-and-IQ-matched individuals with typical development (between the ages of 16 and 30) completed a motor resonance computer game in which each video or sentence portrayed a clockwise or counter-clockwise movement. Participants were instructed to respond to the stimuli by rotating a joystick either clockwise or counter-clockwise in response to a colored square presented on the screen during each video or sentence. Because motor resonance facilitates responses in the same direction as the observed movement (congruent condition) and inhibits responses in the opposite direction of the observed movement (incongruent condition), quicker congruent responses compared to incongruent responses indicate the presence of motor resonance. Current ASD symptoms were assessed using the Social Responsiveness Scale (SRS).

Results: The results indicated that individuals with ASD demonstrated a similar pattern of motor resonance compared to individuals with typical development across the different types of stimuli (social, non-social, and sentences), $F(1,50)=1.24$, $p=.27$. However, within the ASD group, the degree of motor resonance was significantly correlated with current symptom severity (SRS), $r=-.45$, $p=.02$, suggesting that those with more severe ASD symptoms demonstrated less motor resonance.

Conclusions: The present results suggest overall intact motor resonance in adolescents and adults with ASD. The specific methods of this task (lack of emotionally valenced stimuli and use of a motor response to each stimulus) were designed to decrease attention and social demands, which may explain the lack of overall group differences. Intact motor resonance in this population may be behaviorally indicative of intact mirror neuron functioning. Nevertheless, those with more severe ASD symptoms were less likely to demonstrate motor resonance, suggesting that motor resonance may be intimately intertwined with ASD symptom expression. Thus, motor resonance impairments may be evident in a group with more severe symptomatology. Future research and clinical implications are discussed.

115.006 Objective Measures of Imitation and Movement End-Point Re-Enactment in Autism. H. J. Stewart*[1], R. D. McIntosh[1] and J. H. G. Williams[2], (1)*University of Edinburgh*, (2)*University of Aberdeen*

Background:

Imitation is a complex behavior required for social learning. Difficulties in imitating others have been well-documented within ASD populations, but have been largely based on subjective reporting. We developed an approach obtaining objective measures through the use of a computerised kinematics assessment tool (CKAT) which made it possible to compare for imitation for separate measures and also with an alternative form of social learning: movement end-point re-enactment (MER).

Objectives:

Using objective measures, we aimed to determine whether an imitative deficit was present in ASD adolescents when compared to typically developing peers, and if such a deficit existed, whether this was specific to imitation of temporal or

spatial aspects of the action, and to bodily imitation only or MER also.

Methods:

Stimuli consisted of two sets – action imitation (AI), showing an actor drawing the same shapes on a touch-screen laptop; and MER, showing a dot 'drawing' shapes across the laptop screen. Participants were instructed to reproduce the movements that they had watched by drawing with a stylus on a touch-screen laptop as if using pen-and-paper. Drawing conditions were: 3 shapes (circle, square, triangle); 3 sizes (big, medium, small) and 3 speeds (fast, medium, slow). General motor skills were also assessed through a CKAT battery measuring tracking, tracing and aiming abilities, as well as parental questionnaires regarding DCD tendencies and ASD severity. Participants were age (11-17) and IQ matched (ASD n = 16; TD n = 24).

Results:

An ANCOVA [between-subjects: group (ASD, TD); covariate: age, WASI-verbal, WASI-performance] revealed a significant main effect of group for both AI path length ($F(1, 35) = 11.38$, $p = .002$, $h_p^2 = .25$) and duration ($F(1, 35) = 4.38$, $p = .044$, $h_p^2 = .11$) and for MER path length ($F(1, 35) = 5.62$, $p = .023$, $h_p^2 = .14$). Furthermore, a principal components analysis (PCA) with varimax rotation on the 21 items of imitation, motor abilities and individual differences yielded a 4-factor solution explaining 77% of variance. Factor 1 – Imitation Ability, accounted for 49.7% of variance; Factor 2 – Motor Ability and Age, for an additional 13.0%; Factor 3 – Verbal IQ, for a further 8.0%; and finally Factor 4 – Performance IQ, for 5.9%. SRS and DCD scores loaded both on Factors 1 and 3.

Conclusions:

Participants with autism performed more poorly than controls on both types of copying task (MER and AI) and for both measures (path length and duration) after controlling for age and IQ. In a PCA, all copying measures loaded onto a single factor, being highly intercorrelated. However, this copying ability was distinct from age, IQ and measured motor control, supporting the hypothesis that it represents a separate construct. Our results provide strong evidence for a specific social learning deficit in autism but suggest that it is not confined to imitation.

115.007 Atypical Updating of Face Representations with Experience in Children with Autism. L. Ewing*, E. Pellicano and G. Rhodes, *University of Western Australia*

Background: Adaptive coding, or the calibration of perception through experience, is widely thought to enhance processing across sensory domains. An elegant adaptation study conducted by Pellicano, Jeffery, Burr, & Rhodes (2007) revealed significantly reduced face identity aftereffects in children with autism relative to typical children. The authors suggested that these reduced aftereffects might signal diminished perceptual updating of visual representations with experience in autism, which could contribute to observed face processing difficulties. It remains an intruiguing, open question whether whether any diminished perceptual updating in autism is restricted to faces, or affects the perception of visual stimuli more broadly.

Objectives: This study investigated whether reduced perceptual updating in children with autism extends beyond faces, to non-face stimulus categories. The selectivity of diminished aftereffects in autism may prove informative about the mechanisms driving reduced perceptual updating in autism, and the scope of its functional consequences. Broadly diminished adaptation would arguably support a pervasive perceptual atypicality in autism. In contrast, disproportionately reduced perceptual updating for face stimuli compared to non-face stimuli (relative to typical children) could signal that reduced adaptation is tied to social stimuli specifically, contributing to a face selective processing atypicality.

Methods: A developmentally appropriate figural aftereffect task directly measured perceptual updating following exposure to figurally distorted (expanded/contracted) upright faces, inverted faces and cars, in typical children (n=29) and children with autism (n=29) of similar age and cognitive ability. A size change between the study and test stimuli limited the likelihood that any processing atypicalities reflected group differences in adaptation to low-level features of the stimuli.

Results: Figural aftereffects for upright faces, but *not* inverted faces or cars, were significantly diminished in children with autism, relative to typical children. Moreover, the group difference was amplified when we isolated the 'face-selective' component of the aftereffect, by partialling out the mid-level shape adaptation common to upright and inverted face stimuli. Notably, aftereffects of typical children were disproportionately larger for upright faces than for inverted faces and cars, but the magnitude of aftereffects of children with autism was not similarly modulated by stimulus category.

Conclusions: This study provides an important step forward in our understanding of perceptual updating atypicalities in children with autism. Consistent with a functional role for adaptation in face perception, our findings suggest that reduced perceptual updating in children with autism may constitute a high-level, and possibly face-selective, visual processing atypicality, relative to typical children.

Clinical Phenotype Program
116 Clinical Phenotype: Influences
Chair: D. L. Robins *Georgia State University*

116.001 Assessment of Symptom Severity in Siblings with Autism Spectrum Disorder: Comparing Parental Report Versus Direct Observation Methods Using Multilevel Modeling. E. Duku*, S. Georgiades, P. Szatmari, J. Cairney and K. Georgiades, *Offord Centre for Child Studies, McMaster University*

Background: Despite high heritability estimates for Autism Spectrum Disorder (ASD), so far, only a few inherited genes have been linked to an increased risk for the disorder. This failure to identify inherited autism genes raises important methodological questions concerning our ability to clearly define and/or accurately measure the ASD phenotype. The most common approaches to the assessment of ASD symptoms include a direct observation of the child and a semi-structured interview of the parent. However, to date, these two approaches have never been contrasted among multiplex families (i.e., families with more than one child with ASD).

Objectives: This study explores issues related to the assessment of the ASD phenotype in multiplex ASD families. The specific objectives of this study are (a) to estimate the "between" (shared) versus "within" (unique) family variance in ASD symptom severity across two assessment methods, direct child observation and parental report; and (b) to examine the effect of child and family-level covariates on ASD symptom severity across the two assessment methods.

Methods: Data came from the Canadian Genetics of Autism Study investigating genetic mechanisms of autism susceptibility. The sample consisted of 110 multiplex families who had two children diagnosed with ASD (N=220). All children were assessed using the Autism Diagnostic Interview – Revised (ADI-R; parental report) and the Autism Diagnostic Observation Schedule (ADOS; direct observation). Multilevel regression was used to examine the between-family and within-family variance in ASD symptom severity across the two assessment methods, parental report and direct observation.

Results: Results show that for both methods – parental report (ADI-R) and direct observation (ADOS) – most of the variance in ASD symptom severity is at the child-level (i.e. within families). However, the proportion of variance at the family-level (i.e. between families) is substantially higher for ADOS scores (20.23%) compared to ADI-R scores (11.84%); the reverse pattern is true for the proportion of variance explained at the child-level. Additional results indicate that variables such as the child's age and sibling-pair age discrepancy influence the estimation of child scores and familial correlations of ASD symptom severity.

Conclusions: This study provides the first empirical evidence suggesting the presence of the "sibling de-identification" phenomenon in multiplex ASD families. Specifically, study findings show that when reporting on the symptom severity of two of their children with ASD using the ADI-R, parents tend to "maximize" differences and "minimize" similarities between siblings (relative to differences observed on the ADOS). The implications of these findings are discussed within the larger context of collecting and evaluating phenotypic information for genetic research.

116.002 Comparing Autism Screeners and Physician Surveillance Techniques At 18- and 24-Month Well Child Visits. K. C. Greer*[1], A. B. Barber[2], A. Evans[1], J.

M. Pierucci[2], K. M. Dickey[2], M. R. Klinger[3] and L. G. Klinger[4], (1)*University of Alabama School of Medicine*, (2)*University of Alabama - ASD Clinic*, (3)*Allied Health, University of North Carolina School of Medicine*, (4)*TEACCH, University of North Carolina School of Medicine*

Background: The American Academy of Pediatrics recommends autism-specific screening at 18- and 24-month well child visits in addition to scheduled developmental screening (Johnson & Myers, 2007). However, little research has examined the use of autism-specific screening instruments in primary care settings. Physician concern alone is not adequate in identifying children with autism as pediatricians missed 81% of children who were diagnosed with ASD after failing the M-CHAT (Robins, 2008). Pediatricians also missed 68% of children who screened positive for developmental delay on the Ages and Stages Questionnaire (Hix-Small, 2007). Further, since 92% of caregivers of children with ASD initially discuss concerns with their primary care providers (Siegel, 1988), it is crucial that physicians be able to adequately determine when a child's clinical presentation necessitates further developmental testing.

Objectives: The aim of this study is to examine the relation between scores on the Ages and Stages Questionnaire 3 (ASQ-3), an abbreviated 30-item research version of the Early Screening for Autism and Communication Disorders (ESAC; Wetherby, Woods, & Lord, 2009), physician concerns and parent concerns in 18- and 24-month old children.

Methods: Caregivers of children completed the ASQ-3 and the 30-item abbreviated ESAC at 18- and 24-month well-child visits at one university medical clinic and two rural medical clinics in Alabama. To date, 38 caregivers have participated. The ASQ-3 identifies delays in five areas: communication, gross motor, fine motor, problem solving, and personal-social. The abbreviated ESAC is a 30 item questionnaire that identifies delays in two areas: interacting/communicating and interests/activities; it also has an "additional comments" section. Physicians also completed questionnaires, in which they noted any delays in motor, language, or social development and indicated whether or not they made referrals for developmental testing.

Results: Preliminary data indicate that the ASQ-3 communication domain was negatively correlated with the abbreviated ESAC total score (r = -.46, p = .006) and with physician-concerns about language skills (r = -.40, p = .015). That is, lower standard scores on the ASQ-3 communication domain were correlated with increased ASD symptoms on the abbreviated ESAC and increased physician concern. No significant correlation was found between physician-identified delay and the abbreviated ESAC. Initial parental concern and physician-concerns about language skills were positively correlated with the number of physician referrals (r = .70, p < .001 and r = .60, p <.001, respectively). Parents indicated concerns following completion of the abbreviated ESAC and these concerns were significantly correlated with abbreviated ESAC total. Data collection is ongoing.

Conclusions: There is a modest correlation between the abbreviated ESAC and the ASQ-3, indicating that although the measures are related, they are not redundant. The lack of relationship between physician concerns and abbreviated ESAC total score highlights the importance of using autism-specific training for physicians. Physician training may increase early identification and early intervention referral rates. These results also highlight the importance of caregiver screening in addition to physician surveillance for autism.

116.003 Do Developmental Profiles of Toddlers with ASD Differ Based on Sibling Status Vs. Clinical Referral?. C. A. Saulnier*[1], K. Chawarska[2] and A. Klin[3], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine*, (2)*Yale University School of Medicine*, (3)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Great strides have been made in diagnosing children with ASD at very young ages, with good diagnostic stability evidenced by 18-24 months of age in clinically-referred samples. However, the developmental and diagnostic profiles of younger siblings of children with ASD (i.e., those with a genetic propensity for the disorder) appear to be more

complex in that siblings who develop ASD tend to be higher functioning and have more subtle autism symptomatology, making it challenging to provide accurate diagnoses upon detection of risk.

Objectives: This study directly compares the developmental profiles of 18-24 month-old children with ASD based on whether they were clinically-referred for an evaluation vs. evaluated due to sibling status. Profiles of autism symptomatology, developmental, play, and adaptive skills are analyzed between the groups.

Methods: Participants included 76 children with ASD, 19 of which participated in a research study on infant siblings of children with ASD (i.e., Siblings) and 57 of which participated in an early detection study and did not have a sibling with ASD (i.e., Clinically-referred). Preliminary diagnoses for the Siblings were provided at 18-months, with confirmatory diagnoses of ASD made at 36-months. Preliminary diagnoses for the Clinically-referred children were made during their initial visit, prior to the age of 24 months, and confirmatory diagnoses of ASD were made during a follow-up visit at 36 months. The mean age of the Siblings was 18.74 months (SD=1.49) and 84% were male. The mean age of the Clinically-referred sample was 21.34 months (SD=3.28) and 88% were male.

Results: A significant difference in age was observed between the Siblings and Clinically-referred samples, with the latter being slightly older (t=4.6; *p<.001*). Despite being younger, Siblings had significantly higher Visual Reception [F(1,72)=12.38; p<.01], Fine Motor [F(1,72)=8.49; *p<.01*], Receptive [F(1,72)=9.15; *p<.01*] and Expressive Language [F(1,72)=8.90; *p<.01*] scores on the *Mullen Scales of Early Learning*, with all scores falling within the average range, whereas mean *Mullen* scores for Clinically-referred children fell 1-1.5 standard deviations below the mean. Clinically-referred children evidenced significantly more autism symptomatology on the *ADOS, Toddler Module* [F(1,72)=12.86; *p<.01*], with a mean Social/Affect Algorithm score of 16.46 (SD=4.49) compared to 11.76 (SD=5.50) for the Siblings. No differences were observed in restricted/repetitive behaviors as measured on the *ADOS-T*, or within any domains of adaptive behavior, as measured by the *Vineland Adaptive Behavior Scales*.

Conclusions: Results confirm preliminary findings suggesting that siblings of children with ASD who themselves develop the disorder have different developmental profiles than children with ASD who are clinically-referred for evaluation due to concerns. Siblings tend to be higher functioning but still exhibit significant levels of autism symptomatology, albeit not to the severity of clinically-referred children. Nonetheless, their symptoms are detected earlier, likely due to close monitoring for risk. Although differences are likely referral-based, these data raise the question of differing neuroendophenotypes between children with and without genetic liability for ASD. They also highlight the complexities that arise in, and can certainly impact, the assessment and diagnosis of two varying cohorts of children, both at significant risk for ASD.

116.004 Social Economic Status and the M-CHAT: Unreliable Results for Mothers with Low Education Level.

A. Scarpa*[1], N. M. Reyes[2], M. Patriquin[1], J. Lorenzi[1], T. A. Hassenfeldt[1], V. Desai[3] and K. Kerkering[3], (1)*Virginia Tech*, (2)*Virginia Tech* , (3)*Carilion Clinic*

Background: Children with autism from rural areas and disadvantaged backgrounds (low socioeconomic status; SES) tend to receive an ASD diagnosis at later ages (Rhoades, Scarpa, & Salley, 2008). This delay may increase the average age at which intervention is received (Mandell, Listerud, Levy, & Pinto-Martin, 2002; Mandell, Noval, & Zubritzky, 2005). The Modified Checklist for Autism in Toddlers (M-CHAT) remains the most well-studied, validated, and practical tool for early screening in the primary care setting (Robins, Fein, Barton, & Green, 2001). However, the psychometric properties of the M-CHAT need to be further examined in diverse samples in order to determine if this measure needs to be adapted accordingly.

Objectives: This study investigated internal reliability of the M-CHAT completed by mothers of toddlers from a rural area in Southwest Virginia. The sample contained both English and Spanish-speaking mothers.

Methods: Data were collected from the mothers of 317 toddlers between 17 and 30 months of age. The M-CHAT was completed during children's 18- or 24- month-well visit. The mother's report of her highest academic achievement was used as a proxy for SES. For this study, three academic

achievement categories were created: (1) less than 12th grade/GED completed (n = 90), (2) 12th/GED completed (n = 143), and (3) more than 12th/GED completed (n = 84).

Results: The M-CHAT's internal reliability differed based on mothers' SES. Mothers who had less than or had completed a 12th grade education/GED had Cronbach's alphas of .428 and .225, respectively, whereas mothers who had greater than a 12th grade/GED education obtained a Cronbach's alpha of .729. Similarly, these education groups significantly differed on how many items they failed, $F(2, 313) = 3.701$, p=.026, with less than a 12th grade education/GED failing the most items, than completed 12th grade/GED, and mothers who completed more than a 12th grade/GED education failed the least number of items. Specifically, mothers with less than a 12th grade education/GED tended to fail items 17, and 22, whereas mothers with a 12th grade/GED education or higher tended to fail item 15, $c2(1, N = 315) = 11.141$, p=.004.

Conclusions: This study had two main findings. First, the psychometric properties of the M-CHAT appear to be unreliable when assessing toddlers of mothers with a 12-grade education or less. That is, these results demonstrate that the M-CHAT screening was not acceptable or consistent with what is considered adequate/acceptable internal reliability (alpha > 70). Second, maternal education levels also predicted response patterns of certain items on the M-CHAT. Specifically, toddlers with mothers with lower educational level were more likely to be perceived as developing more atypically. Several factors could have contributed to these unreliable results, including mothers' lack of understanding of typical/atypical behavior, motivation to respond accurately, or poorly constructed questions (e.g., vague language). Including a questionnaire with pictures depicting behaviors being assessed might help mothers provide more informed responses. In any case, work needs to be done to improve reliability of the M-CHAT for use among less educated families during early pediatric screenings.

116.005 Identifying Subgroups within PDD-NOS. L. A. Brennan*, D. A. Fein and M. Barton, *University of Connecticut*

Background: The diagnostic criteria for Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) do not define behaviors necessary for the diagnosis. Rather, the diagnosis is assigned to children who exhibit some of the social and communicative impairments common to children with Pervasive Developmental Disorders but fail to meet the detailed criteria of other pervasive developmental disorders, (Walker et al., 2004). The lack of criteria for PDD-NOS suggests there may be a degree of heterogeneity within this population, yet there seems to be little research exploring the similarities and differences between children with PDD-NOS. Identifying subgroups of children within the PDD-NOS population may enhance our capacity for identifying, understanding, and providing services for these children.

Objectives: To explore potential subgroups within children diagnosed with PDD-NOS at approximately 2 years of age.

Methods: A hierarchical cluster analysis was conduced to detect clusters within a sample of 100 children diagnosed with PDD-NOS between 18-24 months based upon their subdomain scores from the Autism Diagnostic Observation Schedule (ADOS). Using a series of one-way ANOVAs, external validity of the selected clusters was assessed by comparing the groups' scores on the Mullen Scales of Early Learning (Mullen) and Vineland Adaptive Behavior Scales (Vineland).

Results: Hierarchical cluster analysis suggests a 3 cluster solution best fits the data. Group 1 (n= 45) consists of participants with the highest mean scores (suggesting greatest impairment) on each ADOS subdomain when compared to Groups 2 and 3. Participants in Group 2 (n=24) have the lowest mean scores on each ADOS subdomain compared to Groups 1 and 3. Group 3 (n=31) participants' mean scores for the combination of Language and Communication and Reciprocal Social Interaction subdomains, as well as the Play subdomain, fall between that of Groups 1 and 2. Group 3's mean score for Stereotyped Behaviors and Restricted Interests is most similar to that of Group 1. The one-way ANOVAs used to assess external validity of clusters indicated significant differences between the three clusters on the Visual Reception (F=6.686, p<.05), Receptive (F=8.268, p<.05), and Expressive Language (F=0.630, p<.05) subdomains of the Mullen, as well

as the Communication (F=6.467, p<.05) subdomain of the Vineland. No significant differences were found on the Fine Motor subdomain of the Mullen, nor on the Daily Living and Socialization subdomains of the Vineland.

Conclusions: Preliminary analyses suggest that three clusters best describe this sample of children diagnosed with PDD-NOS. There appear to be subgroups of children characterized by limited (Group 2), mildly limited (Group 3), or moderately limited (Group 1) play skills, language, and communication abilities. However, the presence of stereotyped behaviors in Group 3 appeared more similar to Group 1 than Group 2. External validation analyses indicate that these clusters differ significantly on measures other than the ADOS. Subsequent analyses will follow children diagnosed with PDD-NOS at age 2 to determine whether cluster assignment remains stable at reevaluation at age 4 and whether cluster assignment at age 2 is significantly related to outcomes at age 4. We will also compare clusters based upon demographic characteristics (e.g. gender).

116.006 Examining Sex Differences in Item Endorsement on the Modified Checklist for Autism in Toddlers (M-CHAT). N. N. Ludwig*[1], D. L. Robins[1] and D. A. Fein[2], (1)*Georgia State University*, (2)*University of Connecticut*

Background: Epidemiological studies of Autism Spectrum Disorders (ASDs) indicate 1% prevalence and a 4:1 male-to-female ratio, and it is expected that early autism screening tools would detect boys and girls at a similar rate. Despite this, our previous findings demonstrate that girls show higher false positive rates on the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 1999).

Objectives: To examine the characteristics of items endorsed differentially for boys and girls on the Modified Checklist for Autism in Toddlers to better understand the differential predictive value of this tool based on sex.

Methods: The sample included 9601 males and 9140 females (mean age=20.35 months, SD=3.10) screened for ASDs using the M-CHAT, a parent-report questionnaire, at toddler's pediatric well-visits. Parents of children who screened positive on the M-CHAT were offered the M-CHAT Follow-up Interview (FUI). Those who screened positive on the FUI were offered a clinical evaluation.

Results: For the total sample, mean total scores on the M-CHAT differed based on sex, M_{male}=1.00, SD=1.70, M_{female}=.80, SD=1.31, t(18739)=9.11, p<.001 d=.13 Of the subsample who completed the FUI, mean total scores differed based on sex, M_{male}= 1.78, SD=2.87, M_{female}=1.15, SD=2.16, t(1277)=4.23, p<.001 , d=.25. Chi-square analyses indicated that 11 of 23 items on the M-CHAT were endorsed more often in boys than girls (p's<.001) and no items were endorsed more in girls than boys. On the FUI, only one out of 23 items was endorsed more often in boys than girls (pointing to show interest; p=.001). A discriminant function analysis yielded nine items in boys and eleven items in girls that best predicted ASD. Eight of the critical items overlapped (*interest in peers, brings objects to show, response to name, point to show interest, wondered if deaf, follows point, pretend play, response to smile*), but *point to request* was a better predictor of a diagnosis in females and *understands what others say* was a better predictor in males.

Conclusions: Overall, parents endorse more items for boys than girls on both the M-CHAT and FUI. However, only half of the M-CHAT items are significantly endorsed more often in boys than in girls, and this decreases to one item at the FUI level. This suggests that half of the M-CHAT's items may be contributing to reduced PPV in girls compared to boys. The critical items for girls and boys are largely overlapping, but there are some differences in item content. Future research will examine sex-specific scoring algorithms to maximize sensitivity and specificity.

116.008 Simons Variation in Individuals Project: Characterizing the Phenotype of 16p11.2 Deletion Syndrome. E. Hanson*[1], R. P. Goin-Kochel[2], J. A. Burko[1], B. M. Cerban[1], W. Chung[3], S. M. Kanne[2], A. Laakman[2], A. Lian Cavanagh[1], R. McNally Keehn[4], F. K. Miller[5], J. E. Olson[1], A. V. Snow[4], L. Green Snyder[1], J. E. Spiro[6], A. D. Stevens[7], N. Visyak[1], J. Tjernagel[6], J. R. Wenegrat[7] and R. Bernier[7], (1)*Children's Hospital Boston*, (2)*Baylor College of Medicine*, (3)*Columbia University*, (4)*Harvard Medical School*, (5)*University of*

Michigan, (6)*Simons Foundation*, (7)*University of Washington*

Background: Twin and family studies suggest that genetic factors are important in the development of ASD although it is also clear that these influences are complex. Much past work in this field has been marred by inconsistent diagnostic methodology and poorly defined subject populations making it challenging to link particular genes to clinical subtypes. The 16p11.2 deletion is the most common genetic disorder associated with ASD. While the exact incidence of ASD in individuals with 16p11.2 deletion is unknown, ASD appears to be more prevalent in these individuals than in the general population (Fernandez et al. 2011, Hanson et al. 2010). The prevalence of medical problems, particularly obesity (Jaquemont et al. 2011) as well as neurological conditions (Horev et al. 2011) are also higher. We are characterizing the phenotype of this disorder by studying over 100 individuals with this deletion.

Objectives: To characterize the phenotype of 16p11.2 deletion syndrome.

Methods: Subjects are recruited from across the United States through the Simons VIP Connect website. All consenting participants with a documented deletion in 16p11.2 (29,557,497-30,107,356 bp) receive a comprehensive diagnostic assessment including an Autism Diagnostic Observation Schedule (ADOS), a Diagnostic Interview Schedule for Children (DISC), cognitive, language, behavioral and adaptive skills assessments. Parents are interviewed for medical history. The Autism Diagnostic Interview – Revised (ADI-R) is administered when SRS, SCQ or ADOS scores are elevated or there is a clinician concern for ASD.

Results: To date, we have enrolled 67 individuals (from 56 families) with a 16p11.2 deletion. The first 32 children are included in this interim analysis. Of these, 19 individuals (59%) are male. Participants range in age from 2 to 15 years, and have a mean FSIQ of 79 (SD = 14.9). Five individuals received a diagnosis of an ASD. In addition, 14 participants met criteria for ASD on either ADOS or ADI, but not both measures, and so did not meet full study criteria for an ASD. There appeared to be an emerging pattern on ADOS scores for some individuals to have difficulties with communication and to have stereotyped behaviors, but no limitations in social skills. Another trend appears to be one of gaining skills with age and no longer meeting ASD diagnostic criteria later in life. The most common diagnoses were Language Disorders (n = 22), Developmental Coordination Disorder (n = 15), Intellectual Disability (n = 6), and ADHD (n = 16). Other diagnoses include Phonological Disorder, Anxiety Disorder, Tic Disorder, and behavioral/mood disorders. Only 1 individual received no neurodevelopmental diagnosis at all.

Conclusions: Among individuals with a 16p11.2 deletion, co-morbid diagnoses were extremely common, with 19 (59%) participants receiving one or more neurodevelopmental diagnoses. The majority of individuals have language delay, motor deficits, and attention issues. These individuals also frequently have a pattern of symptoms similar to but not always reaching threshold for a research diagnosis of ASD. Further analysis will be conducted to ascertain more fully the phenotype of individuals with a 16p11.2 deletion.

Clinical Phenotype Program

117 Clinical Phenotype

117.001 1 Television and Video Game Use Among Children with ASD Compared to Typically Developing Siblings. M. O. Mazurek*, K. Sohl and C. Wenstrup, *University of Missouri*

Background:

Clinical and anecdotal reports suggest that excessive use of television and video games can be a clinically significant problem for children with autism spectrum disorders (ASD). It is possible that for some individuals with ASD, the tendency to engage in restricted and repetitive interests may manifest as preoccupation with television and video games. Surprisingly, there has been almost no empirical research on this topic. This issue has clear clinical relevance given that excessive use of television and video games has been shown to have detrimental effects on functioning and outcomes among typically developing (TD) children (Anderson et al, 2008, Landhuis et al., 2007, Sharif et al., 2009). This study

represents a first step towards characterizing the nature of television and video game use among children with ASD.

Objectives:

1) To examine patterns of television and video game use among children with ASD as compared to TD siblings, and 2) to examine the extent to which children with ASD engage in problematic use of video games.

Methods:

The sample included 202 children with ASD and 179 TD siblings (ages 8-18). Participants were recruited with the assistance of the Interactive Autism Network (IAN) Research Database at Kennedy Krieger Institute and Johns Hopkins Medicine. Data were collected online via web-based parent-completed surveys. Measures included a demographic history form, a modified version of the Problem Video Game Playing Test (PVGT; King et al. 2011), questions assessing parental video game rules and beliefs, and questions assessing hours per day spent in various screen-based and other activities.

Results:

Independent samples t-tests revealed that children with ASD spent significantly more hours per day than TD siblings watching TV (2.2 vs. 1.9, $p = .03$) and playing video games (2.3 vs. 1.2, $p = .000$); and significantly less time than TD siblings engaged in reading, homework, spending time with friends, and physical activity (all $p = .000$). Children with ASD were also significantly less likely than TD siblings to play video games with others, $\chi^2(1, N = 377) = 12.0$, $p = .001$, or to play online multiplayer video games, $\chi^2(1, N = 376) = 13.4$, $p = .000$, and spent fewer hours per day using social media (0.2 vs. 1.0, $p = .000$). Children with ASD also demonstrated significantly higher PVGT scores ($M = 38.99$) than TD siblings ($M = 30.53$), $t(345) = 7.44$, $p = .000$.

Conclusions:

Consistent with anecdotal observations, the results indicate that children with ASD spend a great deal of time watching television and playing video games, and that solitary screen-based media use accounts for a majority of extracurricular time. Children with ASD spent significantly more time watching television and playing video games than TD children, and had higher levels of problematic video game use. In contrast, children with ASD spent little time using social media or engaging in interactive video game play with others. Future studies using well-characterized samples and longitudinal designs are needed to examine the predictors and outcomes of television and video game use among children with ASD.

117.002 2 A Comparative Analysis of Three Autism Spectrum Disorder Screening Measures in a Clinical Population.
C. Corsello*[1], T. E. Gadomski[2], J. A. Estabillo[2], N. Akshoomoff[2] and J. Sebat[3], (1)*Rady Children's Hospital, San Diego*, (2)*University of California, San Diego*, (3)*University of California San Diego*

Background: With the increasing prevalence of autism spectrum disorders (ASD), several instruments have been developed to assess and screen for characteristic behaviors and communication deficits in clinical populations. These measures have been used as level two screeners in clinical settings, but few studies compare the ability of the these instruments to reliably discriminate between ASD and non-spectrum (NS) diagnoses in a diverse clinical sample.

Objectives: To assess the ability of the Social Responsiveness Scale (SRS), Social Communication Questionnaire (SCQ) and Child Behavior Checklist (CBCL) to distinguish between ASD and NS disorders in a diverse patient sample recruited across clinical sites.

Methods: Forty-six subjects between 33 months and 17 years of age (M=83.24 months, SD=46.5) were recruited for a genetics study through three Children's hospital departments (Outpatient Child Psychiatry=7, Developmental Services (speech, occupational therapy, developmental evaluation clinic)=10, and an autism specific clinic=18) and from community events and online resources (n=11). Diagnoses included autism=17, pervasive developmental disorder-not otherwise specified (PDD-NOS)=4, Asperger's syndrome=2, attention deficit hyperactivity disorder=6, developmental delays=6, speech disorders=3, and other (anxiety, depression, genetic disorders)=8. Parents/legal guardians completed the

CBCL, SRS, and SCQ. On the SCQ, a cut-off score of ≥12 was used for children <5 years and ≥15 for children >5 years.

Results: The mean SRS T-scores were significantly higher for the ASD (M=80, SD=12.65) than the NS group (M=68.64, SD=12.78), F(1,41)=8.58, p<.01.The mean SCQ score was also significantly higher for the ASD (M=17.62, SD=6.86) than the NS group (M=10.27, SD=6.36), F(1,41) =13.79, p<.001. However, categorical discrimination between diagnostic groups was much better for the SCQ (sensitivity=76%; specificity=77%) than the SRS.The SRS captured most children with ASD (sensitivity=90%) but misclassified most NS children when using a mild/moderate or severe categorization as the criteria for ASD (specificity=14%). When considering only the SRS severe classification as ASD, performance was similar to the SCQ (specificity=77%; sensitivity=71%). Assessing discriminative validity of the SRS by using receiver operating curve analysis, the area under the curve was .75.Using a T-score of 73 rather than 60 resulted in a specificity of 73% and sensitivity of 76%. Age effects were found for the SCQ, and expanding the lower cut-off of >12 for children <8 years as suggested in an earlier paper (Corsello et al., 2007) improved sensitivity to 81%, but at the expense of specificity (68%). As expected, the CBCL autism scales (Withdrawn, Social Problems and PDD), were not as effective at discriminating between diagnostic groups (sensitivity=62%; specificity=41%).

Conclusions: Both the SRS and SCQ are widely used screening measures within clinical populations; however, age effects and the target populations must be considered when using them to screen for the presence of an ASD. When identifying children with ASDs in a clinical sample, using a lower cut-off for children <8 years on the SCQ and the severe classification on the SRS improved the combination of sensitivity and specificity for the measures.

117.003 3 A New Scoring Algorithm of Autism Diagnostic Interview-Revised (ADI-R) Using Signal Detection Theory Based Analysis. S. H. Kim*[1], J. Zhang[1] and C. E. Lord[2], (1)*University of Michigan*, (2)*Weill Cornell Medical College*

Background: The Autism Diagnostic Interview-Revised (ADI-R; Lord et al., 1994) is a standardized, semi-structured, investigator based interview for parents or caregivers of individuals referred for a possible Autism Spectrum Disorder (ASD). Diagnostic algorithms for the instrument classification of autism and ASD have been developed based on item response models on individual items and on performing Receiver Operating Characteristic (ROC) analysis on overall algorithm scores (Rutter et al. 2003, Kim & Lord, 2011). Following previous statistical approaches, here we applied Signal Detection Theory (SDT) analyses at individual item level in order to generate better discriminability measure and to determine each item's contribution towards overall diagnostic sensitivity and specificity.

Objectives: SDT, including ROC analysis, offers a standard paradigm for determining instrument sensitivity and response bias. Our goals were to use SDT (with ROC) to confirm diagnostic validity of ADI-R algorithms and to explore alternative methods of generating the instrument classifications of autism and/or ASD.

Methods: We selected those items (a total of 30) in the ADI-R on a 0- to 3- point scales (with higher scores indicating more severe impairment). For each item, we constructed distributions of scores for both the Autism/ASD ("A") group and an appropriately matched Control ("C") group that included children with typical development (TD) and non-spectrum developmental disorders (NS). From the two distributions, we constructed an ROC curve and the likelihood ratio values "L" at each scale point (i.e., 0, 1, 2, and 3). In SDT, an ROC curve depicts the tradeoff of false-positive (Type II error) and false-negative (Type I error) caused by shifting the diagnostic criterion (threshold on the scale), while the Area under ROC Curve (AUC) is used as a measure of item discriminability. Since an ROC curve is invariant against a monotone transformation of the likelihood threshold (see Zhang & Mueller, 2005), we used L/(1+L) and 1/(1+L) to convert a subject's item scores into relative likelihood values for both A and C groups. The sum of the item-by-item relative likelihood values yielded an ASD Tendency Score (ATS) to be used for ASD classification. Preliminary test for this method was done for 381 children with ASD, 63 children with NS (e.g., language delays, intellectual disabilities), and 52 TD children from 12 to 47 months of age. ATSs were calculated either using the

aforementioned 30 items in ADI-R or using a subset of 13 items from existing "12-20/NV21-47" algorithm (See Kim & Lord, 2011).

Results: Correlations (Pearson *r*) between 13-item and 30-item ATSs algorithm scores ranged between 0.91 and 0.96 respectively. AUC for individual items ranged from 0.8-0.99, confirming high item discriminability. AUC for Autism/ASD diagnosis based on 13-item or 30-item ATS were compatible (0.978 and 0.980) to algorithm totals (0.979), confirming ADI-R validity.

Conclusions: New scoring method for the ADI-R generated based on a signal detection theory analysis demonstrated strong correlations with existing ADI-R algorithms, confirming their diagnostic validity. Results on a larger sample will be examined and reported.

117.004 4 A Preliminary Analysis of Multi-Level ASD Screening: M-CHAT-R & STAT. M. Khowaja*, D. L. Robins and L. B. Adamson, *Georgia State University*

Background:

A variety of screening tools identify children who are at risk for autism. Level 1 tools are used in unselected samples, but tend to have high false positive rates. Reducing the number of false positives cases will decrease the delay in receiving intervention services for true positive cases.

Objectives:

This study seeks to measure whether a multilevel screening method, using the STAT (Level 2) following screen positive results on the M-CHAT-R and Follow-up Interview (FUI; Level 1), will reduce false positives without significantly increasing the number of missed cases. Additionally, this study seeks to replicate the utility of the STAT with children younger than 24 months of age.

Methods:

Parents in the metro-Atlanta area completed the M-CHAT-R at their child's well-baby visits (n=6,914), 640 of whom screened positive; 99 completed the FUI and continued to screen positive. A subsample of 44 children completed both a STAT (Level 2) and a diagnostic evaluation. STAT cutoffs of 2.00 for children ≥ 24 months and 2.75 for children < 24 months were based on recommendations in Stone, McMahon, and Henderson (2008).

Results:

Sixteen cases screened positive on the STAT, of which 13 received an ASD diagnosis. This multilevel screening method yielded a PPV of .81, compared to preliminary analyses using the M-CHAT-R & FUI alone, which suggest a PPV of .59. Half of the 28 children who screened negative on the STAT had ASD, resulting in inadequate sensitivity of .48 using multilevel screening.

ROC analysis for the subsample of children who completed a STAT before 24 months and also received a diagnostic evaluation (n=23) yielded an area under the curve (AUC) of .69. An optimal STAT cutoff score for this age group was 2.25: sensitivity=.80 and specificity=.71. Psychometric properties of the STAT for children ≥ 24 months (n=21) indicated that a cutoff of 2.00 was optimal: sensitivity=.82 and specificity=.80 (AUC=.88).

Reanalysis of the data for two-level screening using STAT cutoffs of 2.25 and 2.00 by age resulted in one additional ASD case being misclassified as low-risk, but correctly re-classified 8 of the 14 false negatives as true positives. These new cutoffs maintained a strong PPV (.84) and increased sensitivity to .78, which was a 63% improvement compared to using published cutoffs.

Conclusions:

The difference in optimal cutoffs in the current study compared to Stone et al.'s (2008) study may be due to qualitative differences in the sample (at-risk children from general population vs. siblings of children with ASD). The higher PPV resulting from two-level screening compared to Level 1 screening is promising, as is the increased sensitivity when using the new STAT cutoffs. However, final data on the psychometric properties of the M-CHAT-R & FUI alone have not yet been published for comparison in determining the efficacy of multi-level screening. Efforts must continue to reduce the false positive rate without significantly increasing

the number of missed cases. Empirical studies are also needed to inform policy decisions on the early detection of ASD to shorten the delay in receiving appropriate treatment.

117.005 5 ADOS Module 4: Increases in Sensitivity and Comparability to Other Modules Using a Revised Diagnostic Algorithm. V. Hus*[1] and C. E. Lord[2], (1)*University of Michigan*, (2)*Weill Cornell Medical College*

Background: Given the life-long course of autism spectrum disorders (ASD), it is a priority for the field to increase our understanding of how symptoms of ASD manifest across the lifespan. Many longitudinal studies of ASD have included the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000), making it possible to use ADOS scores to examine developmental trajectories of ASD symptoms. Diagnostic algorithms for ADOS Modules 1-3 have been revised to improve diagnostic validity and increase item overlap across modules, thereby facilitating comparisons of scores across childhood and early adolescence (Gotham et al., 2007). Algorithms for the recently published ADOS-Toddler module (Luyster et al., 2009) also follow a similar structure to that of Modules 1-3, making it possible to examine symptom trajectories using the ADOS from a very young age. However, the algorithm for Module 4, used with verbally fluent adolescents and adults, has not yet been revised. This impedes comparison of ADOS scores across the lifespan.

Objectives: To make the Module 4 algorithm consistent with the ADOS-Toddler algorithm and revised algorithms for Modules 1-3.

Methods: A total of 327 Module 4 administrations were collected from 288 individuals (M age=22.31 years). For these 288 individuals, Best Estimate Clinical Diagnosis (BEC) included Autism (33.7%), ASD (31.9%), Nonspectrum (28.8%) and Typical/No Diagnosis (5.6%). Following procedures used to create revised algorithms for Modules 1-3, "preferred" items were chosen for their ability to successfully discriminate Autism and Nonspectrum groups. Exploratory multi-factor item response analysis was used to organize items into new domains and goodness-of-fit was verified using Confirmatory Factor Analysis. After summing items to create an algorithm total, Receiver Operating Curves (ROC; Siegel et al., 1989) were calculated using BEC as the reference standard to determine appropriate diagnostic cut-offs. Sensitivity and specificity were compared for the original algorithm (based on cut-offs for the Communication, Social and Combined domain totals) and the newly proposed algorithm.

Results: Several of the Module 4 preferred items overlapped with items comprising the revised Module 3 algorithm. Results of exploratory and confirmatory factor analyses supported a 2-factor solution, consistent with other modules. Using the original algorithm, 66.1% of individuals with a BEC of Autism met criteria for an ADOS classification of Autism, while 70.5% of individuals with a BEC of ASD met or exceeded thresholds for an ADOS classification of ASD. Specificity of the original algorithm ranged from 81.9 to 93.9%. In contrast, the revised algorithm yielded improved sensitivity, with 86.2% of individuals with Autism meeting the Autism cut-off and 83% of individuals with ASD scoring above the threshold set for ASD. Specificity using the revised algorithm ranged from 85.1 to 90.5%.

Conclusions: In addition to promoting comparability with algorithms used for the ADOS-Toddler and Modules 1-3, revisions to the Module 4 algorithm yielded substantial gains in sensitivity while maintaining similar levels of specificity. Availability of a revised Module 4 algorithm will facilitate future efforts to examine trajectories of ASD symptoms across the lifespan.

117.006 6 Ascertainment of Quantitative Autistic Traits in a National Survey Involving 22,529 Japanese Schoolchildren. Y. Kamio*[1], N. Inada[1], A. Moriwaki[1], M. Kuroda[2] and J. N. Constantino[3], (1)*National Institute of Mental Health, National Center of Neurology and Psychiatry*, (2)*Shukutoku University*, (3)*Washington University School of Medicine*

Background: The evidence to date favors the concept of the autistic spectrum, from clinical level to subthreshold traits, along which behavioral and cognitive impairments vary continuously. Furthermore, continuous distribution of ASD traits in the general child population was found by large-scale behavioral studies employing quantitative measures such as the Social Responsiveness Scale (SRS).

Objectives: This study aimed to clarify the population distribution and factor structure of quantitative traits related to autistic syndromes in a large national population sample in order to examine the psychometric properties of such measurements and their implications for cross-cultural research. A recent Korean study suggested the highest ever reported prevalence for categorically defined autism spectrum disorders (ASD), and notably, symptom counts were found to be continuously distributed in that population, as has been observed in epidemiologic studies in the U.S., U.K., and Germany.

Methods: The Japanese version of the SRS was completed by parents on their 6- to 15-year old children (n=22,529) via a nationwide survey to examine quantitative autistic traits in the largest population-based sample to have specifically assessed for such traits.

Results: The SRS scores showed a skewed normal distribution in the Japanese population, high internal consistency, and no significant relation to IQ within the normal range of IQ scores. Principal components factor analysis supported the existence of a primary factor contributing to a substantial proportion of variance across all three DSM-IV criterion domains for autism.

Conclusions: Our study provides strong confirmation of the dimensional nature of autistic symptomatology in the general population. The findings underscore the recognition that paradigms for categorical case assignment may rest on arbitrary cutoffs imposed on a continuous distribution, which can result in substantial variation in prevalence estimation when the measurements used in case assignment are not standardized for a given population.

117.007 7 Characteristics of Children Misidentified by the SCQ in a Clinic-Referred Sample. A. N. Esler*[1] and J. E. Choi[2], (1)*University of Minnesota*, (2)*University of California, San Francisco*

Background: The Social Communication Questionnaire (SCQ) is a checklist of ASD symptoms based on a well-validated diagnostic interview, the ADI-R. In initial validation studies, the SCQ showed promise as a screener for a research-referred sample (Berument et al., 1999). Subsequent studies using the SCQ with clinic-referred samples revealed low sensitivities and specificities in differentiating children with ASD from children with nonspectrum disorders (e.g., Corsello et al., 2007; Kochhar et al., 2010). Checklists such as the SCQ are often relied on in clinical settings to inform diagnostic decisions, especially when clinicians lack specialized training in ASD diagnosis. The SCQ is commonly used as a criterion for inclusion in research. Information is needed on the characteristics of children who tend to be misclassified by the SCQ to guide decision-making in research and clinical settings.

Objectives: Evaluate accuracy of the SCQ in a clinic-referred sample of children suspected of having ASD and characterize clinical features of children who were misclassified.

Methods: SCQ and psychometric data were analyzed for 100 consecutive referrals to an ASD specialty clinic. Participants were 4 to 18 years of age. Receiver Operating Characteristic (ROC) curves were used to determine sensitivity and specificity for children with best estimate diagnosis of ASD or nonspectrum diagnoses. Assessment data of children who were false positives or false negatives were examined to identify possible associations with being misclassified, including verbal and nonverbal IQ, adaptive skills, problem behaviors on the Behavior Assessment System for Children-2nd edition (BASC-2), demographics, and ASD severity as measured by the ADOS calibrated severity score.

Results: The SCQ showed low sensitivity and specificity using the recommended cutoff of 15, with accuracy of classification at or around chance. Lowering the cutoff to 12 slightly improved sensitivity without further reduction in specificity. Binary logistic regression analysis demonstrated that the odds of false positives on the SCQ significantly increased as nonverbal IQ decreased and significantly increased as a child's number of diagnoses increased. False negatives on the SCQ in our preliminary sample did not show a clear pattern, except that a higher BASC-2 Somatization t-score increased the odds of being missed.

Conclusions: Our preliminary findings affirm previous findings of low sensitivity and specificity for the SCQ in clinic-referred samples. Our analyses suggest children who were

false positives on the SCQ had characteristics, such as multiple diagnoses and lower nonverbal IQ, that are accepted to be confounding factors in ASD diagnosis in general. On the other hand, those missed by the SCQ did not show a pattern of fewer ASD symptoms on the ADOS or fewer problem behaviors compared to true positives. Future studies are needed to determine whether individual parent-endorsed symptoms on the SCQ are supported in well-validated direct measures of ASD symptoms, such as the ADOS, even for children who receive nonspectrum diagnoses. This would further address whether (a) the SCQ is measuring the presence of general behavioral or developmental problems rather than ASD-specific symptoms, or (b) the SCQ reflects the overlap in behavioral symptoms of ASD and other childhood disorders.

117.008 8 Comparisons Between the DISCO and the ADI-R and the ADOS. I. Noens*[1] and G. Nygren[2], (1)*Parenting and Special Education Research Unit, Leuven Autism Research*, (2)*Sahlgrenska University Hospital*

Background: The Diagnostic Interview for Social and Communication Disorders is a standardized, semi-structured and interviewer-based schedule. The DISCO is constructed in a dimensional rather than a categorical way. Based on the broad-ranging nature of autism spectrum disorders, the DISCO items cover a very wide range of skills and features. Originally, the DISCO was designed to provide a comprehensive description of individual characteristics and needs, but the interview can also be used for categorical classification. For this purpose, computerized algorithms have been developed based on classification systems such as the ICD-10 and DSM-IV-TR.

Objectives: To explore the convergent validity of the DISCO algorithms in comparison to ADI-R and ADOS.

Methods: The DISCO interview schedule was administered by trained clinicians in the Netherlands, Sweden, and Belgium. In the Netherlands, the DISCO-11 and the ADOS (Module 1 or 2, revised algorithms) were administered from a sample of 115 children comprising 52 children with ASD (both with and without intellectual disability), 26 children with intellectual disability (non-ASD), and 37 typically developing children. In Sweden, the DISCO-10 and the ADI-R were administered from a Swedish sample of 57 children and adults with and without intellectual disability referred for neuropsychiatric assessment. In Belgium, the DISCO-11 and the ADOS (Module 3) were administered from 30 school-aged children without intellectual disability.

Results: The Dutch study reported a substantial agreement between DISCO-11 and ADOS ($k = .69$, $p < .001$). The correlation between raw total scores of the DISCO and ADOS algorithm was also high ($r(107) = .87$, $p < .001$). The correlation between DISCO and ADOS social/communication domain scores ($r(107) = .87$,. $p < .001$) was much higher than between the restricted/repetitive behaviour domain scores ($r(107) = .64$, $p < .001$), but were both significant. The Swedish study reported that the criterion validity of the DISCO was excellent when compared to the ADI-R. The ADI-R tended somewhat more to 'over diagnose' autism in relation to clinical diagnosis. Five cases with clinical ASD were missed by the ADI-R autism algorithm, but were all picked up with DISCO-10 algorithms. When the ADI-R thresholds for the broader category of ASD (Risi et al., 2006) were applied, four of the five were identified as 'other ASD'. Preliminary findings for the Belgian study appear to support the foregoing results.

Conclusions: The DISCO algorithms show good convergent validity in comparison to ADI-R and ADOS. Advantages over the ADI-R include valuable information of the broader autism phenotype and co-existing problems, relevant to both clinical practice and research.

117.009 9 Cross-Informant Reliability & Validity of Autism Screening Using the First Year Inventory in Israel. A. Ben-Sasson*[1], S. Meyer[2] and H. Amit Ben-Simhon[1], (1)*University of Haifa*, (2)*Child Development Center at Maccabi Hod Hasharon*

Background: Screening for early signs of autism spectrum disorders (ASD) poses both an empirical and clinical challenge. The First Year Inventory (FYI) offers a norm-referenced risk scoring that takes into consideration typical variations in early development of social and regulatory behaviors at 12-months, however requires investigation of its generalizability to other countries. Most previous screening evidence stems from maternal report. The increasing

involvement of fathers in child rearing calls for understanding of both parents report of their child's development.

Objectives: (1) Examine cross-informant reliability in reporting early ASD markers; (2) Test the construct validity of the FYI relative to the Infant Toddler Social Emotional Assessment (ITSEA).

Methods: A sample of 160 parents (82 mothers, *M*age= 32 years, 78 fathers, *M*age= 34 years) of infants ages 11-13 months (55% boys) completed the FYI. Mothers of 51% of infants were full-time workers and 33% of infants were cared for at home by a family member. Mothers also completed selected scales from the ITSEA that correspond with FYI items in the sensory-regulatory and social domains. Infants with medical or developmental concerns were excluded.

Results: The FYI showed high internal consistency among mothers (α=.76) and fathers (α=.73), but there was low cross-informant reliability (ICC=0.47). Repeated measures MANCOVA was used to compare mean FYI social and sensory scores between mothers and fathers controlling for the mother's employment status and the infant's care setting. There was a significant informant effect ($F(2, 71)=5.54$, $p=.006$), with fathers reporting significantly higher mean FYI social scores than mothers ($F(1, 72)=11.08$, $p=.001$). There were no significant interactions between informant and covariate effects. There was a significant effect for mother's employment status upon mean FYI sensory scores, with full-time working mothers reporting significantly higher frequencies of regulatory behaviors than at-home mothers. The distribution of FYI Total risk scores differed between parents, with mothers showing a 95th percentile cutoff of 17.39 which is similar to the original US FYI sample cutoff while fathers had a higher risk cutoff of 22.25. On average fathers reported an FYI Total risk score, which was 3.3 points higher than mothers.

Testing construct validity indicated that the mean FYI social score was significantly correlated with the ITSEA social score ($r=-.54$, $p<.001$, negative due to the inverse direction of scores). The mean FYI sensory-regulatory score was significantly correlated with the ITSEA dysregulation score ($r=0.53$, $p<.001$). There were no significant correlations between social and dysregulation scores across measures.

Conclusions: The FYI shows good levels of reliability and validity when implemented in Israel. Differences between parents may relate to the nature of fathers' involvement in caring for their infants and to their unique perspective on typical social milestones. Findings call for careful interpretation of elevated social risk scores in fathers' report and for the need to collect cross-informant screening information.

117.010 10 Early Autism Screening and Identification (EASI) Clinic: A Nurse Practitioner and Physician Clinic Model. M. T. Ott*[1], J. Plumb[1], S. Vogel[1], R. Eikov[1], M. McCullough[1], C. Colameco[1] and S. E. Levy[2], (1)*Children's Hospital of Philadelphia*, (2)*Children's Hospital of Philadelphia/ University of Pennsylvania*

Background: Early identification of children with autism spectrum disorders (ASDs) facilitates earlier treatment and better outcome. Many parents can identify differences in their child's development as early as 12 months old. Families report increased satisfaction with earlier diagnosis and a simplified referral and evaluation process. There is great need for a "real world" clinical model to facilitate an early clinical evaluation given the current lag in time for diagnostic evaluations at tertiary centers. We report an interdisciplinary evaluation model using pediatric nurse practitioner (PNP) and developmental/behavioral pediatric (DBP) partnership.

Objectives: To describe characteristics of a referred sample of toddlers (< 3 years old) to the EASI (Early Screening and Identification) clinic. These young children have screened positive for ASD and/or have increased risk for the diagnosis (e.g., older sibling has an ASD).

Methods: This is a record review of consecutive EASI clinic evaluations from January 2010 through September 2011. We describe characteristics of the children seen and methods of evaluation. The EASI clinic has a small team including a PNP, DBP attending, speech/language therapist and social worker. The evaluation is arena style, with disciplines

working together while the attending observes through a one way mirror. Several evaluations can occur simultaneously to increase the capacity of the clinic. Evaluations include a comprehensive medical, developmental history and examination, standardized general and autism-specific screening questionnaires, Childhood Autism Rating Scale (CARS) and comprehensive language evaluation. The PNPs have been trained in standardized administration of the Screening Tool for Autism in Toddlers (STAT) to provide structured observations. The team discusses findings, which informs the DSM-IV-TR and agree on recommendations. All families of newly diagnosed children are invited to an informational workshop and are provided with resources for family support and community services.

Results: Data from 163 children seen 2010 -2011 will be analyzed (83% male; ages 14 – 37 months, mean age 26 months). Over 70% were Caucasian, 14% African American, 4% each Latino and Asian, and 5% combination. Most referrals came from Pennsylvania (68%) and New Jersey (31%) and 1% from Delaware. The chief complaints were language delay (89%), social delays (25%), regression of speech or social skills (14%), developmental delay (13%) or repetitive behaviors (10%). Of the toddlers referred, 11% had an older sibling with ASD and 17% were premature. Family satisfaction questionnaires have reported a high degree of satisfaction with this model. We will assess the relationship between ages of referral, risk factors (baby sibling, prematurity, and other diagnoses), other developmental skills, scores on standardized risk questionnaires, scores on the CARS and the STAT.

Conclusions: This descriptive study reports a model of interdisciplinary evaluation for young toddlers which may be effective for determining risk status and/or diagnosis of an ASD. Findings from this study may assist us in determining means of "exporting" this model to other locations where there are nurse practitioners with an interest in collaboration and early ASD identification to implement the model.

117.011 11 NDAR, a Resource to Help Define and Improve Phenotype and Sub-Phenotype Definition in Autism Research.

S. I. Novikova*[1], S. H. Kim[2], A. Thurm[3], B. Koser[1], M. Martin[1], C. Shugars[1], D. Hall[4] and G. F. Farber[1], (1)*National Institute of Mental Health*, (2)*University of Michigan Autism and Communication Disorders Center* , (3)*National Institutes of Health - National Institute of Mental Health*, (4)*National Institute of Mental Health (NIMH)*

Background: **:** The National Database for Autism Research (NDAR) supports data sharing for a broad array of clinical, genomic, and brain imaging autism research data.

Objectives: Categorizing research subjects by phenotype/sub-phenotype and even subtype is essential for those interested in exploring this rich resource. Such categorizing is subject to debate, but by providing query access to tens of thousands of available assessments and data structures on research subjects, the community is able to critique, corroborate and further define the rules associated with the categorization.

Methods: Using data from the 100 projects now contributing data, we have begun a novel approach in addressing the fundamental need to categorize research subjects. By using thousands of subjects across all of these labs, we have defined cutoffs that are supported initially by literature review, but then optimized by statistical analysis. Such results may bias the categories but are normalized to the type of research currently being conducted. For the broader autism phenotype, we chose to sort research participants into three categories (mildly affected, affected, severely affected) only when ADOS and ADI were available along with scores from Vineland, SCQ, or an IQ measure. A subject is only assigned to the category if they met criteria for each assessment. By using an automated rules pipeline, it is possible to rerun the categorization, optimizing the rules, until all subjects with a well characterized phenotype are defined

Results: The NDAR team will present at IMFAR 2012 the rules supporting currently defined phenotypes/subphenotype of "Autism-Like Development Disorders" (the Rules for Severely Affected are provided below as an example) and the Minimally Verbal subtype. Others may be defined by IMFAR 2012. Furthermore, we will update IMFAR attendees on the progress

of utilizing the same pipeline to aggregate across federated resources such as AGRE and SFARI.

ADI-R

Total for Section A: Qualitative Abnormalities in Reciprocal Social Interaction > 10 **AND**

Total Section B: Non-Verbal: Qualitative Abnormalities in Communication >7 **OR**

Total Section B: Verbal: Qualitative Abnormalities in Communication > 8 **AND**

Total Section C: Restricted, Repetitive, and Stereotyped Patterns of Behavior > 3 **AND**

Total Section D ≥1

ADOS Module 1: Module 2: Module 3: Module 4:

Communication Total: > 4 > 5 > 3 > 3 **AND**

Social Interaction Total: > 7 > 6 > 6 > 6 **AND**

Communication + Social Total: > 12 > 12 >10 > 10

And at least one of these tests scores:

SCQ

SCQ total score > 15 **OR**

IQ

Less than average IQ < 85 **OR**

Vineland Survey

Less than average:

Composite domain total score < 85 **AND**

Communication domain total score < 85 **AND**

Living skills domain total score < 85 **AND**

Motor skills domain total score < 85 **AND**

Socialization domain total score < 85

Conclusions: Defining and making categories (phenotypes/sub-phenotypes and subtype) available to the research community for data exploration on such a large scale is novel. When such data is further refined and combined with other types of data from genomics studies and structural imaging, opportunities will be opened up for accelerated scientific discovery.

117.012 12 Psychometric Analysis of the RAADS Screen Scale for Adult ASD. J. Eriksson* and S. Bejerot, *Karolinska Institutet*

Background: Autism spectrum disorders (ASD) manifest with a wide range of symptoms, some of which are also present in other psychiatric disorders. Thus, psychiatric patients can enter adulthood without receiving an ASD diagnosis, because it is cloaked by, or even mistaken for, another psychiatric disorder. There are few diagnostic instruments available for adults with ASD and no wide-spread screening instrument for quick assessment of the need for further evaluation.

Based on a Swedish translation of the Ritvo Autism and Asperger Diagnostic Scale-Revised (RAADS-R), an 18 item self-evaluation scale, RAADS Screen, was designed for screening for ASD in adults. The 18 questions were selected on two main premises; being the statements that best differentiated between the ASD group and the control group and to represent the four domains from RAADS-R in a proportion reflecting both the importance of symptoms in the DSM-IV criteria and the proportions of the original scale. The selection of statements was based on the data from the Swedish validation of RAAD-R.

Objectives: To validate the psychometric properties of RAADS Screen for screening for ASD in adults in the psychiatric population.

Methods: The RAADS Screen questionnaire was administered to 60 adults diagnosed with ASD and 744 adults with no ASD diagnosis; 594 volunteers without any DSM IV

diagnosis and 150 psychiatric outpatients with a current DSM IV diagnosis other than ASD, distributed on the five groups: *primary affective disorder*, *primary psychotic disorder*, *primary anxiety disorders*, *ADHD* and *emotionally unstable personality disorder.*

The total score was compared between the ASD group and the psychiatric groups respectively and together.

Results: Preliminary results show that RAADS Screen discriminate ASD in the psychiatric group as well as in the non-psychiatric group. All psychiatric subgroups had significantly lower score than the ASD group. A cut-off value of 21/54 gives a sensitivity of .8 and a specificity of .65. In the non ASD sample, three factors could be identified with satisfactory internal consistency in the full sample (Cronbach's α between .73 and .89).

Conclusions: RAADS Screen is a valid and reliable instrument, useful for screening for ASD in the adult psychiatric population.

117.013 13 Screening Measures and Diagnostic Outcomes in Young Children Evaluated for An Autism Spectrum Disorder. K. Guest*[1], S. E. O'Kelley[2] and F. J. Biasini[1], (1)*University of Alabama at Birmingham*, (2)*UAB Civitan-Sparks Clinics*

Background: While there is an increased awareness and demand for effective screening tools for young children at risk for ASD, there is not yet consensus on which measures are most effective. The M-CHAT and CSBS-ITC have not been investigated as closely among children who are referred for evaluation due to known or suspected developmental delays. Based on our previous research with these tools, the exploration of screening outcomes relative to diagnosis will be explored.

Objectives: To evaluate the relation of two screening measures for identifying young children with possible ASD with the outcome clinical diagnosis, including:

(1) What is the diagnosis of children with positive and negative screening outcomes on the M-CHAT?

(2) What is the diagnosis of children with positive and negative screening outcomes on the CSBS-ITC?

Methods: As part of the intake process for referred children under the age of 4 years, caregivers completed the CSBS-ITC and M-CHAT in addition to a general intake questionnaire. Final diagnoses were concluded by members of the interdisciplinary team.

Results: 145 children were screened using the M-CHAT and have final clinical diagnosis decisions and 137 children were screened using the CSBS-ITC and have final clinical diagnosis decisions. Of the children who failed the M-CHAT screening, 35% had a final diagnosis of ASD, 20% had a diagnosis of MDD, 22% had a diagnosis Mixed Receptive/Expressive Language Delay (MRec/Exp), 16% had a diagnosis of other DD, and 7% had a diagnosis of Typical Development (TD). Further, of the children who failed the M-CHAT, 39 of the 45 children in the ASD group or 87% were identified; 22 of the 30 children in the MDD group or 73% were identified; 24 of the 33 children or 73% in the MRec/Exp group were identified; 18 of the 21 children or 86% in the other DD group were identified; and 8 of the 16 or 50% in the TD group were identified. Of the children who failed the CSBS-ITC screening, 37% had a final diagnosis of ASD, 21% had a diagnosis of MDD, 22% had a diagnosis MRec/Exp, 12% had a diagnosis of other DD, and 8% had a diagnosis of TD. Additionally, of the children who failed the CSBS-ITC, 40 of the 44 children in the ASD group or 91% were identified; 22 of the 26 children in the MDD group or 85% were identified; 23 of the 31 children or 74% in the MRec/Exp group were identified; 13 of the 20 children or 65% in the other DD group were identified; and 8 of the 16 or 50% in the TD group were identified.

Conclusions: The current data suggests that positive screens on either the M-CHAT or the CSBS-ITC are indicative of children subsequently diagnosed with ASD more often than children with other DDs or typically developing children. However, as has been demonstrated in previous research, both screening tools demonstrate difficulties in distinguishing ASDs from other DDs, especially mixed developmental delays and mixed receptive expressive language delays, at the screening level.

117.014 14 Simons Simplex Collection: ADOS and ADI-R Training and Reliability Maintenance in Multi-Site Phenotyping Research. J. E. Olson*[1], L. Green-Synder[1], E. Brooks[1], A. N. Esler[2], K. Gotham[1], F. K. Miller[3], S. Risi[1], J. Tjernagel[4], L. C. White[1] and C. E. Lord[1], (1)*University of Michigan Autism & Communication Disorders Center*, (2)*University of Minnesota*, (3)*University of Michigan*, (4)*Simons Foundation*

Background: Specific standards of inter-rater reliability on the ADOS and ADI-R are now the expected norm in quality autism research and are critical given known variability in clinical diagnosis. Yet little has been done to study the maintenance of reliability. Some charge that it is an unachievable aim. As 'diagnostic gold-standard' measures should consideration be given to applying more continuous reliability maintenance, especially for multi-site designs? In requiring unparalleled rigorous phenotyping and reliability standards, the Simons Simplex Collection (SSC) and Simons Foundation Autism Research Initiative (SFARI) have offered us a glimpse into just such an aim.

Objectives: To describe the effectiveness of a three-tiered ADOS and ADI-R research reliability training and maintenance program applied to examiners across the 12 sites as part of ongoing SSC data quality assurance.

Methods: ADOS and ADI-R administrations for 2663 simplex families were collected across 12 sites as part of a phenotyping protocol for the Simons Simplex Collection. Clinicians from across these sites (23 designated site supervisors and 28 site examiners) established research reliability on the ADOS/ADI-R prior to independent data collection for inclusion in the SSC repository. Reliability is defined as 90% inter-rater agreement on ADI-R and 80% agreement on ADOS (both full protocol and algorithm). Each supervisor and examiner attended formal training workshops at UMACC or through SSC. Sites were assigned a UMACC ADOS/ADI-R trainer as SSC Consultant. Site supervisors established reliability on the ADI and all Modules of the ADOS with UMACC trainers via live and videotape observation. Site examiners had the option of establishing independent reliability with UMACC or on-site reliability with their site supervisor.

Site supervisors managed within-site reliability maintenance. They were required to directly train and supervise site examiner administrations face-to-face, ensure all administrations were videotaped, run in-house trainings, themselves regularly administer each measure, and co-code each examiner's first quarterly ADI-R and ADOS and submit it to UMACC for review.

Cross-site reliability maintenance was supervised by UMACC consultants. ADOS/ADI-R training DVD's were provided for coding by sites every 6 months and percent agreement with trainer consensus was collected for each examiner and supervisor. Monthly cross-site supervisor teleconferences were provided to discuss coding discrepancies.

UMACC consultants monitored and ensured maintenance of site reliability through on-site training, regular teleconference with individual sites, and videotape review of site staff administrations during training, every 6 months for reliability maintenance checks and as needed during quarterly data quality validation. Inter-rater agreements were calculated and tracked. Targeted remediation of individual administrations and coding was triggered by findings of three consecutive deficient administrations.

Results: In the first year of formal data tracking (April 09-March-10), the average inter-rater reliability for individuals on the project from DVDs submitted then co-coded by UMACC consultants was 85% Protocol and 83% Algorithm for the ADOS (n=41), and 90% Protocol and 89% Algorithm for the ADI-R (n=39).

Conclusions: Inter-rater reliability equal to expected research standards (90% ADI-R and 80% ADOS) can be achieved and sustained across large-scale multi-site studies albeit with intensive training and high levels of infrastructure, monitoring and supervision.

117.015 15 The First Year Inventory: Comparing Parent Report and Clinical Observation in High and Low-Risk for ASD Infants At 12 Months. G. M. Chen*, J. P.

Rowberry, S. Macari, D. Campbell and K. Chawarska, *Yale University School of Medicine*

Background: Most screening instruments for ASD rely on parental report. Although parents have an optimal perspective from which to observe and engage with their infants across diverse contexts, parental report may also have limitations. Extant, albeit limited evidence, suggests that parents of 18-24-month old toddlers with ASD may under-report abnormalities in key social behaviors relevant to screening (Chawarska *et al*., 2007). Given the current emphasis on early screening in infants at high risk for ASD due to genetic liability, evaluating congruency between parent report and clinical observation is critical.

Objectives: To investigate agreement on comparable items of the First Year Inventory (FYI; Reznick *et al.,* 2007), a parent questionnaire designed to screen for ASD at 12 months, and the ADOS-Toddler (ADOS-T; Lord *et al*., in press), a standardized ASD diagnostic tool administered concurrently to 12-month olds at high and low risk for ASD.

Methods: 106 (high-risk=68, low-risk=38) infants were evaluated with the ADOS-T at 12 months by clinicians blind to their risk status. Parents completed the FYI prior to the ADOS-T assessment. Fourteen items tapping into comparable constructs were identified across the ADOS-T and the FYI. Both instruments rate behaviors on a scale of 0 to 3; higher numbers reflect more atypical behaviors. ADOS-T and FYI scores were compared using paired samples t-tests with Bonferroni correction for multiple comparisons separately for HR and LR groups.

Results: There were no significant differences in ratings between HR and LR groups. Regardless of the risk status, parents rated three speech and language-related items (amount of babbling, spontaneous vocalizations directed to others, and gestures) as more typical compared to the clinical assessment (p<.001). Conversely, an item capturing hand and finger mannerisms was rated as more atypical by parents (p<.001). Several discrepancies between parent rating and clinical assessment were observed only in the HR group. HR infants' parents rated eye contact, response to name, and showing behaviors as more typical compared to expert clinicians. Interestingly, response to name, a well replicated 'red flag' for ASD (Nadig *et al*., 2007) was posed twice on the FYI in slightly different form. When the question was phrased globally (*i.e*., "Does your child answer to his name?"), parents rated the infant's behavior as more typical than the clinician (p<.001); however, when the same question was presented in a multiple-choice format ("What do you typically have to do to get your baby to turn towards you?"), the parent and clinician ratings were less discrepant.

Conclusions: Discrepancies between clinician and parent ratings on speech items were common in both groups and likely reflect the effect of context on child's behavior during direct assessment. However, parents of HR infants rated their behaviors on key diagnostic features as more typical. Wording of questions appeared to affect the degree of discrepancy between expert clinician and parent report. These findings suggest a further need to examine sources of discrepancy between parental report and concurrent clinician rating of key diagnostic features as well as the impact of screening instruments' design features on the accuracy of reporting.

117.016 16 The Influence of Examiner and Observer Level of Experience on the Inter-Rater Reliability of ADOS Item and Algorithm Scores and Diagnostic Outcomes. G. Pasco*[1], K. Hudry[2], S. Chandler[1], T. Charman[1] and &. the BASIS Team[3], (1)*Institute of Education*, (2)*La Trobe University*, (3)*British Autism Study of Infant Siblings*

Background: Studies using observational measures such as the ADOS regularly involve two researchers to independently score assessments in order to achieve a best estimate consensus code and to be able to report inter-rater reliability (IRR). Reports of IRR rarely discuss issues relating to the relative levels of experience of raters.

Objectives: To investigates the IRR of individual ADOS items, diagnostic algorithm totals and diagnostic classifications with reference to the relative experience of the ADOS examiner and observer.

Methods: 90 children participating in a high-risk sib study were assessed at 3 years of age (mean 38 months, SD 3.3) using ADOS module 2. All assessments were scored by the examiner and an observer, who then agreed a consensus

score for each item. Of the 8 ADOS-trained researchers 3 were classified as having a relatively high level of experience of the ADOS (e.g. ADOS trainer/10 years of administering research-standard ADOS) while 5 had relatively low levels of experience. Reliability was calculated for individual item scores, diagnostic algorithm totals and diagnostic classification, on the basis of the combination of examiner and observer experience.

Results: IRR for the 28 module 2 items was calculated using percentage agreements between the two raters. The mean percentage agreements for the *High – High* (N=17), *High – Low* (N=40) and *Low – High* (N=31) conditions were 87.5, 85.6 and 87.0, respectively. IRR for diagnostic algorithm totals was calculated using intra-class correlation (ICC) coefficients. For the three conditions the ICCs were .93, .86 & .96, respectively (all $p<.001$). To investigate the influence of the observer rating on the agreed consensus scores the examiner diagnostic algorithm total scores were compared with the consensus total scores. The mean differences were 0.8 (t=-1.97, n/s), 0.7 (t=-2.10, $p<.05$) and 2.1 (t=-6.87, $p<.001$), respectively - the consensus totals were higher in all conditions. The IRR of diagnostic classifications was assessed by comparing the outcomes based on the examiner scoring (i.e *non-spectrum*, or above cut-offs for *autism spectrum* or *autism*) with those based on the agreed consensus scoring. For the three conditions the *chi-squared* and *kappas* were all $p<.01$, ≥.63. The numbers of participants moving to a more "severe" category and to a less "severe" category in each condition were 1 & 2, 3 & 2 and 6 & 0, respectively.

Conclusions: The overall reliability for items and of algorithm scores and diagnostic outcomes was high across all combinations of examiner and observer experience. Consensus algorithm totals were higher than the original examiner scoring, with a resultant tendency for diagnostic outcomes to shift to more "severe" categories, particularly in situations where the examiner was of low experience and the observer was of high experience, suggesting that those with less experience of the ADOS may tend to "under-score" participants when administering the assessment. Results demonstrate that researchers can be trained to achieve acceptable levels of reliability in scoring, even with a complex assessment such as the ADOS, but that there is a need for involvement from expert practitioners to maintain reliability to research standards.

117.017 17 The Modified Checklist for Autism in Toddlers: A Follow up Study Investigating the Early Detection of Autism Spectrum Disorders in a Low Risk Sample. C. Chlebowski*[1], D. L. Robins[2], M. Barton[1] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Georgia State University*

Background: The American Academy of Pediatrics recommends autism specific screening at 18 and 24 months of age. The Modified Checklist for Autism in Toddlers (M-CHAT) is an autism-specific, caregiver-report screening instrument designed for children 16-30 months of age.

Objectives: The purpose of the current project is to provide updated findings regarding the use of the M-CHAT as an autism-specific screening instrument in a population-based sample and to provide longitudinal data from a sub-sample of children screened with the M-CHAT at a follow up around age four.

Methods: The M-CHAT and the M–CHAT Follow-Up Interview (FUI) were used to screen 18,989 children aged 16-30 months at pediatric well child visits; screen positive cases were evaluated and classified as ASD or non-ASD. Rescreening was completed at 42-54 months using the M-CHAT or its revision, the M-CHAT-R, the Social Communication Questionnaire, and a question about ASD concerns to detect missed cases; 3,053 of 5,571 eligible cases completed the rescreen (55%). Screen positive cases were evaluated and classified as ASD or non-ASD.

Results: Of the 18,989 screened cases at Time 1, 92 ASD cases were detected (86 based on M-CHAT + FUI, 6 bypassed FUI based on high M-CHAT scores), along with 79 false positive cases (75 of which had other significant delays) and 6 missed cases; Time 1 Positive Predictive Value (PPV) was .54 for ASD and .98 for all developmental delays. The utility of the M-CHAT total score and critical score cutoffs was assessed in the sample of 92 true positives; 91 children (98.9%) obtained an initial M-CHAT total score of three or higher; one was identified by critical score only. At Time 1, 235

children received an M-CHAT total score of 6 or higher; of those children, 166 (70.6%) continued to screen positive after the M-CHAT Interview and required an evaluation, Of those, 118 received an evaluation, 72 were diagnosed with ASD, 43 had other developmental delays, and only 3 were typically developing. Time 2 PPV for M-CHAT + FUI was .57. There were 10 children who screened negative on the M-CHAT at Time 1 but were evaluated and diagnosed with Autistic Disorder or PDD-NOS at Time 2, producing an upper bound estimate of M-CHAT sensitivity of .85.

Conclusions: Results suggest that the M-CHAT is effective at identifying ASD in a low risk sample. A M-CHAT total score cutoff of three or higher identifies nearly all screen positive cases and, for ease of scoring, using only the M-CHAT total score cutoff is acceptable. Results indicate that 98% of children who screen positive on the M-CHAT + FUI present with developmental delays requiring intervention, indicating that screen positive cases require immediate referral for evaluation and early intervention. An M-CHAT total score of 6 can serve as an appropriate clinical cutoff and providers can bypass the M-CHAT Interview and refer immediately to evaluation/ early intervention if a child obtains a M-CHAT score of 6 or higher. Rescreening is ongoing and will be complete in 2013.

117.018 18 Understanding the Diagnostic Process of Autism Spectrum Disorders: What Methods Are Used and Who Is Making Diagnoses?. S. M. Brown*[1], C. A. McMorris[1], J. H. Schroeder[1], J. M. Bebko[1] and J. J. A. Holden[2], (1)*York University*, (2)*Queen's University*

Background: In Canada, Autism Spectrum Disorders (ASDs) are diagnosed by a variety of health care providers, including psychologists, family doctors, developmental pediatricians, and psychiatrists. Gold standards and best practices for the assessment and diagnosis of ASDs have been outlined by several organizations and professionals (e.g. Filipek et al., 1999; Johnson et al., 2007; Ozonoff et al., 2005); however, in practice the assessment methods used often vary depending on the professional designation, assessment setting (e.g. hospital, private practice, and school), and client characteristics (e.g. developmental level and age). Given that a comprehensive assessment and accurate diagnosis are integral to the development of appropriate treatment plans (Kabot et al., 2003; Rogers, 1998; Williams, Atkins, Soles, 2009), and to accessing services, it is important to examine the specific assessment methods being utilized to make an ASD diagnosis across health care providers.

Objectives: To gain insight into the experiences of families who have gone through the process of receiving an ASD diagnosis. Specifically, to understand which health care professionals are making different ASD diagnoses (i.e. Autism, Asperger, Pervasive Developmental Disorder-not otherwise specified), the measures they are using to make these diagnoses, and the age that children are being diagnosed.

Methods: A review of previous diagnostic reports and parent diagnostic history surveys were used in the current study. Trained researchers reviewed the diagnostic reports to code for assessment measures utilized, age of client, health care profession, and diagnosis given. The parent survey asked parents to report information related to the diagnostic history of their child, such as age of first concern, who referred them to seek a diagnosis, previous diagnoses given, current presence of multiple diagnoses, etc.

Results: Data collection and analysis are near completion. Information from the diagnostic reports, as well as the diagnostic history survey, are being analyzed to identify which heath care providers are more likely to make specific ASD diagnoses, and the age at which these diagnoses are being made. Importantly, the differing assessment measures utilized are being compared across diagnoses, health care providers, and settings.

Conclusions: The results of the study will be important for understanding the assessment processes that are occurring within and between different health care providers, settings, and ASD diagnostic groups. An examination of the current assessment and diagnostic processes is important for determining if best practices are being used and for identifying gaps within the current mental health system, and what can be done to improve training and access to best practice assessments.

117.019 19 Validity of the Social Responsiveness Scale to Differentiate HF-ASD From ODD/CD. H. Musch* and C. M. Freitag, *JW Goethe University Frankfurt am Main*

Background:

Autism spectrum disorders (ASD) are characterised by the presence of impairments in communication, reciprocal social interaction alongside with inflexible behaviour patterns, interests and activities (DSM-IV-TR; ICD-10). The international classification systems aim to establish the presence or absence of categorically defined symptoms, but research indicates, that autism is the extreme end of a continuously distributed trait. The Social Responsiveness Scale (SRS, Constantino & Gruber, 2005) is a 65-item questionnaire for parents and teacher that explicitly focuses on the measurement of autistic traits in children and adolescents which can also be used as a screening instrument. A factor analytic study resulted in a one factor solution (Constantino et al., 2004). A recent study in Germany reported a ROC of 98% when comparing ASD individuals with healthy typically developing controls. The ROC was much lower (81%), when compared to clinical controls who suffered from a mixture of child psychiatric disorders (Bölte et al., 2011).

Objectives:

As no study has been performed to date on the validity of the SRS to differentiate between high-functioning ASD and other specific child psychiatric disorders, the present study aimed to assess its diagnostic validity in differentiating ASD from oppositional defiant disorder / conduct disorder (ODD/CD), which is also characterised by difficulties in reciprocal social interaction.

Methods:

55 individuals with HFASD, 55 age, sex and IQ matched children with ODD / CD and 55 typically developing children were included in the study. Diagnosis was done by ADI-R / ADOS, K-DIPS (child psychiatric diagnostic interview), IQ-measurement, specific questionnaires and clinical observation.

Statistical analysis: Pairwise ROC-analysis between groups, cut-off values and sensitivity/specificity are calculated. The mean total SRS-score is compared between groups, influence of IQ, age, and gender are calculated by linear regression analysis. Correlation analysis will be done with algorithm scores of ADI-R, ADOS, and measures of general psychopathology (CBCL).

Results:

ROC-values, sensitivity and specificity were high, when HF-ASD and typically developing controls were compared, but considerably lower, when HF-ASD had to be differentiated from ODD / CD. Mean SRS total scores of HF-ASD were highest, followed by ODD/CD, lowest in typically developing controls. Gender, but not IQ effects were observed. Correlation with ADI-R and ADOS algorithm scores was in the medium range, CBCL social problems and aggressive behavior scores also correlated with the SRS total score across groups.

Conclusions:

The SRS has been developed as a measure of quantitative autism traits in the general population. Clinically, it is also used as a screening instrument for ASD. The current study replicates the good validity of the SRS to differentiate between ASD and typically developing controls, but alerts to the possibility of false-positive ASD diagnoses in children with ODD / CD by the SRS.

The study was supported by a grant of the JW Goethe University`s Medical Faculty Frankfurt am Main (Heinrich and Fritz Riese foundation).

117.020 20 Diagnostic Stability of Autism Spectrum Disorders Among Children and Siblings of Children with An Autism Spectrum Disorder Diagnosis. A. J. Hinnebusch*[1], K. Carr[2] and D. A. Fein[2], (1)*The University Of Connecticut*, (2)*University of Connecticut*

Background: The stability of ASD diagnoses between 24 and 48 months was investigated in two groups of children at the University of Connecticut: the younger siblings of children with ASD and children with no family history of ASD.

Objectives: Children in this study failed the M-CHAT or M-CHAT-R and follow-up phone interview, and received two diagnostic evaluations. Children received an initial evaluation (time 1) between 16 and 30 months of age, and received ASD diagnoses based on Clinical Best Estimate using DSM-IV Autistic Disorder criteria. At approximately 48 months, children received a follow-up evaluation (time 2), as well as a diagnosis that best reflected their current symptomatology and level of functioning, independent of previous diagnoses.

Methods: The general sample (GEN) consisted of 146 children, and the younger sibling sample (SIBLING) consisted of 26 children. Chi-square analysis was conducted to determine if there were significant differences in diagnostic stability between GEN and SIBLING. We analyzed the groups for the proportion who retained their specific diagnosis (i.e., Autistic Disorder, PDD-NOS, and ASD-Low Mental Age) and for the proportion who retained ASD diagnoses (e.g., Autistic Disorder at time 1, PDD-NOS at time 2).

Results: There were few differences between the groups regarding diagnostic stability. Children in the GEN and SIBLING samples were equally likely to retain Autistic Disorder and ASD-Low MA diagnoses, and equally likely to retain ASD diagnoses as a whole. The only significant difference between the two groups was that SIBLING children who received PDD-NOS diagnoses at time 1 were more likely to retain an ASD diagnosis at time 2 than GEN children. In the SIBLING group, 83.3% of children with PDD-NOS at time 1 retained an ASD diagnosis at time 2; 72.7% of the GEN group with PDD-NOS at time 1 retained an ASD diagnosis at time 2 [x^2 *(1, N = 67 = 4.788, p = .029*]. All children in both groups who received ASD-Low MA diagnoses at time 1 continued to have ASD diagnoses at time 2.

Conclusions: These results indicate a relatively high level of diagnostic stability for ASD diagnoses in the both GEN and SIBLING groups, with rates of ASD diagnostic stability for each group of 83.5% and 84.6%, respectively. Children who receive an ASD diagnosis at time 1 are likely to retain that diagnosis, regardless of whether or not they have an older sibling with ASD. However, younger siblings do have a higher rate of ASD diagnosis retention at age 4 when they receive a PDD-NOS diagnosis at age 2. Therefore, younger siblings who present with mild ASD symptoms at age 2, as reflected in a PDD-NOS diagnosis, are more likely to continue to exhibit clinical ASD symptomatology as they age than their counterparts with no family history of ASD. This finding may suggest that mild autistic symptoms in multiply affected families present differently from mild autism in simplex families, and that mild symptoms in multiplex families may not be as readily remediated as in simplex families.

117.021 21 Syndrome Specific and Non-Syndrome Specific Predictors of Developmental Change in Higher Functioning Children with Autism. K. E. Ono*[1], H. A. Henderson[2], C. Hileman[3] and P. C. Mundy[4], (1)*University of Miami, Psychology*, (2)*University of Miami*, (3)*MIND Institute, UC Davis*, (4)*UC Davis*

Background: Within typically developing and clinical populations (e.g., ASD, ADHD), behavior problems tend to decrease as children transition into adolescence. Among higher functioning adolescents with autism (HFA), improvements are seen in standard scores of language and cognitive functioning (Sutera et al., 2007). Predictors of symptom improvement tend to be factors that correlate with initial severity including cognitive functioning, age of diagnosis, expressive language, and intervention history. However, non-syndrome specific factors, such as temperamental social withdrawal and effortful control, have yet to be explored in relation to developmental change.

Objectives: 1)To examine change in symptom severity and social/emotional functioning over time in a sample of HFA and an age- and IQ- matched sample of typically developing adolescents (COM). 2)To examine syndrome specific (i.e., IQ and initial symptomatology) and non-syndrome specific (i.e., Age, Effortful Control, and Surgency) factors as predictors of change.

Methods: Participants were 41 HFA and 42 COM adolescents, between the ages of 9 and 18. Parents completed the BASC-2, ASSQ, SCQ, EATQ, and SRS. Adolescents completed the self-report BASC-2 and WISC-IV.

Composite T-scores of parent and adolescent rated internalizing and externalizing behaviors were computed. All measures were collected at two time points separated by 1.5 to 2.5 years.

Results **:** Controlling for age, IQ, and initial symptomatology, repeated measures ANCOVAs did not reveal developmental changes in ASD symptoms. However, an interaction between diagnostic group and time, $F(1,78)=4.31$, $p=.04$, $\eta^2=.05$, revealed that the COM group showed a significant decline in internalizing problems, $F(1,38)=4.57$, $p=.04$, $\eta^2=.11$, but the HFA group did not. Similarly, externalizing problems were predicted by a diagnostic group by time interaction, $F(1,78)=6.08$, $p=.01$, $\eta^2=.07$, with a significant decline in externalizing behaviors in the HFA group, $F(1,37)=6.81$, $p=.01$, $\eta^2=.16$, but not the COM group.

A series of regressions were conducted within the HFA group to analyze syndrome specific (IQ, symptom severity) and non-syndrome specific (age, Effortful Control, Surgency) predictors of change in symptoms and behavior problems. The model for symptom change was not significant. However, change in internalizing problems was significant, $F(5,41)=3.81$, $p=.01$, with greater Surgency predicting more improvement, $t(35)=.2.5$, $p=.02$. The model for change in externalizing was also significant, $F(5,41)=3.36$, $p=.01$, with older age, $t(35)=2.35$, $p=.02$, and higher IQ, $t(35)=2.18$, $p=.04$, predicting more improvement.

Conclusions: In summary, HFA participants did not show a decline in symptom severity and did not, as a group, show a reduction in internalizing problems like the COM sample did. However, within the HFA group, more approach oriented children showed a greater reduction in internalizing problems. Temperamental approach may allow children with HFA to benefit from the rich social learning environments of adolescence and function to reduce feelings of anxiety and depression. Interestingly, HFA participants showed more improvement in externalizing problems than COM participants and these improvements were most pronounced for older participants and those with higher verbal IQs. These factors may allow for improved socialization both at school and in the home. Results will be discussed in terms of risk and protective factors promoting behavior change over the transition to adolescence.

117.022 22 Prospective Case Study of Siblings of Children with Autism Spectrum Disorders in Japan. F. Someki*[1], T. Miyachi[2], K. J. Tsuchiya[1], K. Matsumoto[1], Y. Seno[3], S. Nakajima[1] and M. Tsujii[4], (1)*Hamamatsu University School of Medicine*, (2)*Nagoya City University Hospital*, (3)*Aichi Prefectural University*, (4)*Chukyo University*

Background: The prevalence of autism spectrum disorders (ASD) has been increasing over the past 15 years, and currently the estimated prevalence rate of ASD ranges from approximately 6.6 to 12 per 1,000 births in developed countries such as the United States, United Kingdom and Japan (e.g., Baird et al., 2000; Fombonne et al., 2003; Honda et al., 2005). Although the estimated appearance rates vary, it is certain that the number of children with ASD in our society is not small to be ignored. Recently, Ozonoff and colleagues (2011) reported that siblings of those who have ASD have even higher prevalence rates of ASD than general population, indicating the importance of early screening of siblings of ASD children. However, little is known about the details of the siblings' developmental course yet, especially in countries other than the U.S.

Objectives: The purpose of this study was to examine unique developmental characteristics among younger siblings of children with ASD, if there was any.

Methods: This study was a part of a small prospective study of siblings of children with ASD in Japan. All the participants (i.e., siblings) of the study were assessed at the following months: 4, 6, 10, 14, 18, 24, 31, 37 and 50 using the Mullen Scales of Early Learning (Mullen, 1995). For this presentation, two to three participants were selected to examine the early signs of ASD and other developmental risk. The results of each assessment will be presented at the presentation.

Results: For those participants who exhibited early signs of ASD or other developmental risk, the signs started to appear as

early as 18 months. Unique behavioral characteristics were also observed during the assessments.

Conclusions: Although the number of participants were very few, this study suggested the importance of early screening of siblings of children with ASD both quantitatively and qualitatively.

117.023 23 Gender Differences in Pragmatic Language Features Associated with the Broad Autism Phenotype Among Parents of Children with Autism. J. Klusek*[1] and M. Losh[2], (1)*University of North Carolina at Chapel Hill*, (2)*Northwestern University*

Background: Pragmatic language impairment is a primary feature of the broad autism phenotype (BAP), which is characterized by subthreshold personality and language traits that are seen among family members of individuals with autism and reflect underlying genetic susceptibility (Landa et al., 1992; Piven et al., 1997; Ruser et al., 1997). Although a strong gender bias is seen in autism, with a gender ratio of approximately 4:1, it is unclear whether this gender bias exists in the presentation of the BAP in general, and specifically in pragmatic language features of the BAP. Prior reports are conflicting, with some indication that pragmatic language difficulties may be more frequent among mothers than fathers (Piven et al., 1997; Ruser et al., 2007), while other reports have failed to detect gender effects (Landa et al., 1992). Understanding gender bias in the BAP may lead to a more comprehensive characterization of the BAP, and inform potential etiologic mechanisms in the BAP and autism.

Objectives: This study characterized pragmatic language among parents of individuals with autism in order to examine gender differences in the BAP. Additionally, associations between pragmatic language features and personality traits that have been documented as part of the BAP (i.e. aloof, rigid, perfectionistic, and untactful traits) were explored in order to identify features that may be differentially associated with pragmatic language features in males versus females.

Methods: Semi-structured conversational interviews were conducted with fathers (n=39) and mothers (n=49) of individuals with autism. The Pragmatic Rating Scale-Revised (PRS; Landa et al., 1992) was used to assess pragmatic language violations from videotaped interview. Scores were computed for the PRS total score, and for three PRS subscales that had been derived through factor analysis in an independent sample (Losh et al., in review). The Modified Personality Assessment Schedule (M-PAS) was administered to assess aloof, untactful, rigid and perfectionistic personality features as potential correlates of pragmatic language features.

Results: Fathers and mothers of children with autism did not differ on PRS-total score, the PRS-dominating and PRS-suprasegmental subscales. Fathers scored significantly higher than mothers on the PRS-withdrawn subscale ($t(86) = 2.56$, $p = .012$), which is characterized primarily by conversation that was vague, terse, and lacking reciprocity. Exploratory correlations showed that aloof personality was significantly associated with the PRS-total score ($r = .337$, $p = .019$), the PRS-withdrawn subscale ($r = .395$, $p = .005$), and the PRS-suprasegmental subscale ($r = .468$, $p = .001$) among mothers, while these relationships did not approach significance among fathers ($ps > .412$). No other significant associations were detected with personality features.

Conclusions: Fathers of children with autism showed elevated rates of withdrawn communication style as compared to mothers, although overall pragmatic language ability did not differ between these groups. Pragmatic language features were associated with aloof personality style among mothers but not among fathers. Therefore, mechanisms underlying pragmatic language in the BAP may be gender-specific, although it remains unclear as to whether these gender differences are environmentally or biologically mediated. Knowledge of gender differences in BAP can contribute to our understanding of how genetically-linked traits associated with autism are transmitted within families.

117.024 24 Specific Phenotypes in Autism Spectrum Disorders Are More Prevalent in Affected Females. E. Ben Itzchak*[1], S. Ben-Shachar[2] and D. A. Zachor[3], (1)*Ariel University Center of Samaria*, (2)*Tel Aviv Sourasky Medical Center*, (3)*Tel Aviv University / Assaf Harofeh Medical Center*

Background:

Autism spectrum disorders (ASD) represent a heterogeneous group of conditions. In addition to the classic triad of ASD (impaired language and communication and stereotyped behavior), some individuals show other phenotypes such as, accelerated head growth and macrocephaly, seizures (5-46%), developmental regression (15-30%) and various neurological deficits. Because females compose only about 20% of the ASD population, these female-specific characterizations may be overlooked when investigating the entire ASD group. We hypothesized that the presence of different clinical phenotypes represents more extensive brain involvement and will be associated with increased female's presentation in ASD.

Objectives: To examine the M:F ratio in specific clinical phenotypes commonly described in ASD, including macro- and microcephaly, seizures, developmental regression and minor neurological deficits (MND).

Methods:

The study included 611 participants aged 15m-18y (M=42.6m SD=28.4m) referred to a national autism center for diagnosis of ASD. Evaluation included neurological and behavioral assessments and obtaining of medical, developmental and familial histories from the parents. ASD diagnosis included the use of the Autism Diagnosis Interview-Revised (ADI-R) and the Autism Diagnosis Observation Schedule (ADOS) tests, and meeting criteria for autism/ASD based on DSM-IV criteria.

Results:

M:F ratio in the ASD group (n=537) was 6.8:1 and significantly higher than the ratio of 2.7:1 in the group that did not meet criteria for ASD (n=74). Mean head circumference (HC) percentile for males (50.0±26.2) was significantly larger (p=.01) than for females (42.0±29.0). Microcephaly (≤3%) and macrocephaly (≥97%) were more frequent in ASD than expected (5.9%, 22.4% respectively). The M:F ratio was significantly lower (p=.001) in the microcephalic group (2.1:1; n=31) compared to the >3 HC percentile group (7.7:1; n=496), indicating an increased rate of microcephaly among females with ASD compared with males. However, M:F ratios in the macrocephalic group (6.2:1; n=118) and the <97 HC percentile group (10.4:1; n=409) were not significantly different. Seizures were documented in 5.8% of the ASD group (n=502). The rate of seizures among females with ASD was 13.4%, higher than the rate of 4.6% in the male population. M:F ratio in the seizures group was significantly lower (p<.01)) than in the non-seizures group (2.5:1; 7.3:1 respectively). Regression was noted in 21.8% of the ASD group (n=532) and was significantly higher (p<.05) for females (31.9%) than for males (20.3%). M:F ratio for the group with social regression (4.3:1) was significantly lower (p<.05) than for the non-regressive group (8.4:1). M:F ratio differences were not observed for regression in other domains. MND was documented in 56.8% of the ASD cases and included hyperlaxity of joints (38.8%), hypotonia (28.0%), abnormal DTR (20.4%) and cerebellar dysfunction (27.0%). M:F ratio in the MND group (5.0:1) was significantly lower (p<.05) than the ratio for the group without MND (11.3:1).

Conclusions:

The higher proportion of microcephaly, seizures, developmental regression and MND in females suggests the existence of 'female ASD' that presents with unique clinical manifestations. This increased female representation in the examined phenotypes suggests that the etiologies and mechanism of ASD in females are different, broader and more associated with other neurological abnormalities than in males.

117.025 25 Autism Spectrum Disorder: A Gender Defiant Disorder. S. Bejerot*[1], J. M. Eriksson[1], M. B. Humble[2] and E. Eriksson[3], (1)*Karolinska Institutet*, (2)*Uppsala University Hospital*, (3)*Institute of Neuroscience and Physiology*

Background:

One hypothesis that has been advanced to account for the cognitive style in autism spectrum disorders (ASD), is referred to as "the extreme male brain". This model views ASD as resulting from increased testosterone exposure in utero. However, many adults with ASD appear androgynous, youngish for their age and are ambiguous in sexual

preferences according to clinical observations. Also, ASD is common in gender identity disorder.

Objectives:

The present study aims to examine testosterone levels and signs of masculinization / feminization in adults with ASD compared to healthy controls.

Methods:

50 adults (24 females and 26 males) with an established diagnose of ASD and without intellectual disability, and 53 age and sex matched healthy controls participated in this study. The ASD diagnosis was confirmed with the ADOS interview. All subjects were photographed in underwear. Circumference of head, wrists, chest, waist and hip were measured with tape measure and second to fourth digit ratio (2D:4D) was measured with a caliper from the middle of the proximal crease to the fingertip. The participants' voices were recorded while they were reading a short story. Blood test for analyses of serum testosterone (sT) and bioactive testosterone were drawn between 9 AM and 1.20 PM in all participants.

Eight independent observers, 18-47 years, assessed the extent to which the participants' appearance was considered to be gender-characteristic. The characteristics were estimated based on a 5-point likert scale. Masculinization / feminization of the voices were judged accordingly. Inter-rater reliability was calculated using Cronbach's alpha. A sample of the photos was re-evaluated a month later to assess intra-rater reliability.

Results:

Females with ASD had higher total and bioactive testosterone levels, less feminine facial features and larger head circumference than female controls. Males in the ASD group were assessed as having less masculine body characteristics and voice quality, and displayed higher (i.e. less masculine) 2D:4D ratios, but similar testosterone levels as compared to controls. Androgynous facial features correlated strongly and positively with autistic traits measured with The Autism-Spectrum Quotient in the total sample.

Conclusions:

Our findings suggest that ASD, rather than being characterized by masculinization in both sexes, may constitute a gender defiant disorder.

117.026 26 Gender Differences in Clinical Presentation of Autism Spectrum Disorders. Y. J. Howe*[1], Y. E. Yatchmink[1] and E. M. Morrow[2], (1)*Hasbro Children's Hospital, Brown Alpert Medical School*, (2)*Brown University*

Background: It is well known that many more males present with autism than females, with an overall male to female ratio of around 4.5:1. Furthermore, this ratio becomes more discrepant among those with higher IQ, with reports of gender ratios as high as 5.7:1. However, whether there are clinical differences in autism presentation between males and females is less well understood. Earlier studies suggested worse autism symptoms in females, but this was thought to be solely related to IQ. Studies in high functioning autism have suggested worse social functioning and psychopathology in females as compared with males. It is difficult to draw conclusions across studies due to the limited number of females available and heterogeneity among subjects between studies.

Objectives: The aim of this study was to examine differences in clinical presentation of Autism Spectrum Disorders (ASDs) between males and females across a range of developmental functioning using standardized measures of symptom severity.

Methods: Data were obtained from the Autism Genetics Resource Exchange (AGRE), a national dataset of primarily multiplex families with children with ASDs. There were 1446 males and 343 females over the age of 5 that met Autism Diagnostic Interview (ADI) and Autism Diagnostic Observation Schedule (ADOS) criteria for Autism or Autism Spectrum. We separated subjects into 4 groups based on age and verbal ability, similar to the methods proposed by Gotham et al in their 2007 revised ADOS algorithm: 1) those administered ADOS Module 1 who were nonverbal, 2) those administered ADOS Module 1 who had some words, 3) those administered Module 2 (for those with phrase speech), and 4) those administered Modules 3 or 4 (for those who have fluent speech). Within each group, scores on the Stanford-Binet

Intelligence Scales, Vineland Adaptive Behavioral Scales (VABS), and parent-rated Social Responsiveness Scales (SRS) were compared between the genders.

Results: There were no significant age or IQ differences between genders, within each group. There were no gender-associated clinical differences noted among those administered Modules 1 or 2. Among those administered Modules 3 or 4, females had lower SRS scores (better social functioning; $p<0.05$) higher VABS scores (better adaptive functioning; $p<0.01$), and lower ADOS severity scores ($p<0.01$) than males. Despite an average IQ of 95 in males and females administered Modules 3 or 4, the VABS Adaptive Behavior Composite was significantly impaired (<75) for both males and females.

Conclusions: In this dataset of multiplex families with autism, higher functioning females diagnosed with Autism Spectrum Disorders appear to have better adaptive and social functioning than males. These results suggest that in the general population females may not be diagnosed with autism due to better social and self-care skills. However the significant discrepancy between IQ and adaptive functioning noted in higher functioning autistic individuals highlights the importance of appropriately identifying ASDs in order to provide appropriate therapy. These results are currently being replicated in other datasets, with similar findings.

117.027 27 Gender Differences in Emotional and Behavioral Characteristics of Children with ASD. W. T. Brooks*[1] and E. M. Butter[2], (1)*The Ohio State University Nisonger Center*, (2)*Nationwide Children's Hospital*

Background:

There is little research examining how gender affects behavioral and emotional characteristics of children with ASD. Early studies suggest that girls with ASD may be more at risk than boys with ASD for developing internalizing and affective problems, which may be particularly pronounced in older girls. It is critical to identify gender differences to determine if specific gender-targeted diagnostic and treatment methods should be developed to address the unique challenges that boys and girls with ASD experience.

Objectives:

It is hypothesized that girls with ASD will present with more internalizing and affective problems than boys with ASD; increased age and level of intellectual functioning will contribute to higher internalizing and affective problems; and gender will interact with these factors, with older, higher-functioning girls exhibiting more problems.

Methods:

A record review from a Midwestern ASD assessment clinic was conducted. Participants included 357 boys and 58 girls, ranging from 1.5 to 18.5 years old (mean age = 5.3 years). There were no differences between girls and boys on age, level of intellectual disability, or ASD diagnosis. Participants had been diagnosed with ASD by experienced clinicians, using DSM-IV criteria, parent interviews, and standardized caregiver-rated and clinician observational measures, including the parent-rated Child Behavior Checklist (CBCL).

One-way ANOVAs were conducted to compare CBCL T-scores between girls and boys on several clusters of CBCL scales, including the syndrome scales, the internalizing, externalizing, and total problems domains, and the DSM oriented scales. Correlations among gender, age, level of ID, and CBCL subscales were also examined. A hierarchical stepwise linear regression was conducted to determine how much of the variance on particular scales could be accounted for by gender, age, level of intellectual disability, and the interaction between gender/age and gender/intellectual disability.

Results:

There were no statistically significant differences between boys and girls with ASD on any of the CBCL scales, but there were differences on two of the CBCL scales with moderate effect sizes. On the affective ($p = .051$, $\eta^2 = .31$) and sleep scales ($p = .039$, $\eta^2 = .23$), girls scored higher than boys. Regression analyses indicated that gender did not significantly contribute to affective or sleep subscale scores, although age and level of ID did, with older children with higher levels of intellectual functioning exhibiting more affective and sleep problems. Gender/age and gender/intellectual disability

interactions did not contribute significantly to scores. Age was significantly positively correlated with the anxiety/depression, sleep, affective, and ADHD scales, as well as the internalizing, externalizing, and total problems domains. Level of ID was significantly negatively correlated with the anxiety/depression subscale and positively correlated with the attention and ADHD scales.

Conclusions:

Although there were fewer gender differences than expected, some interesting trends emerged, suggesting that girls with ASD may experience more affective and sleep problems than boys with ASD. Age and intellectual functioning played a larger role in predicting these CBCL scores than gender, indicating the need for clinicians to consider these factors when assessing emotional and behavioral problems in individuals with ASD throughout the lifespan.

117.028 28 Disparity in Report of Autism-Related Behaviors by Child Sex and SES: Findings From a Population-Based Study in Taiwan. P. C. Tsai*[1], L. C. Lee[1], I. T. Li[2], R. A. Harrington[1], P. Yang[3], C. L. Chang[4] and F. W. Lung[5], (1)*Johns Hopkins Bloomberg School of Public Health*, (2)*Calo Hospital*, (3)*Kaohsiung Medical University* , (4)*Kaohsiung Armed Forces General Hospital*, (5)*Taipei City Hospital*

Background: Evidence indicates that many people live with ASD without being diagnosed. Such under-diagnosis underscores the urgent need for population-based studies that provide full coverage of case identification in the target population. Though providing clinical assessments to each individual in a population is not practical, multi-stage case identification that involves screening followed by clinical evaluation is a feasible way to identify ASD, especially for populations without complete autism or autism-related services registries. Screeners that aim to identify individuals at high risk for ASD are vital for multi-stage case identification. While the majority of ASD screeners for children are caregiver-reported, a biased report would make the screening result invalid. In addition to psychometrics of screening tools, investigating how SES factors affect reporting deserves attention. Understanding potential biases due to SES will improve the identification of autism-related behaviors and reduce false positives and negatives.

Objectives: To examine disparities in caregiver-reported SCQ scores by child sex and SES factors.

Methods: A population-based epidemiologic study of autism in children aged 6-8 involving a multi-stage case identification design was conducted in PingTung, Taiwan from 2008-2010. The SCQ rates autism-related behaviors and was used as a screener to identify children at high risk for ASD. The SCQ was translated and back-translated into traditional Chinese Mandarin and pilot tested before its use in this population. Studies from Western countries recommend a cut-point of 15 on the SCQ for differentiating between likely ASD and non-ASD diagnoses. This analysis includes a total of 2279 primary caregivers (60.0% mothers, 17.5% fathers, 22.5% grandparents and others) who completed the screener on their child (1083 boys and 1156 girls).

Results: Fathers reported significantly higher SCQ scores (more behavioral concerns) than did mothers and other caregivers (p-values all <.0001). As education levels of mother's and fathers' increased, the reported SCQ scores decreased with p-values <.001 for fathers and <.0001 for mothers. As expected, SCQ scores of children born preterm (7.66 ± 5.71) were significantly higher than those born full term (6.25 ± 4.63), with p<.0001. Using 15 as a cut-off, compared to fathers with an Associate/college degree, fathers with an education level <=middle school were 4 times (OR= 4.36, 95%CI: 2.76-6.90) more likely to report SCQ>=15, while those with a high school degree were almost twice (OR=1.82, 95%CI: 1.17-2.82) as likely to do so. A similar pattern was observed with mother's education level where <=middle school was 5.79 times (95%CI: 3.58-9.36) and high school was 1.83 times (95%CI: 1.15-2.92) more likely to report SCQ>=15 compared to Associate/college. Moreover, children born preterm were more than twice (OR=2.72, 95%CI: 1.77-4.19) as likely as full term children to have a reported SCQ score>=15.

Conclusions: Caregiver reported autism-related behaviors are associated with respondents' characteristics in this large scale population-based study in Taiwan. Fathers reported

more behavioral issues in their child than did mothers and other caregivers; and lower education levels were associated with reports of clinically concerning autism-related behaviors. Psychometrics of the SCQ and validation of data using multiple respondents on the same child will be discussed.

117.029 29 Evaluating Interactions Between Autism Severity and Typically Developing Adolescent Siblings' Resources and Coherence Levels. L. O. Smith* and J. H. Elder, *University of Florida*

Background: Research involving sibling dyads, particularly those in which one has a disability, is vitally important to health care providers because of integral roles family members play in providing, promoting and protecting the disabled person. It is necessary to identify the resources in the unaffected siblings that promote or interfere with their adaptation in order to facilitate adjustment and enhance conditions for all family members. Given the rising prevalence, complex nature of autism, and autism's impact on family adjustment, it is critically important to characterize unaffected siblings of individuals with ASD.

Objectives: The primary aim of the study was to characterize adolescent siblings of individuals with an Autism Spectrum Disorder through a description of demographic data, coping strategies, network quality, psychological well-being, and life orientation. A secondary aim was to test a health promotion model of Salutogenesis by Antonovsky.

Methods: Professional agencies serving families with an ASD were contacted via local offices and Internet websites to recruit for the study. Families who had a family member with autism, PDD-NOS, or Asperger syndrome contacted the researcher and were mailed a research packet if they and had a typically developing adolescent sibling who had lived with the individual with ASD for > than one year. Parents provided consent and completed a demographic survey and the Childhood Autism Rating Scale-2. Sibling assent yielded a sample of adolescent siblings (N=100). Data were obtained using four instruments: Network of Relationship Questionnaire – Social Provision Version; Adolescent Coping Orientation for Problem Experiences; Youth Self Report; and Sense of Coherence. Bivariate data from each instrument's subscales provided rich descriptions. Correlations of the concepts of resources, stress and coherence were examined and hierarchical multiple regression models were used to test the model. An indirect effect of each resource was also analyzed.

Results: A majority of the adolescent siblings were white (86%), female (59%). The median age was 14 (SD=2.02) with 63% older than their sibling with ASD. SOC scores were greater in female siblings and siblings from small families. Each of the instruments subscales had significant correlations ($p < .001$) to the SOC. The theoretical framework of Salutogenesis was supported by sibling data. With age and gender constant, higher SOC scores were inversely related to ASD severity ($r = -.270$; $p < 001$). The total problem scale on the YSR mediated the relationship of ASD severity and sibling SOC scores.

Conclusions: The functional capacity of individuals with ASD can vary but most have a normal lifespan and may outlive their parents. Thus, siblings of those with ASD may also be future caregivers; this has significant social implications. To date, little is known about the resources TD adolescent siblings have or need to prepare them to assume this important role. Thus, this research builds on previous sibling research and fills a gap in the literature by characterizing TD adolescent siblings of individuals with ASD. This study is a first step for promoting the health and adjustment of TD siblings of individuals with ASD.

117.030 30 Correspondance Between Maternal Concerns and Concurrent Infant Behavior in 12-Month-Old Infants At Risk for Autism. M. R. Thompson*[1], H. Tager-Flusberg[1] and C. A. Nelson[2], (1)*Boston University*, (2)*Harvard Medical School/Children's Hospital Boston*

Background: Data on the early development of autism spectrum disorders (ASD) primarily comes from two lines of research – prospective investigations monitoring the development of infants at risk for autism, and retrospective investigations of behavior based on parent interviews or coding of family home videos. Recent work on parent report measures suggests poor correspondence between retrospective reports of early infant behavior and observational measures of these same infants' scored from home video (Ozonoff et al., 2011). However, the relationship between parents' report of developmental concerns and infants' current behaviors has

not been systematically studied. Understanding the relationships between these concurrent measures will be important for both characterizing the early behavioral phenotype as well as improved screening and early diagnosis.

Objectives: The goal of this investigation is to examine parents' report of developmental concerns and the relationship between these reported concerns and infants' concurrent behaviors.

Methods: As part of their participation in an ongoing longitudinal study of infants as risk for autism, families were asked to complete short weekly diaries about infants' language and gesture acquisition, social play behaviors, and any developmental concerns on the part of the parent. Infants are considered low risk if there is no family history of autism (LRC) and high risk if at least one older sibling has a diagnosis. The present analysis included 40 families (25 HRA, 16 LRC), and focused on the 8-week period surrounding infants' first birthdays. Parental concerns were scored across several domains including both illness-related (flu, teething, fever, etc.) and ASD-relevant (language, social, temperament, repetitive behaviors, etc) concerns. A total score for each domain was calculated as the average number of concerns reported during this 8-week period. Infants were seen in the laboratory at 12 months of age, where they were administered the Mullen Scales of Early Learning (MSEL) and the Autism Diagnostic Observation Scale for Infants (AOSI). Verbal and Non-Verbal Developmental Quotients (VDQ and NVDQ) were calculated from MSEL scores, and infants' AOSI total scores were used as an index of ASD symptoms.

Results: HRA mothers reported significantly more ASD-relevant concerns than the LRC mothers ($t(27) = 3.47$, $p < .01$). There were no group differences in the number of illness-related concerns. HRA infants had significantly lower VDQ, but not NVDQ scores than the LRC infants. For HRA infants, maternal ASD-relevant concerns were significantly negatively correlated with infants' VDQ scores, but not AOSI total scores (VDQ: $r = -.50$, $p < .05$; AOSI: $r = .24$, $p = .26$).

Conclusions: The HRA mothers in this sample reported significantly more ASD-relevant concerns around infants' first birthdays than a group of age-matched control mothers. While these concerns were correlated with infants' concurrent language level, they were not correlated with infants' ASD symptoms. These results suggest that HRA mothers may be better at recognizing and reporting more concrete language-related 'red flags' such as lack of babbling or responding to name than more global measures of social engagement. The implications of these findings will be discussed.

117.031 31 The Early Developmental Trajectory of Initiating Joint Attention, but Not Expressive Vocabulary, Predicts Later ASD Severity in ASD-Sibs. L. V. Ibanez*[1], D. S. Messinger[2], Z. Warren[3] and W. L. Stone[4], (1)*University of Washington* , (2)*University of Miami*, (3)*Vanderbilt University*, (4)*University of Washington*

Background:

Joint attention and expressive vocabulary are two key facets of social communication that undergo rapid change early in life. These two communicative competencies have been examined in the at-risk siblings of children with an Autism Spectrum Disorder (ASD; ASD-sibs) as compared to the infant siblings of typically developing children (COMP-sibs). It remains unclear, however, when differences between the two groups emerge as the developmental trajectories of these behaviors across multiple time points have not been evaluated.

Objectives:

To describe the developmental trajectories of initiating joint attention (IJA) and expressive vocabulary in ASD-sibs and COMP-sibs between 12-18 months, and the extent to which they predict later ASD symptom severity at 24 months.

Methods:

IJA and expressive vocabulary were examined in ASD-sibs (n=50) and COMP-sibs (n=39) at 12, 15, and 18 months. IJA was measured as the number of Directing Attention items passed on the Screening Tool for Autism in Toddlers (STAT). Expressive vocabulary was measured as the Understands and Says score on the MacArthur Communicative Development Inventory. ASD severity was measured as the calibrated severity score on the Autism Diagnostic Observation Schedule

at 24 months in 28 ASD-sibs and 24 COMP-sibs for whom data were available.

Results:

Hierarchical Linear Models were used to model IJA and expressive vocabulary. IJA had an intercept significantly different from 0 that varied between infants, β_{00}=1.41, p<.01, and significant fixed linear change, β_{10}=.15, p<.01. Group status had a significant effect on the intercept, β_{01}=-.48, p<.01; ASD-sibs had lower overall IJA than COMP-sibs.

Expressive vocabulary had a fixed intercept significantly different from 0, β_{00} =5.79, p<.01, fixed non-significant linear change, β_{10}=-.13, p=.89, and significant quadratic change that varied between infants, β_{20}=1.85, p< .01. IJA was a significant time-varying predictor of expressive vocabulary, β_{30} =1.57, p=.04. Group status had a significant effect on the quadratic change, β_{21}=-.83, p<.02, as ASD-sibs had a slower upward curvature (increase) in expressive vocabulary than COMP-sibs between 12 and18 months.

The ordinary least squares estimates of the intercept of IJA and the quadratic change of expressive vocabulary (modeled independently of IJA) were examined as predictors of ASD severity. Among ASD-sibs, individual IJA intercepts predicted ASD severity, r(26)=-.75, p<.01; this association was not significant for COMP-sibs, r(22)=-.17, p=.42. Quadratic change in expressive language was not associated with ASD severity in either group, ps<.53.

Conclusions:

Differences between ASD-sibs and COMP-sibs in the developmental trajectories of joint attention and expressive vocabulary emerged within the first 18 months. Relative to COMP-sibs, ASD-sibs demonstrated slower growth in expressive vocabulary and showed lower levels of IJA at baseline and through 18 months (due to similar growth rates). Among ASD-sibs, higher baseline levels of IJA predicted lower ASD severity. Higher levels of IJA also predicted higher levels of expressive vocabulary for both groups. Overall, difficulties with IJA evident by 12 months (baseline) may represent an early marker of later ASD impairment.

117.032 32 Cognitive Profiles of Siblings of Individuals with ASD. J. M. Wolf*, P. Ventola and K. A. Pelphrey, *Yale University*

Background:

While it is widely established that individuals with ASD have varied cognitive profiles (Goldstein et al., 2008; Szatmari et al., 1995; Zander & Dahlgren, 2010; Ventola et al., 2010), little is known about the cognitive profiles of their unaffected siblings. The few studies that have been conducted have yielded mixed results. While overall cognitive abilities are generally found to be comparable between individuals who do and do not have a sibling with ASD, some studies have reported language or verbal weaknesses in individuals with siblings with ASD (Yirmiya et al., 2007; Gamliel et al., 2009). In addition, some studies (Fombonne et al., 1997; Folstein et al., 1999) have found a higher degree of variability in the cognitive profiles of siblings of individuals with ASD.

Objectives:

To further elucidate the nature of cognitive profiles of siblings of children with ASD.

Methods:

The DAS-II School Age Battery was administered to 50 siblings of children with autism spectrum disorders who participated in an MRI study at the Yale Child Study Center. The sample ranged in age from 5 to 16 years (mean = 11.3, s.d. 2.9) with a mean GCA score of 110.4 (s.d. 17.2).

Results:

Intra-individual discrepancies greater than 1 s.d. (15 points) in either direction were found at the following frequencies: verbal (V) vs. nonverbal (NV) abilities (38%); V vs. spatial (S) abilities (34%); NV vs. S abilities (20%). These frequencies are higher than would be expected based on the normative sample. Discrepancies of greater than 2 standard deviations were less frequent, but still greater than what would be expected based on the normative sample. However, this was entirely attributable to brothers, who exhibited discrepancies at notably higher rates than the normative sample (V vs. NV: 11.1%, V vs.

S: 11.1%, NV vs. S: 3.7%). None of the sisters in the sample showed discrepancies between any domains that exceeded 2 standard deviations. No clear pattern emerged with regard to the direction of the discrepancies. There were no significant differences between domain standard scores for the sample as a whole (reflecting the lack of directionality of the discrepancies), and standard deviations for each domain were comparable to the general population, suggesting typical levels of inter-individual variability for each domain.

Conclusions:

Siblings with autism spectrum disorders were found to have more intra-individual variability in their cognitive profiles than the general population. Despite prior findings of verbal weaknesses in siblings, the present study found no clear directionality to the cognitive discrepancies, with some individuals showing verbal strengths and others showing verbal weaknesses. Frequencies of discrepancies among cognitive domains in siblings were generally similar to those previously found in children diagnosed with an autism spectrum disorder (Ventola, 2010). These results are consistent with Kaiser et al.'s (2010) finding of shared dysfunction between children with ASD and their unaffected siblings, and provide further support for a common genetic vulnerability.

117.033 33 Excess of Non-Verbal Cases of Autism Spectrum Disorders (ASDs) Presenting to Orthodox Clinical Practice in Africa: A Trend Possibly Resulting From Late Diagnosis and Intervention. M. O. Bakare*, *Federal Neuro-Psychiatric Hospital, Upper Chime, New Haven, Enugu, Enugu State, Nigeria*

Background:

Characteristics of children with autism spectrum disorders (ASDs) in Africa are not known because of unavailability of large scale epidemiological studies in this region.

Objectives:

This review explored the age at first presentation of African children with ASDs to orthodox clinical practice and their expressive language ability at presentation.

Methods:

Literature search of case series and case reports of ASDs coming from Africa was done through PubMed/MEDLINE, Google Scholar, African Journal Online (AJOL), and archives of Nigerian Journal of Psychiatry. Six literatures included the content related to age of the child at first presentation to orthodox clinical practice and symptoms presentation related to expressive language ability and thus fulfilled the inclusion criteria. Postulations were made to explain the observations emanating from the review.

Results:

Excess of non-verbal cases over verbal cases of ASDs were presenting to orthodox clinical practice and there is a common denominator of late presentation/diagnosis and in turn interventions with most cases presenting for the first time well above eight years of age. The postulations made to explain these observations included; low level of knowledge and awareness about ASDs in Africa; problems with help seeking behaviour and lack of mental healthcare facilities and trained personnel.

Conclusions:

There may be a shift in the trend of excess non-verbal cases of ASDs over the verbal cases presenting to orthodox clinical practice with enhancement of processes directed at ensuring early diagnosis and interventions, especially interventions aimed at improving speech and language development well early enough.

117.034 34 Predicting Externalizing Behavior in Children with An Autism Spectrum Disorder Using the Child Routines Questionnaire. M. Pennick*[1], L. Greening[2], F. J. Biasini[1] and L. Stoppelbein[1], (1)*University of Alabama at Birmingham*, (2)*University of Mississippi Medical Center*

Background: There is a widely held belief that providing daily routines reduces acting out behaviors for individuals with an autism spectrum disorder (ASD). In the literature, this idea is supported by numerous qualitative accounts of the effectiveness of routines in decreasing behavior problems. The use of routines has also been incorporated as a part of

interventions that attempt to decrease the symptoms of autism (for example: Marquenie, et al., 20011; Laushey, et al., 2009). One measure that provides quantitative data about routines is the Child Routines Questionnaire (CRQ; Jordan, 2003; Sytsma et al., 2001). In typically developing children this measure has been shown to effectively predict externalizing behaviors (e.g., aggression, defiance). In one of the only quantitative studies of routines in autism, a group of typically developing children was compared to a group of children with an ASD. The researchers found that the CRQ score was not associated with less externalizing behavior in children with an ASD relative to the typical developing children (Henderson et al., 2011).

Objectives: This study builds on previous research by Henderson et al. by using the CRQ to investigate the relation between daily routines and externalizing behaviors in children with an ASD. It is especially interesting to understand how routines are important in various psychopathologies in children, as it has been shown that routines decrease symptomatology in children receiving psychological services (Ivanova & Israel, 2006) Thus, ADHD has been used as a comparison group for a sample of individuals with PDD NOS since children with ADHD often show higher levels of externalizing behavior secondary to their diagnosis.

Methods: Children admitted to a child psychiatric inpatient unit and their families were invited to participate in the study. The sample consisted of 58 individuals with PDD NOS and a comparison group of children with ADHD that was randomly selected and matched for age and sex to the PDD NOS group.

Results: Multiple regression analyses were used to examine the relation between CRQ, diagnostic status, and mother's irascibility to predict externalizing behavior. The results suggested that all three variables were significant predictors of child externalizing behavior. Thus, the CRI was examined further as a moderator of the relation between diagnostic status and externalizing behavior problems. More specifically, it was found that the PDD group responded to increased routines as measured by the CRI with less externalizing behavior relative to the children with ADHD . It was also found that mother's irascibility was a partial mediator of the relationship between diagnosis and CRI score.

Conclusions: While it remains unclear if routines decrease externalizing behaviors in typically developing children more than in children with ASD, it is clear that routines do have an effect on externalizing behaviors especially when those with ADHD are compared to children with ASD. In addition the emotional distress, specifically, irascibility of mothers is an important aspect of the relation between routines and externalizing behaviors. More research is needed to clearly explain these relations using objective measures of routines and externalizing behaviors in children with ASD.

117.035 35 Restricted, Repetitive Behavior: A Comparison of Children with Autism Spectrum Disorder, Obsessive-Compulsive Disorder, Down Syndrome and Two Typical Control Groups. D. W. Evans*[1], L. Scahill[2], P. T. Orr[3], S. M. Myers[3], T. Challman[3], G. S. Gerhard[3], S. Lazar[1], A. Morena De Luca[3] and D. H. Ledbetter[3], (1)*Bucknell University*, (2)*Yale University* , (3)*Geisinger Health System*

Background: Restricted, repetitive behavior (RRB) is a core feature in a wide variety of neurodevelopmental and neuropsychiatric disorders including autism spectrum disorders (ASD), Tourette syndrome (TS), and Obsessive-Compulsive Disorder (OCD), among many others. RRBs also vary as a function of developmental status, and children with Down syndrome (DS) for example, exhibit repetitive behavior commensurate to their mental age status. Few empirical efforts have compared the rates of RRB in various groups of children representing a range of neurodevelopmental or neuropsychiatric disorders .

Objectives: We aim to examine rates of RRB in children with the following diagnoses: ASD, OCD, Down syndrome, as well as two groups of neuro-typical children – one matched to the Mental Age, another to the Chronological Age of the DS group. We examine the clinical sensitivity of the Childhood Routines Inventory (CRI) with children of varying diagnostic status

Methods: **:** Parents of two-hundred fourteen children and adolescents ranging in age from 1 to 14 (1 to 21 years for the DS group) completed the CRI. Participants were recruited from a university-based clinic in the Northeast (the OCD group (n=42)) as well as sites in the Southeastern US (the DS (n=44), ASD (n=41) and neurotypical groups (CA match n=42; MA

match n=45). The CRI is a 19-item parent-report inventory assessing restricted, repetitive behavior. The CRI was normed on over 1500 families of typically-developing children yielding a two-factor structure—Repetitive Behavior and "Just Right" behavior (Evans, Leckman, Carter, Reznick, Henshaw, King & Pauls, 1997). Subsequently, factor analyses were performed on a sample of 319 children with neurodevelopmental disorders, and the factor structure yielded al third factor – sensory sensitivities. Whereas other measures of RRB tend to yield restricted ranges in typically-developing children, the CRI is normally distributed in typically-developing samples, allowing for more rigorous comparisons of typical and clinical samples.

Results: ANOVA compared the means of three CRI scales across diagnostic groups. For the Just Right factor groups differed significantly ($F(4,204)=14.02$, $p < .0001$). Post hoc tests revealed that the ASD group had significantly higher scores than all other groups. Similar results emerged for the Repetitive Behavior subscale ($F(4,200)=40.72$, $p< .0001$): the ASD group was significantly higher than all other groups, followed by DS, OCD and then CA-matched typical children. Only the ASD group differed from all other groups on the sensory sensitivities factor ($F(4,205)= 17.18$, $p<.0001$).

Conclusions: The factor structure of the CRI is best represented by a 3-factor structure in children with neurodevelopmental disorders. The three factors differentiate children with ASD from other diagnostic groups, as well as from MA- and CA-matched typical children. The CRI provides a useful clinical and research tool for assessing restricted, repetitive behavior in both typically and atypically-developing children.

117.036 36 Idiosyncratic Use of Language and Unusual References in Narratives of Optimal Outcome Children with a History of Autism Spectrum Disorders. J. Suh*[1], I. M. Eigsti[1], M. Barton[1], L. Naigles[1], S. Strazza[1], A. Orinstein[1], E. Troyb[1], K. E. Tyson[1], M. Helt[1], M. A. Rosenthal[1], R. T. Schultz[2], M. C. Stevens[3], E. A. Kelley[4] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Children's Hospital of Philadelphia*, (3)*Institute of Living, Hartford Hospital / Yale University*, (4)*Queen's University*

Background: A study is currently following children who have a history of autism spectrum disorder (ASD), but who no longer meet diagnostic criteria for such a disorder. These children have achieved social and language skills within the average range for their ages and receive little or no school support. Several recent studies suggest that this small subset of children, once diagnosed with ASDs, achieve "optimal outcomes" (Sutera et al., 2007; Helt et al., 2008; Kelley, Naigles, & Fein, 2010).

Objectives: The purpose of this study was to analyze narratives of individuals who have achieved "optimal outcomes" (OO) and contrast them with narratives of individuals with high-functioning autism (HFA) and typical development (TD), with a focus on idiosyncratic language and unusual references. Spontaneous narratives provide an especially sensitive method for investigating language abilities.

Methods: The "Tuesday" story from the Autism Diagnostic Observation Scale (ADOS) was collected from 45 participants (n= 15 per group), matched on age (*M* = 12.8, *range* = 9.9-15.6) and VIQ [*M (SD)*= 111.9 (16.4), 105.9 (15.9), and 114.0 (12.4) for OO, HFA, and TD, respectively, *p* = .26]. Narratives were analyzed by coders naïve to diagnosis. Idiosyncratic language was operationalized as unconventional use of language ("*congregating around a human suburb"*), overly formal or scripted language ("*stay tuned for the sequel"*), or use of neologisms *("electronical wires").* Unusual references were operationalized as odd specific references not apparent from the pictures (e.g., frogs named after Star Wars characters). The composite variable "idiosyncratic language/unusual references" was created to measure whether individuals in one group were more likely than another group to use *either* idiosyncratic language or make unusual references.

Results:

Logisitical regression analyses were conducted to determine whether group membership (OO, HFA, TD) could predict the use of idiosyncratic language and unusual references in narratives. The HFA group was significantly more likely to use idiosyncratic language than the TD group (odds ratio, 18.76, Wald c^2 (1)= 5.962, p=.02). However, the OO group did not

differ significantly from either the HFA or TD groups (p's >.11). Specifically, 4/15 OO individuals, 8/15 HFA individuals, and 1/15 TD individuals displayed idiosyncratic language in their narratives. There were no significant differences among groups in use of unusual references (p's>.07). However, the OO group and HFA groups were more likely than the TD group to produce *either* idiosyncratic language or make unusual references [OO: odds ratio, 6.30, Wald c^2 (1)= 4.635, p=.03; HFA: odds ratio, 7.8, Wald c^2 (1)= 5.883, p=.02]; there was no significant difference between the OO and HFA groups (p=.80). Specifically, 9/15 OO and 10/15 HFA individuals did so, compared to only 3/15 TD individuals.

Conclusions:

Despite achieving social and language skills within the average range, OO individuals are more likely than TD individuals to display idiosyncratic language or make odd specific references when producing narratives. These characteristics may transfer to and impact the quality of their conversations and social interactions with others. Furthermore, these results suggest that these pragmatic features of language may be more resistant to remediation.

117.037 37 The Behavior and Sensory Interests Questionnaire: Validation in a Sample of Children with Autism Spectrum Disorder. R. McNally Keehn*[1], N. Visyak[2], E. Thorpe[2], L. Harvey[3], E. Baroni[4], R. Hundley[5] and E. Hanson[2], (1)*Harvard Medical School*, (2)*Children's Hospital Boston*, (3)*University of Michigan Autism & Communication Disorders Center (UMACC)*, (4)*University of Maine*, (5)*Vanderbilt. University*

Background: Restricted and repetitive behaviors represent a core diagnostic feature of autism spectrum disorder (ASD), while sensory interests are thought to be an associated feature of the disorder. Prior research has shown that aberrant repetitive behaviors and sensory interests interfere with environmental exploration, development of play skills, and learning and academic performance in children with ASD. The Behavior and Sensory Interests Questionnaire (BSIQ) is a newly developed interviewer-administered, caregiver-report instrument that comprehensively assesses behaviors across six domains: Stereotyped Behavior, Unusual Sensory Interests/Aversions, Compulsive and Ritualistic Behavior, Rigidity, Aggressive/Self-Injurious Behavior, Language Perseveration, and Perseverative Interests.

Objectives: The aim of this study is to determine the psychometric properties of the BSIQ in a large cohort of children with ASD.

Methods: BSIQ data has been collected on a sample of 150 children (83% male; mean age = 7.94 years) with ASD as part of a larger study investigating phenotypic and genetic factors in ASD. ASD diagnoses were confirmed using the Autism Diagnostic Observation Scale and Autism Diagnostic Interview-Revised. Data collection for test-retest and inter-rater reliability is ongoing (target n = 60-100).

Results: Data analysis is currently underway. Preliminary analysis suggests excellent internal consistency among scale items (Chronbach's alpha = .91). An exploratory factor analysis will be conducted to determine the underlying factor structure of the BSIQ. In addition, test-retest and inter-rater reliability analyses will be conducted.

Conclusions: The BSIQ appears to be a feasible instrument for measuring restricted and repetitive behaviors and aberrant sensory interests in children with ASD. Implications for the use of the BSIQ across research and clinical settings will be presented. Finally, avenues for future research, including a comparison of the BSIQ across various developmental disorders, will be discussed.

117.038 38 Investigating the Association Between Anxiety and Fixed Interests, Repetitive Behaviors in Preschool Children with ASD. K. A. Baird*[1], P. Szatmari[1], S. Georgiades[2], E. Duku[2], S. E. Bryson[3], E. Fombonne[4], W. Roberts[5], I. M. Smith[3], T. Vaillancourt[6], J. Volden[7], C. Waddell[8] and L. Zwaigenbaum[7], (1)*McMaster University*, (2)*Offord Centre for Child Studies, McMaster University*, (3)*Dalhousie University/IWK Health Centre*, (4)*Montreal Children's Hospital*, (5)*The Hospital for Sick Children*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*

Background:

Autism Spectrum Disorder is a neurodevelopmental disorder characterized by two domains of symptoms; social

communicative impairments, and fixed interests and repetitive behaviors (FIRBs; APA, 2011). However, ASD often incorporates a wide variety of additional phenotypes making diagnostic accuracy and designing intervention programs difficult (Bellini, 2004). Anxiety symptoms are one of the most frequently reported phenotypes described in children with ASD (Bauminger, 2010, Oswald, Ollendick, & Scahill, 2009). Several studies have measured prevalence of anxiety symptoms among ASD individuals across age groups. The research available on anxiety in this population has demonstrated elevated levels of anxiety compared to other populations of children (Gillott et al., 2001; Kim et al., 2000). One popular suggestion why anxiety is a commonly reported feature in children with ASD is that this population lacks the coping mechanisms needed to manage stress (Groden et al, 2002). Anxiety has been described as an outcome of FIRBS, such that characteristic behaviours like insistence on sameness may lead to anxiety in children with autism (Muris, 1998) or that FIRBS are a way of coping with stress. In either case, increased levels of FIRBS would predict increased levels of anxiety.

Objectives:

The main objective of the current study is to examine the ability of FIRBs at baseline to predict anxiety 12-months later. Additionally, we examined whether the relationship between FIRBs and anxiety is influenced by child variables characteristics such as gender, age, IQ, and other ASD symptoms (i.e., social communication deficits).

Methods:

The sample consists of 68 preschool children who met clinical criteria for ASD according to the DSM-IV. A hierarchical linear regression was conducted to investigate whether FIRBs (as indexed by the Repetitive Behaviour Scale-Revised (RBS-R) overall score mean) at baseline predicts anxiety (as indexed by the Child Behaviour Checklist (CBCL) 1.5-5 anxious/depressed t-score) 12-months later over and above all child variables (age, sex, IQ) and other behaviour measures (ADOS module 1 social and communication raw scores).

Results:

FIRBs at baseline significantly predicted anxiety 12-months later (r^2=0.49, p=0.001) over and above all child variables (Age, sex, IQ and other behaviour measures). None of the child variables were significant predictors of anxiety.

Conclusions:

The current study proposes that FIRBs are a predictive measure of later anxiety in preschool children with ASD. This finding provides important clinical implications in terms of a clinical acknowledgement that early FIRBS may be an early manifestation of later anxiety or of treating FIRBs at an early age to prevent the onset of anxiety. Furthermore, these results combined with previous literature inform us that anxiety covaries with FIRBs and provide new information with regards to the way in which anxiety interacts with the core diagnostic features of ASD.

117.039 39 Cognitive Profiles and ASD Symptomatology. J. E. Elgin*, K. Ankenman, L. Vincent and R. Bernier, *University of Washington*

Background: Numerous studies have reported enhanced nonverbal relative to verbal IQ (NV > V) in children with ASD, and that children with a NV > V cognitive split display greater social impairment than children with other cognitive profiles (Tager-Flausberg & Joseph, 2003; Joseph, Tager-Flausberg, & Lord, 2002). Furthermore, recent genetic research has identified a quantitative trait locus influencing nonverbal-verbal IQ discrepancy in multiplex ASD families suggesting that IQ discrepancy may be a potential ASD phenotype (Chapman, et al., 2011). These findings support the hypothesis that children with this IQ discrepancy represent a unique subtype within ASD.

Objectives: We aimed to explore cognitive profiles in children with ASD and assess the relationship of nonverbal-verbal discrepancy to ASD symptomatology. We hypothesized 1) a distinct NV > V cognitive split would be observed in children with ASD with greater frequency than normative samples and 2) the presence of a NV > V split would be associated with greater ASD symptomatology and adaptive functioning impairment.

Methods: Participants included 1949 children (1710 males; 244 females) with ASD between the ages of 4 years and 17 years, 11 months old (*M* = 8.83 years, *SD* = 3.49) from the Simons Simplex Collection. Children were assigned to three different groups (NV > V, V > NV, and no discrepancy) based on the degree of split between their nonverbal and verbal IQ as measured by the Differential Ability Scales – 2nd edition (DAS-2). ASD symptomatology was measured using the Calibrated Severity Score (CSS) from the Autism Diagnostic Observation Schedule (ADOS) and domain scores from the Autism Diagnostic Interview-Revised (ADI-R). Adaptive behavior was measured using the Vineland Adaptive Behavior Scales (VABS).

Results: In our sample, 1150 (58.9%) showed no cognitive split, 535 (27.4%) showed a NV > V cognitive split, and the remaining 269 (13.8%) displayed a V > NV cognitive split. Results indicate a greater rate of NV > V IQ discrepancy relative to the DAS-2 normative sample ($X^2(2) = 236.31$, $p < .001$). MANCOVA, with age and gender covaried, revealed significant group differences in ASD symptomatology. The NV > V group showed greater impairment than the other groups on the ADOS CSS ($F(2, 1845) = 12.62$, $p < .001$) and the ADI-R social ($F(2, 1845) = 8.75$, $p < .001$) and communication ($F(2, 1845) = 11.23$, $p < .001$) domains. No significant group differences were found in adaptive functioning or ADI-R restricted and repetitive behaviors.

Conclusions: Our findings indicate that, within our large cohort of children with ASD, significantly more children exhibited the NV > V IQ discrepancy profile than would be expected in a neurotypical population. Children with the NV > V profile displayed elevated ASD symptomatology per clinician observation as well as parent interview compared to those with the V > NV profile and with no discrepancy. These findings are consistent with previous work identifying higher rates of a NV > V discrepancy in children with ASD and support the existence of an ASD subtype that may be a valuable phenotype for future genetic studies.

117.040 40 Overfocusing: A Possible Extension of the Broad Autism Phenotype. R. Allen* and M. Kinsbourne, *The New School for Social Research*

Background:

Existing literature provides support for the broad autism phenotype (BAP), the sub-clinical expressions of autistic characteristics in first-degree relatives of individuals with autism spectrum disorders (ASD). Key features of the BAP have been identified as social deficits, communication difficulties, and rigid personality. These features are congruent with the diagnostic criteria for autism. It has been proposed that hyperarousal may underlie these symptoms and call for compensatory overfocusing or shunning sensation by means of inflexible, perseverative and internalized attention. Overfocusing was found in 75% of a sample of 222 children with ASD (Liss, Saulnier, Fein, & Kinsbourne, 2006).

Objectives:

To determine the prevalence of overfocused attention in ASD parents, as an as yet unidentified component of the BAP.

Methods:

Thirty mothers of children with ASD completed the Kinsbourne Overfocusing Scale as a self-report and as an informant-based measure for the child's biological father. The mothers also completed the Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al. 2007), short versions of the Empathy Quotient and Systemizing Quotient (EQ-S & SQ-S; Wakabayashi et al., 2006), demographic information, and a parent-report measure of the severity level of the child's ASD symptoms overall, and in the domains of social deficits, communication deficits, and restricted/repetitive behavior.

Results:

Forty percent of the mothers exceeded cut-off scores according to the BAPQ self-report criteria. 45% met the criterion for overfocusing. Overfocusing scores were highly correlated with the BAPQ total (r=.77, p=.01), and with the BAPQ subscales, most notably with rigid personality (r=.67, p=01). According to the mothers' report, an even higher 67% (n=14) of ASD fathers met criteria for overfocusing. The overfocusing scores of fathers, reported by mothers, were correlated with the overall severity level of their children's ASD (r=.50, p=.05), and highly correlated with the level of their children's severity on the repetitive and restricted patterns of interest subscale (r=.66, p=.01).

The mothers' overfocusing self-ratings and the children's level of severity were not significantly correlated. Yet mother and father overfocusing scores combined accounted for significantly more variance (37%) than the fathers' overfocusing score alone (25%).

The mothers' EQ-S and SQ-S mean scores were within the normative range. However, the mothers' scores on EQ-S were negatively correlated with their BAPQ Total scores (r=-.64) and the BAPQ Aloof subscale scores (r=-.57).

Conclusions:

The degree of overfocused attention of ASD parents exceeded population norms and correlated significantly with the rated severity level of the children's autistic symptoms. These preliminary findings suggest that overfocusing is prominent among symptoms of the broad autism phenotype. If confirmed, these findings will place overfocused attention not only among core attributes of autistic behavior (Liss et al., 2006) but also of its subclinical expression in parents of autistic children.

117.041 41 Sensory Characteristics of Japanese Children and Youth with Autism Spectrum Disorders. T. Hagiwara*[1] and R. Iwanaga[2], (1)*Hokkaido University of Education*, (2)*Nagasaki University*

Background: An increasing number of research in sensory characteristics in individuals with Autism Spectrum Disorders (ASD) has indicated that a majority of this population has sensory related problems and such traits may have high relationship with those that have been considered as core symptoms of ASD. To investigate these issues and to support individuals who have sensory difficulties, there is a high demand for developing a standardized tool to assess sensory characteristics in Japan. This study was a part of a project of re-standardizing the Sensory Profile (SP: Dunn, 1999) and the Vineland Adaptive Behavior Scales, Second Edition (VABS-II: Sparrow, Cicchetti, & Balla, 2005) in Japan. The project is funded by Japanese Ministry of Health, Labor and Welfare.

Objectives: A pilot study was conducted using the original SP and the VABS-II standardized in the USA for Japanese children and youth with ASD. The study focused on (1) distributions of the study samples on the SP sections/factors, (2) differences between younger participants (3-10yrs) and older participants (over 11yrs) in the SP sections/factors, (3) relationship between the SP sections/factors and the VABS-II Maladaptive Behavior Index (VABS-II MBI).

Methods: 141 caregivers of children and youth with ASD aged 3 to 27 (95 male, 17 female) agreed to fill out the SP and the VABS-II. Although all forms of the SP and the VABS-II were translated in Japanese, scoring was completed using the norms originally developed in the USA.

Results: (1) Distributions of the study samples were skewed to "Definite Differences" in 9 out of 14 areas in the SP sections, and 7 out of 9 areas in the SP factors. (2) The SP scores of younger participants indicated higher sensory atypicality in 5 out of 14 areas in the SP sections, and 2 out of 9 areas in the SP factors, compared to those of older participants. (3) 6 out of 14 areas of the SP sections, and 4 out of 9 areas of the SP factors, were moderately and significantly correlated with the VABS-II MBI.

Conclusions: The SP scores revealed that Japanese children and youth with ASD obviously appear to have problems in sensory processing. Differences in the SP scores between younger and older participants may suggest that further investigation is warranted for developmental change in sensory difficulties of individuals with ASD. Moderate correlations between the SP and the VABS-II imply relationships in manifestation of sensory difficulties and maladaptive behaviors in ASD population. Since problems in social adaptations have been major indicators of ASD symptoms, sensory characteristics could also be the other indicators for diagnosing and assessing ASD. Overall, the results of the study supported the findings of related studies conducted in other countries; however, because the study used the norms of the original versions of the SP and the VABS-II that were standardized in the USA, some degrees of caution may be needed to discuss the implications of the results. Japanese standardizations of the SP and the Vineland-II are currently in progress.

117.042 42 Patterns of ASD-Onset and Parents' Beliefs about Causes. R. P. Goin-Kochel*[1], S. Mire[2] and A. G. Dempsey[3], (1)*Baylor College of Medicine*, (2)*University*

of Houston , (3)*University of Texas Health Science Center at Houston*

Background: Researchers traditionally have described two types of onset for autism spectrum disorders (ASD): *early onset*, which refers to delays/aberrant development during the first several months of life, and *regressive*, which characterizes children who exhibited seemingly typical development, then lost previously acquired skills. Recent investigations have expanded these categories to include *plateau* (no loss, but halted acquisition of new skills) and *early onset plus regression* (delays with loss of skills also observed) (e.g., Kalb et al., 2010; Shumway et al., 2011). Understanding the nature and prevalence of ASD onset is valuable because different developmental courses may imply different etiological mechanisms. Parental report of regression in their children also has been shown to color parents' beliefs about causes of ASD (Goin-Kochel & Myers, 2005), which has further implications for the types of treatments that parents choose to pursue.

Objectives: (a) To provide descriptive information about ASD-onset types among a large, well-characterized sample; (b) To determine whether parents' beliefs about causes of ASD are associated with their reports of how ASD manifested in their children.

Methods: Data will be analyzed for children with ASD (probands; *N* = 2755; *M* age = 9 years, *SD* = 3.6 years, range = 4—17.9 years) who participated in the Simons Simplex Collection (SSC). Type of ASD onset will be categorized using data from the *Autism Diagnostic Interview—Revised* (ADI-R), according to the system used in Shumway et al. (2011). A subset of these families (*n* = 68) participated in an additional project that used an ASD-adapted version of the *Revised Illness Perception Questionnaire* (IPQ; Moss-Morris, et al., 2002) to query parents' level of agreement with 21 possible causes of ASD. Frequencies of ASD-onset types will be presented for the entire SSC sample as a partial replication of Shumway et al. Frequencies of etiological beliefs about ASD have been calculated for the subset of families who completed the IPQ. Chi-square tests of homogeneity will be computed with data from the IPQ subsample to assess possible relationships between ASD-onset type and causal beliefs about ASD.

Results: The largest proportions of families agreed with 4 possible causes for ASD: genetics (75.8%), child's brain structure (59.7%), will of God (46.3%), and toxins found in vaccines/immunizations (41.8%). Disagreement was espoused by the largest percentages (52.2—93.9%) for all remaining possible causes (e.g., germ/virus, my partner's age, stress at birth), with the exception of "environmental pollution," which was espoused in relatively equal proportions (37.4% = agree; 28.4% = neutral; 34.3% = disagree). Results regarding ASD-onset patterns and their potential associations with beliefs about causes for ASD are forthcoming.

Conclusions: Most parents *disagreed* with a greater number of potential causes than agreed with them (16 vs. 4 causes). A larger proportion espoused vaccines as causing ASD than in prior work (~42% vs. 33%). This is surprising, given that the SSC was marketed largely as a genetic-factors study of ASD. Additional findings regarding prevalence of ASD-onset types in the SSC and their relations to etiological beliefs about ASD will be discussed.

117.043 43 Family History of Depression and Repetitive Behaviors in ASD. L. Nations*[1], J. Lee[2], J. R. Gilbert[1], M. A. Pericak-Vance[1] and M. L. Cuccaro[1], (1)*John P Hussman Institute for Human Genomics*, (2)*University of Miami*

Background:

Several studies have suggested an association between familial psychiatric disorders, particularly depression, and autism spectrum disorders (ASD) (Delong, 2007; Piven & Palmer, 1999). Depression is significantly more common among relatives of individuals with ASD than individuals with Down syndrome (Delong, 2004; Piven & Palmer, 1999). However, the relationship between ASD and the presence of depression is family members is unclear. At least one study has identified a relationship between the presence of parental depression and higher scores on the ADI-R repetitive behavior domain (Wallace 2008).

Objectives:

The aim of this study is to test whether the presence of depression in parents of individuals with ASD is associated with an increased rate of repetitive behaviors in their affected offspring.

Methods:

431 participants with ASD were identified from a larger dataset of families participating in a genetic study of ASD. All participants were assessed with the Repetitive Behavior Scales-Revised (RBS-R) and Vineland Adaptive Behavior Scales (VABS or VABS-II). Using a standard approach, family history data were collected for first- and second-degree relatives. Participants with ASD (mean age of 111 months, SD=59) were predominantly male (87%). Using family history data, we identified parents who were positive for a diagnosis of depression as reported by the family informant. We then divided probands into those with at least one parent who was positive for depression and those with parents who were negative for depression or other co-occurring neuropsychiatric or health issues. We compared the two groups on RBS-R scales using MANOVA.

Results:

The groups did not differ on sex, ethnicity, race, or age. The MANOVA, adjusting for developmental level (VABS), showed that the groups differed significantly on the dependent measures (Wilks' λ=0.971, $F(6,423)=2.136$, $p=0.048$). Univariate tests indicated that the ASD group in which a parent was positive for depression had significantly higher mean scores (i.e., greater impairment) on the RBS Self Injurious Behaviors scale ($p=0.004$).

Conclusions:

The presence of a parent with depression, based on family history data, is associated with an increased rate of self-injurious behaviors in ASD. There are several possible explanations for this association. First, the presence of self-injury, a severe clinical feature, may affect parental mood. However, depression among parents of children with ASD is often elevated both before and after having a child with ASD (Bolton et al. 1998, Piven & Palmer, 1999). Second, parental depression and repetitive behaviors may share a genetic susceptibility. Specifically, genes involved in the regulation of serotonin have been implicated in both repetitive behaviors (Brune et al. 2006) and depression (Kiyohara 2010). Limitations include the lack of a control group, use of family history data, and parental report of repetitive behaviors.

This study suggests that inspection of family history data may prove valuable in genetic studies of ASD. The current study showed a link between parental depression and a specific feature in ASD. This relationship may reflect a shared underlying genetic basis. Future research should explore the complex relationship between parental traits and behaviors in their affected children.

117.044 44 The Broader Autism Phenotype As a Predictor for Autism Spectrum Disorders. J. A. Burko*, C. M. Slater, L. M. Caccamo, E. Hanson and M. Gregas, *Children's Hospital Boston*

Background: The broader autism phenotype (BAP) is a milder expression of the personality and language impairments seen in Autism Spectrum Disorders (ASD; Hurley, Losh, Parlier, Reznick, Piven, 2007). It is well established that BAP is present in parents of children with ASD at a higher rate than in parents of typically developing children (Hurley et al., 2007). However, the relationship between parents exhibiting BAP and the presentation of their child's autistic features is unclear.

Objectives: This study seeks to examine the relationship between parents with elevated BAP and the severity of symptoms in their child. We predict that the Broader Autism Phenotype Questionnaire & Social Responsiveness Scale will be significantly correlated with the Calibrated Severity Score.

Methods: Approximately 450 families with at least one child clinically diagnosed with ASD have been enrolled in our study. A comprehensive battery was used to assess the cognitive and social functioning of the children with ASD. Diagnostic information was collected through direct assessment and parent report measures. Children with a diagnosis of ASD were administered the Autism Diagnostic Observation Schedule (ADOS), a standardized semi-structured assessment used to evaluate and diagnose Autism Spectrum Disorders. The ADOS is used to confirm diagnosis and used

to generate a Calibrated Severity Score (CSS). Parents completed two questionnaires aimed at measuring the broader autism phenotype: the Broad Autism Phenotype Questionnaire (BAPQ) about themselves and the Social Responsiveness Scale-Adult Research Version (SRS-ARV) about their spouse.

Results: Preliminary analyses indicate that 52 of 902 (5.7%) parents had either elevated BAPQ or SRS-ARV scores. Mothers' and Father's SRS scores were significantly correlated (P=.001), while their BAPQ scores were not found to be correlated to each other. Mothers' BAPQ scores were significantly correlated with the child's Calibrated Severity Score (CSS) on the ADOS when controlling for the fathers' BAPQ scores.

Conclusions: We are currently examining the data further by running a regression analysis to understand better how these parental questionnaires predict CSS in children. We predict that parents with higher BAPQ and SRS scores will have children with higher CSS. This will help to better understand the relationship between the broader autism phenotype and autism spectrum disorders. It remains unclear whether elevated BAPQ and SRS scores were contingent upon the challenges of raising a child with an ASD or if they were previously elevated prior to having an autistic child. Future research could examine if elevated BAPQ & SRS scores were related specifically to communication, reciprocal social interaction or restricted and repetitive behaviors of Autism Spectrum Disorders .

117.045 45 Broader AUTISM PHENOTYPE In PARENTS of CHILDREN with AUTISM, A CASE CONTROL STUDY FROM Tunisia. N. Gaddour*, N. Boussaid, S. Missaoui and L. Gaha, *University of Monastir*

Background:

Considering the genetic determinism of autism, many findings suggest the existence of autistic traits in relatives of affected children, and then a broader autism phenotype.

Objectives:

The objective of this study was to estimate milder autistic traits in parents of children with autism spectrum disorders (ASD)

Methods:

A case control study is conducted at the child psychiatry clinic of University Hospital F. Bourguiba, Monastir, Tunisia comparing a group of parents of children with ASD, diagnosed with CARS and according to DSM IV (N=119) and a control group of parents of typically developing children (TD). Parents were assessed with the Adult Autism Spectrum Quotient (AQ) (Baron-Cohen *et al.* 2001) consisting in 50 quantitative items and 5 sub-scales (imagination, communication, local details, attention switching and socialization)

Results:

First results showed that mean global AQ scores were higher in parents of children with ASD (20,39 ± 6,67 with extremes ranging from 6 to 45) in comparison with parents of TD (17,77±4,37, ranging from 5 to 28) (p=0,04)

Considering AQ subscales, significant differences were found for socialization (3,59±2,39 for ASD vs 2,77±1,67 for TD, p=0,01), imagination (4,54 ± 2 for ASD vs 3,27±1,51 for TD, p<0,001) and communication (3±2,03 for ASD vs 2,1±1,99 for TD, p=0,003)

No major difference was found for local details and attention switching subscales.

Conclusions:

These results confirm the existence of minor autistic traits in parents of children with ASD.

117.046 46 Use of Specific Language Constructs for a Family Genetics Study of Autism and Language Impairment. Z. Fermano*[1], J. Flax[1], A. Hare[1], B. Zimmerman-Bier[2], C. Bartlett[3], S. Buyske[1] and L. Brzustowicz[1], (1)*Rutgers University*, (2)*Saint Peter's University Hospital*, (3)*The Research Institute at Nationwide Children's Hospital & The Ohio State University*

Background: Over the past decade there have been multiple publications comparing the language behaviors of a subset of individuals with autism who have spoken language to individuals who have been diagnosed with Specific Language Impairment (SLI). One of the motivations for these

comparisons is to determine if there is a genetic link specifically in the language domain. Several genetic studies have already linked both disorders to genes on chromosome 7q using a language phenotype. While SLI is described as the failure to develop adequate language skills in the absence of any neurological or environmental influences, language issues are only part of the defining characteristics of autism. Both ASDs and SLI are complex disorders with potentially multiple gene involvement, so there is no reason not to believe that a subset of individuals with autism and a subset with SLI may share genetic influences. It has been difficult to replicate behavioral and linkage studies due to differences in recruited samples and variables used to create phenotypes. However, most agree that the more refined a phenotype is, the better the chance of it becoming a strong behavioral biomarker for autism.

Objectives: As part of a larger family study of the genetic basis of autism (New Jersey Language and Autism Genetics Study-NJLAGS), we developed language -based phenotypes for linkage and association studies of autism and SLI. We found that family members with language-based learning impairments (LLI) performed similarly to verbal family members who met criteria for ASD when broad language criteria were used such as oral language impairment (LI) and written language impairment (RI) (Flax et al., under review). In this next step of phenotypic characterization, our goal is to create more discrete language phenotypes for ASD and SLI, compare them to the current broader language phenotypes, then determine if they may be more advantageous for the creation of behavioral biomarkers.

Methods: Seven language constructs (subtypes) were created using task item analysis and test construct validity from the 22 subtest variables of the NJLAGS language testing battery. Subtypes include Language Comprehension, Expression, Phonological Processing, Verbal Memory, Higher Order Language, Processing Speed, Language Structure, and Written Language. Using bivariate correlational analyses, we looked separately at those individuals who were previously categorized as affected for ASD or LLI from the NJLAGS study and examined the strength of these newly created constructs to see if they may in fact serve as more discrete language phenotypes for future genetic analyses.

Results: Overall, there were more significant associations among the subtests included in each language construct for the ASD group than in the LLI group. Additionally, while there was some agreement between the two groups on which subtests within a construct were associated, there was greater variability in the number of subtests that were correlated and the strength of the correlations for the LLI group.

Conclusions: Using specific language constructs to characterize language phenotypes is a reasonable method for decreasing genetic heterogeneity in family linkage and association studies.

117.047 47 Broad Autism Phenotype in Typically Developing Children Predicts Performance on An Eye-Tracking Measure of Joint Attention. M. R. Swanson*[1], V. Erstenyuk[2], M. Jyotishi[3], F. Masry[3], G. Serlin[4] and M. J. Siller[1], (1)*The Graduate Center of City University of New York*, (2)*Hunter College, City University of New York*, (3)*Hunter College*, (4)*Graduate Center of the City University of New York*

Background: The current study constitutes the second step in a program of research that aims to develop, refine and validate a candidate endophenotype measure that has the potential to enhance our understanding of the etiology of Autism Spectrum Disorder (ASD). Children with this disorder often show deficits in gaze following. The proposed measure takes advantage of modern eye-tracking technology and evaluates how individuals allocate their attention when viewing social video vignettes that display an adult model (Face) who is gazing at a series of targets (Target) that appear and disappear in the four corners of the screen (congruent condition). Gaze allocation in the experimental condition is compared to a set of control stimuli where the model's gaze is not directed at the targets (incongruent condition). Data from our previous research (Swanson et al., under review) on neurotypical adults (N = 44) revealed two major findings. First, gaze allocation of adults differed significantly between the congruent and incongruent conditions. Second, individual differences in gaze allocation were significantly predicted by a self-report measure evaluating features of the broad autism phenotype (BAP).

Objectives: The current study adds to this program of research in two ways. First, we evaluate the feasibility of administering our experimental paradigm to a population of typically developing children. Second, we investigate how scores on a parent-report measure of the BAP predict gaze allocation during our experimental paradigm (SRS, Social Responsiveness Scale; Constantino et al., 2003).

Methods: Fifty typically developing children between the ages of 3 and 9 years participated in a series of standardized assessments to evaluate their verbal and non-verbal cognitive abilities. Parents completed the SRS, background, and medical questionnaires. Four children (8%) were excluded due to poor eye tracking data. The remaining 46 children (21 girls, 25 boys) were on average 6 years, 4 months old (*SD*=19.6 months).

Results: Typically developing children allocated less attention to the Face in the congruent (estimated marginal mean = 28.35%, SE = 2.17) than in the incongruent (estimated marginal mean = 32.41%, SE = 2.18) condition, $F(1,1221) = 10.77$, $p<.01$. Conversely, participants allocated more attention to the Target in the congruent (estimated marginal mean = 66.72%, SE = 2.31) than in the incongruent (estimated marginal mean = 62.54%, SE = 2.33) condition, $F(1,1221) = 10.59$, $p<.01$. We also fit a model with gaze time to the Target as the dependent variable, experimental condition (congruent or incongruent) and SRS *t* scores as main effects, and one interaction term (experimental condition*SRS *t* scores). With regards to the Target, results showed a significant condition*SRS *t* scores interaction effect, $F(1,1221) = 7.73$, $p<.01$. These results indicate that differences in gaze time allocation between the congruent and incongruent condition are more pronounced for participants with low SRS scores and less pronounced for individuals with high SRS scores.

Conclusions:

This program of research enhances our knowledge of basic science in regards to underlying neuropsychological processes that represent a potential ASD endophenotype. We are currently extending this research to include 22 language-matched children with ASD.

117.048 48 The Long-Term Course of Autism. Symptomatology and Social Adaptation Across the Life Span in a German Sample with Autism Spectrum Disorders. E. Duketis*, K. Teufel, R. Weber and C. M. Freitag, *Goethe University*

Background: Autism is known as a chronic condition associated with persistent deficits in social functioning and daily living skills. There is still a limited number of studies validating this concept and giving insight in the course of autism across the life span. A high variability in outcome has been shown in previous stuides. As prognostic factors cognitive and language abilities were replicated, but the relationship of severity and the pattern of autistic symptomatology on the later outcome remains still unclear. To our knowledge this is the first follow-up study assessing symptom patterns and social adaptation in a German sample.

Objectives: The aim of this study was to examine the outcome of participants with autism spectrum disorders in adolescence and adulthood with specific reference to social aspects (living conditions, education, employment) and the severity and patterns of the autism symptomatology. The identification of early characteristics predicting the social outcome of this condition is another relevant aim.

Methods: The current clinical sample comprises 20 patients first diagnosed with an autism spectrum disorder between 1991 and 2006 in Frankfurt. The patients were followed a minimum of three years after diagnosis with a mean of 9,9 years (SD 4,34). Mean age at follow up was 21,07 years (SD 6,19). Participants received a follow-up evaluation using the ADI and ADOS for diagnosis and as outcome parameters for severity of the autism symptomatology. The psychosocial outcome was measured using a sociodemographic interview assessing living conditions, educational success and employment at follow up. The social outcome among the partcipants was summarized using a classification similar to ratings published in previous studies ranging from good, fair, restricted to poor social outcome.

Results: All participants met diagnostic criteria for autism spectrum disorders at follow-up. Parents report still a significant reduction in autism symptom severity in all domains

from early childhood (assessed retrospectively for the age of 4-5 years) to the time of initial diagnosis. In the prospective examination with the ADOS the symptom patterns appear relatively stable from initial diagnosis to follow up. The social outcome in adolescence and adulthood is classified for about half of the participants as good to fair and for half of the participants as restricted to poor. As the strongest prognostic factor for social outcome cognitive abilities at age of diagnosis is replicated. No significant correlation was found between autism symptom severity at the time of diagnosis and later social outcome.

Conclusions: The preliminary findings confirm a very high diagnostic stability for autism spectrum disorders across the life span. A large proportion of the patients with autism spectrum disorders show a markedly improvement in symptom severity from preschool to school age, but show a relative high stability of symptom severity from adolescence to adulthood. The social outcome on the other hand is quite variable and is predicted even within the high-functioning-individuals by the cognitive abilities.

117.049 49 Social and Sexual Knowledge and Interests of High-Functioning Adults with ASD. M. E. Van Bourgondien*, *THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL*

Social and Sexual Knowledge and Interests of High-Functioning Adults with ASD

Background: Research on the intimate relationships and sexuality of adults with ASD is limited. Few studies have directly assessing the behaviors of high-functioning adults with ASD (Ousley & Mesibov, 1991, Henault & Attwood, 2005). As the population of individuals with autism ages, we need to add to our knowledge of the romantic and sexual interests and experiences of adults with autism in order to better address their needs.

Objectives: Goal of the study was to describe the current and past relationship status and sexual experiences of 50 adults with high functioning ASD, to determine their sexual knowledge, romantic and sexual interest, and finally to compare the findings with the results of a previous self-report study conducted by Ousley & Mesibov (1991).

Methods: Individuals with documented diagnoses of high-functioning ASD were recruited through clinics that served individuals with ASD and their families. The participants were asked about their previous engagement and current interest in romantic activities including dating, holding hands, hugging, kissing and sexual intercourse with members of both sexes. Finally, the participants were asked to define terms related to sexual anatomy and behavior. The data collection is just being completed.

Preliminary Results: The 50 participants included 31 males and 11 females. Forty-one subjects were single, 7 were divorced and 3 were married (one was divorced and remarried). Eleven participants were currently dating or married. Seventy-four of the subjects have dated at some time in their life. Forty-four percent have engaged in sexual intercourse with someone of the opposite sex at some time in their life. Four men reported engaging in sexual intercourse with both women and men. Analysis of the relationship between the desire to engage in sexual activities and actual sexual experience and knowledge has not yet been completed.

Sixty percent of the participants were definitely interested in dating members of the opposite sex and another 30% were a little interested in dating. Sixty-two percent were definitely interested in having sexual intercourse with a person of the opposite sex and an additional 16% had a little interest. The majority of males and females had no interest in dating (78%) or sexual activity (86%) with a partner of the same sex.

Conclusions: Preliminary conclusions indicate that the majority of adults with ASD express an interest in romantic and sexual interactions with members of the opposite sex, but are not successful in their efforts. Less than half of the participants have been sexually active at anytime in their life, and most reported that this activity occurred when they were in college or a young adult. While many of these individuals have dated or have been married at some time in their life currently only 11 were actually in a relationship and of these at least 4 of the relationships do not involve sexual intimacy. Interventions need to focus on how to develop romantic relationships as well as developing coping skills for individuals who are not getting their needs met.

117.050 50 Perceptions of Social Functioning In Young Children with ASD: Comparing Parent and Teacher Reports. M. B. Jackson*[1], M. Adolphson Horn[1] and E. Laugeson[2], (1)*The Help Group - UCLA Autism Research Alliance*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background: Research has investigated differences between parent-reports and self-reports of social functioning for children with Autism Spectrum Disorders (ASD); however, less is known about the specific relationship between parent-reports and teacher-reports of social functioning among children with ASD (Murray, Ruble, Willis, & Molloy, 2009). Moreover, the limited research that has been done in this area tends to focus on older children (Constantino, 2003). Because practitioners tend to use a multi-informant approach when assessing young children with ASD (Lecavalier et al., 2004), this branch of research should be more widely investigated, and represents a gap in the literature.

Objectives: This study examines both the differences and similarities in perceptions of social functioning among teachers and parents of preschool-aged children with ASD. The relationship between parent-reports and teacher-reports of social functioning on two standardized measures were investigated.

Methods: Parents and teachers of 11 children with ASD ranging from 3 to 5 years of age (M = 4.14, SD = .66) participated in this study. Raters completed the Social Responsiveness Scale (SRS; Constantino, 2005) and the Social Skills Rating System (SSRS; Gresham & Elliot, 1990) to assess perceptions of children's psychosocial functioning. Bivariate correlations were done on parent-reports and teacher-reports for the SRS and SSRS. Partial correlations were done as well in order to control for potentially extraneous variables.

Results: Results reveal that parent-reports of overall social responsiveness were significantly correlated with teacher-reports of social responsiveness on the SRS (r=.715, p=.013). However, this correlation was no longer significant when controlling for parent-reports and teacher-reports of Autistic Mannerisms on the SRS (p=.323). In addition, parent-reports were not significantly correlated with teacher-reports on the SSRS (r=.489, p=.127), due to lower reports of Self-Control (p=.036) by parents. Inter-item correlations showed that parent-reports and teacher-reports of Assertion on the SSRS did significantly correlate with one another (r=.685, p=.020).

Conclusions: The finding that parent-reports and teacher-reports on the SRS were only significantly correlated because of their reports of Autistic Mannerisms suggests that teachers and parents are in agreement on areas of functioning that are more outwardly apparent and quantifiable. The agreement between parents and teachers when specifically assessing Assertion on the SSRS, another more easily observable area of functioning, supports this conclusion. Nevertheless, teachers and parents do not appear to be in accordance when assessing areas of functioning that are more internal and not as easily perceptible, as shown by the lower teacher-reports than parent-reports of Self-Control on the SSRS. Assuming these findings are accurate representations of children's social behavior in different contexts, results suggest that certain social behaviors are context-dependent. Consequently, interventions targeting better communication about social functioning between parents and teachers of preschool-aged children with ASD would be advantageous.

117.051 51 Exploring the Associated Features of ASD. R. Kent*[1], S. R. Leekam[1], J. Gould[2] and L. Wing[2], (1)*Cardiff University*, (2)*National Autistic Society*

Background: The Diagnostic Interview for Social & Communication Disorders (DISCO) is a semi-structured diagnostic interview conducted with parents or caregivers that assesses the broad range of symptoms present in individuals with ASD. It covers all ages and levels of development. The DISCO allows measurement of both symptoms relevant for a diagnosis (social communication, social interaction and repetitive or restricted behaviours) as well as a number of symptoms that are associated with ASD, using a three scale severity rating (no/minor/marked problem). Such associated symptoms include sensory atypicalities emotional problems, motor atypicalities and impaired daily living skills (such as feeding, dressing & washing).

Objectives: The aim of the current study was to establish the prevalence of associated symptoms in individuals with ASD in

comparison to clinical and typically developing controls as well as determine the relationship between associated and core features.

Methods: DISCO interviews collected from parents of 200 individuals during clinical diagnosis were analysed. In addition an ASD sample of 33 (17 High Functioning Autism, 16 Low Functioning Autism) were compared against individuals with a developmental delay (DD;19) or language delay (LD;15) and typically developing (TD;15) individuals in order to assess the uniqueness of these symptoms to the ASD sample.

Results: The frequency of associated problems in ASD was high, with 80% of the sample having at least 1 marked motor problem, 86.5% 1 marked impairment in their daily living skills, 92.5% at least 1 marked sensory atypicality and 85% 1 marked emotional problem. Comparisons between groups revealed significant differences in presence of associated symptoms between LD/DD and ASD groups for emotional and sensory atypicalities and between ASD and TD samples for impairments in motor behaviours and daily living skills. Regression analyses of the larger (n=200) sample were conducted to assess if the associated symptoms were uniquely related to any of the core symptoms of ASD that are required for diagnosis (social interaction, communication & repetitive behaviours). Specific significant associations were found between sensory processing atypicalities and all of the core features (separate significant associations with social interaction, communication & repetitive behaviours). There were also significant specific associations between social interaction score and emotional problems; and between repetitive behaviours score and impairments in daily living skills.

Conclusions: The wider clinical implications highlight the need to screen individuals for associated as well as core ASD features. For example, assessment of emotional problems could provide indication of anxiety and depressive symptoms, which would require independent treatment. Including measures of associated symptoms will also improve both management and intervention plans for individuals with ASD. The DISCO already provides such measures as part of a developmental history interview and should be considered in clinical practice for diagnosis as well as research of associated symptoms.

117.052 52 Exploring the Sensory Symptoms in Adults with ASD Through Self-Report. L. White*[1], R. Kent[1], S. R. Leekam[1], D. J. McGonigle[2], J. Gould[3] and A. Kourkoulou[1], (1)*Cardiff University*, (2)*Schools of Biosciences/Psychology, Cardiff University*, (3)*National Autistic Society*

Background: The Diagnostic Interview for Social and Communication Disorders (DISCO) is a semi-structured parent interview that assesses the broad range of symptoms present in individuals with ASD, including the presence of sensory features. Research using the DISCO has reported that sensory features are reported in a high percentage of individuals with ASD. Sensory atypicalities are widely present in individuals with ASD but frequency estimates vary according to type of report and tool used. The DISCO differs from other techniques, such as the Sensory Profile, as it is based on sensory modalities.

Objectives: The objective was to assess the frequency of self-reported sensory atypicalities in high functioning adults using a new questionnaire developed from the DISCO. The association between responding to this questionnaire and responding to the Sensory Profile was analysed. The research also analysed the association between responses to the new sensory questionnaire responses and responses to a different self-report questionnaire, measuring autistic traits; the AQ.

Methods: A new 'Sensory Preferences Questionnaire' was developed from the sensory items in the DISCO (see Leekam et al., 2007) and its reliability tested. Twenty three individuals with a clinical diagnosis of high functioning autism or Asperger Syndrome completed the 'Sensory Preferences Questionnaire', AQ and Sensory Profile.

Results: Results revealed a significant difference between ASD and control participants on the 'sensory preferences questionnaire', with higher scores for the ASD group. Significant associations were also found between this measure and both the AQ and Sensory Profile.

Conclusions: It is argued that the sensory items from the DISCO provide a good measure of autism specific sensory problems.

117.053 53 Adults Presenting for a First Diagnosis of An Autism Spectrum Disorder: Issues and Opportunities.
K. A. Loveland*[1] and W. B. Bonnen[2], (1)*University of Texas Health Science Center, Houston*, (2)*University of Texas Health Science Center Houston*

Background: Although intellectually able individuals with ASD or Asperger's are now more often diagnosed in childhood, many are not identified until late adolescence and some not until middle or late adulthood (van Niekirk, Groen, Vissers et al, 2011). There are as yet few studies of their characteristics and needs. Some studies suggest that symptoms of ASD persist throughout life and that as adults these individuals have significant problems in life adjustment (Jantz, 2011; Stuart-Hamilton & Morgan, 2011) as well as frequent psychopathologies (Lehnhardt, Gawronsky, Volpert et al 2011; Lugnegard, Hallerback & Gillberg, 2011). Many questions remain about the developmental course of such persons; the reasons for late diagnosis; factors associated with better or worse outcomes; sex differences; characteristic areas of dysfunction and their effects on adjustment; associations of psychopathologies with ASD; and optimal approaches to intervention.

Objectives: We report findings on a sample of clinic referred older adolescents and adults of average or greater IQ aged 17 -64 years (26% female) who presented for a first diagnosis of an ASD. We examined characteristics of individuals who present late for diagnosis, as well as comorbid disorders that could potentially mask an underlying ASD. We also examined differences between adults who had and had not achieved adult life milestones including marriage/long-term partnership; stable employment/self-support; and independent residence.

Methods: Patients were assessed using a combination of the Ritvo Autism Asperger Scale, the Autism Spectrum Quotient, the Empathy Quotient, developmental and psychiatric history and extensive clinical interview. Subsets of patients also received the Social Responsiveness Scale (adult revision), the ADOS Module 4, the Personality Assessment Inventory, the Adult Self Report and the Adult Behavior Checklist.

Results: About 25% of the sample were employed full time, 25% were unemployed, and the rest either worked part-time or were students. About 50% had experienced difficulty sustaining employment. Thirty-one percent were living independently, 18% in a transitional (supported) situation, and the rest lived with their families. Twenty-three percent were married or partnered or had been so in the past, of these, almost all reported experiencing marital adjustment problems. With regard to psychopathology, 72% met DSM-IV TR criteria for one or more anxiety disorder, with the most common Generalized Anxiety Disorder, OCD, and Social Phobia; 36% met criteria for a depressive mood disorder, 36% for ADHD, and 23% for a specific learning disability. Results thus far suggest that neither age nor intellectual level differed between individuals with more and less favorable outcomes in this group. Moreover, significant psychopathology was common in all subsets of this sample. Those with higher educational level were not more likely to be employed, or married or to live independently.

Conclusions: Adolescents and adults who present for a first diagnosis of an ASD are diverse in their social, vocational and residential status. In this sample, the great majority had significant treatable psychopathology, including in most cases an anxiety disorder. Outcomes were not clearly related to intellectual ability, age, educational level or psychopathology. Further investigation of risk factors for unfavorable outcome is underway.

117.054 54 Adaptive Functioning on the Borderlands of the Autism Spectrum.
R. A. Varrall*[1], D. H. Skuse[2] and W. P. Mandy[3], (1)*Great Ormond Street Hospital*, (2)*Institute of Child Health, University College London*, (3)*University College London*

Background: Autism spectrum disorders (ASDs) are considered to be dimensional, sitting at the extreme end of a continuum that extends throughout the general population. As such, there are individuals with elevated autistic traits who do not meet criteria for an ASD. It is likely that, under current proposals for ASD in DSM-5, the diagnostic threshold will be raised, thus excluding from the autism spectrum some individuals who currently meet criteria for Asperger's syndrome and pervasive developmental disorder not otherwise specified

(PDD-NOS). This raises the question of where the threshold for ASD diagnosis should be set. One approach to evaluating the validity and utility of a diagnostic threshold is to test how well it captures people with high levels of functional impairment and excludes individuals who are not seriously functionally impaired.

Objectives: To investigate levels of adaptive functioning across the range of autistic presentations, to test how well current diagnostic thresholds distinguish between individuals with and without clinically severe levels of adaptive dysfunction.

Methods: Seventy-two young people (mean age = 11.03 years), referred for assessment at a specialist autism spectrum disorder (ASD) clinic were administered the Vinelands Adaptive Behaviour Scales (VABS); the parent-report 3Di; the Autism Diagnostic Observation Schedule (ADOS); Wechsler intelligence tests; and the Repetitive Behaviour Scale-Revised. Participants were classified according to DSM-IV-TR diagnosis, and those below threshold were included if they met AGRE criteria for 'broad spectrum' difficulties. Initially these groups were compared on measures of adaptive function. Correlational and regression models were then used to investigate relationships between IQ, autistic symptomatology and adaptive functioning.

Results: Adaptive functioning was impaired for the great majority of participants (88.9% scored within the VABS 'low' and 'moderately low' range). The proportion of children with impaired adaptive function did not differ significantly ($p>.43$) in individuals with autism (100% with impaired adaptive function), Asperger's syndrome (89%), PDD-NOS (84%) and sub-threshold autistic traits (92%). Individuals with sub-threshold, 'broad spectrum' autistic difficulties experienced adaptive function difficulties that were as severe as those with autism. In regression models, only IQ and reciprocal social interaction impairments were predictive of adaptive functioning difficulties in this clinical sample.

Conclusions: Young people presenting at a social-communication clinic with partial and sub-threshold autistic presentations show significant and severe adaptive functioning difficulties. These are as severe and widespread as disabilities found in children with full PDD diagnoses, namely Autism and Asperger's syndrome. This suggests that current diagnostic thresholds may be set too high to adequately capture all individuals whose autistic traits engender significant disability. Furthermore, plans to make ASD diagnosis more stringent in DSM-5 are likely to exclude children with clinically significant autistic difficulties from the support and treatment that comes with an ASD diagnosis.

117.055 55 Sensory Subtypes in Children with ASD: Latent Profile Analysis Using a National Survey of Sensory Features. K. K. Ausderau*[1], J. Sideris[2] and G. T. Baranek[3], (1)*University of North Carolina*, (2)*Frank Porter Graham Institute* , (3)*University of North Carolina at Chapel Hill*

Background: Sensory features are highly prevalent in children with ASD and have been suggested to have negative consequences in the daily life of children and families. Lacking in the literature is the identification of homogeneous sensory phenotypes that can be used to analyze the relationship of such subtypes with functional outcomes as well as inform precise diagnostic instruments and targeted treatment strategies.

Objectives: This study describes the methodology of characterizing sensory features in children with ASD using latent profile analysis (LPA) to create sensory subtypes and presents the association of the subtypes to child characteristics such as autism severity and mental age.

Methods: Data were collected as part of a national online survey from 1307 participants with ASD, ages 2-12 years. Sample consisted of 1068 boys (CA 93 (34) mos.) and 239 girls (CA 96 (35) mos.). ASD symptom severity was assessed using the Social Responsiveness Scale. The Sensory Experience Questionnaire 3.0 (SEQ) was used in a confirmatory factor analysis (CFA), which yielded four factors of sensory response patterns (i.e., hyporesponsiveness, hyperresponsiveness, seeking, and enhanced perception). Factor scores from the CFA were exported for analysis of latent profiles. LPA was used to detect the presence of distinct groups in the data set. Model fit was assessed with BIC and AIC as well as the Lo-Mendell-Rubin test. Mixed models, allowing for nesting of observation within family, were used to

explore the association of autism severity and mental age to the subtypes.

Results: Four distinct profiles (sensory subtypes) emerged as supported by model fit indices with increasingly small changes in both AIC and BIC values after the inclusion of the fourth profile. Further, the Lo-Mendell-Rubin test of change in the likelihood ratio was significant only up to the fourth profile. The first subtype (n=402, 31%) describes children who scored low on all sensory patterns, while those in the second subtype (n=288, 22%) showed exactly the opposite profile with the high scores in all four sensory patterns. The remaining two subtypes showed a split in their factor scores. The third subtype (n=404, 31%) scored close to the mean on all patterns, with some tendency to score low on seeking and hyporesponsiveness, but slightly above on hyperresponsiveness and enhanced perception. The fourth subtype (n=213, 16%) had the opposite pattern of the third subtype with scores tending to be more extreme on seeking and hyporesponsiveness. Autism severity was significantly related the subtypes while controlling for mental age, with subtypes two and four expressing the highest levels of autism severity, followed by the third subtype, and finally, the first subtype that expressed the least amount of autism severity.

Conclusions: The LPA further explores the co-existence of different sensory patterns in children with ASD. The identification of homogenous subtypes will allow for characterization of children within the subtype to functional child outcomes leading to improved assessment and treatment as well as potential identification of biological markers. Further analyses will determine the extent to which there are significant associations between the identified sensory subtypes with various child characteristics.

117.056 56 Autistic Characteristics Before and After the Age of Three in Children with Autism Spectrum Disorder. J. Shenouda*, S. Neves and W. Zahorodny, *UMDNJ-New Jersey Medical School*

Background: Autism Spectrum Disorder (ASD) is a group of disorders characterized by social impairment, communication impairment, and behavioral abnormalities. ASD is a heterogeneous disorder and manifests as various characteristics that constitute the DSM-IV-TR criteria for ASD diagnosis. Research on the occurrence and appearance of autistic characteristics is necessary to better understand the etiology of ASD as ASD prevalence has dramatically increased over the past decade.

Objectives: This study investigated the frequency of autistic characteristics before and after age three to determine if autistic characteristics increase or decrease in frequency with age, to determine if there are significant race or sex differences, and to examine if ASD children met the DSM-IV-TR criteria for ASD before the age of three.

Methods: Data were collected as part of a population-based ASD surveillance investigation carried out in Essex, Union, Hudson and Ocean Counties. Current findings represent 8-year olds (1998-born) in 2006. ASD ascertainment was by an active, retrospective, multiple-source, case-finding method, developed by the Centers for Disease Control and Prevention (CDC), based on review and analysis of information contained in health and education records. Demographic variables and case-specific data, contained in professional evaluations were analyzed before and after the age of 3. DSM-IV-TR criteria for autistic characteristics were observed in this sample of ASD children. T tests and Chi square tests were used to test associations.

Results: In a sample of 232 ASD children who had an average of 4 professional evaluations before age 3, significant increases in the frequency of seven out of twelve DSM-IV-TR autistic characteristics were found. Of those, 163 children (70%) met the DSM criteria for ASD before the age of 3. The following characteristics changed significantly: DSM-1a, non-verbal social behavior impairment, increased from 67% before the age of 3 to 81% after the age of 3 ($p<.001$) ; DSM-1b, peer interaction impairment, increased from 46% to 60% ($p<.001$); DSM 2b, communication/receptive language impairment, increased from 86% to 93% ($p<.05$); DSM-2c, repetitive language impairment, increased from 51% to 70% ($p<.001$); DSM-3a, restricted pattern of interest, increased from 28% to 46% ($p<.001$); DSM-3b, rigid non-functional routines, increased from 47% to 65% ($p<.001$); DSM-3c, stereotyped behaviors, increased from 50% to 65% ($p<.001$). There were no race differences; however, sex differences were observed. DSM 1b was more frequent in males before the age of 3 (M=

64%, F=37%; p<.01). DSM-1a and DSM-3c were more frequent in females after the age of 3 (M= 64%, F=83% and M=48%, F=70; p<.05 respectively).

Conclusions: Autistic characteristics are not static and some may increase over time. Tracking autistic characteristics over time may aid in the development of targeted interventions aiming to improve functioning. Early identification of ASD is a worthy goal, however, more specific approximation of the ASD characteristics manifesting before age 3 may be needed to guide identification efforts.

117.057 57 Developmental Phenotypes and Severity Profiles of Autism Spectrum Disorders in Preschool Children. K. A. Penner*, D. Chudley and A. Hanlon-Dearman, *University of Manitoba*

Background:

Revisions proposed to the classification of pervasive developmental disorders (PDD) in the DSM-V amalgamate all subcategories into one Autism Spectrum Disorder (ASD) with severity descriptors[1]. Measuring severity has broad applications to clinical, diagnostic, research, and intervention efforts and in disease prognosis. Gotham[2] developed a severity score algorithm using the Autism Diagnostic Observation Schedule–G (ADOS-G), a semi-structured, standardized play assessment with excellent interrater reliability, internal consistency, and test-retest reliability[3]. Gotham's algorithm combines 10 social interaction and communication ADOS items into one category (Social Affect), and adds 4 restricted/ repetitive behaviour items, age, and verbal skills to generate a diagnostic severity score. This approach emphasing clinical phenotype has been validated [4], with parent reports of adaptive skills and behaviour also of prognostic value [5,6,7].

Objectives:

Gotham's algorithm was used to analyze the relationship between clinical diagnosis and severity score in preschoolers referred for autism assessment. Scores and diagnosis were correlated with parent measures of adaptive and executive functioning and behaviour to expand understanding of preschool phenotypes of ASD.

Methods:

Retrospective data was collected from 602 charts of children assessed between 2006 and June 2011. Severity scores were calculated from the ADOS-G, with adaptive functioning, executive functioning (EF), and behavioural assessments including the ABAS-II [8], BASC-p [9], and BRIEF-P[10] respectively. Statistical analysis was performed using SPSS with final clinical diagnosis determined by developmental behavioural paediatricians and /or child psychiatry.

Results:

Severity scores were plotted according to clinical diagnosis, but no defined cut offs distinguished diagnostic groups other than at the ends of the spectrum (Autistic Disorder (AD) vs. Asperger's Syndrome (AS)). Significant differences in adaptive (global, conceptual, adaptability, communication) and behavioural scores (anxiety, internalizing problems, hyperactivity) were found when AS, AD, and Mild Autism (Asperger's + PDD-NOS) were compared individually to other ASD diagnoses, however no significant difference was found in EF.

Conclusions:

Findings suggest severity scores and behavioural phenotypes better distinguished diagnoses at the ends of the autism spectrum (AD vs. Asperger's), with differentiation of ASD and PDD-NOS problematic, supporting the proposed revisions for a single diagnostic category. Use of the ABAS-II, BASC-p, and ADOS-G in phenotypic profiling of preschoolers is recommended. While executive dysfunction is common in ASD[11] it may be difficult to capture by parent report in the preschool years[12]. Ongoing data analysis warrented.

117.058 58 Quantitative Analysis of Prosody in Conversational Speech in Autism Spectrum Disorders and in Developmental Language Disorders. G. Kiss[1], J. van Santen*[2], E. T. Prud'hommeaux[2] and L. M. Black[2], (1)*OHSU*, (2)*Oregon Health & Science University*

Background:

The diagnosis of Autism Spectrum Disorders (ASD) is labor intensive and requires highly trained professionals, limiting

access to diagnostic and hence intervention services. Automated analysis of conversational speech could potentially aid in providing more broadly accessible means for identifying high-risk individuals.

Although speech prosody is often atypical in ASD, prosody plays only a minimal role in diagnostics, possibly because of reliability issues. Relatively few studies exist on prosody in ASD using adequately-sized and well-characterized samples, and using quantitative prosodic measures. Moreover, almost no studies exist that compare prosody in ASD and Developmental Language Disorders (DLD), an important comparison given the symptomatic overlap between these disorders.

Objectives:

Our goal was to identify quantitative prosodic features that can reliably differentiate typical development (TD), DLD, and children with ASD children also diagnosed with DLD (ASD+DLD) or not (ASD-DLD), using ADOS recordings.

Methods:

We analyzed recordings for children aged 4 to 8, diagnosed with TD, DLD, ASD+DLD, or ASD-DLD. All were verbal, intelligible, and had an MLU > 3. We contrasted pairs of groups matched on specific factors:

1) ASD-DLD and TD (matched on verbal IQ)

2) ASD+DLD and DLD (verbal IQ)

3) ASD+DLD and ASD-DLD (ADOS and SCQ scores)

4) DLD and TD (ADOS and SCQ scores)

We additionally matched groups on age, and, for comparisons 1) and 2), also on performance IQ.

For each child we created overall histograms of the pitch values of the entire recording, and per-utterance pitch histograms of each individual utterance. For our prosodic features, we computed standard statistical parameters (e.g., mean, variance, asymmetry, peakedness) for these overall histograms as well as means and variances of the same parameters computed for each per-utterance histogram (e.g., the variance of the per-utterance means).

We also analyzed the spectral content using LTAS (Long Term Average Spectrum; pitch-normalized), and determined "phonemic content" via the histogram of all phoneme classes, extracted from the phonetic transcript.

Results:

Several prosodic features discriminated significantly (at $p<0.05$) between groups. For example, overall peakedness and mean per-utterance peakedness was much higher in the TD group than in the other groups, whereas corresponding spread measures were smaller. The difference in peakedness between ASD-DLD and TD was particularly pronounced, as was the difference in the location parameter (mean pitch), the latter being higher in ASD-DLD. Using only the peakedness feature (measured by kurtosis), we achieved a classification rate of over 75% percent (chance being 50%) contrasting the ASD-DLD and TD groups.

No significant differences in the spectral and phonemic content were detected, suggesting that there were no significant differences in articulation, which is plausible given that all children were verbal and intelligible.

Conclusions:

Children with TD had generally narrower pitch ranges than children with ASD or DLD. Future research will focus on relating these distribution-parameter results to differences in pitch curve shapes. Automatic classification methods using only these prosodic features can perform significantly better than chance. These features are robust and easy to extract from conversational speech, making them good candidates for use in automated screening methods.

117.059 59 Narrative Ability In AUTISM and the BROAD AUTISM PHENOTYPE. A. H. Hogan-Brown*, N. Friend, J. Lebersfeld, L. F. Ayres and M. Losh, *Northwestern University*

Background: Family and twin studies indicate that the defining features of autism can manifest in more subtle form among unaffected relatives. These features have been

described as constituting a 'broad autism phenotype' (BAP). Subtle differences in language use constitute a principal feature of the BAP. In particular, prior studies have documented patterns of pragmatic language use and impoverished narrative production among parents of individuals with autism (Landa et al., 1991, 1992). This study aimed to better define the narrative abilities of parents, through analysis of narratives elicited by socially complex stimuli (Paul, Schieffer, & Brown, 2004,) in high functioning individuals with ASD and their parents.

Objectives: This study examined narrative production among high functioning individuals with ASD, their parents, and respective control groups in order to better define the nature and potential overlap of narrative profiles in ASD and the BAP.

Methods: Participants included 30 high functioning adults with ASD, 9 age- and IQ-matched controls, 44 parents of individuals with ASD, and 12 control parents. Following procedures detailed in Paul et al. (2004), an illustrated slide drawn from the Thematic Apperception Test (TAT) was used to elicit narratives. Participants were instructed to "tell a story with a beginning, middle, and end," and to "describe what the characters were thinking, feeling, and doing." These interactions were video-recorded and transcribed verbatim. Narratives were coded by two coders blind to group status for the following features: 1) story structure (including a beginning, middle, and end); 2) description of characters' thoughts or feelings; 3) whether the participant produced a story or simply described disparate elements of the picture; 4) temporal coherence; and 5) expressed anxiety about the narrative task. All disagreements were resolved through discussion.

Results: While there were no group differences in the number of narratives produced, marked differences were detected in the quality of narratives across groups. Specifically, nearly half of the ASD group and a quarter of the ASD parent group failed to describe character feelings or thoughts, whereas this was not the case among controls (p values <.05). Furthermore, individuals with ASD and their parents more often neglected to conclude their stories with formal resolutions (p values<.05). Additionally, we noted that 17% of the ASD group and 11% of the ASD parent group expressed task-related anxiety. These anxieties were not voiced by either control group.

Conclusions: Both the ASD and ASD parent groups exhibited similar differences from controls in narrative production, although such differences were more pronounced in the ASD group. These results provide further evidence that narrative ability is impacted in ASD, and that differences in narrative skill are also evident among unaffected parents. Given the centrality of narrative to communicative interactions, results showing impairment in narrative construction and in expression of thoughts and feelings may hold clinical implications. That both individuals with ASD and parents showed an awareness of these difficulties is also of clinical importance. Finally, these findings may also help to define genetically meaningful language features.

Epidemiology Program

118 Genetic, Prenatal and Biological Risk Factors

118.061 61 Prevalence of Emotional and Behavioural Disorders in Young Children with Autistic Disorder in Jamaica. M. Samms-Vaughan*, J. A. T. Reece, S. Pellington and S. C. Smile, *The University of the West Indies*

Prevalence **of Emotional and Behavioural Disorders in Young Children with Autistic Disorder in Jamaica**

Background: Children with Autistic Disorder are known to have more co-morbid emotional and behavioral disorders (EBD) than their typically developing peers. This has resulted in intervention strategies designed to reduce withdrawn behavior, aggressive behavior and attention problems, in particular. There may be cultural differences in the EBD that children with autistic disorder manifest. There is little available information on the prevalence of EBD in children diagnosed with autistic disorder in developing countries, including Jamaica.

Objectives: The objective of this study is to determine the prevalence of co-morbid emotional and behavioural disorders in young children diagnosed with autistic disorder in Jamaica.

Methods: The Jamaica Autism Database (JAD) contains 500 children diagnosed at Jamaica's main referral centre for autism, the University Hospital of the West Indies (UHWI), since 1999. Ninety two (92) children between the ages of 11/2 and 5 years, who were diagnosed with autistic disorder, using DSM IV criteria , a standardised tool, the Childhood Autism Rating Scale (CARS), and who had the Child Behavior Checklist 11/2-5 years parent report and the Teacher Report Form completed were included in this study. These forms require adults to rate 99 individual behaviours as being absent, present but not frequently occurring and present but frequently occurring. Cross informant syndromes for the following EBDs were derived for both forms: Emotionally Reactive, Anxious/Depressed, Somatic Complaints, Withdrawn, Attention Problems, and Aggressive Behavior. The parent report also includes a Sleep Problem syndrome. Children's syndrome scores are subsequently rated as being in the non-clinical range, the borderline clinically significant range and the clinically significant range. In this study, the latter two categories were combined m resulting in two ratings: not clinically significant or clinically significant.

Results: There were 77 males (83.7%), the mean age of the population was 4.5 years (SD 1.7). Less than 20% of parents or teachers reported behaviours consistent with Emotional Reactivity, Anxiety/Depression, Somatic Complaints, Affective Problems and Anxiety. Parents reported sleep problems in 12.8%. Both parents and teachers reported similar, relatively high prevalence of Withdrawn Behaviour (47.6%, 43.5%), Attention Problems (39.1%, 40.2%), Aggressive Behaviour (29.3%, 23.8%) and Oppositional Defiant Problems (28.3%, 20.7%). Discrepancy between parent and teacher reports occurred only for ADHD, with prevalence of 11.7% and 33.7%, respectively. Pervasive Developmental Problems, of which autistic disorder is the most common, was reported at 64.1% by parents and 50% by teachers.

Conclusions: Parents and teachers report similar prevalence of EBD in young Jamaican children with autism. Similar to findings reported in the literature from the USA, Withdrawn Behaviour, Attention Problems and Aggression are the most prevalent of the EBDs in young children with autism. Clinicians should enquire of symptoms of these disorders when a diagnosis of autism is being considered, to ensure holistic care of the child..

118.062 62 Relationship of Neonatal Head Ultrasound Abnormalities to Adult Autism Spectrum Disorders in a Low Birthweight Population. T. Z. Movsas*[1], J. A. Pinto-Martin[2], A. H. Whitaker[3], J. F. Feldman[3], J. M. Lorenz[4], S. Korzeniewski[5], S. E. Levy[6] and N. S. Paneth[1], (1)*College of Human Medicine, Michigan State University*, (2)*University of Pennsylvania School of Nursing and School of Medicine*, (3)*New York State Institute*, (4)*New York Presbyterian Hospital-Columbia University Medical Center*, (5)*Wayne State Univ School of Medicine*, (6)*Children's Hospital of Philadelphia/ University of Pennsylvania*

Background: Preterm low birthweight (LBW) infants are at excess risk for both perinatal brain injury, as detected by neonatal head ultrasound (HUS), and for later autism spectrum disorder (ASD) diagnosis. Although there is a well-established relationship between the presence of parenchymal lesions and/or ventricular enlargement (which are thought to reflect white matter damage) on neonatal head ultrasounds to major motor and cognitive disability, the relationship between neonatal HUS abnormalities and ASD in preterm LBW survivors has not been well studied.

Objectives: To examine the relation of two groups of neonatal HUS abnormalities, namely parenchymal lesions and/or ventricular enlargement (PL/VE) and germinal matrix and/or intraventricular hemorrhage (GM/IVH), to adult ASD in a preterm LBW birth cohort.

Methods: A regional tricounty cohort of 1,105 infants < 2 kg born 1984-87 (the Central NJ Neonatal Brain Hemorrhage study) was systematically screened with neonatal HUS for perinatal brain injury. ASD was assessed in two stages:screening at age 16 and diagnostic evaluation at age 21. 60% (70/117) of screen positives at age 16 years and a systematically chosen sample of 119 screen negatives were evaluated diagnostically for ASD (Total N=189) at age 21 years. 14 cases of ASD were identified. The relation of neonatal HUS abnormalities to ASD was examined with

logistic regression without and with control for other pre- and perinatal risk factors and for cognitive ability and motor problems assessed at age 16.

Results: PL/VE, as detected by neonatal HUS, increased risk for later ASD (OR=7.36; 95%CI: 2.04, 26.51). This relation withstood control for male gender and maternal hypertension during pregnancy, the only two of 32 other risk factors examined that were found to have marginal ($p<.10$) or significant ($p < .05$) relations to ASD. GM/IVH did not increase risk for ASD. The relation of PL/VE to ASD at age 21 also withstood control for cognitive but not motor problems. Among the 14 cases of ASD, five were in the PL/VE group; of these, the majority (N=4) had VE and only one had PL. VE, by itself, increased risk for later ASD significantly (unadjusted OR= 8.3; 95% CI: 2.1, 32.5).

Conclusions: In preterm LBW infants, neonatal HUS-detected PL/VE increased risk for ASD independently of cognitive ability but not motor problems. The possibility that neonatal VE might be an important risk factor for later ASD deserves further exploration.

118.063 63 Longitudinal Measures of Community and Social Participation in Young Adults with Autism. E. Myers*[1], G. Stobbe[1], B. Davis[1] and K. Bjornson[2], (1)*University of Washington* , (2)*University of Washington*

Background:

The frequency of Autistic Spectrum Disorders (ASDs) has tripled in the last three decades. Children diagnosed with an ASD during childhood have persistent disability and less favorable outcomes in developmental and psychosocial domains as they move into adulthood. They often demonstrate poor maintenance of social relationships and remain highly dependent on caregivers for support. Despite efforts to improve adult outcomes for individuals with Autism Spectrum Disorders, few studies have longitudinally described community and social participation in this population during their transition from childhood to adulthood. Available studies are limited by small sample size or are not longitudinal in design. These are essential elements of any study whose goal is to better characterize social and community supports needs in this population.

Objectives:

- To examine and describe the frequencies of community and social life participation in a population based sample of children with Autistic Spectrum Disorders as they move into adulthood.
- To determine the individual, family, and school characteristics associated with social and community participation as this population transitions into adulthood.

Methods:

This study is a secondary data analysis from the National Longitudinal Transition Study 2 (NLTS2), a national prospective cohort study funded by the US Department of Education. The NLTS2 followed a representative sample of students receiving special education between the ages of 13 to 16 years old who were in at least 7th grade at commencement of the study on December 1, 2000. Participant information was gathered prospectively from parents, teachers, principals, school records, and students themselves and compiled into five waves of data during their transition into adulthood. This analysis will assess data from waves 1 (13-18 years), 3 (17-22 years), and 5(21-26 years). The frequencies of social and community participation at each Wave, as measured by the number of an individual's structured group activities as well as other proxy measures of social participation, will be evaluated. Child, family, school, and community characteristics associated with higher levels of community and social participation will be determined.

Results:

We will document the longitudinal social and community participation of a nationally representative sample of persons with ASD. A model describing the associations between child, school, family, and community characteristics and levels of social and community participation in young adults with ASD will be presented.

Conclusions:

A better understanding of the factors influencing social and community participation among young adults with autistic spectrum disorders is needed. This information has potential implications for program and public policy aimed at optimizing the life experiences of young adults with ASD.

118.064 64 Seafood Consumption and Blood Mercury Concentrations in Jamaican Children with and without Autism Spectrum Disorders. M. H. Rahbar*[1], M. Samms-Vaughan[2], K. A. Loveland[3], M. Ardjomand-Hessabi[1], Z. Chen[1], J. Bressler[4], S. Pellington[2], M. L. Grove[4], K. M. Bloom[1], D. A. Pearson[3], G. C. Lalor[2] and E. Boerwinkle[4], (1)*The University of Texas Health Science Center at Houston*, (2)*The University of the West Indies*, (3)*University of Texas Medical School, Houston*, (4)*The University of Texas School of Public Health at Houston*

Background:

Mercury is a toxic metal with harmful effects on human health that could lead to neurodevelopmental disorders including language, learning, and attention deficits as well as intellectual and developmental disabilities. Autism Spectrum Disorders (ASDs) are lifelong neurodevelopmental and behavioral disorders that manifest in early childhood and are characterized by impairments and difficulty in social interaction, communication and language as well as repetitive behavior and sensory–motor movements. The etiology of ASD is complex and not fully understood. Several studies have investigated the possible association between exposure to mercury and ASD but their findings are conflicting.

Objectives: To investigate the association between blood mercury concentrations and ASD in children, and to assess the role of fish consumption in blood mercury concentrations in Jamaican children.

Methods: The Jamaican Autism study is a NIH-supported age- and sex-matched case-control study that began enrollment in December 2009, investigating whether environmental exposures to mercury, lead, arsenic, manganese, and cadmium have a role in the onset of autism. We administered the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R) to children, 2-8 years of age, in the University of West Indies' Jamaica Autism Database, who were previously identified as being at risk for ASD based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria and the Childhood Autism Rating Scale. For each case, we identified an age- and sex-matched control using the Social Communication Questionnaire. We also administered a pre-tested questionnaire to assess demographic and socioeconomic information, parental education levels, medication, childhood immunization history, and potential exposure to mercury through food, with a particular focus on the types and amount of seafood consumed by children. At the end of the interview, we collected 2 mLs of whole blood from each child, to be analyzed in the US for a variety of environmental exposures. Using General Linear Models we compared mean blood mercury concentrations by ASD status for the available 65 matched pairs who had all the required data.

Results: In our sample, 86.2% of children were male with a mean age of about 65 months. The cases and controls were 96.9% and 98.5% Afro-Caribbean, respectively. We found a significant upward trend for the mean blood mercury concentrations in relation to the frequency of seafood consumption for both cases and controls (P-values < 0.05). Children who ate "sardine or mackerel fish" had a significantly higher geometric mean blood mercury concentration than children who did not eat these fish (0.96 µg/L vs 0.41 µg/L, P-value = 0.0028). After controlling for parental education levels, maternal age, and frequency of seafood consumption, there was no significant association between blood mercury concentrations and ASD status.

Conclusions: We did not find a significant association between ASD and blood mercury concentrations. However, we recommend development of appropriate interventions to increase parents' awareness that excessive seafood consumption can lead to elevated mercury blood concentrations in children and is potentially hazardous to human health.

118.065 65 Genetic Polymorphism of Methylenetetrahydrofolate Reductase in Children with Autism in Northeast China. K. Wu*[1], L. Xia[2], D. Zhao[1], W. Xia[1] and L. J. Wu[1], (1)*Harbin Medical University*, (2)*The First Hospital of Harbin Medical University*

Background: 5, 10-methylenetetrahydrofolate reductase (MTHFR) is a key enzyme in folate metabolism, diverting metabolites toward methylation reactions or nucleotide synthesis. Autism is a severe neurodevelopmental disorder which has intricate pathobiology with indispensable influences of genetic factors in the development. Although several autism genetic risk genes have been identified, the pathogenesis of autism is not fully explained.

Objectives: This case-control study was undertaken to analyze the association between MTHFR C677T and A1298C polymorphisms and autism susceptibility in children of northeast China.

Methods: A total of 263 cases (3-13 years-old; 237 boys and 26 girls) with autism and 70 controls (3-6 years-old; 59 boys and 11 girls) were randomly selected from the northeast areas of China. Analysis of the polymorphisms was done using the polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) method and confirmed by direct sequencing.

Results:

The C677T mutation (CT or TT genotype) and A1298C mutation (AC or CC genotype) were confirmed by sequencing. And the CT + TT genotype of C677T was present in 52.85% of autistic children and in 14.29% of nonautistic children (OR=6.726,95% CI 3.30-13.70, P<0.005). The frequencies of MTHFR A1298C mutant genotypes (27.76 vs. 12.86%) were found to be higher in autistic group compared with nonautistic group with 2.604-fold increased risk for autism (95% CI 1.23-5.51, P<0.005). When the individuals were classified according to MTHFR genotypes as follows: individuals with mutant C677T and mutant A1298C; individuals with mutant C677T and wild-type A1298C; individuals with wild-type C677T and mutant A1298C; individuals with wild-type C677T and wild-type A1298C, gene combination analysis showed a significant statistic difference (P<0.05).

Conclusions:

These findings indicate that the polymorphisms of MTHFR C677T and A1298C genes may be a risk factor for autism in children of northeast China.

118.066 66 Community Influenza Level and Risk of Autism Spectrum Disorders. O. Zerbo*, A. M. Iosif, C. K. Walker and I. Hertz-Picciotto, *University of California Davis*

Background: Epidemiological studies and animal model studies have suggested an association between maternal influenza infection during pregnancy and neurodevelopmental disorders in the offspring.

Objectives: To examine whether high probability of exposure to influenza and influenza-like illnesses during pregnancy is associated with autism spectrum disorders.

Methods: The study included 5,487,491 children born in California between 1991 and 2001. The outcome was autism diagnosed before the child's sixth birth date. Autism cases (*n* = 17,515) were identified from diagnoses recorded in databases of the California Department of Developmental Services in 1991 through 2008. Separately, we obtained individual level data on all admissions, statewide, for influenza and influenza-like illnesses (international code for diseases 480 – 488) from 1991 to 2002 from the Office of Statewide Health Planning and Development. Daily population rates of hospitalization for influenza and influenza like illnesses were calculated by county. These county rates were then assigned to each woman as a proxy of her level of exposure to influenza for several time periods during pregnancy assuming that high rates would lead to increased probability of infection. Multivariate logistic regression models were used to estimate odds ratios with their 95% confidence intervals for autism by rates of hospitalization.

Results: Maternal exposure to influenza defined as occurring any time during pregnancy was not associated with autism. However, maternal high probability of exposure to influenza during the first 8 weeks of pregnancy was associated with 8% (OR = 1.08 95% CI 1.03 – 1.13) increased risk of autism. No

association was found with any other time window of pregnancy.

Conclusions: The results raise the possibility that early pregnancy may be a critical window when influenza infection or factors associated with influenza infection such as fever increases the risk of autism. Our results are similar to those previously reported on associations between maternal influenza infection and risk of schizophrenia.

118.067 67 Intrauterine and Neonatal Levels of Neurotrophic Factors and Matrix Metalloproteinases-9 and Risk of Autism Spectrum Disorders. M. W. Abdallah*[1], B. D. Pearce[2], N. Larsen[3], K. Greaves-Lord[4], E. C. Bonefeld-Jørgensen[1], B. Nørgaard-Pedersen[3], D. M. Hougaard[3], E. L. Mortensen[5] and J. Grove[1], (1)*Aarhus University Faculty of Health Sciences*, (2)*Rollins School of Public Health, Emory University*, (3)*Statens Serum Institute*, (4)*Erasmus MC - Sophia's Children's Hospital*, (5)*University of Copenhagen*

Background:

In concert with many neuropathological findings and accumulating lines of research suggesting that synaptic pathways are disrupted in some cases of autism spectrum disorders (ASD), abnormal formation of neuronal connections or elimination of inappropriate connections have been postulated to play a crucial role in the onset of ASD. Matrix metalloproteinases (MMP's) and Neurotrophic Factors (NTFs) are two distinct families of secreted proteins with a pivotal function in a variety of forms of synaptogenesis and neuroplasticity.

Objectives:

To measure levels of MMP-9 and selected NTFs (brain-derived neurotrophic factor [BDNF], Neurotrophin-4 [NT-4], and transforming growth factor-β [TGF-β]) during pregnancy (*in amniotic fluid [AF] samples*), and after birth (*in neonatal dried blood spot samples [n-DBBS]*) in individuals diagnosed with ASD later in life and in controls.

Methods:

A total of 414 ASD cases and 820 control subjects, frequency-matched to cases on gender and year of birth, were included in the study. AF samples and n-DBBS were retrieved from a Danish Historic Birth Cohort (HBC) and the Danish Newborn Screening Biobank (DNSB), respectively. Both resources are maintained at Statens Serum Institute, Copenhagen, Denmark. Necessary administrative and ethical approvals were obtained accordingly. Using a unique identifier (CPR number) assigned for each citizen in Denmark, background information, psychiatric and somatic comorbidities and obstetric history of the study population were retrieved from different Danish nation-wide health registers. Measurements of the selected NTFs and MMP-9 were performed with an in-house assay panel using the multiplex flow cytometric assay system Luminex MultiAnalyte Profiling Technology. Associations were analyzed with continuous measures (tobit regression) as well as dichotomized at the lower and upper 10th percentiles cut-off points derived from the controls' distributions (logistic regression). Supplementary analyses were performed on cases with infantile autism, cases diagnosed with ICD-10 only and after stratifying on gender.

Results:

In second trimester amniotic fluid samples, MMP-9 levels were elevated in ASD cases compared to controls (Crude and adjusted tobit regression *P* values: 0.01 and 0.06). In n-DBBS, ASD cases were more likely to have BDNF levels in the lower 10th percentile (crude OR: 1.53 [95% CI: 1.04 – 2.24], *P* value=0.03), and a similar pattern was seen for TGF-β in females with ASD (crude OR: 2.36 [95% CI: 1.05 – 5.33], *P* value=0.04). In ASD cases diagnosed with ICD-10, however, NT-4 levels were less likely to be in upper 10th percentile compared to controls (crude OR: 0.22 [95% CI: 0.05 – 0.98], *P* value=0.05).

Conclusions:

Findings from this study suggest a differential pattern of MMP-9 during pregnancy and of NTFs after birth. Elevated levels MMP-9 during pregnancy may be an indicator of a hyper-plasticity state within the central nervous system. On the other hand, decreased NTFs levels during neonatal period may contribute to the pathophysiology of ASD through impairments

of neuroplasticity. Further research is required to confirm our results and to examine the specificity of the findings to ASD.

118.068 68 Behavior Changes Associated with Food Intake and Eating Disorders in Children with Autism in Oman.

Y. M. Al-Farsi*[1], M. I. Waly[1], M. Al-Sharbati[1], M. M. Al-Khaduri[1], O. A. Al-Farsi[1], M. Al-Shafaee[1] and R. Deth[2], (1)*Sultan Qaboos University*, (2)*Northeastern University*

Background:

Eating disorders, food preference and amount of food eaten among autistic children were the focus of recent research which was mostly conducted in Western countries. These countries are different from Oman in terms of culture, food habits and foods availability.

Objectives:

The purpose of this study was to: (1) address validity of the Western published reports as compared to Oman, (2) Assess behavioral issues that often faced parents of Omani autistic children with regard foods likes and dislikes, (3) estimate the prevalence of eating disorders among Omani autistic children, (4) evaluate the amount of food eaten by study subjects.

Methods:

A retrospective case-control study included 40 Omani autistic children and 40 controls matched for age and gender.

Results:

Functional assessment indicated that food refusal behaviors were maintained by escape and avoidance of non-preferred foods. The increase in the amount and range of food eaten was reported during activities at home and school setting. Eating disorders were not reported among the enrolled study subjects. Anthropometric assessment indicated prevalence of underweight among the study subjects. The study results were generally in accordance with the recently published Western reports.

Conclusions:

Intensive behavior intervention is needed for Omani autistic children in order to increase duration of in-seat behavior at meal times across the day for this high risk group of children.

118.069 69 Association of Adverse Antenatal and Perinatal Events with Occurrence of Autism: A Case Control Study.

Y. M. Al-Farsi*[1], M. M. Al-Khaduri[1], M. Al-Sharbati[1], M. I. Waly[1], O. A. Al-Farsi[1], M. Al-Shafaee[1] and R. Deth[2], (1)*Sultan Qaboos University*, (2)*Northeastern University*

Background:

Early life events, especially during perinatal and neonatal period, have been proposed as important factors in the etiologic pathways of autism

Objectives:

To evaluate the association between selected antental and perinatal adverse events and autism spectrum disorders (ASD).

Methods:

A retrospective case-control study has been nested on ongoing prospective cohort study, and it included 102 ASD cases and 102 controls.

Results:

Adjusted odds ratios (OR) were generated from logistic regression models. ASD was found to be associated with social problems during pregnancy (OR = 1.39; 95% CI 1.01, 4.2), serious illness or trauma (OR = 1.5; 95% CI 1.02, 3.2), medication intake during pregnancy (OR = 1.6; 95% CI 0.96, 4.6), and premature delivery (OR = 1.7; 95% CI 1.1, 2.6). No evidence has been obtained for a significant association with gestational diabetes, anemia, and exposure to X-ray, or caesarian section.

Conclusions:

This study indicates that adverse early life events mightbe associated with increased risk of ASD. Further proof is sought through conduct of an undergoing prospective cohort study.

118.070 70 Assisted Reproduction Techniques and ASD. M. A. Stokes*[1], J. A. McGillivray[1], J. A. Manjiviona[2], K. Saunders[3] and T. Attwood[4], (1)*Deakin University*, (2)*The University of Melbourne*, (3)*Private practicioner*, (4)*Griffith University*

Background: Given clinicians working with Autistic Spectrum Disorders (ASD) and some in clinics specialising in Assisted Reproduction Techniques (ART) report an anecdotal association of ASD with the use of an ART, it is important to establish if ART is a concern for ASD. A number of studies to date have undertaken assessment of the relationship between various assisted reproduction techniques (ART) and the incidence of Autistic Spectrum Disorders (ASD). While some find an effect, others don't. However, none of these studies have controlled for all important confounds, such as paternal age, maternal age, birth weight, and familial causes.

Objectives: We sought to measure if ART increases the likelihood of a later diagnosis of an ASD after controlling for maternal and paternal age, birth weight, and having a relative with a similar diagnosis. We hypothesised that after these variables were controlled, users of ART would be more likely to have a child later diagnosed with an ASD.

Methods: We undertook a retrospective online questionnaire. The instrument asked parents (n=989) to respond if they had a child with an ASD regarding that child (n=520), or if they did not have a child with an ASD (n=469), to respond regarding either their oldest (n=227) or youngest child (n=242), depending upon which version of the questionnaire they were invited to complete. The instrument assessed diagnostic status, maternal age at birth, paternal age at birth, birth weight, biological relationship to others with a similar diagnosis, and ART type.

Results: We obtained results for 98 women who reported having used an ART. Of these, 52 had used In Vitro Fertilisation (IVF) or IntraCytoplasmic Sperm Injection (ICSI), 29 had used hormonal or medical ovulatory induction, with the remaining 17 either not detailing the technique or using various other ARTs. On average, mothers having used an ART were 3.6 years older ($p<0.05$), fathers were 3.9 years older ($p<0.05$), and infants born following these techniques were 310 grams lighter ($p<0.05$). We found the children who were later diagnosed with ASD had older mothers (1.08 years, $p<0.05$), but not older fathers (0.61 years, p=ns), and were on average 110 grams lighter ($p<0.05$). Interestingly, after controlling for maternal age, paternal age, birth weight, and having a genetic relative with a similar diagnosis, not all ARTs were associated with an increased risk of a later ASD diagnosis. However, certain ARTs were associated with ASD. Use of either ICSI or IVF was found to increase the risk of a later diagnosis by 2.12 times (95%CI 1.08 – 4.13; $p<0.05$).

Conclusions: The use of manipulative ARTs, such as IVF or ICSI increased the risk of later diagnoses of ASD, while use of hormonal or medical techniques did not. This suggests that the elevated risk from some techniques is not due to teratogenic effects, but may be due to manipulation of gametes prior to implantation.

118.071 71 In Utero Exposure to B2AR Agonists and Risk for Autism Spectrum Disorders. N. B. Gidaya*[1], B. K. Lee[1], I. Burstyn[1], E. L. Mortensen[2] and C. J. Newschaffer[1], (1)*Drexel University School of Public Health*, (2)*University of Copenhagen*

Background: Certain medications taken in the prenatal period have been documented as risk factors for autism spectrum disorders (ASD). The teratogenic potential of most drugs with respect to neurodevelopmental outcomes is generally understudied, and it is important to consider prenatal prescription drug use as neurodevelopmental risk factors in order to weigh these potential risks with known benefits. For women with asthma, the use of prescription drugs in pregnancy can still be the recommended standard of care. Beta-2-adrenergic receptor (B2AR) agonist drugs such as salmeterol and formoterol are used to reduce asthma exacerbations. In addition, the B2AR within the catecholamine system is essential for normal nervous system development. Since B2AR agonists drugs are known to cross the placenta and cause an increase of B2AR signaling or overstimulation of the receptor it may result in the disruption, replication or differentiation of developing neurons in the fetus.

Objectives: The objective of this study was to investigate associations between use of B2ARs during pregnancy and risk for ASD.

Methods: The matched case-control study sample consisted of 5,203 ASD cases and 52,030 controls born in Denmark between January 1, 1997 and December 31, 2006 with ASD case status ascertainment through March 11, 2011. Data from Denmark's health registers were linked using unique individual civil-registry number and provided detailed information regarding prescription drugs used during pregnancy, ASD diagnosis as well as health and socioeconomic status. Ten controls per ASD case were individually matched on birth month and year. Conditional logistic regression models were adjusted for parental age and child gender. Estimates were calculated for any exposure during pregnancy, preconception and by trimester. Separate analyses were conducted to address confounding by indication.

Results: Of the 5,203 cases of ASD, 177 children were exposed to B2ARs during pregnancy. In adjusted conditional regression models, we found an increased risk for ASD associated with exposure to B2ARs anytime during pregnancy (adjusted OR, 1.28 [95% CI, 1.09-1.51]). The largest increase in risk was associated with exposure in the second trimester (adjusted OR, 1.39 [95% CI, 1.11-1.74]). Two separate analyses were performed to control for confounding by indication for exposure anytime during pregnancy. Statistical adjustment for maternal asthma resulted in consistently elevated estimates (adjusted OR, 1.28 [95% CI, 1.08-1.52]). Restriction to only mothers with asthma also resulted in estimates suggesting elevated risk (adjusted OR, 1.35 [95% CI, 0.86-2.12]).

Conclusions: B2AR agonist exposure during pregnancy, especially during the second trimester, may be associated with an increased risk for ASD. Limitations include lack of data regarding in-hospital terbutaline use, though this is unlikely to affect 2nd trimester exposure estimates. Under-reporting of asthma in the registry may lead to imperfect control of confounding by indication since not all asthmatics on B2ARs are identified. Sensitivity analyses will be performed to examine the impact of misclassification of exposure and indicating condition. Results from this study add to the limited knowledge on prenatal pharmacological exposures as potential ASD risk factors which need to be balanced against the benefits of indicated medication use by pregnant mothers.

118.072 72 Prenatal Influences on Autism Spectrum Disorders: Negative Evidence From a Twin Study. L. Meyer* and H. H. Goldsmith, *University of Wisconsin-Madison*

Background: A recent meta-analysis revealed several prenatal factors linked to later autism development (Gardener, Spiegelman, & Buka, 2009). General prenatal optimality may also play a role. Cotwins do not share all prenatal factors, making a twin study a viable and informative design to study the prenatal influences on autism. Dichorionic twins have especially differentiated prenatal experiences. During fetal development, dermal ridges develop concurrently with the brain, so disturbances in one system may reflect atypical development of the other. Also, physical asymmetries are thought to represent poor developmental canalization. Finally, the sexual dimorphism of the digit ratio between the second and fourth fingers is widely attributed to prenatal sex hormone exposure, making it a potential marker of the "extreme male brain" theory of autism.

Objectives: Older studies link chorionicity, dermatoglyphics, asymmetry, and digit ratio to autism or other psychiatric conditions. We sought to replicate and extend these prior investigations to determine whether autism concordance in twins varies by chorionicity and whether autism status is related to a-b ridge count, a-b asymmetry, and digit ratio.

Methods: Fifty-four pairs (23 monozygotic) of proband-ascertained twins (i.e., at least one twin is autistic) and participated, with a mean age of 8:5. We classified participants as being on the autism spectrum based on the Autism Diagnostic Observation Schedule and the Social Communication Questionnaire. We determined chorionicity via birth records, measured dermatoglyphics from palm prints, and scanned participants' hands to calculate digit ratio.

Results: As expected, monozygotic twins are more concordant for autism than are dizygotic twins (69% vs. 23%). Monochorionic twins are no more likely to be concordant than

monozygotic-dichorionic twins (53% vs. 67%). Autistic and non-autistic participants did not differ in average a-b ridge count, $t(98) = -0.21$, $p = 0.84$; asymmetry, $t(88) = 0.13$, $p = 0.90$; or digit ratio, $t(90) = -0.83$, $p = 0.41$. Digit ratio did show the expected sex effect, $t(90) = 2.18$, uncorrected $p = 0.02$. Zygosity is unrelated to cotwin similarity of a-b ridge count, $t(45) = 0.03$, $p = 0.98$ or asymmetry, $t(35) = 0.96$, $p = 0.34$, but digit ratios are more similar for monozygotic twins than dizygotic same sex twins, $t(40) = -2.48$, uncorrected $p = 0.02$.

Conclusions: The current study failed to replicate prior findings linking lower a-b ridge counts and digit ratios with autism and did not find a relationship between dermatoglyphic asymmetry and autism. Collectively, these null results suggest that any nonshared prenatal environmental factors that are differentiated by chorionicity or that affect a-b ridge count, asymmetry, and digit ratio are not major players in the development of autism.

118.073 73 Maternal Dietary Fat and Fatty Acid Intake in Association with Autism Spectrum Disorder. K. Lyall*[1], K. Munger[2], E. O'Reilly[2], S. L. Santangelo[2] and A. Ascherio[2], (1)*University of California, Davis, MIND Institute*, (2)*Harvard School of Public Health*

Background: Polyunsaturated fats, including omega-3 fatty acids, are essential for fetal brain development. While prior work has examined potential associations between maternal fish intake and child developmental outcomes, it is not known how maternal fat and fatty acid intake from other sources may influence risk of autism spectrum disorder (ASD).

Objectives: To determine whether maternal intake of fats and fatty acids influences risk of ASD using prospectively collected dietary information.

Methods: We utilized data from the Nurses' Health Study II (NHS II), a large prospective cohort with questionnaires mailed every 2 years since 1989 to over 116,000 nurses in the United States. Dietary information was collected in 1991, 1995, 1999, and 2003 from a validated 131-item Food Frequency Questionnaire. 27,516 NHS II participants had a child born between 1991-2007; for the primary analysis, women who did not return at least one of two NHS II questionnaires with information on ASD, and those who did not have an FFQ completed before the child's birth were excluded. Major types of fats and fatty acids were categorized into quartiles. We further explored risk in individuals with the top and bottom 10% of intake, as well as those in the lowest 5% of the distribution of intake. Intake of fish and use of fish oil supplements was also assessed. Binomial regression was used to obtain crude and multivariate adjusted risk ratios for the association between maternal dietary fat and ASD.

Results: 18,045 women, including 317 who reported a child with ASD, were included in primary analyses. In adjusted analyses, risk of having a child with ASD decreased with increasing polyunsaturated fat intake (RR for the highest vs. the lowest quartile =0.67, 95% CI 0.49, 0.92; p for trend = 0.008); nearly identical protective associations were seen for the top quartiles of omega-6 and linoleic fatty acid intake. Overall, intake of omega-3 fatty acids was not associated with risk of ASD, although the results of exploratory analyses suggested a possible increase in risk among women with the lowest 5% of intake of omega-3 fatty acid (RR= 1.53, 95% CI 1.00, 2.32), and for those with the lowest 10% of intake of alpha-linoleic acid (ALA) in particular (RR=1.42, 95% CI 1.04, 1.95). These associations appeared to strengthen when assessed in women for whom dietary information referred to pregnancy (n=5,884, including only 86 cases; RR for omega-3=2.42, 95% CI 1.19, 4.91; RR for ALA=2.23, 95% CI 1.30, 3.84). Neither fish intake nor intakes of total fat, monounsaturated, trans, or saturated fat, or fat from animal, vegetable, and dairy sources, or other fatty acids, were significantly associated with ASD. In a secondary analysis, results were similar when including women with FFQs collected during lactation.

Conclusions: The preliminary results of this large longitudinal investigation suggest that maternal intake of polyunsaturated fatty acids may influence risk of having a child with ASD. In particular, low intakes of essential fatty acids linoleic and alpha-linolenic may increase risk. Further work should assess maternal intake of these fats during pregnancy.

118.074 74 Maternal Immune-Mediated Conditions in Association with Child Immune-Related Outcomes and Autism Spectrum Disorders. K. Lyall*[1], P. Ashwood[1], J. Van de Water[2] and I. Hertz-Picciotto[1], (1)*University of*

California, Davis, MIND Institute, (2)*University of California, Davis*

Background: Prior work has suggested that aberrations in the maternal immune system, from asthma/allergies to autoantibodies, have the ability to affect risk of autism. However, whether maternal immune responses promote immune-related phenotypes within autism has not been explored in detail.

Objectives: We sought to determine whether maternal autoimmune disease, asthma, and allergies influenced whether there were immune-related subphenotypes (specifically, gastrointestinal diagnoses, asthma, and allergies) in the child with autism, and whether these maternal immune-mediated conditions affected child scores on cognitive and behavioral tests.

Methods: Participants were members of the CHildhood Autism Risks from Genetics and the Environment (CHARGE) study, a large population-based case-control study. The primary study group included typically developing controls and confirmed cases of autism spectrum disorder (ASD) according to ADI-R and ADOS. We compared basic frequencies of child asthma, allergy, and GI problems according to maternal immune conditions, and used logistic regression to obtain crude and multivariate adjusted odds ratios for these associations overall and by case status. We compared differences in child scores on the Mullen Scales of Early Learning (MSL) and the Aberrant Behavior Checklist (ABC) according to maternal immune-related conditions using multivariate linear regression.

Results: 553 children with ASD, 377 typically developing children and 157 children with developmental delay were included in these analyses. Although we did not see significant associations with maternal-immune mediated conditions and overall risk of ASD in this study, other differences according to these maternal conditions were found. Maternal autoimmune disorders significantly increased risk of child GI diagnosis in cases but not controls (adjusted OR within case children=3.21, 95% confidence interval 1.65, 6.28). This association was not seen in a secondary analysis assessing GI diagnosis according to maternal autoimmune disease in developmentally delayed children (a group with high prevalence of GI diagnosis), suggesting specificity of the association to ASD. Maternal asthma and allergies did increase risk of child asthma and allergies overall, but risk did not differ by case status. With regard to child cognitive and behavioral scores, in adjusted analyses, maternal autoimmune diseases were associated with higher scores on the inappropriate speech subscale of the ABC in analyses combining cases and controls (p=.01), and in analyses of case children only (p=.03), but not in control children only. Maternal asthma was associated with higher scores on the hyperactivity subscale (p=0.01) in analyes of all children and in children with ASD. Other comparisons between maternal conditions and child scores were non-significant after adjustment for child year of birth, regional area, child sex, and maternal age.

Conclusions: Our results suggest that maternal immune-mediated conditions may account for some of the phenotypic variability within ASD, and point to the importance of the maternal immune response in affecting neurodevelopmental outcomes. In particular, case children whose mothers have an autoimmune disease may be at greater risk for GI diagnosis relative to those children whose mothers do not have such conditions.

118.075 75 A Familial History of Pink Disease Identified As a Risk Factor for Autism Spectrum Disorders. K. Shandley* and D. W. Austin, *Swinburne University of Technology*

Background: The aetiology of Autism Spectrum Disorders (ASD) remains a mystery, although contemporary research points to a combination of genetic and environmental factors. Controversially, exposure to toxic substances, particularly mercury, has been postulated as a possible environmental trigger in the development of an ASD. Historically, the pervasive use of mercury in medicinal products is well documented, including the consequences of its use, such as the case of Pink Disease, or infantile acrodynia, which was especially prevalent in the first half of the 20th century. Primarily attributed to exposure to mercury commonly found in teething powders, approximately 1 in 500 exposed children developed the condition. The differential risk factor was identified to be an idiosyncratic sensitivity to mercury.

Analogous to the Pink Disease experience, if mercury is a potential environmental trigger of ASD, a sensitivity to mercury may also be present in children with an ASD.

Objectives: The objective of the present study is to determine whether a diagnosis of ASD is more prevalent among children with a familial history of Pink Disease (mercury sensitivity) in comparison to a comparable general population prevalence.

Methods: To test this objective, Pink Disease survivors were surveyed to ascertain the health outcomes of their descendants. The survey included sociodemographic questions regarding the Pink Disease survivor, and information pertaining to the Pink Disease survivor's children and grandchildren. For each descendant, the survivor was asked to provide their gender and date-of-birth, and whether they had been diagnosed with any of the following conditions prior to the age of 16 years: autism, Asperger's, attention deficit hyperactivity disorder, epilepsy, Fragile X, and/or Down Syndrome. Participants were recruited via the Australian Pink Disease Support Group (a not-for-profit group dedicated to providing support and information to Pink Disease survivors and their families – the only such group in the world). In order to minimize response bias, the true purpose of the study was not included on recruitment materials sent out to potential participants; instead, the materials indicated that the purpose of the study was to investigate the general health outcomes of the descendants of Pink Disease survivors. Five hundred and twenty-two participants completed the survey which gathered health data on 1366 grandchildren. The prevalence rates for each of the listed conditions was calculated and compared to well-established general population prevalence rates. Only live births, biological children, and children surviving to at least 5 years-of-age were included in the analysis.

Results: The results showed that the prevalence rate of ASD among the grandchildren of Pink Disease survivors (1 in 25) was significantly higher than the general population prevalence rate (1 in 160) of the same birth year cohort. There were no significant differences in prevalence rates among for any of the non-ASD conditions.

Conclusions: The results support the hypothesis that mercury sensitivity may be a heritable/genetic risk factor for ASD.

118.076 76 The Fertility Behavior of Parents with Children with Autism. K. R. Makovi*, K. Y. Liu and P. S. Bearman, *Columbia University*

Background:

A child's developmental disorder may influence decisions about future childbearing. Some parents of children with disabilities report choosing not to have more children so that they may devote more resources to their affected child. Others report deciding to have additional children in order to benefit their affected child, both short and long term. Jones and Szatmari first linked autism in children to future fertility, concluding that parents of children with autism stop having further children. However, existing evidence that addresses this question related to autism is limited, relying on small and selective samples, and typically anecdotal.

Objectives:

Yet, until now, the topic has not been examined with a sociological eye. Thus, we are placing parents' decisions of children with autism in the broader context of family planning to elucidate the causal path that links autism to future childbearing. Our aim is to assess if there is "stoppage" at the population level.

Methods:

We use mixed methods: qualitative and quantitative. First, we deploy the voices of parents from the Autism Life Histories Survey to focus on theories of cause and effects of autism on the family ecology. Second, we link these theories to fertility behavior using matching and event history analysis on data from the California Birth Master Files from 1992-2007 and autism diagnoses from the Department of Developmental Services (DDS). We attempt to eliminate confounding effects of mothers' characteristics which could be related both to autism diagnosis in children and to family planning decisions. Moreover, we use three different strategies for inferring time of first suspicion, which is an important factor in the event history models.

Results:

Based on the matching analysis, mothers of a first-born child diagnosed with autism are equally likely to proceed to a second birth as mothers of a first-born child without the condition. On the other hand, proceeding to a third birth is estimated to be 8% less likely. If the analysis is replicated among the most severely affected – based on the DDS' evaluative items that measure communication and social functioning – it appears that this dynamic is driven primarily by mothers of first children with autism who fall in the lowest quartile on communication functioning. The event history analysis gives similar results.

Conclusions:

Based on our qualitative analysis, we conclude that parents' coping strategies are heterogeneous, which results in different fertility decisions across families. This, however, leads to no stoppage at the population level when proceeding to a second birth. On the other hand, severity seems to make a difference, especially if it manifests through communication skills, but its effects are only pronounced for third births.

118.077 77 Maternal Hospitalization for Infection During Pregnancy and Risk of Autism Spectrum Disorders. B. K. Lee*[1], C. Dalman[2], C. J. Newschaffer[1], I. Burstyn[1], Å. Blomström[2], S. Idring[2], H. Karlsson[3], R. M. Gardner[2] and C. Magnusson[2], (1)*Drexel University School of Public Health*, (2)*Karolinska Institutet*, (3)*Johns Hopkins University School of Medicine*

Background: Prenatal infection is a potent environmental influence of early life neurobehavioral function. Animal model studies indicate that maternal immune activation during pregnancy can result in behavioral abnormalities and neuropathologies in offspring. In humans, multiple epidemiological studies point to maternal infections during pregnancy as a risk factor for neurological disorders such as schizophrenia, cerebral palsy, and autism spectrum disorders (ASD). A large, recent study of over 10,000 ASD cases by Atladottir and colleagues using Danish health register data reported that maternal hospitalization for bacterial and viral infections were associated with increased ASD risk, and that the risk varied by trimester. To date however, no other epidemiological studies have addressed this topic.

Objectives: To examine the association between maternal hospitalization for infection during pregnancy and overall risk of any ASD.

Methods: The Stockholm Youth Cohort is a record-linkage study comprising all individuals aged 0-17 years, ever resident in Stockholm County in 2001-2007 (N=589,114). A sample of 4,435 ASD cases and 43,534 birth year and sex-matched controls were extracted for analysis. Using the identification number assigned to all persons in Sweden, individuals were linked to national and regional data registers. ICD-8, 9, and 10 codes for maternal infections recorded during the pregnancy period in the Inpatient Register were linked with child ASD outcomes as of the December 2007, ascertained from a complete case-finding approach covering all pathways to ASD care in Stockholm County. Conditional logistic regression models estimated odds ratios adjusted for maternal and paternal age, family use of psychiatric services, maternal origin, birth parity, and parental occupation and income.

Results: Of the mothers of the 4,435 ASD cases, 66 (1.5%) had a primary inpatient diagnosis for infection during pregnancy, while 199 (4.5%) had any inpatient diagnosis for infection during pregnancy. In comparison, mothers of non-ASD cases had a 1.3% prevalence of primary inpatient diagnosis and 3.1% prevalence of any inpatient diagnosis for infection during pregnancy. Adjusted odds ratios for primary inpatient diagnosis and any inpatient diagnosis of infection during pregnancy were 1.14 (95% CI: 0.88 to 1.49), and 1.37 (95% CI: 1.26 to 1.71), respectively.

Conclusions: In a large, population-based Swedish cohort, we found evidence of an increased risk of ASD with maternal hospitalization for infection during pregnancy, although results were sensitive to whether primary or secondary diagnoses were used. Additional work will be performed to examine sensitivity of results to confounding, trimester-specific associations, as well as by subtype of infection and ASD. These findings provide additional support that maternal infections during pregnancy may increase risk of ASD.

118.078 78 Genome-Wide DNA Methylation in Pregnancy – Preliminary Results From the EARLI Study. J. Feinberg[1], S. Brown[2], D. Hiller[1], L. A. Croen[3], I. Hertz-Picciotto[4], C. J. Newschaffer[5], A. Feinberg[1] and M. D. Fallin*[6], (1)*Johns Hopkins School of Medicine*, (2)*Johns Hopkins School of Public Health*, (3)*Kaiser Permanente Division of Research*, (4)*UC Davis*, (5)*Drexel University School of Public Health*, (6)*Johns Hopkins School od Public Health*

Background: Several lines of evidence point to a potential role for epigenetic mechanisms in autism etiology. Changes in DNA methylation (DNAm) during development or early life may be most relevant for ASDs. Thus, looking at DNAm in mothers during pregnancy and in their babies in early childhood provides an opportunity for understanding the role of epigenetics in ASD during critical windows of development. Further, DNAm is affected by environmental factors and therefore could be a biological mechanism linking environments during pregnancy and early life and risk for ASD.

Objectives: As foundational pilot work towards understanding the role of epigenetics in autism, we have measured DNAm across the genome in blood samples from EARLI mothers taken at multiple pregnancy visits to assess changes in DNAm over the pregnancy interval and correlations between DNAm and maternal characteristics that may related to ASD risk.

Methods: We performed genome-wide DNAm analysis on blood samples of 46 pregnant women from the EARLI study using CHARM 2.0, an array-based genome-wide approach containing over 4 million probes. Women contributed between 2 and 4 separate samples for DNAm measurements corresponding to the first, second, and third trimesters of pregnancy and 3 months post-pregnancy. We first searched for regions where DNAm is changing over time in the mothers, then looked for regions of the genome that are differentially methylated between mothers with particular exposures such as prenatal vitamin use or potential ASD risk factors such as auto-immune disorders.

Results: We do not see large changes in DNAm within mothers over the pregnancy interval in this pilot sample. We do observe differences in DNAm between mothers with and without particular characteristics such as presence of autoimmune disorders. Results of comparisons with a larger array of factors will be presented.

Conclusions: This work has allowed us to develop the laboratory pipeline to analyze DNAm in epidemiologic samples. It appears that DNAm marks in blood are stable throughout pregnancy, which has implications for interpretation of results relating DNAm with potential ASD risk factors and outcomes. We have developed a strategy for identifying differentially methylated regions related to risk factors and outcomes. This strategy is being applied across a spectrum of variables with the goal of identifying epigenetic marks that may relate to environmental risk factors and thus elucidate mechanisms by which these risk factors influence ASD risk.

118.079 79 Birth Weight in ASD-Affected Twin Pairs. W. Froehlich*[1], S. Cleveland[1], A. Londono Tobon[1], A. Torres[1], J. M. Phillips[1], B. Cohen[2], T. Torigoe[2], J. Miller[2], A. Fedele[2], J. Collins[3], K. S. Smith[3], L. Lotspeich[1], L. A. Croen[4], S. Ozonoff[5], C. Lajonchere[2], J. K. Grether[3], N. Risch[6] and J. Hallmayer[1], (1)*Stanford University*, (2)*Autism Genetic Resource Exchange*, (3)*California Department of Public Health*, (4)*Kaiser Permanente, Division of Research*, (5)*UC Davis*, (6)*University of California San Francisco*

Background:

Multiple studies have associated low or very low birth weight with Autism Spectrum Disorders (ASDs). If low birth weight is connected with ASDs, it is reasonable to hypothesize that, in ASD-discordant twin pairs, the twin with the smaller birth weight will more often be the affected twin, and that ASD-concordant twin pairs will have lower average birth weights than ASD-discordant pairs. Additionally, in ASD-concordant pairs, the twin with the smaller birth weight may be more severely affected.

Objectives:

To examine the relationship of relative birth weight in ASD-affected twin pairs and ASD severity in a large twin sample.

Methods:

Twin pairs were identified through the California Department of Development Services in cooperation with the California Department of Public Health (CDPH) and were eligible if at least one twin met ASD criteria without an associated neurogenetic condition. Assessments included the ADI-R, ADOS, IQ testing, Social Responsiveness Scale (SRS), Peabody Picture Vocabulary Test (PPVT), and Vineland Adaptive Behavior Scale (VABS). Birth weight was extracted from CDPH birth records.

Only same-sex pairs were included in this analysis. Univariate analyses of covariance (ANCOVAs) controlling for gestational age were used to compare birth weights in affected and unaffected twins, as well as within pair birth weight averages. Paired sample t-tests compared birth weights in affected and unaffected co-twins. To examine birth weight in relation to measures of severity, partial correlations controlling for gestational and gender were used.

Results:

Analyses included 122 same-sex pairs (N=72 ASD-discordant pairs and N=50 ASD-concordant pairs).

In ASD-discordant pairs, the affected twin had a lower birth weight in only 7/16 MZM pairs (43.8%), 2/5 MZF pairs (40%), 19/42 DZM pairs (45.2%), and 3/9 DZF pairs (33.3%). Comparing mean birth weights of unaffected twins to affected twins, ANCOVAs controlling for gestational age showed no significant differences in either males or females (mean=2489 grams, N=142 affected males vs. mean=2557 grams, N=57 unaffected males; and mean=2403 grams, N=28 affected females vs. mean=2355 grams, N=14 unaffected females). Paired sample t-tests showed no significant differences in birth weights between affected and unaffected twins for DZ, ASD-discordant twin pairs (N=51) or for MZ, ASD-discordant twin pairs (N=21).

Overall, ANCOVA controlling for gestational age showed no significant difference in the within pair birth weight averages for ASD-concordant (mean=2458 grams, N=49) compared to ASD-discordant pairs (mean=2508 grams, N=71). ANCOVA remained non-significant for male only and female only comparisons.

Controlling for gestational age and gender, birth weight did not correlate with ASD severity in affected individuals as measured by ADOS severity, IQ, SRS, PPVT, or VABS. Furthermore, ANCOVA controlling for gestational age and gender demonstrated no significant difference in birth weight comparing those diagnosed with strict autism (N=81) versus autism spectrum disorder (N=17).

Conclusions:

Results suggest relative birth weights do not distinguish twins with ASDs from their unaffected co-twins in ASD-discordant pairs. Within pair averages of birth weights were not significantly different in ASD-concordant compared to ASD-discordant twin pairs. Additionally, birth weight does not correlate with ASD severity in this cohort of twins.

118.080 80 Thyroid Hormones in Pregnancies At Elevated Risk of Autism Spectrum Disorders. I. Burstyn*[1], S. Devaraj[2], L. A. Croen[3], M. D. Fallin[4], I. Hertz-Picciotto[5] and C. J. Newschaffer[6], (1)*Drexel University*, (2) *Baylor College of Medicine*, (3)*Kaiser Permanente Division of Research*, (4)*Johns Hopkins School of Public Health*, (5)*University of California, Davis*, (6)*Drexel University School of Public Health*

Background: There has been a long-standing speculation about the role of the hypothyroid state during pregnancy and risk of autism spectrum disorders (ASD) in the child. Maternal thyroid autoimmune disease has been implicated in ASD. Considering primarily toxicological evidence, a specific hypothesis about the role of maternal hypothyroxinemia was advanced.

Objectives: To examine whether maternal thyroid hormones (thyroid stimulating hormone (TSH) and free thyroxin (fT4)) were in hypothyroid state (elevated TSH and depressed fT4) in mothers who previously gave birth to child with ASD compared with normative ranges from typical pregnancies in the US.

Methods: We determined levels of fT4 and TSH in samples of serum from the first 88 pregnant women enrolled in the Early Autism Risk Longitudinal Investigation (EARLI). EARLI is a prospective pregnancy cohort study enrolling women who have previously given birth to a child subsequently diagnosed

with autism. Comprehensive data collection includes biospecimen collection throughout pregnancy. Available 210 maternal pregnancy serum samples as of Feb-15-2011 were analyzed using standard immunoassays. Levels of thyroid hormones were log-transformed prior to statistical analyses to account for skew in their distribution. One-sided t-tests on trimester-specific logarithmic means were performed in reference to available normative ranges for the US (three reports). Mixed effects models were used to correct for repeated measurements during pregnancy.

Results: The range of TSH and fT4 values and their variability were similar to what is seen in the normative pregnancy samples, although TSH appeared to be somewhat elevated in EARLI mothers. There were 13 (6%) measurements with TSH>3mIU/L and three measurements (1%) with TSH>5mIU/L suggesting a hypothyroid state in some women if the single reference range is used across trimesters. There were no measurements with TSH<0.08mIU/L that would suggest a hyperthyroid state. There was consistent evidence for elevated TSH in 2nd trimester samples relative to reference ranges (n=123, median 1.47, IQR 0.99-1.89) with all p-values for one-sided t-tests <0.05. The fT4 measurements were also depressed in 1st and 2nd trimesters relative to the general pregnancy population (p<0.01). Consideration of repeated measurements of hormones in pregnant women using mixed effects models that accounted for within-mother random effect did not alter the overall pattern.

Conclusions: Comparisons to external reference ranges and clinical cut-off values for subclinical hypothyroidism revealed that high-risk pregnancies appear to be at an increased risk of deficiency in thyroid hormones. Women enrolled in EARLI have a range of thyroid hormone levels detected in their prenatal serum, providing reassurance that it will be possible in the future to investigate variation in prenatal thyroid hormones in relation to child's risk of ASD within a high-risk pregnancy cohort.

118.081 81 Residential Proximity to Agricultural Pesticides and Cognitive and Behavioral Scores in the CHARGE Study. J. F. Shelton*[1], E. M. Geraghty[2], D. J. Tancredi[3] and I. Hertz-Picciotto[4], (1)*UC Davis Department of Public Health Sciences*, (2)*UC Davis School of Medicine*, (3)*UC Davis School of Medicine and Center for Healthcare Policy and Research*, (4)*University of California Davis*

Background: Studies of gestational exposures to organochlorine and organophosphate pesticides have suggested an association between exposure during pregnancy and the risk of an autism spectrum disorder. In California, commercial application of pesticides is recorded at the spatial resolution of one square mile (2.6 sq. km) in a publically available historical pesticide use report database by chemical type, date, and location.

Objectives: To describe the levels of pesticide application around the home of families of children with and without developmental disorders.

Methods: Utilizing home address records from the CHARGE study we reconstructed the agricultural application during pregnancy within the range of 1500m (slightly less than one mile) of the home, and restricted analyses to the Alta and Valley Mountain Regional Center catchment areas (located in the Sacramento and Central Valley of California) (N=575) where agricultural pesticide use was most prevalent. We summed the pounds of pesticide applied per three months of pregnancy to create a cumulative exposure for each trimester. Linear regression was used to estimate the relationship between each of four classes of pesticides (pyrethroids, organophosphates, organochlorines, and carbamates) and scores of the Mullen Scales of Early Learning (MSEL) and the Vineland Adaptive Behavioral Scales (VABS).

Results: All pesticide classes were inversely associated with decreased cognitive and adaptive behavior, but only the pyrethroid class was significantly so. Second trimester pyrethroid exposure (65 exposed) was associated with a 3.8 point decline in MSEL scores (p=0.03) and a 4 point decrease in the VABS (p=0.002) per 10lb increase in application after adjusting for the diagnostic class, regional center, child's gender, mothers education, year of birth and weighting by sampling probability.

Conclusions: Preliminary results show residential proximity to greater amounts of commercially applied pyrethroid

insecticides was associated with decreased scores of cognition and adaptive behavior in California.

118.082 82 Prenatal Biomarkers of Oxidative Stress and Reduced Methylation Capacity in An Autism High-Risk Pregnancy Cohort. S. J. James*[1], S. Melnyk[1], L. A. Croen[2], M. D. Fallin[3], I. Hertz-Picciotto[4] and C. J. Newschaffer[5], (1)*University of Arkansas for Medical Sciences*, (2)*Kaiser Permanente Division of Research*, (3)*Johns Hopkins School of Public Health*, (4)*UC Davis*, (5)*Drexel University School of Public Health*

Background: In two independent cohorts of post-pregnant mothers of autistic children, molecular abnormalities in folate-dependent one-carbon metabolism were identified. Specifically, glutathione redox/antioxidant status was significantly more oxidized and associated with protein/DNA oxidative damage and DNA hypomethylation in these mothers. These observations suggest the possibility that metabolic imbalance during gestation may influence the epigenetic and redox microenvironment of the fetus to promote abnormal neurodevelopment resulting in autism.

Objectives: In collaboration with the EARLI Network, the goal of the present investigation is to assess the prevalence of molecular abnormalities in folate-dependent one-carbon metabolism in samples collected from pregnant mothers who already have an older child with autism. This will set the stage for future analyses exploring the association of these maternal prenatal metabolic and molecular biomarkers of epigenetic dysregulation and oxidative stress/damage with autism related phenotypes in this high risk cohort.

Methods: Serial prenatal plasma and urine samples from 120 autism high risk pregnancies and maternal and offspring DNA from the EARLI study will be analyzed. To date, plasma samples from the first 30 pregnancies have been evaluated. HPLC with electrochemical detection was used to quantify plasma levels of S-adenosylmethionine (SAM; major methylation donor), S-adenosylhomocysteine (SAH; methylation product inhibitor), SAM/SAH (cellular methylation capacity), homocysteine (established risk factor for neurodevelopmental abnormalities), glutathione (GSH: major intracellular antioxidant); GSSG (oxidized form of glutathione), GSH/GSSG (antioxidant/detoxification capacity), and 3-nitrotyrosine (marker of protein oxidative damage). DNA samples will be assessed for global methylation (% 5-methylcytosine/total cytosine) and oxidative damage (8-oxo-deoxyguanine). Urine samples will be assayed for lipid peroxidation.

Results: Over 10% of all samples available from each trimester had functionally significant alterations in the assessed metabolites. The metabolite imbalance was generally greatest during the 2nd and 3rd trimesters which are the periods of greatest brain growth and maturation. For example, while multiple studies have shown that homocysteine levels normally *drop* during normal pregnancy to ~6 umol/L, these preliminary findings indicate that 33% of autism high-risk mothers have homocysteine levels >10.5 umol/L during third trimester accompanied by significant decreases in SAM/SAH methylation capacity and GSH/GSSG antioxidant capacity in the second and third trimester.

Conclusions: These results demonstrate for the first time that abnormalities in folate-dependent methylation metabolism and glutathione-dependent antioxidant/detoxification capacity are present during gestation in a significant percent of mothers at risk for a second child with autism. We will be able to verify this in a larger sample size and incorporate analyses of biomarkers of DNA oxidative damage and hypomethylation. Eventually, these data can be considered as potential risk biomarkers for autism-related endpoints within the enriched-risk cohort.

118.083 83 Frequency of Autism Spectrum Disorder Among Children with Cerebral Palsy, Metropolitan Atlanta Developmental Disabilities Surveillance Program, 2006-2008. D. Christensen*, M. Yeargin-Allsopp, N. Doernberg and K. Van Naarden Braun, *Centers for Disease Control and Prevention*

Background:

Cerebral palsy (CP) is primarily a disorder of movement, but is often accompanied by disturbances of sensation, perception, cognition, communication, and behavior. Information on the frequency of co-occurring neurodevelopmental disorders is useful to guide treatment and service decisions at both the individual and population levels and may also provide clues to

shared risk factors or etiologic pathways. Previous studies have suggested that the frequency of autism spectrum disorders (ASD) among children with cerebral palsy (CP) is higher than the prevalence of ASD in the general population, but information from population-based studies is limited.

Objectives:

The goals of this study were to examine the frequency of ASD among children with CP identified from a population-based surveillance program in metropolitan Atlanta, Georgia. The frequency of ASD by demographic characteristics, CP subtype, walking ability, co-occurring intellectual disability (ID), and co-occurring epilepsy was also examined.

Methods:

We used data from the 2006 and 2008 surveillance years of the Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP). Children were included if they resided in the five-county surveillance area during the surveillance year, were born 8 years prior to the surveillance year, and met the MADDSP case definition for CP. Determination of ASD case status was made using MADDSP methodology. Characteristics included sex, race/ethnicity, CP subtype, co-occurring ID, co-occurring epilepsy, and walking ability. Frequency tables using chi-square statistics were used to examine differences in the frequency of ASD by these characteristics.

Results:

Combining case counts for both surveillance years, 358 children met the MADDSP case definition for CP; of these, 27 (7.5%) also met the case definition for ASD. The frequency of ASD among children with CP did not differ significantly by sex, race/ethnicity, CP subtype, or co-occurring epilepsy, but was higher among children with intellectual disability compared to those without (10.6% vs 5.1%, p=0.05). Among 241 children with CP with available data on walking ability, ASD frequency was higher among those who could walk independently compared to those with limited or no walking ability (11.1% vs 2.3%, p = 0.01).

Conclusions:

The reasons for a possibly elevated frequency of ASD among children with CP compared to the general population are not known, but common risk factors or etiologies might play a role. Research regarding pathways of CNS damage in ASD could potentially benefit from the current body of knowledge regarding specific types and mechanisms of CNS damage associated with CP. The lower frequency of ASD among children with limited to no walking ability suggests that clinicians should be alert to the possibility of ASD among children with CP, especially those with severe motor impairment, to ensure that ASD is identified and these children receive appropriate treatment and support. Diagnostic tests for ASD should accommodate children with disabilities, including those with physical disabilities such as CP.

118.084 84 Folic Acid Supplements in Pregnancy and Severe Language Delay in Children. C. Roth*[1], P. Magnus[2], S. Schjolberg[2], C. Stoltenberg[3], P. Surén[2], I. W. McKeague[1], G. Davey Smith[4], T. Reichborn-Kjennerud[2] and E. Susser[1], (1)*Columbia University*, (2)*Norwegian Institute of Public Health*, (3)*The Norwegian Institute of Public Health*, (4)*University of Bristol*

Background: Prenatal folic acid supplements reduce the risk of neural tube defects and may have beneficial effects on other aspects of neurodevelopment.

Objectives: To examine associations between mothers' use of prenatal folic acid supplements and risk of severe language delay in their children at age 3 years.

Methods: In the prospective Norwegian Mother and Child Study, pregnant women were recruited from 1999-2008. We used data on children born before 2008 whose mothers returned the age 3 follow-up questionnaire by June 16th 2010. The exposure was maternal use of folic acid supplements within the interval from 4 weeks prior to conception to 8 weeks after. The outcome was severe language delay at age 3 based on maternal report. Children with minimal expressive language (only one-word or unintelligible utterances) were rated as having severe language delay. Relative risks were approximated by estimating odds ratios [OR] with 95% confidence intervals [CI] in a logistic regression analysis.

Results: Among 38 954 children, 204 (0.5%) had severe language delay. Children whose mothers took no dietary supplements in the specified exposure interval were the reference group, (n=9052 [24.0%], with severe language delay in 81 [0.9%). Adjusted odds ratios for three patterns of exposure to maternal dietary supplements were: (1) other supplements, but no folic acid (n=2480 [6.6%)], with severe language delay in 22 children [0.9%]; OR, 1.04; 95% CI, 0.62 to 1.74); (2) folic acid only (n=7127 [18.9%], with severe language delay in 28 children [0.4%]; OR, 0.55; 95% CI, 0.35 to 0.86); and (3) folic acid in combination with other supplements (n=19,005 [50.5%], with severe language delay in 73 children [0.4%]; OR, 0.55; 95% CI, 0.39 to 0.78).

Conclusions: Among this Norwegian cohort of mothers and children, maternal use of folic acid supplements in early pregnancy was associated with a reduced risk of severe language delay in children at age 3 years.

118.085 85 Maternal Chemical and Drug Intolerance: A Risk Factor for Autism and ADHD?. R. F. Palmer*, L. Heilbrun and C. S. Miller, *University of Texas Health Science Center San Antonio*

Background: Chemical intolerance—the inability to tolerate a wide variety of everyday chemical exposures (fragrances, auto exhaust, cleaning compounds, etc.)—has been associated in numerous studies with multi-system symptoms including: asthma, chronic fatigue, cognitive and memory problems, etc.

Objectives: The primary objective of this study was to investigate the possible association between maternal chemical intolerance as a risk factor for Attention Deficit/ Hyperactivity Disorder (AD/HD) and Autism Spectrum Disorder (ASD).

Methods: A case-control study was used to test the hypothesis that mothers of children with AD/HD or ASD would score higher on the Quick Environmental Exposure and Sensitivity Inventory (QEESI©)—a validated tool for diagnosing chemical intolerance—than mothers whose children do not have either ASD or AD/HD. Mothers with (n=183) and without (n=146) AD/HD children, and mothers with (n=282) and without (n=72) ASD children participated in separate surveys.

Results: Compared to control mothers, case mothers had significantly higher mean scale scores for Chemical Intolerance ($p < .001$), Other Intolerances (food, drug, caffeine, alcohol etc.) ($p=.006$), and Symptoms ($p<.001$) on the QEESI.

Conclusions: These preliminary findings suggest a possible association between maternal chemical intolerance, ADHD and ASD. Further, if this association is confirmed by additional studies, the QEESI© may be a useful screening tool to identify mothers at risk for having children with AD/HD and autism, and to reduce this risk through early education and intervention—i.e., removal of suspect exposures prior to and during pregnancy.

118.086 86 Prenatal Cytokine Expression Profiles in An Autism High-Risk Pregnancy Cohort: Preliminary Results From the EARLI Study. V. Yau*[1], J. Van de Water[2], L. A. Croen[3], M. D. Fallin[4], I. Hertz-Picciotto[5] and C. J. Newschaffer[6], (1)*Kaiser Permanente*, (2)*University of California, Davis*, (3)*Kaiser Permanente Division of Research*, (4)*Johns Hopkins School of Public Health*, (5)*UC Davis*, (6)*Drexel University School of Public Health*

Background: Many studies document immune aberrations in children already diagnosed with autism, though few have examined immune influences during pregnancy. Levels of selected cytokines in maternal peripheral blood collected at one point during mid-pregnancy have been previously associated with increased risk for autism. However, the pattern of cytokine expression over the entire pregnancy period has not been examined in relation to autism risk.

Objectives: To characterize the cytokine expression levels throughout pregnancy among mothers who have previously given birth to a child diagnosed with ASD. Future analyses will relate cytokine expression levels during pregnancy with developmental outcomes and ASD status of the child.

Methods: The Early Autism Risk Longitudinal Investigation (EARLI) study is designed to prospectively follow a population of pregnant women at elevated risk of giving birth to a child with ASD. Comprehensive data are collected throughout pregnancy and during the first 3 years of life of the baby born into the study. Venous blood samples (N=292) collected

during the first, second, and third trimesters of pregnancy for the first 90 mothers enrolled in the study were analyzed. Cytokines (eotaxin, GM-CSF, IFN-gamma, IL-1a, IL-1b, IL-2, IL-4, IL-6, IL-7, IL-8, IL-10, IL-12, IL-13, IL-17, IP-10, MIP-1a, MIP-1b, MCP-1, RANTES, IL-1ra, TNF-a) were quantified by Luminex multiplex analysis technology. Linear models were used to determine trajectories of log transformed plasma cytokine levels in mothers over the course of pregnancy. Slope values ≥0.1 or ≤-0.1 were used to determine the % of women with increasing or decreasing cytokine levels over this time period.

Results: Among this high-risk pregnancy cohort, a panel of cytokines could be measured reliably in blood specimens collected throughout pregnancy, and a wide range of maternal cytokine expression was detected. Trends in cytokine levels over the entire pregnancy period were detected but were not always in the expected direction. For instance, IL-10 concentrations are expected to increase over the pregnancy period, while IFN-gamma and IL-17 are expected to decrease until a gestational age of 33 weeks. However, in this sample, 2.3% (N=2) of mothers had decreasing IL-10 concentrations, 11.5% (N=10) had increasing IFN gamma levels, and 6.9% (N=6) had increasing IL-17 levels. For three women, the pattern of expression of all three of these cytokines was in the opposite direction as expected, suggesting the presence of an inflammatory process during pregnancy in a subset of women at higher risk for having a second child with autism.

Conclusions: Preliminary results indicate that the trajectories of cytokine expression in this high risk population of pregnant women are quite diverse. Cytokine trajectories that deviate from the expected direction may be useful as early biomarkers for ASD risk in the child. A three year follow-up of a total population of 1,000 successful births is planned, providing an unprecedented resource of biological and environmental data on an autism high-risk pregnancy cohort. Once outcome data are available, this resource will enable the investigation of genetic, environmental, and immunological influences in the prenatal and early postnatal period on ASD risk.

118.087 87 Effects of Prenatal Stress, Prenatal Diet, and Maternal Genotype on Autistic-Like Behavior in Mice.

K. L. Jones*[1], M. J. Will[1], P. M. Hecht[1], C. Giesing[1], C. L. Parker[1], K. Webb[1], K. Poet[1], K. Bohnert[1], N. Ackermann[1], E. Hayes[1], M. McAnally[1], A. Kohler[1], K. Fritsche[1], M. Tilley[2] and D. Q. Beversdorf[3], (1)*University of Missouri*, (2)*Central Methodist University*, (3)*University of Missouri, Columbia*

Background: Multiple studies have reported prenatal stress as a potential risk factor for the development of autism spectrum disorder (ASD). In rodents, a significant reduction in sociability is seen in prenatally stressed offspring of serotonin transporter knockout heterozygous (5-HTT +/-) dams. Additionally, offspring with prenatal maternal diets rich in omega-6 polyunsaturated fatty acids (PUFAs) show decreased social interactions. Finally, diets rich in omega-3 PUFAs are thought to be neuroprotective and may reduce the impact of factors such as the aforementioned gene-stress interaction.

Objectives: In our study, we examined the effects of prenatal diet, prenatal stress, and maternal genotype on behavior in offspring mice.

Methods: Pregnant C57BL/6J and 5-HTT +/- dams were subjected to either chronic variable stress or no stress, with each group further divided into receiving one of four diets beginning 2 weeks before breeding and lasting until offspring were weaned: AIN-93G, AIN-93G with added safflower oil, AIN-93G with added flaxseed oil, and AIN-93G with added pure DHA. Chronic variable stressed mice were given one stressor per day beginning on gestational day 6 until the birth of the offspring. We subsequently recorded the ultrasonic vocalizations (USVs) of the offspring on postnatal day (PD) 8 as a measure of social communication. Beginning on PD 60, adult offspring were tested for sociability, anxiety, and locomotor functioning using a 3-chambered social approach task, an elevated-plus maze, an open field and a rotarod task.

Results: Prenatally stressed offspring of 5-HTT +/- dams displayed a decrease in USVs compared to WT control offspring. Additionally, a diet rich in omega-6 PUFAs decreased the amount of USVs in non-stressed offspring of WT dams. Prenatally stressed offspring of SERT +/- dams exposed to the omega-3 PUFA rich diet had a similar number of calls to those exposed to the control diet. Results are forthcoming in the 3-chambered social approach task,

elevated-plus maze, open field and rotarod task, as data has been collected and is currently being analyzed. We expect a decrease in sociability as well as an increase in anxiety in prenatally stressed 5-HTT +/- offspring as well as in offspring exposed to the AIN-93G with added safflower oil prenatal diet. Finally, we expect prenatally stressed 5-HTT +/- offspring exposed to the AIN-93G with added pure DHA diets to display normal sociability and anxiety levels.

Conclusions: This study provides evidence for a role of maternal genotype, prenatal stress and prenatal diet in offspring sociability in a potential animal model of ASD. Exploration of the relationship between maternal genotype, prenatal stress, prenatal diet and ASD in humans will be necessary to determine the role of this finding in clinical ASD, and further investigation into the mechanism of action of this effect is warranted.

118.088 88 Prenatal Interaction Between Genotype and Stress in the Development of Autism Spectrum Disorder. P. Hecht*[1], K. L. Jones[1], M. Tilley[2] and D. Q. Beversdorf[1], (1)*University of Missouri*, (2)*Central Methodist University*

Background:

While genetics has been shown to have a strong influence in the etiology of Autism Spectrum Disorder (ASD), other factors must also contribute to this disorder. Our previous research has shown a significant increase in prenatal stress in mothers of children with ASD with a peak at weeks 21-32 of gestation. However, not all mothers that encounter stressful situations during pregnancy have children with ASD. It is possible that genetics may play a role in stress tolerance in the development of ASD. The serotonergic system holds particular interest in this regard. The serotonergic system has been implicated as a possible contributing factor to the development of ASD. Moreover, an insertion/deletion polymorphism in the promoter region of the serotonin transporter (5-HTT) gene, SLC6A4, has been associated with anxiety and stress reactivity, and some studies have suggested an association with ASD in carriers of the short allele.

Objectives:

Our aim is to discover if this polymorphism found in the serotonin transporter gene may interact with environmental stressors to produce a higher risk for the development of ASD in the child. This study, to our knowledge, is the first to look at this novel gene and stress interaction on the etiology of ASD.

Methods:

Blood was collected from families with children diagnosed with ASD for genetic analysis. DNA was isolated using Flexigene (Qiagen, Valencia, CA) kit following manufacturer specifications. PCR was performed using previously documented protocol. Mothers were asked to complete several questionnaires regarding their history of stress exposure during pregnancy, and the timing of the stressors.

Results:

Early evidence suggests that mothers with the 5-HTTLPR short allele have higher numbers of stressors and stressor severity during pregnancy, predominantly during the critical period of pregnancy identified in our previous work, when compared to carriers of the long allele.

Conclusions:

This study is beginning to suggest a gene and environment interaction in the development of ASD. Our study continues to show the significance of stress during gestation in the etiology of ASD particularly during weeks 21-32. More importantly, this evidence further identifies a specific potential gene that appears to interact with prenatal stress exposure in association with this risk. Future studies will be needed for further understanding of how environmental factors interact with genetics in autism, and exploration of ways to mitigate this risk.

118.089 89 Using Data From the SC Autism and Developmental Disabilities Monitoring Project to Assess Perinatal and Neonatal Risk Factors for Autism. L. B. King*, J. S. Nicholas, L. A. Carpenter, J. Charles, W. Jenner and T. Hulsey, *Medical University of South Carolina*

Background: Data from the Centers for Disease Control and Prevention indicates that approximately 1 in 110 8-year-old

children are affected with an Autism Spectrum Disorder (ASD). Different studies have found a variety of perinatal and neonatal factors as risk factors for ASD, but the data is inconsistent and often lacks a comparison population.

Objectives: The purpose of this study was to link data from the South Carolina Autism and Developmental Disabilities Monitoring Project (SC ADDM) with the Perinatal Information System (PINS) at the Medical University of South Carolina (MUSC) to allow exploration of perinatal and neonatal factors for a group of children with ASD and a control group without ASD.

Methods: Information was collected on 8-year old children (born in 1992, 1994, 1996, 1998, and 2000) residing in a 23-county area of South Carolina between 2000 and 2008 as part of an ongoing, population-based multiple source surveillance of Autism Spectrum Disorders in South Carolina. At MUSC the Division of Pediatric Epidemiology oversees an integrated patient information system referred to as the Perinatal Information System (PINS). The data contained in this system encompass the events and clinical experiences of maternal and child outcomes from the onset of pregnancy until discharge from developmental pediatrics care and include almost 4,000 different perinatal and neonatal variables. This data has been collected and maintained since 1992. Data from the two databases will be linked. For children with an ASD that are linked to the PINS database, an additional 3 controls from PINS will be picked and matched on age, gender, and race. Differences in perinatal and neonatal risk factors will be compared between the groups and possible associations with ASD risk will be assessed.

Results: To date, only 1 of the 5 study years has been linked. In 2000, there were 2,463 births documented in the PINS dataset. In 2008, there were 264 children with a confirmed surveillance case of ASD. Approximately 12% of the children with ASD (n=31) from SC ADDM were located in the PINS database. The group was 58% black, 42% white, 90% male and 10% female. There was no difference in insurance status (private, Medicaid, self-pay) between the two groups.

Conclusions: The initial findings indicate the feasibility of performing this data linkage. Based on the current knowledge of prevalence, we would expect approximately 1% of the 2,463 births to be confirmed with ASD. In fact, the 31 children represent 1.26% of the cohort with ASD. Further there was a larger than expected percentage of African Americans found in this population. The outcome allows further exploration of this group that, to date, has little information available. It is planned to complete the linkage of the remaining 4 study years (includes 609 children with ASD from SC ADDM) with PINS and expect approximately 73 more matches, to total 104 children linked between the 2 databases. Variables to be explored include birth weight, past pregnancy outcome, parity, prenatal information, maternal pregnancy complications, maternal therapy, neonatal diagnosis, neonatal medications, and neonatal procedures.

118.090 90 Artificial Reproductive Technology Exposure in Children with Autism Spectrum Disorders and Their Siblings. R. Maxim, MD*[1], E. S. Ambrecht[1], J. K. Law[2], C. M. Anderson[2], C. Guild[1], M. W. Baig[3], D. H. Zand[4], A. Nay[1], R. Grimmer[1], A. R. Marvin[2] and P. A. Law[2], (1)*Saint Louis University*, (2)*Kennedy Krieger Institute*, (3)*SSM Cardinal Glennon Children's Hospital*, (4)*Saint Louis University School of Medicine*

Background: Both the prevalence of autism spectrum disorders (ASD) and the use of artificial reproductive technologies (ART) have risen in the last decades. There is limited research on the association of ASD and ART.

Objectives: 1) To explore the association between ART use and risk of ASD. 2) To determine the relationship between ART use and intellectual disability among children with ASD. 3) To assess differences in paternal age by ART exposure status among probands with ASD.

Methods: This study reviews the history of ART use in probands with ASD and their unaffected siblings through a self-reported parental survey administered via the internet by the Interactive Autism Network (IAN). The final sample consisted of 1048 probands with ASD (mean age= 6.4 years, SD= 3.2, 75.4% male), 41% autism, 39% PPD-NOS, 19.4% Asperger's) and 744 siblings without ASD (mean age= 7.4 years, SD= 3.5, 82.7% males)

Results: The prevalence of ART was 5.8% (N=61) among the probands with ASD (N=1048) and 4.6% (N= 34) among the unaffected siblings (N= 744). Children with ASD were more likely to have been exposed to ART when compared with their unaffected siblings without reaching statistical significance in this small sample (crude odds ratio (cOR) = 1.29, p= 0.244). There was no significant difference in the gender of the probands with ASD versus their unaffected siblings. The paternal age at birth was statistically significant higher in children with ASD (paternal age: mean= 36 years, range 26-49 years) versus their unaffected siblings (paternal age: mean= 32.7 years, range 15-55 years) (p< 0.001). The type of ASD diagnosis and the gender did not significantly differ between the two groups.

Comparison of the ASD probands with ART (N=61) versus those without ART (N=987) showed no statistical significant difference in the type of ASD diagnosis and in the gender. A significantly higher percentage of the probands with ASD and a history of ART had cognitive intelligence quotient (IQ) scores in the range of intellectual disability (35.7%) when compared with the ASD probands with no history of ART (19.5%), p < 0.05.

The age of ASD diagnosis among probands with ART was significantly lower by a mean difference of approximately 1 year in comparison to those without ART, p < 0.05. A higher paternal age at birth was observed among ASD probands with ART (36.9 + 6.7 years) versus ASD without ART group (32.7 + 6.4 years), p < 0.001.

Conclusions: More probands with ASD were exposed to ART in comparison to their unaffected siblings in this study population. Probands with ASD conceived by ART were diagnosed with ASD at a younger age than those without ART exposure. The percentage of ASD probands with intellectual disability was 1.8 times greater among individuals with ASD conceived through ART in comparison to those naturally conceived.

118.091 91 The Relationship Between Autism Spectrum Disorders and the Distribution of Hazardous Air Pollutants in Four New Jersey Counties. R. M. McWilliams*[1], D. E. Wartenberg[2] and N. J. Jain[3], (1)*Rutgers University*, (2)*UMDNJ--Robert Wood Johnson Medical School*, (3)*UMDNJ-RWJMS*

Background: A California study reported an association between the diagnosis of autism spectrum disorder (ASD) and residence in regions with elevated levels of air pollutants. Since 1980, the reported prevalence of ASD has risen in the U.S. by a factor of 10, with the highest prevalence in New Jersey (NJ). This increase has been attributed both to increased awareness and diagnosis and a higher incidence due to environmental factors.

Objectives: Using methods from the California study, this study examined the association of prior exposure to air toxics with an ASD diagnosis by age 8 in four NJ counties: Essex, Hudson, Ocean and Union. We characterized cases of ASD, delineated confounding variables, and assessed association.

Methods: We obtained mean annual concentrations of 37 air toxicants by census tract in the four counties from the 1996 EPA online NATA database. Hazardous Air Pollutants (HAPs)were divided into 5 independent groups based on their structure: metals, aromatic and chlorinated solvents, chemicals of interest (e.g. PAHs) and other chemicals. We also divided the chemicals by their mechanistic effects into 7 groups: reproductive, developmental, neurologic, immunologic and endocrine toxicants, carcinogens and those used for pesticides. We acquired data on 8-year-old ASD cases (born in 1992) from the NJ Autism and Developmental Disabilities Monitoring Network. NJ Department of Health and Senior Services provided birth certificate data for the cases and 4 matched controls (birth month and gender) per case for linkage to the exposure data at the census tract level. Using a 4:1 matched case control study design we assessed the strength of association of exposure with case/control status.

Results: When considering the entire analytical sample, matched regression analyses yielded no association of case/control status with exposure. However, when the case/control sets were stratified by expert estimation of of clinical impairment clinical into 3 levels of severity, the composition of each stratum was strikingly different both demographically e.g. male/female ratios: mild - 2.5:1,

moderate - 4.5:1 and severe - 7:1 , and clinically e.g. almost half of cases in the severe stratum were diagnosed with regression and fewer co-diagnosed with psychological disorders. In the structural groups, the Adjusted Odds Ratios (AORs) for the severe ASD cases were significantly elevated and associated with the top 25% of concentrations of aromatic (4.22) and chlorinated (3.82) solvents, PAHs (5.40) and all other chemicals (9.30). When examined mechanistically, AORs in the severe stratum were elevated for endocrine disruptors (4.08), reproductive (4.29) and neuro (4.63) - toxicants, carcinogens (3.93) and pesticides (5.56) at the same concentration.

Conclusions: Results of this study suggest an increased risk of diagnosis with clinically severe ASD in NJ counties with high ambient levels of HAPs, emphasizing the value of stratification in the ASD population. These results also may explain why previous studies that have not stratified subjects by severity of impairment report widely varying results.

118.092 92 Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorder in a Low Birth Weight Cohort: Evidence for a Shared Familial Risk Factor. C. B. Christman*[1], A. H. Whitaker[2], J. F. Feldman[3], J. A. Pinto-Martin[4], S. E. Levy[5], A. E. Silberman[2], N. S. Paneth[6] and J. M. Lorenz[1], (1)*New York Presbyterian Hospital-Columbia University Medical Center*, (2)*New York State Psychiatric Institute*, (3)*New York State Institute*, (4)*University of Pennsylvania School of Nursing and School of Medicine*, (5)*Children's Hospital of Philadelphia/ University of Pennsylvania*, (6)*College of Human Medicine, Michigan State University*

Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorder in a Low Birth Weight Cohort: Evidence for a Shared Familial Risk Factor

Background: Preterm/low birthweight (LBW) infants, who now account for almost 10% of births in the United States, are at excess risk for both ASD and ADHD Family and twin studies have given rise to the notion that Autism Spectrum Disorders (ASD) and Attention-Deficit Hyperactivity Disorder (ADHD) may have familial risk factors in common. Within the preterm/LBW population, ASD and ADHD have two established non-familial risk factors in common, namely male gender and perinatal brain injury, but familial risk factors have been less well studied. A longitudinally followed regional preterm/LBW birth cohort having retrospective data on maternal childhood ADHD symptoms provides an important opportunity to test the hypothesis of shared familial risk for ASD and ADHD,

Objectives: The objective of this study was to determine whether diagnoses of ASD and ADHD but not diagnoses of other psychiatric disorders were associated with maternal recall of ADHD symptoms in their own childhood.

Methods: This study is based on data from a longitudinal epidemiological study of outcomes in a regional LBW (< 2000 g) cohort (the Central NJ Neonatal Brain Hemorrhage Study, NBHS), born 1984-1987 (N=1105). The entire cohort was screened with neonatal serial head ultrasound for perinatal brain injury. At the age 16 follow-up, mothers completed (1) the Wender Utah Rating Scale (WURS), a validated measure for the retrospective measurement of childhood ADHD, on themselves (2) a parental report research psychiatric diagnostic interview covering a wide range of DSM IV diagnoses exclusive of ASD, on their adolescent (3) a screen for ASD on their adolescent. A research diagnostic evaluation of ASD screen positives and a systematic sample of screen negatives was conducted at age 21. Thus, by early adulthood, the NBHS cohort had been assessed for nearly the entire range of DSM IV Axis I diagnoses, including ASD. The twenty-five items on the WURS that have been shown to discriminate between adults with ADHD and controls were used here to derive a total score.

Results: The table below shows the WURS scores in relation the three diagnostic groups of interest.

Wender 25-Item Total Scores by ASD, ADHD, and Any Other Diagnosis

Diagnoses	Positive for Diagnosis		Negative for Diagnosis		Difference	P-values
	N	Mean (± SD)	N	Mean (± SD)	Unadjusted	Adjusted
ASD[a]	13	21.23	169	11.23	.005	.004

		(±15.78)		(±11.77)		
ADHD[b]	20	18.65 (±11.33)	395	11.29 (±12.12)	.008	.006
Other	94	12.65 (±12.08)	301	10.86 (±12.11)	.212	.187

a. Excluding those with ADHD **b. Excluding those with ASD** **c. All other assessed diagnoses combined, exclusive of ASD and ADHD**

d. Adjusted for gender and neonatal head ultrasound abnormalities

Conclusions: In a non-referred preterm/LBW population, retrospectively assessed maternal childhood ADHD symptoms are associated selectively with offspring diagnoses of ASD and ADHD, suggesting that these diagnoses may have a common familial risk factor. This finding awaits replication in prospective follow-up studies of preterm/LBW infants as well as of term infants.

Services Program

119 Impact of Families and Quality of Life

119.093 93 Clinical Validation of the Family Life Impairment Scale in Families Raising a Toddler on the Autism Spectrum. N. Mian*[1], T. W. Soto[2], F. Martinez-Pedraza[2], M. Maye[3] and A. S. Carter[1], (1)*University of Massachusetts Boston*, (2)*University of Massachusetts, Boston*, (3)*University of Massachusetts - Boston*

Background: Developmental, social-emotional, and other forms of psychological symptoms are not only impairing to young children, but can also negatively impact family functioning. Previous research showed significant associations between the Family Life Impairment Scale (FLIS) and problem behaviors, including externalizing, internalizing and sensory symptoms, in a non-clinical representative sample of toddlers (Briggs-Gowan et al., 2006). Four distinct domains of family functioning were also observed in this non-clinical sample, suggesting that family impairment is a multi-dimensional construct (Soto et al., 2009). Impairment in families with a young child with an autism spectrum disorder (ASD) includes parental stress, disruptions in family routines, and limitations in participation in settings that support family needs, such as childcare.. A multidimensional measure of family impairment is needed to assess the degree of family stress and disruption associated with raising a child with ASD.

Objectives: (1) To confirm validation of the four-factor structure of the FLIS. (2) To provide further clinical utility of the FLIS.

Methods: As part of a larger study, mothers (n = 168) of young children with ASD (n = 174; mean age = 28 months) completed the Family Life Impairment Scale (FLIS), a multidimensional measure assessing impairment in 1) *family activities*, 2) *parent activities*, 3) *childcare*, and 4) *positive growth* attributed to the child's behavior, personality or special needs. Children's diagnoses were confirmed with the Autism Diagnostic Interview – Revised (ADI-R), Autism Diagnostic Observation Schedule (ADOS), and clinical impression.

Results: Structural equation modeling was used to test the validation of the FLIS in a population of toddlers with ASD. Overall model fit was good (RMSEA = 0.042; CFI = 0.942. Standardized factor loadings were between 0.36 and 0.91, and all loadings were statistically significant ($p < 0.001$).

Conclusions: Results provide strong evidence for the validity of the four-factor structure of this multidimensional measure of family impairment in this clinical sample. Three domains of impairment and one domain of positive growth were validated in a sample of families with a toddler with ASD, and appear to be adequately assessed by the FLIS. This study indicates that the FLIS is a valid measure of parental perceptions of the effects of a child's disability and behaviors in the family. The FLIS may be a useful clinical tool to assess the impact of the child in the family and to identify specific targets for intervention.

119.094 94 Maternal Cortisol Regulation Patterns, Perceived Parental Stress and Attachment Representations: Impact of a Service Dog's Presence in Families of Children with ASD. S. M. Fecteau*[1], M. Trudel[1], N. Champagne[2] and F. Picard[3], (1)*University of Sherbrooke*, (2)*Fondation Mira*, (3)*Laval University*

Background: Many parents of children with ASD express significantly elevated levels of stress (Baker-Ericzén et al., 2005). Interventions offered in childhood have positive effects on parental stress related to characteristics of the child (Keen et al., 2010). Based on previous studies, it is expected that the use of an assistance dog by the parent as a management strategy for overcoming situations of disability experienced by the child and the family can stimulate social interaction in children with ASD (Burrows et al., 2008) and help regulate the child's physiological stress (Viau et al., 2010). The conceptual model preferred in this study refers to the inter-influence between parenting stress and diurnal cortisol regulation.

Objectives: The study of biological markers in addition to parental stress offers a holistic approach to the regulation of stress by these parents. The current study seeks to better understand the adaptation of mothers according to their hormonal regulation, perceived parental stress and the contribution of their attachment style. Considering the additional obligations engendered by the presence of a dog in the family, we also consider the possible impact of managing a service dog on both psychological and physiological parental stress.

Methods: The use of a homogeneous group of service dogs offers a comparable response to each child and their families in addition to further identify their effects on parental stress. 85 mothers of children diagnosed with ASD (17 girls; ages 5-10 years-old) took part in this study and were distributed in two groups (43 families from a waiting list format to serve as a control group). After a three-week baseline period, a service dog was introduced in the 42 families from the experimental group. Salivary cortisol was collected in both groups at home one day per week (awakening, 30 minutes later and bedtime) for 15 weeks. Parental stress (Parental Stress Index short form; Abidin, 1995), severity of behaviours related to autism (Childhood Autism Rating Scale; Schopler et al., 1988), and parental attachment representations (Narrative-Based Attachment Script Assessment; Waters & Rodrigue-Doolabh, 2004) were evaluated.

Results: Cluster analysis revealed two groups of patterns based on maternal cortisol regulations prior to the dog's arrival characterized by the AUCg (area under the curve with respect to ground). No differences according to child's age, gender nor diagnostic, maternal age and group membership were observed between clusters. Once the clusters were divided in accordance to intervention protocol, higher AUCg at baseline described mothers from the control group. No associations were found between severity of behavioral characteristics related to autism, attachment representations and cortisol patterns. However, higher perceived parental stress was associated with a flatter diurnal rhythm of cortisol.

Conclusions: The findings suggest that the presence of a service dog in the family did not disrupt diurnal cortisol profiles. In consideration of previous research showing a variety of cortisol patterns, the current findings illustrate significant between-subject differences in profiles associated with high-perceived parental stress. Further analysis might allow us to better understand the bidirectional influences between these concepts specific to a family environment .

119.095 95 Depression and Stress Levels in Parents of Young Children with Autism. C. Hess*[1], R. J. Landa[1] and S. Tek[2], (1)*Kennedy Krieger Institute*, (2)*Kennedy Krieger Institute for Autism and Related Disorders*

Background: It has been reported in literature that parents of young children with autism spectrum disorders (ASD) show elevated levels of stress and are at a high risk for depression (Benson & Karlof, 2009). However, parental mental health and its connection to stress and child functioning in parents of young children who have ASD or who are at risk for ASD (e.g., infants and toddlers) have not yet been studied in literature.

Objectives: To investigate differences in parent mental health, stress level, and child functioning in parents of 1- and 2-year-olds who volunteered for an early intervention study.

Methods: We included 30 1-year-olds with social and communication delays who also showed signs of ASD (mean age = 15.46 months) and their parents, and 60 2-year-olds with ASD (mean age = 26.14 months) and their parents. Parents completed the Brief Symptoms Inventory (BSI) depression scale, and Parenting Stress Index (PSI), child and parent domains. The PSI child domain measures stress that stems from raising a child and includes components such as hyperactivity and demandingness. PSI parent domain

measures stress that stems from being a parent and includes components such as depression and social isolation. Children in both groups were administered Mullen Scales of Early Learning (MSEL; Mullen, 1995) and Autism Diagnostic and Observation Schedule (ADOS; Lord et al., 2000) by the expert clinicians.

Results: Overall, parents in both groups had significantly elevated PSI scores on the child domain: 56% of parents of 1-year-olds, and 53% of parents of 2-year-olds had clinically elevated percentile scores on this domain; however the groups did not differ from each other. Parents of 1-year-olds who were at risk for ASD had significantly higher T scores on the BSI depression scale (43% of parents of 1-year-olds, and 13% of parents of 2-year-olds had clinically elevated T scores), as well as on the PSI parent scale (26% of parents of 1-year-olds vs. 10% of parents of 2-year-olds had elevated percentile scores). For parents of 1-year-olds, scores on the BSI depression scale were related to the PSI parent and child domains. For parents of 2-year-olds, scores on the BSI depression were related to the scores on the PSI child domain. For either group, scores on the BSI depression scale were not related to the child level of functioning as measured by the ADOS and the MSEL. For both groups, scores on the BSI depression scale were predicted by the scores on the PSI parent domain.

Conclusions: Parents of toddlers with ASD or who were at risk for ASD reported elevated stress and depression as compared to the norm. Parents of 1-year-olds who were at risk for ASD reported more parental stress and depression than the parents of children with ASD who were just a year older. Parents of young children with ASD or who show early signs of ASD may be at particular risk for developing depression that is due to parental stress, and may require interventions that target parental stress and depression.

119.097 97 Parenting Stress and Aberrant Behavior in Children with Autism Participating in a Multi-Disciplinary Program Providing Medical Care, Dietetic Support, Educational Assessment and Family Resources. L. Hewitson*, A. Potts and A. Behn, *The Johnson Center for Child Health and Development*

Background: Parents of children with autism frequently report significant stress related to their child's behaviors (Hasting et al., 2005). Families with access to a variety of intervention and support services and/or resources typically report experiencing lower stress (Gutierrez et al., 2008; 2009; Levine et al., 2009).

Objectives: To examine the relationship between parental stress and aberrant behavior in children with autism enrolled in a program providing medical care, dietetic support, educational assessment and family resources.

Methods: Twenty children with autism (15 males, 5 females) with a mean age of 7.1 (SD: 2.4 years; range 3.6–11.6 years) met the inclusion criteria for this study. An autism diagnosis was confirmed by a licensed psychologist using both the Autism Diagnostic Observation Scale (ADOS) and Autism Diagnostic Interview-Revised (ADI-R). The Bright Eyes (BE) program provides children and their families with support and financial assistance to initiate appropriate diagnostics, medical care, dietetic support and educational assessment, with follow up appointments for one year. A family-care coordinator provided additional resources on recommended therapies to each family. Maternal stress was measured with the Parenting Stress Index-Long Form (PSI-LF) and problem child behaviors were assessed with the Pervasive Developmental Disorder Behavior Inventory (PDDBI). Measures were collected at two time points: at intake (T1) and 3-4 months post enrollment in the BE program (T2). Bivariate correlations were conducted between parenting stress and autism severity measures. Significant findings are reported when $p<0.05$.

Results: At intake, 75% (15/20) of mothers had clinically relevant PSI–LF scores compared with 60% (12/20) at T2. Maternal stress related to the child domain significantly decreased over time (T1:150.6 vs. T2:139.7, $p=0.02$). Specifically, stress associated the child's demandingness (DE) and lack of adaptability (AD) as well as the mother's acceptability of their child's diagnosis (AC), was significantly reduced (DE, T1:29.7 vs. T2:26.85, $p=0.039$; AD, T1:36.65 vs. T2:33.9, $p=0.023$; and AC, T1:22.0 vs. T2:20.3, $p=0.031$).

PDDBI scores indicated a significant reduction in SENSORY (sensory seeking-type behaviors; T1:27.4 vs.

T2:23.05, p=0.031) and AROUSE (hyperactivity/hypoactivity; T1:25.5 vs. T2:21.5, p=0.045) domains over time.

Significant correlations between AUTISM Composite (a measure of autism severity) and maternal stress were identified at both time points (T1:r=0.79, p=0.001 and T2:r=0.64, p=0.046). Specifically, maternal parenting stress was correlated with the following PDDBI domains: SENSORY (T1:r=0.61, p=0.005 and T2:r=0.6, p=0.007); SOCPP (social pragmatic problems, T1:r=0.68, p=0.001 and T2:r=0.57, p=0.011); AGG (problems with aggressive behavior towards self and/or others, T1:r=0.88, p=0.0 and T2:r=0.8, p<0.001), AROUSE (T1:r=0.8, p<0.001 and T2:r=0.68, p=0.046), REPRIT Composite (a measure of classic autism traits, T1:r=0.75, p=0.003 and T2:r=0.66, p=0.002); FEARS (fears and anxieties, T1:r=0.55, p=0.018 and T2:r=0.5, p=0.033); and AWP Composite (approach/withdrawal problems, T1:r=0.83, p=0.002 and T2:r=0.72, p=0.013).

Conclusions: These results suggest a positive relationship between maternal parenting stress and autism severity in children at initial enrollment in the BE program. However, by implementing a comprehensive treatment program and by providing considerable family support, a significant reduction in children's aberrant behaviors, such as sensory seeking behaviors and hyperactivity/hypoactivity, and a reduction in maternal parenting stress associated with the child domain, were reported.

119.098 98 You Had Me At Hello: How Introductory Type Affects Stigmatization. K. D. Baker*, J. M. Gillis and C. R. Locke, *Auburn University*

Background:

Research findings suggest the way in which an individual with an Autism Spectrum Disorder (ASD) is introduced in various social situations impacts others' judgment and behavior towards that individual (Campbell et al., 2004; Morton & Campbell, 2007; lobst et al., 2009). To date, little research has been conducted pertaining to the amount of stigma individuals with ASD face as they transition into young adulthood, specifically within the college setting.

Objectives:

The primary aim of the study was to examine the amount of stigma individuals with ASD face when entering young adulthood compared to two other highly stigmatized conditions, obesity and depression (Halter, 2004; Koroni, 2008; Roeloffs et al., 2003; Wang, 2004). A secondary aim was to examine the psychometric properties of a scale specifically designed to measure stigma in college settings.

Methods:

A 3x3 between-subjects design was conducted. The two independent variables (IV) were group (ASD, depression, obesity) and introductory type: descriptive (highlighting similarities between the participant and individual), explanatory (highlighting medical causation), and combined (Campbell et al., 2007; lobst et al., 2009). Participants in the online study were 267 Auburn University undergraduates enrolled in Psychology courses. After reading one vignette (which included one level of each IV), participants completed several questionnaires, including the Modified Social Distance Scale (MSDS; see Link et al., 1987) as well as the revised scale (MSDS-College) written by the authors. The MSDS-College was designed to increase ecological and face validity for measuring stigmatization within a college setting. This scale contained 101 items and 6 subscales, including: Academic, Athletic/Intramural Sports, Campus Committee, Housing, Social, and Family subscales.

Results:

A total of 235 valid questionnaires were entered into the analyses. Mean scores across introductory conditions revealed significant differences between the three conditions (alpha<.05), with obesity resulting in lowest scores of stigmatization (m = 118.54, se = 4.04), followed by ASD (m =133.28, se = 4.14) and depression (m =151.86, se = 4.42). No significant difference was revealed for ASD or depression within introductory types. There was strong internal consistency within the MSDS-College with a total Cronbach's alpha of .977 (ranging from .849 to .947). The MSDS and MSDS-College were highly correlated with a Pearson's r of .808 (p<.01).

Conclusions:

The results indicate that introductory type does not affect reports of social distance in the introduction of an individual with an ASD. This study suggests that ASD is more highly stigmatized than obesity. Interestingly, college students reported lower stigma towards the individual in the ASD condition than depression condition. The implications of this finding will be discussed. In both the ASD and depression conditions, introductory type showed no effect. These findings have implications for researchers' understanding of current societal stigma towards chronic health conditions versus mental illness. Similarly, these findings have implications for college campuses that are increasingly incorporating individuals with an ASD into classrooms and dormitory settings. In addition, the MSDS-College demonstrated high concurrent validity with the MSDS. Further analyses of the subscales included on the MSDS-College will be presented.

119.100 100 Service Efficacy As a Moderator of Caregiver Burden in Families of Individuals with Autism Spectrum Disorders. S. L. Fung*[1], A. Tint[1], J. A. Weiss[1] and Y. Lunsky[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Research consistently indicates that parents of children with Autism Spectrum Disorders (ASD) experience considerable stress and burden related to caring for their child (Schieve et al., 2007). A lack of available and accessible services has been shown to cause significant distress for families, which at times can lead to a full-blown crisis (White, McMorris, Weiss & Lunsky, in press). Past research has yielded mixed results on the role that service use plays in preventing or mitigating the effects of caregiver burden and family distress (Gray & Holden, 1992; White & Hastings, 2004). No studies have examined the intermediary role that parents' service efficacy (i.e., knowledge of the service system and perceived ability to effectively access services) may have on the relationship between family distress and caregiver burden.

Objectives: The current investigation aims to examine the relationship between levels of family distress and caregiver burden. In addition, the study aims to examine the role of caregivers' knowledge of the service system and ability to effectively access appropriate services, within the relationship between family distress and caregiver burden.

Methods: As part of a larger study examining service utilization in adolescents and adults with ASD, 233 caregivers completed an online survey. Caregivers (94% mothers) were 33 to 79 years of age (M=48.06, SD=7.32) and children with ASD (80% male) ranged in age from 6 to 56 (M=17.85, SD=6.15). Caregiver ratings of family distress were measured with the Brief Family Distress Scale (Weiss & Lunsky, 2011), and caregiver burden was measured with the Revised Caregiver Appraisal Scale (Burden subscale; Lawton, Moss, Hoffman & Perkinson, 2000). To assess service efficacy, caregivers were asked to rate their perceived knowledge of the service system and ability to access appropriate services, on a 5-point Likert scale, ranging from 1 (disagree a lot) to 5 (agree a lot).

Results: Correlation analyses revealed significant positive associations between family distress and caregiver burden (r=.51, p<.01), and negative correlations between service efficacy and caregiver burden (r=-.22, p<.01). Regression analyses were used to test whether service efficacy moderated the relationship between family distress and caregiver burden. Analyses revealed a significant interaction between family distress and service efficacy ($F_{change}(1, 228)=10.52$, p<.01), such that when families were distressed, knowledge of the service system and ability to access appropriate services ameliorated caregiver burden.

Conclusions: These findings suggest that parents with greater perceptions of service efficacy may experience more positive caregiver and family outcomes. Specifically, parents' knowledge of the service system and ability to access appropriate services may lessen the impact that family distress may have on caregiver burden. The present findings contribute to our knowledge of the importance of service efficacy, as well as expand our understanding of distress or crisis experiences for families with a child with ASD.

119.101 101 Caregiver Characteristics of Participants in a PEERS Program Replication Study. R. Harwood*[1], C. White[1], A. Pulido[2] and A. J. Lincoln[3], (1)*Center for Autism Research Evaluation and Service*, (2)*Alliant International University*, (3)*Alliant International*

University;Center for Autism Research, Evaluation and Service

Background: The Program for the Evaluation and Enrichment of Relations Skills (PEERS) program is a manualized, parent-assisted social skills intervention for adolescents with autism spectrum disorders. Parent (or main caregiver) participation is mandatory and parent sessions are conducted in parallel to teen sessions. The authors of the PEERS Program manual have presented studies evaluating outcomes related to the participating teen, whereas no current research findings have evaluated caregiver characteristics. With the PEERS Program and many other social skills programs, parent involvement is a crucial component and caregiver characteristics including caregiver psychopathology needs to be evaluated in order to tailor programs and recruitment to appropriate populations. Parent training in conjunction with social skills training has been supported in the literature as an effective means of developing and maintaining social skills in deficient children. Evidence suggests peer relationships are impacted not only by social skills of the adolescent, but also parenting factors, parental attachment and family climate. It has been suggested that caregivers' goals and beliefs are important in predicting parental management of peer relationships and adolescents' social skills over time.

Objectives: This study aims to evaluate and analyze the characteristics (including demographic make-up, socioeconomic status, and psychopathology) of caregivers who have a teen participating in a PEERS program replication study. Caregiver characteristics will be used to tailor future recruitment efforts.

Methods: Caregivers of teen participants enrolled in a center-based PEERS Program were administered the Symptom Checklist 90 as well as a demographic questionnaire. Data was collected related to socioeconomic status and education level of caregiver participants as well as method of payment for the program (private insurance versus cash pay).

Results: Upon collecting final data, this study will present relevant caregiver characteristics including psychopathology that are hypothesized to influence enrollment in the PEERS Program and possibly impact teen outcome measures.

Conclusions: Conclusions will be presented in final measures at the conclusion of data collection.

119.102 102 Family Cohesion and Parental Well-Being in Families of Children with An Autism Spectrum Disorder: The Role of Ethnicity. N. Ekas*[1], S. Celimli[2], A. Gutierrez[2] and M. Alessandri[2], (1)*Texas Christian University*, (2)*University of Miami*

Background: Family cohesion is the emotional connection that family members exhibit towards each other that keeps them together as a system. Family cohesion has been found to be directly related to positive outcomes for both parents and children and is essential to understanding the variance in families' reaction to ongoing developmental stressors, such as having a child with Autism Spectrum Disorder (ASD). Familism (familismo), which has a similar meaning as family cohesion, is the term used to emphasize the importance of the family unit in studies of Hispanic populations. While family cohesion (and familism) has been extensively studied in Hispanic families or in families of children with ASD in general, there has been no research focusing on possible ethnic differences (Hispanic vs. Caucasian) in the association between family cohesion and well-being among parents of children with an ASD.

Objectives: To examine the association between family cohesion and parental well-being in families of children with an ASD and determine whether ethnicity moderates the association. This study also examined predictors of family cohesion and whether the associations were different for Hispanic versus Caucasian parents.

Methods: One hundred and twenty-eight parents (Mothers = 117, Fathers = 11) participated in the current study. Seventy-nine parents were Hispanic and 49 were Caucasian. Parents completed several questionnaires assessing child symptom severity (Social Communication Questionnaire), family cohesion (Family Adaptability and Cohesion Scales), depression (Center for Epidemiological Scales – Depression), optimism (Life Orientation Test), benefit finding (Benefit Finding Scale), and social support (Friend, Family, and Spouse/Partner Support scales).

Results: Hierarchical regression analyses were conducted to determine whether ethnicity moderated the association

between family cohesion and parental depression. A significant effect for cohesion emerged (B = -.49, $p < .05$); however, the ethnicity X cohesion interaction was non-significant. We also examined whether child symptom severity, social support, optimism, and benefit finding were predictors of family cohesion and whether ethnicity moderated the associations. Results indicated that ethnicity was a significant moderator of the association between spouse/partner support and family cohesion (B = -.293, $p < .05$). Spouse/partner support was positively associated with family cohesion and this association was stronger in Caucasian families. A similar effect was found for the association between family support and family cohesion.

Conclusions: Previous research has found family cohesion to be important for Hispanic families. In the present study, however, we found that family cohesion was associated with depression for both Hispanic and Caucasian parents. In addition, social support from the parent's immediate and extended family was associated with heightened levels of family cohesion, but the effect was stronger for Caucasian parents. It is possible that cultural differences in the perception of disability may explain the results found in the present study. The findings of this study have important clinical implications with respect to understanding cultural differences in managing parental well-being.

119.103 103 Predictors of Positive and Negative Cognitive Appraisals in Families Raising a Child with Autism. S. Quirke*[1], I. Sladeczek[2] and E. Fombonne[1], (1)*Montreal Children's Hospital*, (2)*McGill University*

Background: The concept of cognitive appraisal was used as a method to examine how parents adapt to raising a child with an autism spectrum disorder (ASD). A parent makes a positive cognitive appraisal when they interpret an event in an adaptive way, such as by viewing the consequences of having a child with a disability in terms of the positives that he or she has added to their life, for example, leading them to become more spiritual. Parents make negative cognitive appraisals when in their view, the consequences of caring for their child with a disability has led to "unwelcome disruption in 'normal' family routines". It is expected that parents from different families will have different reactions to their child's diagnosis of autism. Parents can attribute both positive and negative meaning and interpretations to an event; thus they can make both positive and negative cognitive appraisals. The negative and positive cognitive appraisals that parents make while raising their child with autism were investigated.

Objectives: To investigate the potential factors contributing to parents' positive and negative cognitive appraisals, including family quality of life (FQOL), authoritative parenting, and the child's adaptive and aberrant behaviour. A second objective was to investigate which subscales of family quality of life were predictors of negative cognitive appraisal.

Methods: Fifty-four families with a child between 6 and 9 years old with an ASD participated. In order to confirm the child's diagnosis of autism, gold-standard diagnostic measures for ASD were administered. Questionnaires and interviews were completed by the father or mother of each family.

Results: Three initial multiple linear regression (MLR) analyses were performed. One MLR was performed for each outcome: positive cognitive appraisal and negative cognitive appraisal. Family quality of life predicted 36.6% of the variance in negative cognitive appraisal, and the relationship between the two variables was inverse, such that parents reporting higher satisfaction with their family quality of life reported lower negative cognitive appraisals. An additional MLR was performed to verify which subscales of FQOL predicted negative cognitive appraisal. Family emotional well-being predicted 45.9% of the variance in negative cognitive appraisal.

Conclusions: Parents make both positive and negative cognitive appraisals. Parents reporting higher satisfaction with their family quality of life report lower negative cognitive appraisals. For example, if parents perceive that they are satisfied with the support they receive for their child with a disability, then they appraise the impact of raising their child with autism less negatively. This finding suggests that perceiving satisfaction with family quality of life can be adaptive for parents raising a child with autism. Specifically, if parents report that their family has high emotional well-being, their appraisals are less negative than families with low emotional well-being. This study contributes to the research

literature concerning the positive aspects of caring for a child with a disability. It emphasizes the importance of considering family's cognitive appraisals of the impact of disability when developing interventions.

119.105 105 Effectiveness of the Collaborative Coaching Model When Working with Families of Children with Sensory Processing Dysfunctions. C. Schranz* and D. Sood, *Governors State University*

Background: Children with autism spectrum disorders experience sensory processing dysfunctions (SPD). SPD can interfere with the child's ability to participate in daily activities. Children with poor sensory processing abilities have difficulty regulating their responses to a variety of sensations often affecting their ability to participate in meaningful occupations. Occupational therapists focus on facilitating child's participation in meaningful occupations. There are limited intervention models that focus on collaborating with caregivers to reinforce their development of problem-solving skills that supports generalization of learning and identifying solutions to future progress of the child's participation.

Objectives: Develop a collaborative coaching model (CCM) to support & guide caregivers to develop solution finding skills towards facilitating their child's participation in play within the context of the home environment. Measure the effectiveness of CCM at two levels: (a) child level – by determining if there was a change in the level of participation in play in children with SPD following their participation in the intervention model; (b) caregiver level – by determining if there was a change in the level of self-initiated solution-finding skills of the caregiver following their participation in the intervention model.

Methods: This is a quasi-experimental, one group, pretest-posttest quantitative research study design. Four families of children with identified SPD ages 4-6 years were chosen for this study. Sensory processing patterns of children were measured using the sensory profile, participation in play was measured using the Preschool Activity Card Sort – modified and the level of change of the caregivers' self-initiated solution finding skills was measured using the Self-Initiated Solution Finding Skills Questionnaire CCM consists of four phases. Phase one is the occupational performance evaluation phase in which the caregiver (CG) and the researcher (R) collaborates to identify the impact of person and environment related factors on child's play participation. Phase two is the knowledge building phase in which the CG and R collaborates to understand the impact of person and environment related factors that enable play participation of the child. Phase three is the strategy generation phase in which the researcher and CG problem solve to create best person environment fit for the child. This phase helps develop solution finding skills among the caregivers to facilitate their child's participation. In the last phase the CG implements the strategies and self-evaluates their child's play participation.

Results: Results of this study indicate that there was increase in the level of play participation in children with SPD as well as increase in the caregiver's level of self-initiated solution finding skills following their participation in the intervention model.

Conclusions: The results indicate that the intervention model was effective at both the child level and the caregiver level. Though the participants of the study did not include children with autism but the results can be applied when working with families of children with autism who experience sensory processing dysfunctions. Implications of this study suggest that a collaborative, family-centered approach supports the caregiver's ability to find solutions and develop strategies that enable participation in play in children with SPD.

119.106 106 Predictors of Distress in Mothers of Children with Autism Spectrum Disorders. J. A. MacMullin*[1], J. A. Weiss[1] and Y. Lunsky[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Research consistently indicates that mothers of children with autism spectrum disorders (ASD) experience high levels of distress. There is an urgent need to understand the processes that lead to distress in mothers of children with ASD if we are to mitigate such experiences. There is preliminary evidence to suggest that psychological acceptance, empowerment, and positive gain may help to alleviate distress in mothers of children with ASD (Lloyd & Hastings, 2008; Nachshen & Minnes, 2005). Psychological acceptance refers to embracing both positive and negative emotions, empowerment is the process by which people gain greater access to and control over resources, and positive

gain refers to the positive perceptions of parenting a child with a disability.

Objectives: The current study examined how psychological acceptance, empowerment, and positive gain are related to mothers' perceptions of distress. It was hypothesized that maternal psychological acceptance, empowerment, and positive gain would moderate the relationship between child behavior problems and distress at the initial time point. In addition, it was predicted that maternal psychological acceptance, empowerment, and positive gain at the initial time point would predict a change in the experience of distress over time.

Methods: As part of a large Canadian online survey of children with ASD, 132 mothers of children diagnosed with ASD aged 4-21 years old (108 boys and 24 girls; age *M*= 11.71, *SD*=4.64) completed the Family Empowerment Scale (Koren et al., 1992), the Acceptance and Action Questionnaire-II (Bond et al., in press), the Positive Gain Scale (Pit-ten Cate, 2003), the Behavior Problem Inventory Short Form (Rojahn, Matson, Lott, Esbensen, & Smalls, 2001), and the Brief Family Distress Scale (Weiss & Lunsky, 2011). The measures were completed at two different time points with approximately one year in between. Child diagnoses included Asperger syndrome (32.1%), PDD-NOS (19.8%), Autism (46.6%), and other diagnoses (1.5%).

Results: Preliminary analyses revealed that psychological acceptance and empowerment did not moderate the relationship between behavior problems and distress at the initial time point. However, positive gain may be acting as a moderator because the interaction between behavior problems and positive gain had a trend towards being a significant predictor of distress, $\beta = -.16$, $p = .09$. Empowerment and positive gain at time 1 were found to be significant predictors of a change in distress, $\beta = -.37$, $p = .01$ and $\beta = -.39$, $p = .01$, respectively.

Conclusions: Given that empowerment and positive gain were significant predictors of a change in distress, interventions that target these psychological constructs may be worthwhile pursuits for parents.

119.107 107 Carer Burden Amongst Family Members of Young People with An ASD or ADHD.

T. Cadman*[1], H. Eklund[1], D. Howley[1], H. L. Hayward[1], J. Findon[1], H. Clarke[1], J. Beecham[2], K. Xenitidis[3], D. G. Murphy[1], P. Asherson[4] and K. Glaser[5], (1)*Institute of Psychiatry, King's College London*, (2)*London School of Economics and Political Science*, (3)*South London and Maudsley NHS trust*, (4)*Institute of Psychiatry, Kings College London*, (5)*Kings College London*

Background: Prior work found that caring for young children with Autism Spectrum Disorder (ASD) or Attention Deficit Hyperactivity Disorder (ADHD) is associated with significant psychological burden. While there is considerable evidence to suggest that the impairments associated with these disorders continue into adulthood few studies have examined the psychological impact of caring for young people (adolescents and young adults) with an ASD or ADHD. The lack of suitable services for young people with these conditions implies that much of the responsibility for care falls onto family and friends. Moreover, the little research there is on this issue has largely focused on the impact of maladaptive behaviours and symptomology among the young people with ASD or ADHD. Little is known about the relationship between the young person's level of needs, service use and carer burden. Also, no research has compared levels of burden between two neurodevelopmental disorders such as ASD and ADHD.

Objectives: To investigate the relationship between the needs and service use of young people with ADHD and ASD and the psychological well-being of family caregivers.

Methods: An observational study was conducted with young people (aged 14 to 24) with ADHD and ASD (n=80 and n=78 respectively; both groups diagnosed using 'gold-standard' clinical diagnostic tools such as the ADI and DIVA) and with their parents or partners (usually mothers) (n=81 and n=90 respectively). Face-to-face interviews and questionnaires with young people and their parents were used to assess needs and service use, as well as demographic and health factors including a measure of carer burden among parents (the Zarit Carer Burden Interview, abbreviated version).

Results: Carers of those with an ASD or ADHD reported high levels of carer burden. Carer-ratings of the young person's unmet needs were significantly associated with caregiver burden even when emotional and behavioural problems (and the presence of a learning disability) were controlled for. No association was found between the level of recent service use and caregiver burden.

Conclusions: There is a strong relationship between level of unmet needs of the young person and carer burden. This finding has important implications for service provision suggesting that suitable services that meet the needs of adolescents and young adults with autism and ADHD are likely to play an important role in alleviating caregiver burden.

119.108 108 Dyadic Effects of Mothers' and Fathers' Well-Being in Family Impairment. F. Martinez-Pedraza*, T. W. Soto, M. Maye and A. S. Carter, *University of Massachusetts, Boston*

Background: Parents raising children with ASDs tend to report lower psychological well-being and family adaptation compared to parents of children with other developmental disorders (Lee, 2009; Totsika, et al., 2011). Specifically, high rates of parenting stress are often found among parents of young children with ASDs (Baker-Ericzen, et al., 2005; Davis & Carter, 2008), which may impact overall family outcomes. Research to date has mainly focused on identifying child factors, such as behavior and dysregulation problems, associated with family and individual maternal and paternal stressors; very few studies have examined how family members impact one another over time. Studying the dynamic relationship between mothers' and fathers' well-being may inform our knowledge about family adaptation for families raising children with ASDs. This study represents an initial attempt to explore the partner effects exerted by maternal and paternal parenting stressors on each parent's appraisal of impairment in the family system.

Objectives: To examine the interrelationships of maternal and paternal parenting stress with each parents' perceptions of family impairment, controlling for the impact of child functioning and problem behaviors; and specifically to estimate actor and partner effects in parental reports of family impairment by using the Actor-Partner Interdependence Model.

Methods: Mother-father dyads (n = 132) participated as part of a larger study of families of young recently-diagnosed children with ASDs (ages 18-33 months). Both mothers and fathers completed independent reports of their parenting stress (Parenting Stress Index- Short Form [PSI]), and appraisals of family impairment (Family Life Impairment Scale [FLIS]). Indicators of the child's with an ASD functioning were measured using the Autism Diagnostic Observational Schedule, the Vineland Behavior Scales and the Infant Toddler Socio-Emotional Assessment.

Results: An Actor-Partner Interdependence Model (APIM) was tested in Mplus 5.0 to evaluate how each partner's parenting stress and depressive symptoms impacted the other partner's perceptions of family life impairment. Overall model fit was good (RMSEA = .013; CFI = .998). Mothers' ratings of family impairment were significantly predicted by their partners' parenting stress ($\beta = 0.21$), even when child factors were included in the model. However, fathers' perceptions of family impairment were only affected by their own ratings on parenting stress ($\beta = .31$) and not by their partners' parenting stress.

Conclusions: Results suggest an association between fathers' parenting stress and mothers' appraisals of family impairment. Additionally, the impact of fathers' parenting stress is independent of the contribution of the child's functioning to the mother's appraisal of the family's level of impairment. This study provides evidence of inter-couple dynamics that could be targeted for prevention or intervention in families raising young children with ASDs.

119.109 109 Parental Perspectives of Media Use Among Adolescents with An Autism Spectrum Disorder: A Preliminary Study. M. H. Kuo*, J. Magill-Evans and L. Zwaigenbaum, *University of Alberta*

Background: Adolescents with an autism spectrum disorder (ASD) spend considerable free time in media activities, including watching television, playing video games and surfing websites (Orsmond & Kuo, 2011). Parents play an important role in shaping adolescents' responses to media. We know

little about parents' perspectives toward their adolescents' media use, and the strategies they employ to mediate the adolescents' media use. We use *media* to refer to television, video games, and the Internet.

Objectives: This study investigates how parents of adolescents with an ASD supervise their child's use of media, parents' concerns about their child's media use, and their perceptions of the benefits of using media for their child.

Methods: Seventeen parents of adolescents with an ASD (age 12 to 18; M = 15.6) completed a 24-hour diary to record the adolescents' use of media, from midnight to 11:30 p.m. for every 30-minute interval, on either a weekday or a weekend day. Parents indicated whether the adolescent was using media and what types of media he/she was using. They also completed a survey, which contained a television and a videogame mediation measure querying about their use of three mediating strategies: restrictive mediation (setting time limits or forbidding certain media content), social mediation (joining children in using media but without commenting on the content), and active mediation (discussing or explaining aspects of content during or after using the medium). Through open-ended questions, parents were asked about their concerns and the benefits of media activities for their child, as well as whether they felt stressed when managing the child's use of media and the reasons they felt stressed.

Results: On any given day, the adolescents spent an average of 2.7 hours watching TV, 3.9 hours playing videogames, and 1.4 hours on the Internet. Parents perceived both negative and positive aspects of TV and videogaming but only benefits for Internet use. Concerns related to TV content, quantity of time spent videogaming, and lack of interest in other activities. Benefits included gaining information, learning social skills and humours, and creating opportunities for the adolescents to interact with peers. Half of parents felt stressed managing media use. Their stress primarily came from difficulties getting their child stop playing video games and difficulties having their child engage in activities other than videogaming. Parents used restrictive, social, and active mediating strategies for TV viewing, and were less likely to use social strategies for videogaming. Parents who felt less stressed were less likely to use active mediating strategies for videogame playing than those more stressed.

Conclusions: Although management of media use can cause stress for parents of adolescents with ASD, parents perceived both negative and positive aspects of their child's media use. A better understanding of parents' perspectives and mediating strategies may help parents assess concerns about youth's frequent media use, decrease their stress, and eventually improve family well-being.

119.110 110 Quality of Life for Teens with ASD: Application of a Modified ICF Model. J. Magill-Evans*[1], C. Koning[2] and B. G. Clark[1], (1)*University of Alberta*, (2)*Glenrose Rehabiliation Hospital*

Background: Quality of life is a critical outcome for children with developmental disorders. Heath-related quality of life (HRQoL) for children ages 2 to12 with an Autism Spectrum Disorder (ASD) has been examined recently (Kuhlthau et al., 2010), and extensive work has examined the HRQoL of parents of children with ASD (e.g., Allick et al., 2006; Mugno et al., 2007). No research in ASD has examined parent's perceptions of their teen's HRQoL within a modified version of the International Classification of Functioning, Health and Disability (ICF)(McDougall et al., 2010). This framework offers a unique perspective to guide consideration of HRQoL. Environmental factors such as access to services. activity limitations and opportunities for participation, as well as personal factors have an impact on QoL. Parents' perspectives on the influence of these factors can provide important information about HRQoL for persons with ASD.

Objectives:

1. Examine mother-reported HRQoL for teens
2. Use the modified ICF to examine factors influencing HRQoL

Methods: Participants were 20 mothers of teens (Mean age= 15 years) with an ASD. The parent report form of the Kidscreen-52 (Ravens-Sieberer et al., 2006) was used to examine perceptions of their teens' HRQoL. In semistructured telephone interviews (30 to 60 min. long), mothers addressed services and supports received and factors that had the

biggest impact on the teen's and family's quality of life. Interviews were transcribed verbatim, coded for content analysis and entered into a data management program (NVivo9).

Results: Mean HRQoL scores as reported by mothers were within one standard deviation of the normative mean for all subscales except for Moods/Emotions, Social Support/Peers, and Social Acceptance. The family, including siblings, was an essential part of the environment. Parents' ability to advocate for and identify supports linked to functional impairments provided access to government programs that funded community and school supports. Most teens received support during their education. Several mothers felt this had a great impact on HRQoL although some teens wanted minimal support so they could be normal. Support for participation in community outings or staying with respite families played a positive role in both teens' and families' HRQoL. Mothers also mentioned the importance of other parents or people in the community that helped with decision making, finding information, and getting support. Living in a supportive community that was accepting of their child was important. Developmental issues as teens transition to adulthood were evident in mothers' concerns about their teen's future. Some teens had work or life style goals that mothers identified as unrealistic while others had goals that would require significant support to reach.

Conclusions: These results differ from research with parents of younger children with ASD which indicated a significantly lower HRQoL based on proxy report. Interpretation of these results, using qualitative data from mothers, suggests that teens' and families' QoL results from a complex interplay between the teen's impairments and personal factors, activity limitations, participation, and environmental factors. Consideration for future needs within a developmental framework and parent and teen HRQoL need to be addressed.

119.111 111 The Road to Adulthood: The Concerns and Expectations of Parents of Adolescents with ASD. A. W. Duncan* and S. L. Bishop, *Cincinnati Children's Hospital Medical Center*

Background: The transition to adulthood typically involves tasks such as graduating from high school, participating in postsecondary education, obtaining employment, living independently, and developing meaningful social relationships (Wehman, 2006). Adolescents with ASD often struggle with the developmental tasks of young adulthood due to autism symptomatology, adaptive behavior deficits, and limited postsecondary education and employment opportunities (Hendricks & Wehman, 2009; Seltzer, et al., 2004). More information about needs and difficulties during this developmental period is required to facilitate successful transitions and improve adult outcomes.

Objectives: The objectives of the current study were to (1) examine transition-related concerns and social concerns in parents of adolescents with ASD; (2) assess parental expectations in regards to their children's employment, education, and independent living; and (3) survey what services parents are currently using and what services they anticipate utilizing in the future.

Methods: Eighty-seven parents of adolescents with ASD completed the Adolescent Transition Survey (ATS; Duncan, under development) and the Vineland Adaptive Behavior Scales, Caregiver Survey. The ATS asks parents about the concerns, needs, and expectations in transition-related areas. Adolescents with ASD ranged in age from 13-17 years (M = 182.2 months). Diagnoses of ASD were confirmed by examining the adolescent's electronic medical record.

Results: The average Vineland Adaptive Behavior Composite Score was in the Low range (M = 66.8) and Communication, Socialization, and Daily Living Skills score were also in the Moderately Low to Low range. When asked about general transition concerns, parents reported that they were very or moderately concerned about social skills and social support (75.9%), money management (71.3%), problem solving skills (69.0%), vocational issues (69.0%), decision making and goal setting (69.0%), and future planning (67.8%). While approximately half of parents expected their adolescent to pursue postsecondary education or receive job training, 28% of families were uncertain about their adolescent's education or vocational future. In regards to vocational supports, 78% of parents reported that their adolescent would need assistance finding a job and 53% expected their adolescent to need ongoing support to perform the job.

Preliminary analyses on the qualitative data from the open-ended questions on the ATS revealed that many families believe that their adolescent will achieve an outcome in adulthood that involves residential independence, postsecondary education, and/ or employment. However, parents also reported that there are many barriers to a successful post-school outcome including lack of resources at school and in the community to teach relevant job skills, develop social skills with peers and adults, and build critical independent living skills. Further analyses will be conducted on the qualitative data from the ATS to identify themes related to current parental concerns, knowledge of the transition process, future expectations, service utilization, and potential barriers to a successful transition.

Conclusions: The findings suggest that parents of adolescents with ASD have significant transition-related concerns. Gathering detailed information from parents can help highlight areas that could be targeted in interventions to empower families and build skills in adolescents with ASD.

119.112 112 An Evaluation of Support Needs, Gaps and Perceived Solutions for Children, Adolescents and Young Adults with ASD: Lived Experience and the Need for Service System Advancement. W. Roberts*[1], D. B. Nicholas[2], I. E. Drmic[3], S. Mitchell[3] and E. Ko[3], (1)*University of Toronto*, (2)*University of Calgary*, (3)*Hospital for Sick Children*

Background: Clinical experience in autism highlights that improved access and coordination of services for persons with autism are needed. However, there continues to be a lack of systematic attention given to understanding individual and family service-related need, and identifying the most pressing areas for service improvement.

Objectives: This mixed method study, based on a case study design, examined the lived experience of young persons with ASD </=25 years of age, and their families, with a focus on service needs, current access to resources, and potential gaps between services needs and access.

Methods: Multi-dimensional data collection, drawn from the children, youth and young adults with autism and their parent(s), comprised the following:

(1) Autism assessment measures examining diagnostic symptomatology, cognitive functioning, language skills, adaptive functioning, academic achievement, anxiety, attention, behavioural, social and emotional supports, sensory-based symptoms, quality of life, and parent stress;

(2) Child and parent qualitative interviews exploring perceived experiences and needs for services; and

(3) Family assessment data examining context and family dynamics relative to services used and needed.

Participants: A total of 30 comprehensive case studies with >60 participants (young person and parent[s]) were stratified across age cohorts as follows: (i) preschool: n=8 family units, (ii) school age: n=7 family units, (iii) adolescent: n=8 family units, and (iv) young adult: n=7 family units. Participants were further stratified for range of backgrounds such as child functioning, services received, cultural background, functioning, and household SES. A comprehensive inter-professional assessment model was trialed using an integrated 'tag team' assessment approach.

Results: The 'tag-team' approach reportedly resulted in an enhanced (family-centred) research experience for participants. Findings identify young persons with autism and their families as profoundly impacted by autism and the need for vigilant family and community care. However, needs were consistently reported to not be met with sufficiently resourced service plans and resources. Care was largely uncoordinated, suggesting a patchwork of limited resources. Generally, parents expressed frustration and in some cases, desperation, as they independently navigated the service delivery system. Over time, many parents described symptoms of exhaustion and burnout, yet also demonstrated acumen in dealing with the needs of their child. Transitional challenges and mental health service gaps presented formidable barriers to system access, navigation and family quality of life; and these challenges are currently insufficiently addressed by current service options. Overall, findings highlight the need for improved service delivery, continuity of care, navigational support, and family-centred models that offer relationally-based generative interactions that support access to a sufficient array of services.

Conclusions: These findings critique existing models of service delivery in that these models obscure and under-treat pressing problems and needs. Services tend to remain uncoordinated and largely unresponsive to the challenges of persons with autism over time and development. Participants recommend a service delivery approach that is integrated and coordinated, and comprehensively addresses the complex and shifting needs of children and adults with autism.

119.113 113 Autism in the World Autism in the World: A Comparative Study in Atlanta, GA USA and Kerala, India. J. C. Sarrett*, *Emory University*

Background: Autism is becoming an increasingly recognized condition around the world, especially in developing nations. Along with this recognition often comes a host of assumptions, concepts and strategies that may or may not be appropriate for new cultural locations. As international recognition and efforts grow, there is a need to understand how to best collaborate with other cultures in creating facilities, awareness programs and training programs that best fit into the communities in which they are entering.

Objectives: The present study aims to understand which cultural factors are most crucial in autism related understandings and interactions. By understanding how autism in influenced by culture, future international work can have a fuller appreciation for unique cultural contexts and create more customized practices in collaboration with professionals and parents around the world. The current presentation covers some initial cultural factors that the study is finding to be important considerations for this type of work.

Methods: This study employs a cross-cultural design that collects data in Kerala, India and Atlanta, GA USA. The PI conducted interviews with parents of children with autism and the professionals who work with them in Kerala from June 2011 to December 2011. She also observed these adults in their usual interactions with the children in a variety of contexts. In addition, demographic data was collected from each participant; behavioral profiles of the children were conducted with the parents; and historical and cultural contextual data about the region's educational, medical and social environment was gathered. Beginning in January, 2012, the PI began collect identical data from participants in Atlanta, GA, matching subjects based on demographic and, when possible, child behavioral characteristics. All interview data was transcribed and coded thematically using grounded theory in order to reveal patterns between and within each cultural group.

Results: The PI will be presenting preliminary results of the study as data collection and analysis is ongoing. The data from the collected behavioral profiles of the children and the demographic characteristics of the groups will be presented, however the focus will be on initial findings on similarities and differences between the two cultural groups in services desired, outcomes desired, materials available, commonly used treatment approaches, definitions of autism, and prominent causal theories.

Conclusions: As the study is ongoing, the conclusions will be preliminary. However, one likely conclusion will focus on possible ways to adapt western style approaches to autism to a Keralan context. Kerala is unique in it's high concentration of western medical facilities and can therefore act as a preview for developing nations that are beginning to import western medical treatments, ideas and concepts, including autism. As such, this study provides particular insight for future cross-cultural collaborations in autism related research, intervention and advocacy such that this work can proceed with efficiency and awareness.

119.114 114 Greek Mental Health and Education Professionals' Knowledge and Views Regarding Autism. D. Papoudi*,

Background:

The complex nature of autism gives rise to a range of professional perspectives. It can therefore be a challenge to examine the understanding about autism among various groups of professionals who are working in supporting children with autism and their families across a very diverse spectrum. There is a necessity for multidisciplinary work in diagnosing, understanding and making effective provision for children with autism (Jordan, 2001). For this to become practice, disciplines in the diagnosis, treatment and education of children with autism should share a common undestranding and a common language of autism.

Objectives:

The present study was designed to investigate the knowledge and views about autism that mental health professionals (psychologists, speech therapists and occupational therapists), and education professionals (inclusive class teachers and special school teachers) hold in Greece.

Methods:

A self-report questionnaire was constructed, consisting of professionals' reports on the following issues: nature, etiology and treatment of autism, education and inclusive education for children with autism. The questionnaire was developed by drawing statements from a variety of professional autism resources (e.g. comprehensive literature review, DSM-IV, 1994, and the Public Laws about Special Education in Greece). Questionnaire completion was anonymous and participants (n=138) were asked to state their view along a five-point likert type scale (from 1= strongly disagree to 5= strongly agree). Professionals used in the current study included psychologists (n = 59), speech therapists (n=18), occupational therapists (n=15), inclusive class teachers (n=18) and special school teachers (n=28). For the purpose of analysis, psychologists, speech therapists and occupational therapists were grouped as mental health professionals (n=92).

Results:

Results showed that the responses among all professionals did not vary greatly regarding issues such as nature, etiology and treatment of autism. The Mann-Whitney statistical test was used to make comparisons between groups and main significant differences were found a) between mental health professionals and special school teachers in statements related to education and b) between mental health professionals and inclusive class teachers in statements related to inclusive education for children with autism.

Conclusions:

The results of the present study provide evidence that views about autism have changed regarding the nature and aetiology compared to previous studies (Stone, 1987; Heidgerken, Geffken, Modi & Frakey, 2005) and that professionals in Greece are acquainted with the changing views of autism in the scientific world. Certainly, awareness has improved considerably the last decade and professionals have gained in knowledge about autism. However, for collaboration to be increased and to be effective among mental health and education professionals, there is a great need for a common view of how to support children with autism. Mental health professionals and education professionals in Greece are involved in training and applying intervention programms to children with autism and therefore their knowldge and views of autism have a significant and immediate impact on their practices. Furthermore, in order children with autism to get the most effective support, professionals across disciplines should share the same views so that information towards parents is consistent and not conflicting.

119.115 115 Autism Awareness and Attitudes towards Treatment in Care Givers of Children Aged 3-6 Years Old in Harbin, China. J. Wang[1], X. Zhou*[1], W. Xia[1], C. H. Sun[1], L. J. Wu[1] and J. L. Wang[2], (1)*Harbin Medical University*, (2)*University of Calgary*

Background: It is very important for the parents and other care-givers, especially in the developing countries like China, to obtain adequate knowledge and awareness about ASD, which would ensure early identification and intervention of ASD. However, the levels of awareness about ASD and attitudes towards treatment in China are unknown.

Objectives: To (1) estimate the proportion of people in the community who could correctly recognize autism spectrum disorders (ASD), (2) describe the attitudes towards various treatments for ASD, and (3) identify factors associated with ASD recognition.

Methods: A population-based cross-sectional survey was conducted in Harbin, China (n = 4947). We estimated the proportions of participants who were at different levels of knowledge about ASD and of their attitudes towards mental health service use. Multivariate logistic regression modeling was used to identify factors associated with the recognition of ASD.

Results: Overall, 2786 (57.8%) of the respondents could recognize the ASD. Recognition of autism depended on gender, residing areas, age and educational levels. With respect to the attitudes towards mental health service use for ASD, 4007 respondents (84.6%) chose to visit a health organization for treatment; 2470 (68.2%) made the choice of consulting with a psychotherapist.

Conclusions: There is a large room for improvement in awareness about ASD and treatment in the Chinese communities. Insufficient knowledge about ASD and inappropriate attitudes towards mental health service use may impede the efforts of early identification and intervention. Health education and promotion are needed to improve people's knowledge about ASD and available mental health services.

119.116 116 Intervention Focussing on the Interaction Styles of Parents and Therapists of Children with Autism and Limited Speech: Case Studies From Bangladesh. N. Y. Ahmed*[1] and A. L. Richdale[2], (1)*Hope Autism Center*, (2)*La Trobe University*

Background: Language deficit is an important criterion for the diagnosis of autism. Interactions of parents / carers and their responsiveness to the child have been proven as major contributors for speech development. Evidence supporting speech interventions applicable to Bangladeshi autistic children is scarce. This study looked at the interaction styles of parents and therapists of Bangladeshi children with autism and their ways of encouraging children's speech. This study reports on case studies of eight children diagnosed with speech delay and autism who received an intervention for their speech development from an autism centre in Bangladesh.

Objectives: To assess an intervention which emphasized stimulating children's speech, focussing on the interaction styles of the parents and therapists of children with autism.

Methods: A detailed history was taken on children's speech development, current level of speech, ways of expressing needs, mood, parents' strategies for speech development, their ways of interaction with the children and also on the presence of any family tension or parents' depression regarding child's development. The 4-month intervention emphasised stimulating children's speech in a child directed way focussing on responsive interaction and encouraging children's speech without emphasising that speech was the focus of the interaction. Speech was reinforced using intrinsic reinforcers. Data were collected at assessment and after 1st month, 2nd month, 3rd month and 4th month of the intervention through play observation and history taking.

Results: The case histories showed that all the children had developed some speech at some stage but either, the amount, voice or clarity of speech was inadequate considering the children's age. At some point the children had stopped talking or rarely said any words and they did not use their words communicatively. All cases started using at least one word within two to three months of the intervention and within four months they were expressing their needs verbally instead of throwing temper tantrums. One child was using full sentences in proper context after four months. Cases who were speaking very softly started speaking louder than before and the clarity of their speech was also better than before. With their speech development, children also seemed to be much happier than before.

Conclusions: This qualitative study shows improvement in speech after a 4-month intervention period. The success of the intervention suggests responsive interaction style of parents and therapists involved in the care of Bangladeshi children with autism and language delay can enhance improvement in the children's speech. Interventions for speech development should include steps that enhance responsive interactions between parents and therapists and these children. Child development centres in any setting can potentially use the intervention applied in this study if families and autism professionals are aware of the basic principles of this applied intervention.

119.117 117 Relations Between the Individual and Joint Attachment Scripts in Couples with a Child with Autism. M. R. Semensato[1] and C. A. Bosa*[2], (1)*Federal Ubiversity of Rio Grande do Sul*, (2)*Federal University of Rio Grande do Sul*

Background: The attachment theory posits that having a secure attachment in infancy may influence the quality of couples's relationship later in life. The individual attachment

script is a cognitive structure which reflects the quality of experiences between a person and their caregivers since childhood. In adulthood, the joint attachment script reflects both the individual script and that built by a couple in their relationship. The ability to trust and to both support and be supported by the partner is specially important when the couple faces difficulties such as having a child with autism. Therefore, the need of a mutual support may be facilitated by the presence of a history of both individual secure attachment (with the caregivers) and joint secure attachment (with a partner).

Objectives: This study has investigated if a couple who has an individual script of secure attachment also has indicators of a secure joint attachment.

Methods: Three couples whose child has autism participated in the study. The individual attachment script was assessed by the Attachment Script Assessment – ASA, which identify if the subject has or not an access to a secure script. The couple's attachment script was accessed by a semi-structured interview which was analyzed by content analysis. The assessment was conducted by two independent coders. The coders who assessed the interview were blind to the results of the ASA. The qualitative analyses of the interview generated the following categories: Task divisions between the couple, Situations of support and solidarity, Dissonance and antagonism, Individual characteristics (or features), Perception of the child, Conjugality and Social network.

Results: Main results showed that each couple had a different pattern of individual secure attachment. In one couple both partners had access to the secure attachment script; in the other, only one had this access to a secure attachment script; in the third one, both partners did not have the access to the secure script. The couples in which at least one member had access to the individual secure attachment script also tended to present indicators of joint attachment script, such as sense of a fair task division, empathy and ability to manage conflicts and to seek social support in and outside the family. Regardless the fact of having or not access to a secure attachment script, the three couples reported difficulties in their marital life, especially lack of intimacy. Finally, all couples reported a poor family support network. Their main support was their other children, although the couples with more joint attachment indicators tended to seek the professional network more often.

Conclusions: The results point to the potential relationship between individual and joint attachment script, leading to a promising area of studies and intervention with the parents that have a child with autism.

Services Program

120 Schools, Employment and Community

120.118 118 Communicating about Autism: Translating and Sharing Research Evidence with Community Audiences. J. Jivraj*[1], C. Piatt[1], M. Viau[2], L. Zwaigenbaum[1], M. Elsabbagh[3], D. B. Nicholas[4] and E. Fombonne[5], (1)*University of Alberta*, (2)*Autism Research Training Program*, (3)*Centre for Brain and Cognitive Development, Birkbeck*, (4)*University of Calgary*, (5)*McGill University*

Background:

The Common Slides Project (CSP) is a knowledge translation project intended to increase awareness of autism research evidence among diverse audiences in the community (e.g., parent groups, teachers). Leveraging the expertise of a national Autism Research Training (ART) Program, an online set of presentation materials were developed to serve as a resource for trainees to tailor to specific audiences.

Objectives:

(1) Conduct a formative evaluation of the clarity and relevance of the CSP presentation materials; and (2) reflect on the process of developing presentation materials with diverse autism stakeholders.

Methods:

ART trainees and faculty collaboratively developed slide sets introducing autism, and describing first signs, prevalence, genetics, and risk factors. Quantitative and qualitative feedback was obtained from three groups in Edmonton, Alberta: (a) clinicians, researchers and advocates (n=25), and (b) two groups of psychology undergraduates (n=15, n=8). The

first two groups evaluated each slide, and the third group rated presentations as a whole. Participants provided ratings on statements about the clarity, relevance and appropriateness of the materials using a 5-point scale (where 0 = strongly disagree and 4 = strongly agree) and made additional suggestions on how the slides/presentations could be improved.

Feedback on the slide development process was collected at a national forum with representatives from ASD stakeholder groups, trainees, and faculty.

Results:

The first two groups rated individual slides, and generally agreed that "The message was clear" (M=3.08, SD=.18; M=3.35, SD=.33). Supplementary comments provided constructive input on how to refine the slides. For example, a slide designed to illustrate a team-based approach to treating ASD by including a family at the centre, and clinical groups radiating around the family elicited critiques from three respondents who noted that the "figure makes it look like the family is separate from, rather than part of the team."

The third group rated the overall presentation. Respondents agreed that the "Messages on the slides were clear" (*M*= 3.75, *SD*=.46) and "The presentation influenced my ideas and attitudes about ASDs" (*M*=3.38, *SD*=.74) noting the relevance of information on "genes regarding the cause of autism" and "studies… on vaccines, gluten, parental ages, etc."

The following considerations for enhancing the process of developing the CSP emerged at the national stakeholder forum: 1) Slide presentations should be developed in partnership with mentors from among community stakeholders who offer expertise in developing engaging personal narratives and insight into community preferences. 2) The paradigm should be shifted from a dissemination model to a public engagement model to allow for two-way exchange and learning between researchers and stakeholders.

Conclusions:

The CSP is a collaborative venture undertaken by trainees of the ART Program. In view of the wide gap between research advances and the integration of emerging evidence into community practice, this knowledge translation project continues to rely on input and evaluation at every stakeholder level to produce meaningful, accurate, and accessible materials. Trainees play a crucial role in mediating the relationship between science and society and develop sensitive communication strategies to bridge this divide.

120.119 119 Impact of a Multidisciplinary Parent Education Program on Families of Children Recently Diagnosed with An ASD. K. V. Christodulu*, M. L. Rinaldi, K. Knapp-Ines, L. Hiruma and V. Costanzo, *University at Albany, SUNY*

Background: Research indicates that parents of children with ASDs experience greater levels of stress than parents of typically developing children and even parents of children with other disabilities and chronic illness (Hassall et al., 2005). In addition, parents of children with pervasive developmental disorders have been found to report a lower quality of life compared to parents of typically developing children (Mungo et al., 2007). Recent studies suggest that providing parents of young children with autism information about the diagnosis and effective treatment practices through parent education programs and support groups can decrease parenting stress (Keen et al., 2009; Tonge et al., 2006) and improve overall quality of life (Shu & Lung, 2005). The Center for Autism and Related Disabilities at the University at Albany developed an education program for parents/caregivers of children newly diagnosed with autism. Training modules for the program were selected from topics recognized by the CDC, NIH, and ASA as important for parents and families.

Objectives: Given the importance of families in the development, education, and behavioral support of children with this disability, it is imperative that programs aimed at increasing parent knowledge, decreasing parenting stress, and improving family quality of life be available in a format that is both efficient and effective.

Methods: Families were recruited to participate in this project through the network of programs associated with the Center for Autism and Related Disabilities located in Albany, NY. To participate in this project, each child was required to meet the following criteria: have a primary diagnosis of an ASD; have

received the diagnosis within 12 months; be between the ages of 12 months and 5 years of age; reside in one of the 9 counties comprising the Capital Region of NYS. Data is available on 14 parents whose children met the above criteria and completed the program. Evaluation of the parent education program was conducted using reliable and valid tools. Each of the measures was completed by parents prior to and following participation in the education program. In addition, to assess overall parent satisfaction with the education program (social validity), a parent satisfaction survey was administered following completion of the program.

Results: Preliminary data suggest that following the education program, parents were reporting less stress overall. Data also indicate that parents reported improvements in quality of life following the program, and also had greater knowledge of autism. Parents reported being highly satisfied with the program.

Conclusions: Data from evaluation of the parent education program indicate that families of children recently diagnosed with autism are greatly benefitting from participation. Overall, parents are highly satisfied with the program and following completion they are more knowledgeable about autism and report lower levels of stress and improved quality of life. A significant gap in services exists for this population, as little support is available for parents following a diagnosis of autism in their child. By developing an education program designed specifically for parents of newly identified children, we are providing an essential service that does not presently exist.

120.120 120 Developmental and Autism Spectrum Disorder Screening Practices Among Primary Care Physicians. K. Hughes*, J. E. Farmer and K. Sohl, *University of Missouri*

Background:

Evidence has shown that children with Autism Spectrum Disorders (ASD) have improved outcomes through early detection, diagnosis, and intervention. Recommendations for developmental and ASD screening have been published for over 10 years; however, the mean age of diagnosis is reported as 4 years of age.

Objectives:

The study objectives were to examine developmental and ASD screening practices among primary care physicians and to identify potential opportunities to support improvement in these practices.

Methods:

Sixty primary care physicians affiliated with a Midwest university-based hospital system were sent an online survey with 27 questions regarding current developmental screening and referral practices, barriers to screening, level of previous training and perceived need for future training about developmental and ASD screening. A total of 34 physicians completed the survey (56.7%). Thirty-three percent were general pediatricians, 58% were family physicians, and 9% were medicine/pediatric physicians. Survey data were analyzed based on frequency of responses.

Results:

Overall, 52% of responding physicians reported the use of developmental screening tools at well child evaluations. Family physicians were more likely to report the use of developmental screening tools compared to pediatric physicians (63% versus 36%, respectively). Of physicians who do not routinely screen for developmental delays, reliance on clinical observation was most frequently indicated as the reason (69%).

Overall, 58% of responding physicians report routine use of ASD screening tools. Interestingly, pediatric physicians were more likely to report routine ASD screening over family physicians (93% versus 32% respectively). The most frequently reported first course of action when physicians suspects ASD was to refer to a clinical specialist over the option of administering an ASD screening tool for the following age categories: <24 months (39%), 2-3 years (58%), and 4-5 years (66%). Most frequently reported barrier for ASD screening was not being familiar enough with the ASD screening tools (36%).

Conclusions:

Findings from this study show a continued lack of adherence to the recommended guidelines for developmental and ASD screening among primary care providers. The results indicate there is a gap in ASD screening knowledge among family physicians indicating a need to focus training efforts on this population of providers. Findings also suggest a lack of knowledge among primary care physicians on what to do with patients suspected of having ASD, including when to screen using a standardized tool and when to refer to a clinical specialist. The results of this study are important for determining where practice improvements for screening and referral need to be made and for guiding future training efforts in this area.

120.121 121 Training Public School Teachers to Use Data-Based Decision Analysis with Discrete Trial Training.

D. T. Zavatkay*[1], D. Bamford[2], C. Cunningham[2] and L. Gianino[3], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Marcus Autism Center & Children's Healthcare of Atlanta*, (3)*Marcus Autism Center & Childrens Healthcare of Atlanta*

Background:

Behavior analysts and consultants working in schools most often train teachers to implement procedures and, on occasion, to record data regarding procedural fidelity and the client's response to the interventions. But, often, the consultants fall short in training skills in data analysis and the use of data when making treatment decisions. This often inhibits student progress and also perpetuates the school systems' reliance on the use of outside consultants.

Objectives:

This study examined the training efficacy when public school teachers were trained to follow a protocol for implementing discrete trial teaching (DTT) methods and to conduct data-based decisions analysis (DBDA) regarding the teaching strategies within the classroom setting. Specifically, DBDA was to determine when to fade level of prompts used and to determine when the students demonstrated mastery of skills and were in need of new targeted acquisition skills.

Methods:

Six classroom teachers teaching in self-contained special education classrooms for children with moderate intellectual disabilities and autism in public elementary schools (grades K-5th) were trained by a Board Certified Behavior Analyst in methods of implementation and data collection associated with DTT. The teachers were also trained to make data based decisions according to specified rules for making changes in program targets (i.e., determining mastery) and for adding or fading prompts used during teaching. Data for the current objective were obtained after review monthly data tracking forms completed by each teacher throughout the school year. Percent correct and incorrect decisions per month were calculated. An error analysis was also conducted to determine specific errors made. Error analysis focused on the following:

Prompt Fading

- Changed indicated but no change (% I + PC)
- Made change without change being indicated (% I - PC)
- Change to incorrect prompt level (WP: Wrong Prompt)
- Target Introduction
- New target needed, no change made (% I +TC)
- Not mastered, but target was changed (% I - TC)
- Introduced an incorrect target (WT: Wrong Target)

Results:

The majority of teachers made significantly more errors using DBDA immediately following didactic training. Most consistent errors were either failing to fade or increase the prompting level when change was indicated or not moving to the correct prompt level as indicated in the protocol. Errors significantly

decreased for all teachers following brief in-vivo consultation and feedback. High procedural fidelity was maintained as the intensity and frequency of consultation was faded across the three training years.

Conclusions:

Overall, results show that the teachers were able to proficiently follow protocols to make data based decisions for DTT programming. However, proficiency was not consistent following only didactic training. Brief, in-vivo performance feedback was necessary for most teachers to demonstrate these skills with minimized decision errors. Continued training in these skills for public school teachers will further the impact of behavior analysis on public school education of children with autism and will reduce the reliance of the school systems on expensive consultation.

120.122 122 User Centric Evidence Based Inclusive School Design Guidelines for Children with Autism. R. Khare*[1] and A. Mullick[2], (1)*School of Planning and Architecture*, (2)*Georgia Institute of Technology*

Background: Autism is a developmental disorder that leads to a different and characteristic pattern of perceiving, thinking and learning. To design a supportive learning environment for autism, it is necessary to understand behavioral pattern of children and its relation with the physical environment. The present study employs an evidence based research method to explore the effect of environmental settings in educational spaces on children with autism for universal access and application.

Objectives: The current study develops a framework that works as a tool for designing high performance autism friendly educational spaces beneficial for all. Largely, the aim of the study is to recognize the environmental aspects effecting performance of children with autism, measure their impact on learning and then develop a set of guidelines for architects and designers to design autism friendly educational settings. The study also makes an effort to explore the effect of the identified environmental aspects on able-bodied children to establish a base for Universal Design.

Methods: The research process followed in the current study mostly derives from environment-behavior research methods. It employs several research approaches; sequentially starting with a concept, it draws from accumulated knowledge, existing theories and preliminary field survey to formulate the hypothesis. The hypothesis is then tested to verify the concept for the purposes, those can be generalized. There are several stages to this research study; in initial stages, learning behaviors of children in educational spaces helped in identifying 'eighteen environmental design parameters' that are enabling for autism. These eighteen design parameters are tested in the subsequent stages to provide evidence based body of knowledge to design autism friendly and inclusive educational spaces. Although the overall study considers many design aspects such as observation, survey and evaluation, the main purpose of this presentation is to discuss design guidelines of inclusive educational environment for children with autism.

Results: An extensive survey is carried out in the research and data is collected from sixteen educational spaces in USA and six in India. Overall rating of identified design parameters is done by eighteen autism experts and also from fourteen regular education experts. The research samples represent all age groups, elementary, middle and primary; different type of educations settings, inclusive and specialized; different education experts, autism and regular education, and different cultural context in the countries- developed and developing. The empirical data is then structured, compared and analyzed both intimately and distantly at the same time. Manifest and latent inferences from observations are drawn to answer the research questions and formulate autism friendly design guidelines.

Conclusions: With escalating incidence of autism and advent of inclusive education, it has become vital to explore the scope of environmental design for autism. The present research is a sequential progression that stands on existing body of knowledge, to produce environmental design guidelines those are enabling for children with autism. Using a research process, with pre-established foundations, it generates new evidence based knowledge, to design

supportive, accessible and inclusive learning environment for all children with and without autism.

120.123 123 An Examination of IEP Quality, Parent and Teacher Stress, and Teacher Background for Children with Autism Spectrum Disorders in Rural and Urban Areas. M. A. Murphy* and L. A. Ruble, *University of Kentucky*

Background: Recent estimates indicate that as many as 1 out of 110 children have an autism spectrum disorder (ASD; ADDM, 2009), and more than 190,000 children in 2009 received special education services under the autism category (U.S. Department of Education, 2009). Research indicates that parents (Abbeduto et al., 2004) and teachers (Kokkinos & Davazoglou, 2009) of children with ASD experience more stress in comparison to other disabilities. Further, Individualized Education Program (IEP) quality for students with ASD has been found to be weak (Ruble, McGrew, Dalrymple, & Yung, 2010), which is discouraging as IEPs drive the educational services students with special needs receive. Students with ASD in rural areas may face additional challenges in comparison to their urban counterparts due to a consistent shortage in special education teachers and personnel in rural school districts (Ludlow, Coner, & Schechter, 2005; Pennington, Horn, & Berrong, 2009). Moreover, rural parents have voiced concerns regarding their child's educational outcomes and the availability of school personnel (Applequist, 2009). Specific to ASD, there is a limited amount of research that compares IEP quality, parent and teacher stress, teacher background and child goal attainment in rural and urban areas.

Objectives: The purpose of this study is to compare IEP quality, parent and teacher stress, parent and teacher alliance, teacher background variables, and child goal attainment for students with ASD in rural and urban areas.

Methods: This study will utilize an existing data set of 79 parents and teachers who participated in a randomized control study of the Collaborative Model for Promoting Competence and Success (COMPASS; Ruble & Dalrymple, 2002) which evaluated a parent-teacher consultative framework developed to improve student IEPs and child educational outcomes. Parents and teachers completed a variety of assessment measures including measures of stress, background, and parent-teacher alliance. IEP quality was measured by a reliable IEP evaluation tool (Ruble, et al., 2010) that assessed students' individual goals (i.e., were they measurable, described in behavioral terms, the conditions under which the behavior must occur, etc.) and the description of students' present level of performance. Of the total sample, 49% of students received services in rural areas (M_{age} = 6 years).

Results: Results are currently being analyzed. Cross-tabulation results via Chi-square analyses (i.e., rural vs. urban) will be utilized to compare parents and teachers in rural and urban areas on the variables of interest (i.e., IEP quality, parent and teacher stress, parent and teacher alliance, teacher background variables of number of years teaching children with autism and number of students taught, and child goal attainment).

Conclusions: Findings from this study will shed light on the current state of educational services for children with ASD. Further, the findings may highlight the current disparities between rural and urban regions, and provide evidence for the needed improvement of the services available to children regardless of geographic location.

120.124 124 Training Teachers in Social Skills: Does Self Efficacy Play a Role?. J. Salt*, C. Flint and K. Johnsen, *HAVE Dreams*

Background: Teachers who are certified in special education rarely receive specialized training in autism. As teacher self efficacy has been related to many positive benefits in the classroom, research has begun to look at self-efficacy effects during teacher training (Ruble et. al., 2011). 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. Preliminary evaluations of the training (IMFAR, 2009; BPS, 2010) have demonstrated that participants significantly increased their knowledge of structured teaching practices by attending our training.

Furthermore, once they returned to their home schools they implemented a multitude of structured teaching techniques. However, teacher self report indicated social behavior goals were one of the hardest to implement. To further study our training in relation to social behavior, we added a teacher self efficacy measure to our evaluation protocol.

Objectives: This study investigated the effectiveness of the training model to increase teachers competence in social skills instruction. The study addressed: (i) teacher change in self competence to teach social instruction and (ii) the relationship of teachers self efficacy to outcome.

Methods: Participating teachers (n= 105) who attended the hands on 5 day training workshop completed a structured teaching competence questionnaire pre and post training. The questionnaire was developed and piloted by the lead trainers to assess key aspects of structured teaching practice and principles. In addition, teachers completed the Teachers Sense of Efficacy Scale (TSES, 2001) pre-training. We utilized the TSES subscale 'Efficacy for Instructional Practices' and the social behavior subscale of our questionnaire for this analysis.

Results: i) T-test revealed that for the whole group, there was a significant ($p<.01$) increase in scores of self competence to teach social instruction pre and post training. ii) TSES scores were divided by the mean score to create high and low self efficacy groups. To compare group performance on the social behavior measure 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.

Conclusions: These results indicate the effectiveness of our training program. By attending the training, teachers increased their confidence in their ability to teach social behavior, at any level of social ability, to individuals with ASD. However, teachers general self efficacy for instructional strategies appeared to have little relationship to increase in competence for teaching social skills. This has important implications for teaching the autism curriculum. Even teachers who have high self efficacy for general teaching instruction, should receive specific training in providing social skills for students with ASD.

120.125 125 A Meta-Analysis of the Reading Comprehension Skills of Students with Autism Spectrum Disorders. H. M. Brown*, J. Oram Cardy and A. Johnson, *The University of Western Ontario*

Background: Researchers have tended to suggest that students with ASD have weaknesses in reading comprehension despite superior decoding ability. Results have been conflicting, however, with some studies showing that students with ASD have typical reading comprehension and decoding skills, and others reporting impairments in both domains. To date, no formal meta-analysis has been conducted of reading comprehension skills in the ASD population.

Objectives: 1. Use meta-analysis to determine the size of the difference in reading comprehension between individuals with ASD and their typically developing (TD) peers as well as the direction and consistency of this effect. 2. To determine whether the effect sizes across studies are heterogeneous, i.e., whether there is true variation in effects. 3. Examine the degree to which decoding ability, vocabulary knowledge, Performance IQ (PIQ) and age are predictors for reading comprehension skill in the ASD population.

Methods: We conducted a meta-analysis of 33 studies of individuals with ASD that included a measure of reading comprehension. Effect sizes for the difference between the reading comprehension scores of individuals with ASD and their TD peers was calculated using Hedge's g standardized mean difference. The statistical significance of an overall summary effect size was tested with a Z-test, and a Q-test was used to determine that the effects sizes for reading comprehension scores were heterogeneous. The four predictor variables (decoding, vocabulary, PIQ, age) were analyzed using the tau-squared method and the proportion of variance explained by each covariate was calculated.

Results: The summary effect for reading comprehension in individuals with ASD across all the studies was -1.0 SD. That is, individuals with ASD tended to score 1 SD below their TD peers in reading comprehension. However, this meta-analysis

also found that the true effect size of the difference between groups does vary from one study to the next, varying between -2.3 SD to +0.3 SD. *Moderator variables:* Decoding, vocabulary knowledge and PIQ all significantly predicted the reading comprehension scores of individuals with ASD. Vocabulary was the strongest predictor of reading comprehension, explaining 90% of the variance in reading comprehension scores, followed by PIQ predicting 54% and decoding predicting 39%. Age was not a significant predictor of reading comprehension scores.

Conclusions: There was great variability in the reading comprehension scores of the individuals with ASD to the extent that some individuals had severe deficits in reading comprehension, whereas others had reading comprehension skills that were similar to their TD peers of the same age and grade level. It is important to note, however, that in many instances, individuals with ASD were compared to controls who had higher PIQs and/or greater vocabularies. Furthermore, some authors pre-selected individuals with ASD who had decoding strengths along with reading comprehension deficits and did not select individuals with different reading profiles. Overall, results suggest that having ASD increases the likelihood that a student may have problems with reading comprehension, but whether a given student actually has reading comprehension deficits may depend more on other factors (such as language ability) than simply their ASD diagnosis.

120.126 126 A Culturally-Informed Ecological Approach to Study the Transition to Kindergarten for Ethnically Diverse Parents of Children with ASD. E. Starr*[1], T. Martini[2] and B. Kuo[1], (1)*University of Windsor*, (2)*Brock University*

Background:

Transition to kindergarten (TTK) can be a stressful event for ethnically diverse parents of children with ASD. Stressors may include, but are not limited to: a) compromised communication with school personnel because of parents' limited dominant language proficiency, b) unfamiliarity with procedural and bureaucratic strains with North American culture and systems, and c) value conflict with the individualistic, Eurocentric values of educational approaches in Canada and the United States. The Ecological Systems model (Bronfenbrenner, 1989) considers the dynamic interplay between individuals and the environment over time, and therefore provides a useful lens through which to study TTK and ASD, and to conduct research with ethnically/culturally diverse people.

Objectives:

The purpose of this pilot study was to gather preliminary information concerning TTK from ethnically diverse parents of children with ASD, and from those involved in planning and facilitating TTK for these children. Given the exploratory nature of this study, no *a priori* hypotheses were formulated. However, it was expected that culturally diverse families would report experiencing TTK-related stressors that differed from those reported by parents of neurotypical children in prior research.

Methods:

Six focus groups were conducted: one each with English-speaking (N = 7), Mandarin-speaking (N = 2), and Arabic-speaking (N = 3) parents, one with kindergarten teachers (N = 6), and one each with two groups of service providers: Early Intervention providers (N = 2), and Early Childhood Resource Teachers (N = 16). Questions explored the following topics: How do participants define a successful transition? What positive and negative experiences were associated with TTK for ethnically diverse parents of children with ASD, and what are the unique transition-related challenges faced by these families? All focus groups were audiotaped, transcribed, and translated into English where necessary. Data were analyzed using the open-coding method.

Results:

Four overarching themes emerged from the data: *Relationship Building*, *Communication*, *Knowledge*, and *Support*. The ecological complexity of TTK was highlighted by the fact that the nature of the four themes differed by group (i.e., teacher, service provider, or the cultural/linguistic diversity of parents) and, for parents, according to whether their child's transition was viewed positively or negatively. For example: to best meet the needs of the child, participants talked about the need for

positive relationships between service providers and teachers, parents and teachers, and teachers and children. Whereas parents discussed the need for advocacy and communication (with diverse parents finding these particularly difficult) and described associated stresses, teachers found parents' preferences for detailed communication difficult given the classroom situation.

Conclusions:

Although these findings represent the perspectives of a small number of participants they highlight the ecological nature of the TTK process, and the differences experienced by ethnically diverse families. Given the ethnic makeup of North America, additional TTK research related to children with ASD using larger, diverse samples is needed, as is the development of effective and sensitive TTK transition processes and policies.

120.127 127 Psychometric Properties of a Newly Developed Teacher Self-Efficacy Scale for Teachers of Students with ASD. J. L. Birdwhistell*, L. A. Ruble, M. D. Toland and E. L. Usher, *University of Kentucky*

Background:

Special education teachers have a difficult job providing individualized instruction, collecting progress data, and facing the potential for slower student progress (Farber, 2001). These increased expectations often result in high levels of stress, burnout, and teacher turnover. Recent research has focused on examining the role of teacher self-efficacy as a buffer to stress and burnout.

Utilizing self-report measures, researchers have found that teachers with lower self-efficacy experience more difficulties in teaching, decreased job satisfaction, and higher levels of stress related to teaching (Betoret, 2006). Additionally, teachers indicate high levels of stress attributed to working with students with disabilities and an overall sense that they lack professional competence (Kokkinos & Davazoglou, 2009).

The drastic rise in the identification of students with autism spectrum disorder (ASD) has put special education teachers at a heightened risk for stress and burnout due to the unique deficits in social, communication, and restricted and repetitive behavior (Jennett, Harris, & Mesibov, 2003). Despite these concerns, little research has examined the role of teacher self-efficacy among teachers of students with ASD. One study found that teachers who reported higher levels of confidence in their classroom management abilities reported lower levels of burnout (Ruble, Usher, & McGrew, 2011). However, the researchers recommended a teacher self-efficacy measure that is more sensitive to the skills and tasks required of teachers of students with ASD for future research.

Objectives:

The purpose of this study is two-fold: (a) to evaluate the psychometric properties (dimensionality, internal consistency, and construct validity) of a newly developed teacher self-efficacy scale for teachers of students with ASD that assesses teachers' perceptions of their ability to conduct various assessment, intervention, and classroom-based practices for students with ASD; and (b) to replicate findings of a previous study (Ruble et al., 2011) with a new sample using this more specific teacher self-efficacy measure and to examine how it relates to teacher stress and burnout.

Methods:

Data were collected as part of a larger randomized controlled study (Ruble, McGrew, Toland, & Dalrymple, 2011). Data were collected at baseline from 44 special education teachers of children between the ages of three and eight with ASD. Teacher self-report on the teacher self-efficacy scale, Maslach Burnout Inventory, and Part B of the Index of Teaching Stress will be analyzed.

Results:

Internal consistency of reliability will be estimated using Cronbach's coefficient alpha, Pearson correlations will be estimated to examine the relationship of self-efficacy with stress and burnout, and dimensionality will be examined using principal components parallel analysis using raw data permutations.

Conclusions:

This research will evaluate the utility of a new measure that is catered to the unique skill set required of teachers of students with ASD. Furthermore, results will reveal the relationship between teacher self-efficacy, stress, and burnout. Given the increase in students identified with ASD and the typical lack of teacher training in autism, it is important to know whether the beliefs that teachers hold about their skills in educating students with ASD is related to teachers' reported levels of stress and burnout.

120.128 128 Teacher Responsivity to Child Communication Acts in Autism Preschool Classrooms. E. R. Monn*, L. D. Johnson and A. Dimian, *University of Minnesota*

Background: Free-play within preschool classrooms provides important, developmentally appropriate intervention opportunities for preschoolers with Autism. With communication deficits being a core feature of autism, teacher responsiveness to child communicative acts during play presents an important opportunity to reinforce and encourage early communication skills.

Objectives: The purpose of this study was to examine the naturally occurring relations between child and teacher communicative behaviors during play with a specific focus on exploring how those relations may change as a function of children's overall language skills.

Methods: Twenty-nine preschool aged children with autism were videotaped during a 30-minute play period as it naturally occurred during the typical classroom routines. During the play period, children had the opportunity to engage in free-play with peers and toys with adults facilitating the play period as would be typical for each classroom. Videos were then coded using the MOOSES (Multi-Option Observation System for Experimental Studies) recording system. Child communication acts were coded as directed towards a peer, directed towards an adult, or undirected. Teacher intervention codes included commenting, expansion, mapping, repeating, or directives. A second observer independently coded 30% of the videos for interrater reliability.

Results: Sequential dependencies were examined to explore the relation between children's communicative acts and teacher intervention. Yule's Q was used as the index for this relation based on recommendations from Yoder & Fuerer (2000). Yule's Q is a transformed odds ratio bound by -1.0 and 1.0 that controls for the number of coded behaviors which may also be used in subsequent statistical analyses. A score closer to 1.0 suggests a high degree of dependency (e.g., any child communicative act was responded to by the adult) and a score closer to -1.0 suggests a high degree of independence (e.g., the child exhibited communicative acts, but they are never responded to by a teacher). When examined as a group, pooled Yule's Q scores indicated that the relation between child communicative acts and teacher intervention tended occur more independently of the other (Q = -.30). Hypothesizing that this relation may be influenced by the communication skill level of the child, children were divided into two groups (Average and Below Average Language Skills) based on PLS-4 scores. When compared, sequential dependencies between child communication acts and teacher intervention for the Average skills group remained similar to findings for the whole group (Yule's Q = -.33) and the Below Average skills group experienced a near zero relation (Yule's Q = .02).

Conclusions: From a behavioral perspective, a higher degree of sequential dependency between child communicative acts and teacher intervention may be important to reinforcing and teaching early language and communication skills. In this study, despite the occurrence of child communicative acts and the occurrence of teacher behaviors meant to support skill development (i.e., language mapping, expanding, commenting, etc.), there was little sequential dependency between those sets of behaviors. Preliminary findings do suggest, however, that there may be some difference in the nature of those dependencies as a function of the child's overall language proficiency.

120.129 129 Private and School-Based Therapies: Characteristics of Children Receiving Services Across Settings. S. Mire*[1], K. P. Nowell[1], G. T. Schanding[2] and R. P. Goin-Kochel[3], (1)*University of Houston, School Psychology*, (2)*University of Houston*, (3)*Baylor College of Medicine*

Background: Children with autism spectrum disorders (ASD) receive speech (ST) and occupational therapies (OT) in

private settings and/or through public school districts. For many reasons, parents often rely on schools to provide these related services (Thomas et al., 2007). However, not all students with ASD are eligible for school-based services; clinical diagnosis is not sufficient for eligibility under the Individuals with Disabilities Educational Improvement Act of 2004 (IDEIA, 2004), which also requires "educational need". Various factors may contribute to determination of "educational need" and resulting IDEIA (2004) eligibility, including cognitive and communication deficits rather than social impairments, which are central to ASD diagnoses (Eaves & Ho, 1997; White et al., 2007). Understanding characteristics of children with ASD receiving therapies in different settings (e.g., private and/or school-based) may inform gaps in service delivery across settings that may better address the diverse needs of students in this population.

Objectives: To (a) provide descriptive information about lifetime utilization of private and school-based therapies for students with ASD in a large, well-characterized sample; (b) determine whether specific child and/or family characteristics influence the likelihood of their receiving therapies in private versus school-based settings.

Methods: Data were analyzed for students with ASD (*N* = 2,115; *M* age = 8.5 years, *SD* = 3.5 years, range = 4—17.11 years) who participated in the Simons Simplex Collection (SSC). Parents provided detailed history of ever using private and school-based therapies. Verbal cognitive scores were derived from norm-referenced, standardized instruments, and severity of ASD symptomatology was measured using the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2001). Frequencies of use for private and school-based ST and OT were calculated. Logistic regressions allowed examination of factors predicting use of therapies in different settings. Forthcoming analyses include chi-square tests of homogeneity to investigate potential differences (e.g., cognitive functioning, ASD symptoms, SES) among students who received therapies in different settings.

Results: Most participants had received school-based ST (80.4%) and OT (66.4%) at some time. Fewer students had ever received the same services privately (ST: 52.6%; OT: 41.4%). Logistic regressions indicated factors contributing to students' lifetime use of private ST were parent education, family income, ASD severity, child age, age of problem onset, and verbal cognitive score. Predictors for lifetime use of school-based ST included race/ethnicity, family income, age of problem onset, and verbal cognitive score. Use of private OT was predicted by parent education, family income, ASD severity, age of problem onset, and verbal cognitive score; factors predicting school-based OT were race/ethnicity, family income, ASD severity, age of problem onset, and verbal cognitive score. Chi-square results are forthcoming.

Conclusions: More students received ST and OT services in the school setting compared to private settings, consistent with Thomas et al.'s (2007) suggestion that parents rely heavily on schools to treat their children with ASD. However, logistic regression results suggested lower cognitive functioning predicts receiving *all* services, not just school-based. Age further influenced services, with younger students being more likely to receive them. Additional findings and further discussion will be provided.

120.131 131 Effective Interventions for Challenging Behaviours of Children and Youth with Autism and Developmental Disorders In School Settings: A Knowledge Translation Project. Q. Senkow[1], J. Montgomery*[2], J. Douglas[3], D. J. Heinrichs[2], S. North[2], S. Shooshtari[2], J. Virues-Ortega[2], T. L. Martin[2], L. Dodson[2], B. Temple[2] and C. T. Yu[2], (1)*Seine River School Division*, (2)*University of Manitoba*, (3)*St. Amant School*

Background: Teachers in classrooms with children who have autism and or developmental disabilities, are presented with severe, challenging, or unusual behaviors from students each day. Some of these behaviours are spitting, kicking, hitting, biting, temper tantrums, screaming, self-injurious behavior, stereotyped and repetitive behaviour. These behaviors undoubtedly affect the classroom climate, in addition to affecting teacher, educational assistant, and indeed student well-being. This project was a subcomponent on a larger project on knowledge translation. Teachers were an integral part of the research team of the (interdisciplinary) knowledge translation team, involved in asking specific questions about effective interventions for behaviors

demonstrated by children in their classrooms. The team conducted a systematic review and analysis of the relevant research literature, quality analysis procedure to literature reviewed, produced a synthesis, and finally created knowledge- user friendly 'deliverables" to assist in the translation of research to practice for this particular problem. The goal was to give the classroom teachers strategies to use that were grounded in well conducted research. Results are discussed in terms of main findings and considerations for knowledge users.

Objectives: This study aimed to identify effective strategies for intervening with challenging behaviors in the classroom and produce user-friendly materials to assist in the uptake of evidence based practice.

Methods: A systematic review of the literature was conducted from the years 2000 to 2011. The articles reviewed adhered to the following inclusion criteria:

- Peer reviewed articles published between 2000 and 2011
- Studies focused on autism or developmental disability
- A specific strategy for reduction of challenging behaviours was presented
- Strategies were potentially adaptable to be applied by teachers
- Age of participants between 0 and 21

A quality analysis procedure (Downs & Black, 1998; Merlin, Westin, Tooher, 2009) was applied to the articles included to establish a hierarchy of interventions (in relation to the state of the evidence). A synthesis paper was produced, and from those findings, user-friendly "deliverables" were prepared and disseminated.

Results: Main findings of the synthesis are presented and results are discussed in terms of implications for bridging the gap from research to practice.

Conclusions: Information on effective strategies for reducing challenging behaviors in classrooms is limited by the types of study designs employed and contextual factors that limit the generalizability of research findings. Barriers and facilitators to the application of research findings in real life contexts are discussed in terms of implications for the knowledge translation process.

120.132 132 Qualified Jobs for People with ASC in Germany. Progress in Vocational Training and Inclusion of Adolescents in the Labour Market. M. Dalferth*, *University of Applied Sciences Regensburg*

Background: There is no sufficiently assured knowledge about vocational support for people with ASC and their participation in the working life in western societies. Inadequate employment as well as social exclusion of people with ASC / Asperger's Syndrome from the labour market in Germany led to initiate a pilot project in external vocational training centres in 2002. The aim of the project was to prepare the adolescents for competitive jobs. In the last few years we have developed different methods of job support for adolescents with ASC. I have supervised the enhancement of adequate vocational training and inclusion of people with ASC in semi-sheltered and competitive workplaces.

Objectives: Continuous evaluation of the support for adolescents with autism in 5 vocational training centres in Germany. Results of vocational development and job placement.

Methods: Mail questionnaires (centres), expert-interviews (staff), structured interviews (graduates)

Results: The successful realisation of a special training programme (the 'Abensberg Training Programme' - ATP) has led to a rise in numbers of participants with autism in vocational training centres in the last few years. At the moment 397 young people with ASC are undergoing vocational training in 12 external training centres.

The results of the progress and inclusion in the 5 training centres will be recorded. After pre-vocational training and a differentiated assessment procedures 262 young people have started a vocational training in 2010. 88 have already finished the training of 2.5 – 3.5 years; 46 (52.3 %) have already found a job on the labour market. 14 (15.9%) trainees are working in a

sheltered workshop, 9 (10.2%) undergo further training and 19 (21.6%) are still looking for a job.

Conclusions: People with autism can – depending on the characteristic of their autistic conditions – be successfully trained in different kinds of qualified jobs or job areas. They are able to unfold their potentials and find employment. Prerequisites: Creating suitable conditions in the training centres, careful assessment, consideration of skills and interests, individual support measures including vocational *and* social training, structured teaching methods as well as special designs of workplaces, job assistance, modification of exam conditions. The sustainability of an inclusive job on the labour market requires on-the-job training and crisis intervention if needed. What must always be taken account of are the framework conditions such as the housing situation, the day-to-day management, leisure time amenities, social contacts, financial security, and the perspective of life.

120.133 133 An Assessment of the Needs of Tertiary Education Students with Autism Spectrum Disorder (ASD). R. Y. Cai*[1], A. L. Richdale[1] and C. Dissanayake[2], (1)*La Trobe University*, (2)*Olga Tennison Autism Research Centre*

Background: Few people with an ASD achieve a post-school qualification, with many having poor outcomes. There are resulting negative financial and personal costs for people with ASD and their families, and a significant cost-burden for communities. To date there is no research on the needs of people with ASD in tertiary education settings, nor of the needs of staff who teach and support them. No framework or plan exists specifically for the support of these students whose needs may not be well understood due to their particular difficulties and behaviours associated with ASD.

Objectives: The aim in this project was to understand the needs of, and the supports required by and for people with ASD undertaking tertiary studies in either Technical and Further Education (TAFE) colleges or Universities in Victoria, Australia.

Methods: Twenty-three (16 male, 7 female) tertiary students with ASD and 15 (14 parents, 1 sister) family members participated in semi-structured focus groups conducted at 6 tertiary institutions (2 Universities, 4 TAFE colleges). Students also completed brief demographic form and the Autism Spectrum Quotient (AQ), while family participants completed a brief demographic form and the Social Communication Questionnaire (SCQ). Three in-depth interviews were conducted with two male, first year university students throughout 2011 in order to understand their experiences during their first year of university. Data were analysed using NVivo 9.

Results: Students' average age was 25 years (Range 17-59 years), with 4 in their first year of study. With one exception (self-report), all students had AQ (M = 30.1) and/or SCQ (M = 23.8) scores consistent with their ASD diagnosis. The key traits and characteristics of students with ASD as identified in this project were deficits in communication and social skills, preference for structure and routine, high anxiety and proneness to depression, poor organisation and time management skills, and difficulties processing information. The results indicated that the current supports provided to students are inadequate and inconsistent across tertiary institutions. During transition to tertiary education current processes for student disclosure of their ASD diagnosis are ineffective, with families unaware of the potential benefits of such disclosure. Students are often unprepared for tertiary study. On-time support provided by disability units is critical and, in particular, it is important for disability coordinators to connect students with other relevant support services. Although students still live at home (64%), privacy issues exclude parents from providing support for their child's tertiary education.

Conclusions: The traits and characteristics associated with ASD hinder students learning in tertiary education settings, and their support needs are great. Existing support for students should be uniform and consistent, taking account of their ASD characteristics and associated needs, thereby providing an environment in which they can achieve successful outcomes.

120.134 134 Examining Vocational Services for Adults with Autism. D. B. Nicholas*[1], H. Emery[2] and L. Zwaigenbaum[3], (1)*University of Calgary*, (2)*University of Calgary* , (3)*University of Alberta*

Background: The project addresses the under-studied and under-served area of vocational services for adults with autism spectrum disorders (ASDs). Despite gains in vocational and employment supports for adults with ASDs, substantial gaps remain. The Canadian *Participation in Activity Limitation Survey* (PALS, 2006) database suggests that adult males (25-64 years) with ASDs, have remarkably lower employment and labour force participation. Only 40% of adult males in this category are employed. Less than half participate in the labour force (employed or unemployed but looking for work). These employment outcomes are approximately 10 percent lower than that observed among other disabled male counterparts. Vocation-related service needs for adults with ASDs have thus emerged with increased urgency as a growing cohort of adolescents with ASDs are aging into adulthood.

Objectives:

The project aims to identify needs, barriers and opportunities related to vocational success for adults with ASDs. 'Vocation' is defined as *meaningful, routine, sustained activity that is growth provoking, personally rewarding and often associated with the provision of a living wage*. Specific research questions are as follows.

1. What services support meaningful vocational opportunities for adults with ASDs in Alberta?

2. What services (or components of services) offer best evidence for beneficial outcomes?

3. What types of vocational services are most beneficial for which specific groups of adults with ASDs (i.e., nature of challenges with respect to language, intellectual development, presentation of ASDs, etc.)?

Methods: An online environmental scan has been conducted in which models of vocational practice in ASDs (or relevant to ASDs) across Alberta have been systematically collected and reviewed. A second level followup survey and interview with a sub-sample of participants, based on maximum variation, are being conducted to further examine the practice and experience of vocational supports for persons with ASDs.

Results: Findings identify a diverse range of vocational services and models being offered such as job coaching in natural settings, peer groups and programs fostering vocational opportunity and/or skill building. These findings identify challenging, multi-level issues in the workplace such as concerns that vocational services appear to be inconsistently implemented across communities. There is preliminary evidence suggesting that supported employment for persons with ASDs potentially offers increased labour market productivity and engagement. These findings contribute to our understanding related to needs, sources and gaps in vocational resources for adults, as well as offer recommendations for moving forward.

Conclusions: Challenges and opportunities related to vocational experience and support in ASDs have not been fully considered in a Canadian context. There appears to be a general lack of vocational inclusion for persons with ASDs. Findings will inform practice and community-level application and development.

Reference

Participation in Activity Limitation Survey, 2006, www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=82m0023X&lang=eng; accessed November 7, 2011.

120.135 135 The Sensory Audit: Making Workplaces Safer for Individuals on the Autism Spectrum. A. E. Robertson* and D. R. Simmons, *University of Glasgow*

Background:

Individuals with ASD (e.g. Baranek et al., 2006; Leekam et al., 2007; Crane et al., 2009), as well as those with high levels of autistic traits (Robertson & Simmons, 2011a, submitted), have difficulties with sensory processing. In particular, the everyday aspects of typical working and social environments can become distressing for those with sensory sensitivities (Robertson & Simmons, 2011b, submitted). However, there is currently no systematic way to evaluate environments that may be problematic for people with ASD. Using a combination of survey techniques and electronic sensing, we have developed a toolkit that can be used to provide a comprehensive

description of the sensory environment in a given location, as well as recommendations to reduce the impact of the identified hazards.

Objectives:

To develop the know-how and technology necessary to provide a full **sensory audit** for working environments for individuals with ASD.

Methods:

1) Details of problematic environments were extracted from previous studies (e.g. Robertson & Simmons, IMFAR 2010; Robertson & Simmons, IMFAR 2011).

2) Focus groups were carried out at a local company which recruits a largely ASD-diagnosed workforce).

3) Measurement of the environment focused on three areas: vision; audition and olfaction.

4) Visual aspects of the environment were recorded using photographs, meter-based measurements of colour, brightness and flicker.

5) Problematic noises and general ambient noise levels were recorded. The sound levels of these noises were noted. The loudness, sharpness, roughness and frequency composition were of each sound were analysed.

6) Olfactory aspects of the environment were assessed using participants who had been screened for typical olfactory thresholds, identification and discrimination ability.

Results:

1) Detailed protocols were developed, which included:

   a. Instructions on how to carry out the measurements

   b. Details of how to analyse the results

   c. Information about the equipment used

   d. Hints and tips for amelioration of environmental hazards.

2) The most problematic stimuli were identified and their properties analysed

3) A project web-site with the toolkit was developed.

Conclusions:

1) Particular sensory issues were identified, including:

   a. Noise throughout the office from nearby building work

   b. Glare and light patterns (caused by light streaming through blinds) in the exterior offices

   c. Noise from the reception desk (e.g. people phoning, customers being greeted)

2) Amelioration of the environment was offered:

   a. The building contractor was contacted and the hours were adapted.

   b. Those susceptible to the light were moved to an open-plan interior office space

   c. Ear plugs were made freely available

3) A standardized toolkit which details how to assess an environment and analyse the results was developed, which will soon be made available to the general public.

120.136 136 Social Interest of Typically Developing Peers in a Child with ASD. M. Zakai-Mashiach*, M. Ziv and E. Dromi, *Tel Aviv University*

Background:

The present study focused on typically developing (TD) children's social interest in a child with Autistic Spectrum Disorder (ASD) that was included in their preschool class. Although the literature presents rich evidence on the importance of inclusion for children with ASD, its effects on the TD children, who play a decisive role in the process, are rarely discussed. Inclusion very often elicits first-time encounters between TD children and a child with special educational needs, highlighting the importance of research not only on the clinical impact of inclusion on the ASD preschoolers, but also the effects of mainstreaming on the TD peers.

Objectives:

The first research question was whether the teachers and educational aids (paraprofessionals) are able to distinguish between children who demonstrate social interest and those who avoid social contacts with the child with ASD. The second question was whether the difference between the two groups of TD children is attributed to Theory of Mind development or to the general social profile of the TD child.

Methods:

110 TD Israeli preschoolers ranging in age from 3 to 6 years old participated in the study. An original questionnaire was designed for reporting on the social relatedness with the ASD child (The Social Relatedness Questionnaire; Zakai-Mashiach, Dromi, & Ziv, 2008) . The teachers and the educational aids were also interviewed. For collecting information on the social profile The Profile of Peer Relations (Walker,2005) was administered . A scale of five tasks (TOM scale; Wellman & Liu, 2004) was used for testing TOM development.

Results:

Findings indicated that (1) preschoolers' social interest in the child with ASD was detected by teachers and educational aids (2) the number of children who demonstrated social interest increased with age, (3) social relatedness was not explained by differences in the social profile, (4) TOM scores increased with age, but were only partly related to the difference between the two groups of TD participants. Among the three-year-olds better TOM scores, especially in the "Knowledge access" task were related to judgments on social interest in the ASD child.

Conclusions:

Social inclusion of children who were diagnosed with ASD in regular preschools is an important challenge for professionals and for the community. It is important that future research will focus not only on the consequent positive effects of inclusion on the ASD preschoolers. It is our inclination that future research should also examine the effects of mainstreaming on the cognitive and social development of the TD peers. Gaining better understanding of inclusion in general and social interaction between unequal partners in particular will make this challenge more easily reachable.

120.137 137 Social Skills Programming for Individuals on the Autism Spectrum: Training Social Workers. K. Johnsen*, C. Flint, D. Fenceroy and J. Salt, *HAVE Dreams*

Background: As the number of children identified with autism increases, pressures on school districts to provide quality services magnifies. Within Illinois, school social workers are often the key professional within a school team that provides any kind of social skill training opportunities for those with Autism Spectrum Disorders. However, many professionals are inadequately prepared through their undergraduate training or professional experiences, to cope with the spectrum of autism deficits. During our training, participants learn how to apply interventions across a range of skill sets (concrete learners through to high functioning learners). The training is multi-modal in that it includes lectures, real life examples, video demonstration, and opportunities to create social activities. At the end of training participants must be able to create social games, activities and opportunities for their pupils at their schools. The training incorporates structured teaching methodology which is specifically designed to accommodate the characteristic strengths, and neurological differences of individuals on the autism spectrum.

Objectives: This study investigated the preliminary effectiveness of the training model to increase social workers competence in social skills programming. The study addressed (i) competence of social skills programming gained across the training period (ii) the implementation of specific social strategies following training.

Methods: (i) Participating social workers (n= 22) who attended the training workshop completed a structured questionnaire pre and post training. The questionnaire was developed and piloted by the lead trainers to assess key aspects of social communication and social skills interventions. Each of three sections described a student with skills sets at the concrete level (early learner); intermediate level; abstract level (advanced leaner). Participants answered four questions in

each section regarding that child. The final questionnaire had 12 questions, with a maximum total score of 72. (ii) 10-14 days following training, participants were contacted by email and asked to return a survey of social skills strategies they implemented in their schools.

Results: i) T-test revealed that there was a significant ($p<.01$) increase in competence scores pre and post training at each level of social development (concrete, intermediate, abstract). ii) A response rate of n= 15 (68%) was achieved for the follow up survey. Follow up questions indicated that some aspect of the structured teaching training was implemented into practice by 14/15 (93%) of responders. Follow up consultation, and further training was requested by 15/15 (100%) of responders.

Conclusions: By attending the training, participants increased their confidence in their ability to teach social behavior, at any level of social ability, to individuals with ASD. Furthermore, once they returned to their home schools they implemented a multitude of social and social communication techniques. Although satisfaction of training was very high, desire for ongoing consultation at follow up is an issue that could be addressed. These results indicate the preliminary effectiveness of our training program. A more rigorous methodology is needed to extend confidence in these evaluation results. The training is now being provided to a much larger sample.

120.138 138 Participation of Children with and without Autism Spectrum Disorders in Social, Leisure, and Recreational Activities. V. Lopes* and P. Minnes, *Queen's University*

Background: Participation, as defined by the World Health Organization, refers to involvement and engagement in life situations, including social, recreational, and leisure activities. Participation in activities provides opportunities for social interaction and the formation of peer relationships. For children with physical and developmental disabilities (DD), participation has been shown to be associated with a number of positive developmental outcomes, including competency-related benefits (e.g., skill development), social benefits, and psychological/emotional benefits (e.g., enhanced self-confidence) (King, Petrenchik, Law, & Hurley, 2009). Although participation in social, recreational and leisure activities is essential to overall well being, previous literature shows that in comparison to peers without disabilities, school aged children, adolescents, and adults with Autism Spectrum Disorders (ASDs) (e.g., Orsmond, Wyngaarden Krauss, & Mailick Seltzer, 2004) are not participating, or participate less, in activities. Whether this finding holds true for preschool and early school-aged children with ASD needs to be investigated.

Objectives: The purpose of the current study was to evaluate the frequency and intensity of participation in social, leisure, and recreational activities for preschool and early school aged children with ASD, in comparison to their typically developing (TD) peers. For purposes of this study, recreational activities will refer to more formally organized and structured activities such as team sports and lessons. Social activities will refer to activities the child engages in with peers occurring outside of the context of a formal recreational activity (i.e., presence of a coach). Leisure activities will refer to activities that the child does alone or with a parent without peers present.

Methods: Parents of young children between the ages of 3 and 8 years were invited to complete an online survey that asked for information about family demographics, child adaptive and maladaptive behaviour, child social skills, parental stress, advocacy and empowerment, family preference for recreation, family cohesion, and service utilization. Additionally, parents were asked about their child's participation in activities, the frequency of participation, whether the participation occurred with typically developing children, and who supported the child in the activity.

Results: To date, eighty parents of children with ASD (mean age = 68 months) and eighty parents of TD children (mean age = 67 months) completed the survey. As data collection is ongoing, results are preliminary. Data will be presented regarding the child's level of functioning (adaptive behaviour), social competency, and frequency of participation in social, formal recreational and informal leisure activities, in comparison to similar aged TD peers.

Conclusions: The results of the current study will provide valuable information regarding the frequency of participation of young children with ASD in comparison to their TD peers to

see whether previously reported discrepancies in rates of participation of older children and adolescents occur in younger children. The implications of these findings will be discussed in relation to the inclusion of young children with disabilities in activities; and the service needs of these children and their families.

120.139 139 Stepping Out: Social Recreation for Young Adults On the Autism Spectrum. H. Wickenheiser*, *Sinneave Foundation*

Background: There is value in social recreation programs for young adults with disabilities. This project examined the "Stepping Out" program which provides opportunity for young adults on the autism spectrum to learn social and recreational skills.The Health economist data and a 2008 research study conducted by Taylor Reece Spencer at the University of Connecticut showed that quality of life is directly related to ones physical independence. Less stress in the family dynamic also lends to an increase in quality of life (Spencer 2008, p.8.). The literature indicates that there is a lack of social recreational programs for adults with disabilities.

Objectives: Due to a lack of programming for youth of this age group in the city of Calgary, Canada 'Stepping Out' was initiated. This intervention aims to: 1) provide an outlet for young adults with disabilities to learn social and recreational skills, 2) utilize social recreational activities to create a heightened sense of independence and foster ongoing friendships, and 3) interact with participants that highlights their strengths and potential and only secondarily, focuses on their disability. Weekly activity sessions covering the broad spectrum of the areas of physical fitness were incorporated, including the use of circuit training, boxing, dance, yoga and field trips such as skating and swimming. Participants gain and practice key social skills through mechanisms such as prompting and role modeling of regulated 'turn taking', self-expression, active listening, sharing and maintaining eye contact.

Methods: Pre- and post-intervention data was collected based on a mixed method design. Data collection comprised: fitness testing, observational data, and survey findings. Key points of intervention (e.g., 'team building', 'ice breaker' games, journaling) were subjected to observation and weekly recorded, which was subsequently qualitatively analyzed for perceived outcomes and interventional processes in yielding outcomes.

Results: Short, mid and long-term outcomes were found using surveys, fitness testing and journaling. Outcomes ranged from social impacts such as having fun, getting out of the house, improved social interaction and trying something new. Young adults with autism were found to become more outgoing and confident in doing recreational activities.. This appeared to heighten self-esteem, stimulate hope for parents, and create increased willingness among participants to participate in future social recreation programs. The results showed a difference from the commencement to the termination of the intervention. Initially the young adults were hesitant to participate and by the end were engaged freely without prompting.

Conclusions: The project represents a small sample of young adults and their families. These findings highlight the potential benefit of social recreation programs for young adults on the autism spectrum. Results across methods consistent highlight encouraging findings comprising beneficial impacts and processes. Further research in this under-studied area of intervention is warranted as these findings highlight the promise of social recreational programs for young adults with autism and their families.

Epidemiology Program

121 Screening, Incidence, Prevalence and Study Methods

121.140 140 Topics of Worry in Mothers of Children with An Autism Spectrum Disorder or Down Syndrome. P. L. Ogston*[1], V. H. Mackintosh[2] and B. J. Myers[1], (1)*Virginia Commonwealth University*, (2)*University of Mary Washington*

Background:

Parents who have a child with a disability face heightened responsibilities and stressors that require extra energy and may contribute to worry-laden thoughts.

Objectives:

The aim of this study was to identify topics of worry for mothers of children with an autism spectrum disorder (ASD) or Down syndrome (DS).

Methods:

Mothers of children with an ASD (*n* = 199) or DS (*n* = 60) responded to an online questionnaire that assessed their worries. They answered the question, "When you wake up in the middle of the night, what is it that you worry about?" Participants were recruited via advertisements placed in newsletters and on websites of organizations associated with ASD's and DS. Data were collected between July of 2006 and February of 2007. Coders identified and reached agreement on qualitative themes.

Results:

Mothers expressed worries about their child's **safety** (e.g. "Is everyone in the house safe? Are the doors locked and alarms on so as I can hear when and if someone opens it…particularly our little runner?"), **health, and death** (16.2%). They worried what their **own death** would mean for their child (6.6%; e.g. "I also have these horrible nightmares where I die in my sleep and no one knows and my son is all alone in the apartment."). Mothers described **school-related** worries (5.4%; e.g. "If something happens to her I need to have a back-up plan and there are few educational situations that are a good match.") and whether their child would ever be **able to live independently**. They worried about their **child's adjustment** and ability to establish **relationships**, (7.7%; e.g. "My child will never have a romantic relationship or friends; we will die and he will have nowhere to live and will be stuck in an institution").

Mothers also revealed worries unrelated to their child with a disability. Some concerned **daily hassles** (24.3%; e.g. "Little things that need to be done the next day"). **Finances** were a big concern (14.7%); one mother worried, "if we will have enough money to make it through the next few months." Mothers wrote about **work-related tasks** ("Having too much work to do - not at home - at work") and **whether they could get things done** (6.9%). Others wrote about **their own wellbeing and happiness** (12.7%; e.g. "Relationships, when will I ever be non-tired, how can I make it through life.").

Conclusions:

Mothers' responses gave a glimpse of their special experience as a parent of a child with a disability. However, they hold many roles: as individuals, mothers, wives, friends, and daughters. Those employed outside the home also have to fulfill their work-related responsibilities. They worry about their children and families but also think about their own wellbeing and have maintained their sense of self. These findings serve as a reminder that these mothers have hopes and problems of their own that go beyond their role as mothers of children with a disability.

121.141 141 Prevalence of Autism Spectrum Disorders in Qatar. F. Alshaban*,

Background:

Prevalence rate of autism-spectrum disorders (ASD) in Qatar is uncertain, and speculation that their incidence is increasing continues to cause concern.

Although the apparent increased prevalence of autism may reflect improved detection and recognition of autism and its variants.

No comprehensive survey has been done to estimate the prevalence of Autism in Qatar.

Objectives: To estimate the prevalence of autism-spectrum disorders among Qatari families, and other families resided in Qatar.Also to look for certain social, ethnic, and cultural factors and its association with the prevalence.

Methods:

The target population for this study is children aged 3 through 18 years whose parents resided in Qatar.

Children with ASD in Qatar going to be identified using a two-phase process.

In Phase 1,

1. Children from a representative sample of all primary schools in Qatar going to be preliminarily screened using Social Communications Questionnaires, and those who are suspected to have ASD will be approached through phase 2.

1. Review of records of children with possible ASD from the following institutions:

1). Shafallah Center for children with special needs records, which includes all children with preliminary diagnosis of ASD, who attends special classes for Autism.

2). Other centers and school which has similar facilities.

3). Records from the Supreme Counsel of Health, Hamad Medical Corporation, and any other health centers.

In Phase 2,

Clinical evaluation is conducted by a developmental psychologist, and/or pediatrician, it includes a medical, developmental, and behavioral history; a standard physical and neurologic examination, In addition, the Autism Diagnostic Interview (ADI-R), and Autism Diagnostic Observation Schedule-G (ADOS-G) will be administered.

Results:

Preliminary analysis of 179 subjects showed the highest prevalence among age group 7-14 years (61%).

Male/female ratio was 82% /18%, which is around 5/1.

Further works needed to calculate the total prevalence rate.

Conclusions:

Obtaining a reliable estimate is important in planning for providing the best health care and educational services needed to improve the overall outcome of Autism.

121.142 142 Developing Autism Early Identification, Treatment and Research Strategies in Argentina. A. Rattazzi*[1], K. Gutson[1], C. Plebst[1], M. L. Massolo[2], V. M. Ensenat[1], S. Cukier[1] and L. A. Croen[2], (1)*PANAACEA*, (2)*Kaiser Permanente Division of Research*

Background: The concept of public health is relatively new in Latin America where general knowledge about ASDs is poor. In Argentina, most of the trained clinicians, diagnostic and treatment resources, and medical infrastructure are centralized in the capital, Buenos Aires, and knowledge and resources in the interior of the country are largely lacking.

Objectives: To conduct a pilot project to address ASD knowledge and resource gaps in Argentina and to build public health infrastructure for ASD across the country. Specifically, we are 1) developing and solidifying collaborative relationships with stakeholders in Argentina who can influence infrastructure development for autism public health initiatives, 2) developing and conducting a community-based and culturally-sensitive early detection project in a representative mid-sized Argentine city to establish the screening prevalence of ASD among toddlers, and 3) developing a feasible, generalizable and cost effective model program of autism service delivery in the country.

Methods: This 2-year pilot project is an international collaboration between researchers and clinicians from the US and Argentina. In the first year, we will identify additional stakeholders and conduct a needs assessment to identify knowledge gaps, resource needs, and priority research questions; conduct a structured survey among health and education professionals to examine *knowledge* about ASD, *approaches* to ASD diagnosis, and *behaviors* regarding referral to ASD services; and develop culturally-relevant strategies for raising autism awareness in Argentina. In year two, the binational team will conduct an ASD screening project in a typical city in the interior of the country. The general toddler population (18 - 36 months) will be screened with the M-CHAT (Spanish version) through the various healthcare and educational settings serving children <4 years of age. Children who fail the screener will be referred for follow-up diagnostic assessment using AOSI for children <2 and ADOS for children >2, Mullen Scales of Early Learning and VABS-II. Children diagnosed with ASD will receive early intervention based on the Early Start Denver Model (ESDM). Following a “train the trainer” model, Argentine co-

investigators will receive training on ESDM in the US, and then will conduct ESDM training in Olavarría for health professionals, who in turn will train parents.

Results: A summary of the results from the needs assessment, the development of the provider survey and strategies for the ASD awareness campaign will be presented. We estimate a population of approximately 4500 children between 1-3 years of age available for the screening project.

Conclusions: This project addresses significant barriers to early identification, diagnosis and treatment of autism in Argentina by increasing public and professional awareness of autism spectrum disorders, increasing knowledge of public health research methodology, and providing training and expertise to health providers and educators in early identification and diagnosis. It will build infrastructure in Argentina for early identification and population-based surveillance of children with ASDs which is necessary for future health planning initiatives, risk factor studies, and appropriate clinical interventions. Through this effort, in-country and international relationships will be strengthened and expanded and the ASD research and clinical capacity in Argentina will be greatly enhanced.

121.143 143 An Epidemiological Review Study on the Prevalence and Incidence Rate of Autism Spectrum Disorder in Ethnic Chinese Population. L. Feng[1] and J. Wong*[2], (1)*National Univeristy of Singapore*, (2)*National University of Singapore*

Background: Recent data from the West suggest that autism spectrum disorder (ASD) is becoming more prevalent. In Asia, the latest study from Korea reported a high rate of 2.64 percent.(1) It is not known whether there is an increasing trend of ASD among Chinese.

Objectives: To present the findings of a systemic review of epidemiologic data (prevalence and incidence) of ASD from major studies conducted in Chinese populations.

Methods: We conducted a systemic review on studies that reported the prevalence and/or incidence of ASD among Chinese populations (mainland China, Hong Kong, Taiwan, Singapore, and Malaysia).

Results: There is no national wide survey data on ASD in mainland China. Local data are available only in recent years and the reported prevalence ranged from 0.28‰ to 7.54‰.(2-4) The latest study reported an overall prevalence of 7.54‰ among preschool children in mainstream kindergartens. The rate for autism, Asperger syndrome and pervasive developmental disorder-not otherwise specified was 2.95‰, 4.1‰ and 0.49‰ respectively.(5)

In Hong Kong, Wong et al calculated the incidence and prevalence of autism spectrum disorder for the period of 1986 to 2005 based on registry data and population demographics. The estimated incidence of autism spectrum disorder was 5.49 per 10,000 person-Years. The average prevalence rate was 1.61‰ and there was a steady increase of the prevalence rate over the 20 years period.(6)

In Taiwan, Chien and colleagues reported that the cumulative prevalence of ASD increased from 0.18 to 2.87‰ from 1996 to 2005. The annual incidence rate increased from 0.91 to 4.41 per 10,000 per year from 1997 to 2005.(7)However, the rates were calculated based on health insurance database and may not reflect the real frequency in the population.

There is a large Chinese resident population in Singapore (approximately 3.8 million) and Malaysia (approximately 5.6 million) respectively. Currently there is no published data on the prevalence and incidence of ASD among Chinese Singaporeans and Chinese Malaysian.

Conclusions: There are limited studies reporting on ASD prevalence and incidence rates in ethnic Chinese population in Asia. This is further limited by the differing study methodologies making the data comparison challenging. While existing data appear to suggest, it remains unclear whether there is a true rise in the prevalence of ASD in ethnic Chinese population across geographic sites. A collaborative multi-site population-based epidemiologic study being planned would be able to yield much needed information for service planning.

121.144 144 The Validity of Modified Checklist for Autism in Toddlers (M-CHAT) in Turkish. B. Kara[1], N. M. Mukaddes*[2], I. Altintas[3], D. Guntepe[3], G. Gokcay[3] and M. Ozmen[3], (1)*Kocaeli Medical School*, (2)*Istanbul*

University,Istanbul Faculty of Medicine, (3)*Istanbul University*

Background: The Modified Checklist for Autism in Toddlers (M-CHAT) is one of the specific measures designed for use in pediatric setting to identify toddlers at risk for autism (Robins et al, 2001). The psychometric properties of this instrument have been examined in several language and cultures however, there is no study investigating the psychometric properties of the M-CHAT in Turkish.

Objectives: To evaluate the validity of the M-CHAT (Modified Checklist for Autism in Toddlers) in Turkish, as a screening test for pervasive developmental disorders in children, in an 18-36 month-old sample from Istanbul.

Methods: **:** The M-CHAT questionnaire was filled out independently by 191 mothers and/or fathers, when they were waiting for the well-child examination of their child. A high screen positive rate was found. A telephone interview was carried out with parents to confirm the answers. At the telephone interview most positive screens reverted to negative. Because of this unacceptably high false positive rate, a second study was done, in which the M-CHAT was administered by healthcare staff in a short interview with parents to two groups. In the first group (high risk group), there were 80 children at 18-36 months of age, who were initially diagnosed with a Pervasive Developmental Disorder at the Child Neurology Department of Istanbul Medical Faculty, Istanbul University. In the second (low risk group), there were 538 children of the same age, who were regularly followed by the Well Child Clinic of Istanbul Medical Faculty, Istanbul University. Two screen positives were found in the low risk group. These two children, a random sample of the 120 children from the low risk group and all of the high risk group were invited to a clinical evaluation. Diagnostic evaluation was done using Childhood Autism Rating Scale (CARS) and DSM-IV-TR diagnostic criteria. The validity of the M-CHAT was assessed against clinical diagnosis and CARS.

Results: The sensitivity, specificity, positive predictive value and negative predictive value of the M-CHAT test were found 95,7%, 88,7%, 75%, and 98,3%, respectively.

Conclusions: The validity of the M-CHAT in Turkey depends on the administration method. The sensitivity, specificity, positive and negative predictive value of M-CHAT were high, when the healthcare staff interviewed parents to complete the questionnaire. Our findings led us to conclude that M-CHAT is a useful tool in Turkey for screening of pervasive developmental disorders in primary care, after the age of 18 months, but that parents cannot complete it independently with specifity for autism.

121.145 145 External Validation of Autism Spectrum Disorder Classification in the Utah Autism and Developmental Disabilities Monitoring (ADDM) Network Site. D. Bilder*[1], J. Pinborough-Zimmerman[1], A. V. Bakian[2], P. Carbone[1], P. B. Petersen[3] and C. E. Rice[4], (1)*University of Utah School of Medicine*, (2)*University of Utah*, (3)*Carmen B. Pingree School for Children with Autism*, (4)*National Center on Birth Defects and Developmental Disabilities*

Background: Prevalence of Autism Spectrum Disorders (ASD) is estimated in Utah as part of the Autism and Developmental Disabilities Monitoring (ADDM) Network. The ADDM Network uses a multi-source, population-based approach to identify children with an ASD from existing education and health records. Given recent increases in ASD prevalence across ADDM Network sites including Utah, evaluating the potential for misclassification is important.

Objectives: This study's objectives were: 1) measure agreement in classifying children as an ASD case between Utah ADDM (UT ADDM) clinician review and independent expert reviewers for final case definition, and 2) identify factors responsible for disagreement in final case status between the UT ADDM clinician review and independent expert review.

Methods: UT ADDM clinician reviewers used a coding guide based on the *DSM-IV-TR* criteria for autistic disorder and ASD-NOS (PDD, PDD-NOS, Asperger's) to identify eight-year-old children with ASD in study year 2008 from developmental and behavioral information abstracted from existing records. Thirty records from children classified and thirty records from children not classified as ASD cases according to ADDM

protocol were randomly selected and given to three independent reviewers considered medical experts in ASD diagnosis. The independent reviewers, blinded to UT ADDM case status, evaluated the records and reported impressions including final case definition (ASD case vs. non-case) and ASD subtype classification (Autism vs. ASD-NOS), degree of case certainty, reasons for low certainty or non-case status, and quality of record. Reliability was measured using Cohen's kappa measure of agreement. Multiple logistic regression models were formulated to investigate the factors responsible for disagreement in final case status between UT ADDM clinician review and independent expert review.

Results: Strong two-way agreement was achieved between the UT ADDM clinician reviewers and each of the three independent expert reviewers for final case definition (case versus non-case; $\kappa = 0.82$, 0.92 and 0.82). However, there was fair two-way agreement for ASD classification subtype (Autism vs. ASD-NOS; $\kappa = 0.33$, 0.36, and 0.13). This was not surprising as ADDM subtyping is based on the number and pattern of behaviors in the records, rather than clinical judgment. Despite strong agreement on two-way final case definition, disagreement occurred with UT ADDM for at least one of the expert reviewers in 9 out of 30 records classified as a case by UT ADDM. The record–level factors found to influence discordance in final case definition included independent expert reviewer's rating of record quality (p =0.01) and degree of certainty (p = 0.007). Reviewers most often cited that the child's profile could possibly be accounted for by Intellectual Disability as the reason for not classifying a child as an ASD case.

Conclusions: Overall, there was very good agreement between UT ADDM and independent expert reviewers on ASD case status providing support for ADDM ASD prevalence estimates. Our findings are consistent with other studies that have found conflicting agreement among clinicians in the identification of ASD subtypes.

121.146 146 Autism Incidence and Prevalence in California, 2000-2010. A. S. Winter* and P. S. Bearman, *Columbia University*

Background: Both the incidence and prevalence of autism in the United States have risen steadily over the past few decades. The most recent widely cited estimate of the prevalence rate of Autism Spectrum Disorders is from 2006 and is one in every 110 children aged eight years. Whether the prevalence of autism in the United States has continued to increase, remained stable, or even decreased since 2006 is currently not known.

Objectives: In this paper, we estimate the incidence and prevalence rates for autism in the state of California for the years 2000 through 2010 using the largest administrative dataset available. We then examine the demographic and socioeconomic composition as well as the developmental functioning of those who were diagnosed during the study period.

Methods: To calculate incidence and prevalence rates of autism in California, we link the state's Birth Master Files to the Department of Developmental Services' (DDS) annual autism caseload records. We then explore factors that may influence observed trends by determining whether the groups of children diagnosed in each year vary by sex, age, race/ethnicity, Medi-Cal status, maternal education, maternal age at birth, or presence of intellectual disability.

Results: The incidence of autism for children between the ages of three and nine in California rose between 2000 and 2008 but then declined from 2008 to 2010. This most recent dip in autism incidence could be the result of changes within the DDS' reporting system that were made in 2008 or cuts that were made to the DDS' budget due to California's budget deficit. Between 2000 and 2010: the sex ratio of those diagnosed with autism remained relatively stable; age of diagnosis decreased; the proportion of Hispanic people being diagnosed with autism increased; the maternal level of education of those being diagnosed remained relatively stable; and the percentage of people diagnosed with autism who also had DDS record of intellectual disability decreased.

Conclusions: Overall, autism incidence rose between 2000 and 2008 and then declined between 2008 and 2010. Not only are our results the most recent estimate of the incidence of autism in the United States to date, but we also used a statewide dataset, the largest dataset of its kind available.

121.147 147 Spatio-Temporal Patterns of Relative Risk for Autism Spectrum Disorders in Utah. A. V. Bakian*, J. Pinborough-Zimmerman and W. M. McMahon, *University of Utah*

Background: A spatio-temporal analysis of relative risk describes variation in the risk of a disease or condition across a geographical region. Discrepancy in the spatio-temporal relative risk of Autism Spectrum Disorders (ASDs) across a surveillance region may infer variation in the biological and/or environmental risk factors associated with ASDs, the availability of services for children with ASDs, or disparities in the identification of ASDs by race/ethnicity and/or socioeconomic class. A 100% increase in the measured prevalence of ASDs among eight-year-old children was reported in Utah between 2002 and 2008 (Pinborough-Zimmerman et al. 2011). Despite this overall increase in prevalence, localized variation likely existed in the relative risk for ASD across space and time within the surveillance region during this study period.

Objectives: The purpose of this study was to model spatio-temporal patterns of risk for ASDs in three birth cohorts in a three county surveillance region in Utah. The following objectives were addressed: 1) identify areas of significantly heightened relative risk, 2) determine the temporal persistence of areas of heightened relative risk across birth cohorts, and 3) describe changes in the size and geometry of relative risk hotspots across years.

Methods: Using an administrative multisource record review methodology, ASDs (n = 590) were identified in eight-year-old children born in 1994, 1998, and 2000 and residing in a three county surveillance region by the Utah Registry of Autism and Developmental Disabilities (URADD). The control population (n = 10,534) was comprised of a gender-matched, random selection of children from these birth cohort's birth certificates. Maternal residential birth addresses of cases and controls were geocoded by the Utah Department of Health and then linked to URADD. Spatio-temporal relative risk was modeled using adaptive kernel-smoothed relative risk functions (Kelsall and Diggle 1995), and areas of heightened relative risk (or relative risk hotspots) were identified using asymptotic normality approximations (Davies and Hazelton 2010).

Results: Heightened areas of spatial relative risk were identified in all three birth cohorts. Relative risk varied from 0.5 to 2.4 throughout the surveillance region. Three areas of heightened relative risk were observed in the 1994 and 2000 birth cohorts. Four areas of heightened relative risk were identified in the 1998 birth cohort. Two areas of heightened relative risk persisted across the three study years. The temporally stable relative risk hotspots covered a larger area of the surveillance region in 2002 than in 2006 but increased in size again in 2008.

Conclusions: Both temporally stable and ephemeral areas of heightened relative risk for ASD were identified. In these hotspots, children were at 1.4-2.4 times greater risk for ASD than children residing elsewhere in the surveillance region. The existence of temporally stable and single-year relative risk hotspots indicates that both long-term and short-term effects influence the spatial pattern of relative risk in Utah. The next step will involve statistical modeling to elucidate the potential variables responsible for these different spatio-temporal patterns including neighborhood effects, locally distributed environmental or biological risk factors, social or familial effects, ascertainment bias, and/or sociodemographic variables.

121.148 148 Prevalence and Case Validity of Autism Spectrum Disorders in the Stockholm Youth Cohort. S. Idring*[1], D. Rai[1], H. Dal[1], C. Dalman[1], H. Sturm[1], E. Zander[1], B. K. Lee[2], E. Serlachius[1] and C. Magnusson[1], (1)*Karolinska Institutet*, (2)*Drexel University School of Public Health*

Background: The prevalence of autism spectrum disorders (ASD) has risen sharply over the past two decades and is now estimated at approximately 1% to as high as 2.6% in recent large-scale studies. Recent Scandinavian reports are inconsistent, with rates ranging from 0.1 to 1%. Although changes in diagnostic practices and wider recognition may explain part of the observed rise, a true increase in incidence of ASDs has not been ruled out. Therefore, there is a need of large, prospective, population-based studies exploring modifiable risk factors.

Objectives: To describe the study design of the Stockholm Youth Cohort (SYC), a register-based total population study

with extensive and prospectively recorded information on potential determinants and consequences of ASD. Furthermore, to determine the prevalence of ASD with and without comorbid intellectual disability and explore the validity of registry-based diagnoses.

Methods: The Stockholm Youth Cohort is a record-linkage study comprising all individuals aged 0-17 years, ever resident in Stockholm County in 2001-2007 (N=589,114). Cases (N=4,952) were identified using a multisource approach, involving registers covering all pathways to ASD diagnosis and care, and categorized according to presence of co-morbid intellectual disability. Clinical notes for 177 randomly selected cases were reviewed in detail to ascertain case validity.

Results: The 2007 year prevalence of ASD in all youths was 1.1%, presenting with intellectual disability in 42% of cases. Prevalence varied across birth cohorts, peaking at 1.4% for children aged 12-16 years. Clinical notes for 177 randomly selected cases were reviewed, and ASD diagnosis confirmed in 96%.

Conclusions: Findings from this contemporary total population cohort, set in Stockholm County, is in accordance with recently reported estimates from Western countries at around 1%, based on valid case ascertainment. The Stockholm Youth Cohort, in light of the availability of extensive information from Sweden's comprehensive registers, constitutes an important resource for ASD research. Ongoing work, including collection of biological samples, will enrich the study further over coming years.

121.149 149 The Study to Explore Early Development: Study Design and Implementation of a Multi-Site Epidemiologic Study in Autism. D. E. Schendel*[1], C. DiGuiseppi[2], L. A. Croen[3], M. D. Fallin[4], P. Reed[5], L. A. Schieve[6], L. D. Wiggins[1], J. L. Daniels[7], J. K. Grether[8], S. E. Levy[9], L. Miller[10], C. J. Newschaffer[11], J. A. Pinto-Martin[12], C. Robinson[13], G. Windham[8], A. A. Alexander[14], A. S. Aylsworth[7], P. Bernal[15], J. Bonner[5], L. Blaskey[9], C. Bradley[16], J. Collins[17], C. J. Ferretti[18], H. Farzadegan[19], E. Giarelli[20], M. Harvey[14], S. Hepburn[21], M. Herr[22], K. Kaparich[2], R. J. Landa[23], L. C. Lee[24], B. Levenseller[25], S. Meyerer[24], M. H. Rahbar[26], A. Ratchford[27], A. M. Reynolds[2], S. Rosenberg[2], J. Rusyniak[28], S. Shapira[29], K. S. Smith[8], M. C. Souders[30], P. A. Thompson[5], L. Young[31] and M. Yeargin-Allsopp[1], (1)*Centers for Disease Control and Prevention*, (2)*University of Colorado Denver*, (3)*Kaiser Permanente Division of Research*, (4)*Johns Hopkins School of Public Health*, (5)*Michigan State University*, (6)*National Center on Birth Defects and Developmental Disabilities*, (7)*University of North Carolina*, (8)*California Department of Public Health*, (9)*Children's Hospital of Philadelphia*, (10)*Colorado Dept of Public Health and Environment*, (11)*Drexel University School of Public Health*, (12)*University of Pennsylvania School of Nursing and School of Medicine*, (13)*University of Colorado Denver School of Medicine*, (14)*National Center on Birth Defects* , (15)*Kaiser Permanente*, (16)*University of North Carolina at Chapel Hill*, (17)*Kaiser Permanente, Division of Research*, (18)*Center for Autism, Childrens Hospital of Philadelphia*, (19)*Department of Epidemiology, Johns Hopkins University Bloomberg School of Public Health*, (20)*University of Pennsylvania*, (21)*University of Colorado Denver, Anscutz Medical Campus*, (22)*University of North Carolina* , (23)*Kennedy Krieger Institute*, (24)*Johns Hopkins Bloomberg School of Public Health*, (25)*University of Pennsylvania School of Nursing*, (26)*The University of Texas Health Science Center at Houston*, (27)*Colorado Department of Public Health and Environment*, (28)*Kennedy Krieger Institute and Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine*, (29)*National Center on Birth Defects and Developmental Disabilities (NCBDDD)*, (30)*University of Pennsylvania/The Children's Hospital of Philadelphia*, (31)*University of Pennsylvania, School of Nursing*

Background: Apart from the identification of some rare genetic conditions that commonly are associated with autism spectrum disorders (ASD), causal mechanisms for the disorders remain largely unknown. The Study to Explore Early Development (SEED) was designed by the Centers for Autism and Developmental Disabilities Research and Epidemiology

(CADDRE) Network to address gaps in understanding of the ASD phenotype and etiology.

Objectives: Investigate (1) ASD behavioral phenotype and associated developmental, medical, and psychiatric conditions with a special focus on identifying distinct symptom profiles to guide etiologic analysis and (2) genetic and environmental risk factors, with emphasis on immunologic, hormonal, medical, and sociodemographic characteristics.

Methods: Case–control design with population-based ascertainment of children aged 2–5 years with an ASD and children in two control groups&hibar;one from the general population (POP) and one with non-ASD developmental problems (DD). Potential ASD and DD children are ascertained through multiple sources using a broad diagnostic net to ensure that both diagnosed and undiagnosed ASD children are identified. POP children are identified from birth certificates. Potential participants are contacted via written invitation followed by telephone contact for eligibility and ASD screening. The Social Communication Questionnaire (SCQ) is administered to all participants to determine which children require full clinical evaluation to determine final ASD classification. Final classifications are dependent on the child's ascertainment source (broad diagnostic net or birth certificate), SCQ results and, when indicated, results from the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diag nostic Interview–Revised (ADI-R). Participant data are from parent-completed questionnaires, interviews, clinical evaluations, biospecimen sampling (blood samples, dried blood spot cards, hair, buccal swabs), and medical record abstraction. Systematic quality control (QC) is conducted for each contact with participants. Health and education professionals, voluntary organizations, and parents were engaged in SEED development and implementation.

Results: Enrollment was initiated in late 2007. Among 19,682 ASD/DD and 24,279 POP families for whom the invitation process has been finalized: 63% ASD/DD and 68% POP families never responded to the written invitation or invitation call (in 77% ASD/DD and 80% POP non-responders, accuracy of contact information was unknown); 10% ASD/DD and 12% POP children exceeded the eligible age limit before contact could be made; 27% ASD/DD and 20% POP families were contacted by telephone. Among 5, 263 ASD/DD and 4,879 POP families with telephone contact: 34% ASD/DD and 39% POP families refused; 22% ASD/DD and 35% POP families were ineligible; 43% of ASD/DD and 25% POP families consented to participate. Among 3,576 participants, 972 of 1,525 (64%) in the ASD workflow and 1,344 of 2,051 (66%) in the DD/POP workflow were assigned a final study group classification: 600 Final ASD (of which 116 (19%) did not have a previous ASD diagnosis), 83 Possible ASD, 835 Final DD, 798 Final POP.

Conclusions: The richness of SEED's detailed phenotype, environment, genetic, and biomarker data and the large, well-defined study sample will permit the simultaneous investigation of numerous genetic, environmental and phenotypic features and their interplay.

121.150 150 Demographic Profile of Families and Children Enrolled in the Study to Explore Early Development (SEED): A Case-Control Study of Autism Spectrum Disorder. C. DiGuiseppi*[1], J. L. Daniels[2], M. D. Fallin[3], S. Rosenberg[1], L. A. Schieve[4], K. C. Thomas[2], G. Windham[5], P. Bernal[6], L. A. Croen[7], L. C. Lee[8], L. Miller[9], J. A. Pinto-Martin[10] and D. E. Schendel[11], (1)*University of Colorado Denver*, (2)*University of North Carolina*, (3)*Johns Hopkins School of Public Health*, (4)*National Center on Birth Defects and Developmental Disabilities*, (5)*California Department of Public Health*, (6)*Kaiser Permanente*, (7)*Kaiser Permanente, Division of Research*, (8)*Johns Hopkins Bloomberg School of Public Health*, (9)*Colorado Dept of Public Health and Environment*, (10)*University of Pennsylvania School of Nursing and School of Medicine*, (11)*Centers for Disease Control and Prevention*

Background: The Study to Explore Early Development (SEED) was designed to enhance knowledge of autism spectrum disorder (ASD) characteristics and etiologies. Disparities in ASD prevalence according to race, ethnicity, and socioeconomic status have been reported, which may reflect differences in underlying etiologies or in ascertainment or diagnosis. SEED presents a unique opportunity to investigate

the demographic profile of ASD because of its population-based, multi-site ascertainment and large sample size.

Objectives: Our objective was to describe the demographic profile of families and children enrolled in SEED, and compare demographic characteristics among the three study groups: children with ASD, children with developmental delay or disorder (DD) and population controls (POP).

Methods: Children aged 2-5 years were ascertained through birth certificate records and multiple health and education sources serving children with developmental problems. The primary caregiver was interviewed to collect demographic characteristics of the household, biological parents, and enrolled child. Groups were compared using ANOVA or multinomial logistic regression, as appropriate.

Results: Caregiver interviews were completed for 2,229 children enrolled between December 2007 and May 2011, including 597 ASD, 835 DD, and 797 POP. Child mean age at enrollment (M=54.9 months, SD=7.7) did not differ by study group. Overall, 64.8% were male; as expected, child sex differed significantly among the three groups, ranging from 52.8% in POP controls to 79.2% in children with ASD. Mean maternal and paternal ages at child's birth were 31.9 years (SD=5.5) and 34.1 years (SD=6.1), respectively. Maternal race included White (69.0%), Black (15.9%), Asian (5.1%), Multi-Racial (4.5%) and Other Race (5.4%). Among mothers, 11.9% were Hispanic, 17.8% were foreign born and 10.6% primarily spoke a language other than English. Mothers were well educated, with 85.4% having had at least some formal education after high school and only 5.3% not having finished high school. Characteristics of fathers were similar to those of mothers: 17.3% were Black, 4.8% Asian, 3.2% Multi-Racial, and 6.3% Other Race; 12.1% were Hispanic; 18.2% were foreign born; and 76.3% had some formal education after high school. Total household income in the year prior to the interview was generally high; 28.5% had yearly incomes greater than $110,000 while only 31.8% had incomes of $50,000 (median US household income) or less. Average household size was 4.3 (SD=1.2). There were significant differences among the three study groups in household income and in maternal and paternal race, ethnicity, country of birth, primary language, and education. There were no group differences for maternal or paternal age or household size.

Conclusions: SEED successfully enrolled a diverse sample of participants, including substantial proportions of minority and immigrant families. Although the sample was generally high income and well educated, socioeconomic differences among the three study groups were nevertheless identified, as were other demographic differences by group. SEED offers important opportunities to explore sociodemographic risk factors related to ASD.

121.151 151 A School-Based Prevalence Estimate of Autistic Symptoms in 3-8 Year Olds: Preliminary Results From Two Indian Cities. B. Chakrabarti*[1], A. Rudra[2], S. Banerjee[3], N. Singhal[4], M. Barua[4] and S. Mukerji[3], (1)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (2)*University of Reading*, (3)*Creating Connections*, (4)*Action for Autism, National Centre for Autism*

Background:

While estimates (based on studies in the UK and USA) suggest that India could have more than 2 million children with Autism Spectrum Disorders (ASD) (Krishnamurthy 2008), this remains to be tested. Prevalence estimates from Asian countries vary widely across time and country (China :0.003%- 0.17%, Japan: 0.011%-0.21% (Sun and Allison 2010); South Korea: 2.64% (Kim et al., 2011)). This variation could be due to a) the use of different screening and diagnostic instruments, b) differences in cultural norms for identifying ASD, and c) different levels of awareness about ASD and autistic behaviour in the target population across time and region, and d) genetic differences between populations. There is thus an urgent need to measure the prevalence of ASD in India.

Objectives:

To conduct the first stage of a pilot epidemiological study of ASD on children in mainstream and special schools in two Indian cities, Delhi and Kolkata, using a standardized screening instrument, translated into the local languages.

Methods:

Schools from all socio-economic sectors were selected from 3 municipal wards each in Delhi and Kolkata. A minimum of 6500 children of 3 to 8 years in each city was targeted as the initial sample size. The 12-item Social Communication Disorder Checklist (SCDC) (Skuse et al, 1995) questionnaire (sensitivity=0.9, specificity=0.69 in detecting ASD) was translated into Hindi and Bengali and validated (see Abstract#10869 Rudra et al.). The questionnaire along with information sheets and consent forms were distributed to parents/caregivers. The same questionnaire was administered personally on consenting class teachers of all schools as well as to the parents who were unable to read.

Results:

Teacher-report data on SCDC was obtained for 7000 children in Delhi and 6500 children in Kolkata. Of these 6.3% in Delhi and 6.74 % in Kolkata met the cut off score of 9 on SCDC. 29.74% parent response was obtained in Delhi and 51% parent response was obtained in Kolkata. A surprisingly high percentage (Delhi: 32.32%, Kolkata :23.1%) of the children met the cut off (scored >=9) on the parent report data on SCDC.

Conclusions:

Preliminary data suggests a high prevalence of autistic symptoms (measured using SCDC) on an initial sample of >6500 children each in two cities. This maybe due to a number of reasons that include a) the modest specificity of SCDC, b) over-reporting by parents who are particularly concerned about their children, and c) cultural norms and/or genetic differences at a population level. The planned next stage is to follow up the screen positive children from this stage with confirmatory diagnostic questionnaires and interviews (e.g. the ADOS and the SCQ), using a design similar to (Allison et al 2009). It is hoped that this data will contribute to generating a prevalence estimate of ASD in India that will, in turn, a) help determine the economic burden of the disease, and b) inform the development of appropriate policy for supporting children with ASD in this region.

121.152 152 The EARLI Study As a Resource for Autism Etiologic Research. C. J. Newschaffer*[1], L. A. Croen[2], M. D. Fallin[3], I. Hertz-Picciotto[4], H. Farzadegan[5] and D. Nguyen[4], (1)*Drexel University School of Public Health*, (2)*Kaiser Permanente Division of Research*, (3)*Johns Hopkins School of Public Health*, (4)*UC Davis*, (5)*Department of Epidemiology, Johns Hopkins University Bloomberg School of Public Health*

Background: Infant sibling studies have been at the vanguard of autism spectrum disorder (ASD) research over the past decade, providing important new knowledge about the earliest emerging signs of ASD and expanding our understanding of the developmental course of this complex disorder. Studies focused on siblings of children with ASD also have unrealized potential for contributing to ASD etiologic research. Moving the targeted time of enrollment back from infancy toward conception creates tremendous opportunities for optimally studying risk factors and risk biomarkers during the pre-, peri- and neonatal periods. By doing so, a traditional sibling study, which already incorporates close developmental follow-up of at-risk infants through the third year of life, is essentially reconfigured as an enriched-risk pregnancy cohort study.

Objectives: To describe, in detail, the design, data collection approach, and progress to date for the Early Autism Risk Longitudinal Investigation (EARLI) – a multisite, autism enriched risk pregnancy cohort study that has now been in the field for 2 ½ of its planned ten years. Our goal is to provide a larger segment of the autism research community with a more in-depth understanding of EARLI in order to catalyze collaborative opportunities and maximize the scientific return from this valuable cohort.

Methods: ASD enriched-risk prospective pregnancy cohort study.

Results: EARLI has enrolled 200 of a projected 850 women who are mothers of a child with ASD (proband) at the start of a subsequent pregnancy. 80% of currently enrolled families also have a participating biologic father. Proband diagnostic status is confirmed at enrollment and biologic samples collected. In depth longitudinal exposure data are collected at multiple points in pregnancy via self-report, biosampling, and environmental sampling. Biosamples are collected at delivery and babies (siblings) are followed for exposure (with serial biosamples) and developmental outcomes until age three.

138 at-risk siblings have been born into the cohort to date, with 69 six month and 32 12-month follow-up visits completed thus far. Self-report instrument completeness has been very good and biologic sampling compliance has also been strong. The EARLI biorepository already contains nearly 2000 aliquots each of serum plasma and whole blood, 1500 aliquots of extracted DNA, over 4000 urine sample aliquots, 150 semen sample aliquots, 550 placental biopsies, 425 breast milk aliquots and 200 meconium samples. Detailed maternal interviews have been completed on 99% of the subjects and the median number of weekly pregnancy diaries is 0.9 – close to the target of 1 per week. Dust samples have been collected at 94% of all home visits. At least one blood sample is available on 99.5% of all enrolled mother and 97% of enrolled fathers.

Conclusions: The EARLI study is building a comprehensive resource for analyses of potential autism risk factors and biomarkers. As an NIH Autism Center of Excellence Network, EARLI seeks to proactively engage members of the autism research community to explore alternative approaches by which EARLI can best advance our understanding of autism etiology.

121.153 153 A Pilot Project of Early Detection and Diagnosis of Autism Spectrum Disorders in a Public Children Hospital in Buenos Aires, Argentina. K. A. Gutson*[1], M. I. Colantonio Llambías[2], A. Rattazzi[1], N. Regatky[3], M. G. Salamanco[3] and I. M. Alfieri[3], (1)*PANAACEA*, (2)*Hospital de Niños* , (3)*Hospital de Niños "Dr. Ricardo Gutiérrez"*

A pilot project of early detection and diagnosis of autism spectrum disorders in a public children hospital in Buenos Aires, Argentina

Background: The use of autism screening tools in pediatric health check-ups of children between 18 and 24 months allow early identification of children with autism spectrum disorders (ASD). No studies in this respect have yet been published in Argentina.

Objectives: To facilitate the early identification of children at risk for autism spectrum disorders. Specific aims: 1) To explore the applicability of a standardized screening method for ASD in children attending a pediatric outpatient service; 2) To propose a procedure protocol for early diagnosis in children with ASD.

Methods: this is a prospective, cross-sectional, descriptive and diagnostic pilot study. A random sample of 100 children between 18 and 24 months of age without previous diagnosis of ASD or other developmental disorder who attended health check-ups at an outpatient service of a pediatric general hospital in Buenos Aires were screened. Parents completed the spanish version of the M-CHAT in the waiting room of the outpatient service. Posteriorly, a trained pediatrician administered the observational items of the CHAT (part B), checked M-CHAT responses and obtained a medical history of the child. Children who screened positive in the CHAT or M-CHAT, or who presented relevant clinical findings, underwent a diagnostic assessment using ADOS, ADI-R, a clinical evaluation, and VABS-II. Furthermore, they were evaluated by an interdisciplinary team constituted by a pediatrician, a child neurologist, child mental health professionals, a speech therapist, an audiologist and an ophthalmologist. Genetic testing was performed on patients diagnosed with ASD.

Results: Sample: 61 females, 39 males. 11 children screened positive (11%) 10 males and 1 female. Diagnoses: 3 Autistic Disorder, 1 PPD-NOS, 3 Developmental delay, 1 Speech delay, 1 Speech delay plus Reactive attachment disorder, 1 Reactive attachment disorder. 1 child did not receive the diagnostic assessment. 9 children screened positive in the M-CHAT and 2 children did by CHAT and clinical findings. Parents of 9 of the children were concerned about their child development previous to the screening, but only 3 had sought for medical assistance. However, none of the 3 received a proper response from health care system when they consulted.

Conclusions: The small sample size does not permit conclusions to be applied to the general population in Argentina. The implemented screening method was effective in our population as it detected all the patients who were later diagnosed with ASD. The study demonstrated the need to train pediatricians in the evaluation of early risk indicators, as in most cases, parental concerns existed prior to screening. As well, the study allowed the consolidation of a diagnostic

interdisciplinary team in a public hospital setting. Data obtained in this study support the need for more research on ASD culturally appropriate screening tools and on early identification procedure protocols of at-risk children.

121.154 154 The Early Start Saga Model: Community-Based Health Check-Ups for Screening Infants and Toddlers with Autism Spectrum Disorder in Japan. T. Haramaki*[1] and T. Kuroki[2], (1)*Saga University* , (2)*National Hospital Organization Hizen Psychiatric Center*

Background: Recently, it is recommended that screening of autism should be incorporated into routine medical practice for 2 year-old or younger children. The Early Start Saga Model, a community-based project for detecting and supporting children with autism spectrum disorder (ASD) at the earliest life stage in Saga Prefecture, Japan, launched in 2002 and has achieved a favorable outcome such as high rates (over 95%) of use of municipal health check-ups at the age of 1.5 and 3 years after birth. It consists of two steps of screening. The first step is to check development of children and to serve an open consultation for their mothers regarding child rearing, and to screen any diseases and developmental abnormalities by pediatricians. The second step is to detect children with high risk of ASD. To conduct the second step, public health nurses in the local community have been trained to perform a semi-structured interview with a mother using a questionnaire for ASD screening, which has been originally developed according to critical measures in research on early developmental milestones; e.g. joint attention, social smiles and other items, as shown in M-CHAT and Red Flags. The inter-rater reliability has been established.

Objectives: To validate community-based health check-ups for screening infants and toddlers with ASD, the rate of children with high risk of ASD was analyzed.

Methods: All data were collected from public health departments of all cities and counties in Saga Prefecture from 2008 to 2010 and analyzed statistically on the basis of the community birth-cohort survey.

Results: Among the children who visited health check-ups in each community, children with high risk of ASD were screened at the rate of from 11.1% to 17.1% in every year. The boy: girl ratio was 1.5 – 1.9: 1. Children followed up after screening examination eventually received definite diagnosis of ASD at a relatively high rate (appr. 30%).

Conclusions: The screening system of community-based health check-ups by public health nurses may be effective for detecting children with high risk of ASD. Further studies are needed to elucidate cumulative prevalence of ASD among high-risk children.

121.155 155 Overview of Population-Based ASD Screening Studies in Europe: 20 Years After CHAT. P. Garcia Primo[1], A. Hellendoorn[2], S. Schjolberg[3] and E. Van Daalen*[4], (1)*University of Salamanca*, (2)*Utrecht University*, (3)*The Norwegian Institute of Public Health*, (4)*University Medical Centre Utrecht*

Background: Great efforts have been put into developing methods for early identification of toddlers with autism spectrum disorder (ASD) across Europe since the Checklist for Autism in Toddlers (CHAT) was first developed in 1992. Many studies have used similar screening instruments. The administration of them, however, differs considerably.. A group of researchers involved in population-based ASD screening studies in Europe have gathered in order to collaborate and interchange experiences in this area. This group is part of COST action grant: "Enhancing the scientific study of early autism: A network to improve research, services and outcomes (ESSEA: www.cost-essea.com)"**. Objectives:** The first aim of this study is to provide a systematic overview of the different screening procedures and the corresponding validity measures for early identification of ASD used in all the population-based studies across Europe with the Checklist for Autism in Toddlers (CHAT), the Modified Checklist for Autism in Toddlers (M-CHAT), the Early Screening of Autistic Traits (ESAT), the Checklist for Early Signs of Developmental Disorders (CESDD), the Social Communication Questionnaire (SCQ), and the Communication and Symbolic Behavior-Scales-Developmental Profile-Infant Toddler Checklist (CSBS-DP-ITC). A second aim will be to describe the challenges regarding early screening by extracting data from this overview**. Methods:** MEDLINE and PsychINFO were used to find published ASD screening studies. Only population-

based screening studies conducted in Europe were selected. And investigated. Additional information not available in the articles and some unpublished data was gathered by approaching the main researchers through the COST-ESSEA network. Information from each study were either extracted from the article or calculated from gathered data . The resulting material was tabulated to make the data comparable and to extract the most important issues regarding early screening methods**. Results:** The administration and outcomes of the screening instruments vary on several aspects. While some screening tools are the same across studies, they are administered in combination with a different surveillance or first screening approach, subsequently influencing validity measures. Furthermore, ages at screening and during diagnostic procedures, and the time between assessments, vary across studies. This also affects sensitivity and specificity. At a very young age it might be hard to differentiate between ASD and other developmental disorders, and signs of ASD might be too subtle to recognize. Population screening at 14 months results in low sensitivity and many false positives. Studies are also not alike in the setting and procedures of the screeners**. Conclusions:** The screening procedures for the early identification of ASD across Europe differ on many aspects, including surveillance ages, procedures and setting. This affects the validity measures of those instruments and the identification of ASD. Since screening instruments for ASD are administered in varied ways it is valuable both for clinical and research purposes to have some kind of overview in which different methods are compared. Although it is impossible to draw firm conclusions as to which screening method is most effective, the overview and the issues raised may help future implementation of screening methods and thereby improve the early identification of ASD.

121.156 156 Prevalence of Autism Spectrum Disorders in Children: A Review of International Population-Based Studies. L. C. Lee*[1], R. A. Harrington[1] and C. E. Rice[2], (1)*Johns Hopkins Bloomberg School of Public Health*, (2)*National Center on Birth Defects and Developmental Disabilities*

Background: Prevalence estimates from well-designed epidemiologic studies help inform public health officials and policy makers as to the necessary allocation of resources for treatment and intervention programs for families affected by autism spectrum disorders (ASDs). In addition, secular trends in autism prevalence across nations with distinct racial/ethnic and environmental backgrounds can provide an alternative descriptive epidemiologic framework for formulating testable questions about heritable and environmental risk factors. Measuring ASD incidence can be problematic because the actual onset of an ASD is not necessarily related to the time of identification, so changes in identification patterns would influence trends in age-specific incidence rates. Prevalence estimates are based on new and existing cases up to a defined age. Therefore, looking at prevalence of ASDs in older children could potentially control for some of the challenges related to only focusing on incidence. For this reason, this review focuses on prevalence rather than incidence. By doing so, we hope to diminish any confounding that might be due to timing of identification in order to provide comparable numbers across studies worldwide to inform the ASD distribution.

Objectives: This study aims to review the most up-to-date reports on prevalence estimates of autistic disorder (AD) and ASDs in children from population-based studies in different continents and regions of the globe.

Methods: We reviewed 45 international population-based studies published from 1997 to 2011 on the prevalence of AD and ASDs in children. To minimize the diversities in diagnostic criteria and case ascertainment, only population-based studies that adopted DSM-IV, ICD-10, and/or comparable diagnostic systems (e.g., ADI-R and ADOS) were included. Point estimates and 95% CIs of prevalence rates were calculated and graphed by continent, ordered by median birth year.

Results: Overall, the medians of reported AD prevalence estimates, per 1,000, in the reviewed studies are 1.6 and 1.8 in North America, 1.4 in Scandinavia, 1.7 in Europe, 3.0 in Asia, and 3.2 in Australia. Median ASD prevalence per 1,000 are 6.6 in North America, 4.0 in Scandinavia, 4.4 and 5.7 in Europe, 6.3 and 8.6 in Asia, and 4.1 in Australia. For both AD and ASDs, higher prevalence was reported in more recent birth cohorts, and in older children.

Conclusions: Diagnostic criteria for AD are considered to be more akin to "classic" autism than are the criteria for other ASDs and are similar to the diagnostic criteria of earlier versions of the DSM and ICD. This suggests that the increase of AD, and likely ASD, prevalence internationally over time may reflect the influence of factors in addition to the change of autism diagnosis, such as development of available services, professional and public awareness, diagnostic practice, and early identification.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC.

121.157 157 Developing UK ASD Research Capacity: Regional and UK ASD Research Databases Include Children with Similar Characteristics. F. Warnell*, M. Johnson, H. McConachie and J. Parr, *Newcastle University*

Background: ASD research often requires large numbers of participants, or participants with uncommon characteristics. To improve recruitment to studies, and enable families to take part in research, we developed two large databases: the Database of Children with ASD in the North East (Dasl^{n}e) from 2003, and a pilot national database, the Autism Spectrum Database-UK (ASD-UK) from 2011.

Objectives: To identify the similarities and differences between the children included in Dasl^{n}e (shown representative of the Regional population, McConachie et al., 2009 *Archives of Disease in Childhood*) and the children recruited in the first 6 months to the national ASD-UK. To show ASD researchers from the UK and abroad the extent to which the databases include children who are broadly representative of the overall childhood ASD population.

Methods: Children with ASD are identified in North East England through local ASD assessment teams, and lists held by education. For ASD-UK, parents are approached through Child Development Teams. All parents give informed consent, and complete information packs about themselves and their child (or children) with ASD, and siblings. Child's diagnosis data are validated through information obtained from clinicians. For this analysis, data on child characteristics were compared.

Results: After 8 years, Dasl^{n}e includes 1038 children – around 55% of children aged 2-18 diagnosed with ASD from the population. After 6 months' recruitment, 203 children have been included on ASD-UK. Due to its sampling method, ASD-UK includes a slightly higher proportion of children diagnosed before age 6 years than Dasl^{n}e (61% vs. 55% respectively); 14% of Dasl^{n}e children were diagnosed when aged 9 or over. Related to age at diagnosis and local diagnostic practice, the databases vary somewhat in proportions of children with parent-reported specific diagnoses: Autism 19% ASD-UK vs. 26% Dasl^{n}e, Asperger syndrome 13% vs. 23%, and ASD 64% vs. 45% respectively. The proportions of boys and girls with specific diagnoses are, however, similar between ASD-UK and Dasl^{n}e: Autism: boys 74% vs. 83%; girls 26% vs. 17%; Asperger syndrome: boys 93% vs. 88%; girls 7% vs. 12%; ASD: boys 87% vs. 86%; girls 13% vs. 14%. Learning disability is more common in ASD-UK than Dasl^{n}e children (42% vs. 32% respectively). However, the proportion of children receiving statutory educational support is very similar (54% vs. 51% respectively). School age children from the databases are similarly likely to attend mainstream school (57 vs. 51%), or a support unit attached to a mainstream school (10% vs. 11%).

Conclusions: Despite their different sampling frames, and differences in the methods of recruitment for Dasl^{n}e and ASD-UK, many of the characteristics of the children included in the databases are very similar. The large number of children that will be recruited through ASD-UK seem likely to be as representative of the overall ASD population as our large and successful Regional database. Researchers wishing to recruit from ASD-UK and the population-based Dasl^{n}e can identify which is more scientifically appropriate for their study, knowing that the two databases are both as representative as possible of the ASD child population.

121.158 158 A Diverse Autism Registry for Etiologic and Effectiveness Studies: Prevalence and Demographic Characteristics. L. A. Croen*[1], M. A. Lutsky[1], V. M. Yau[1], Y. Qian[1], F. Lynch[2], K. Pearson[2], A. Owen-Smith[3], R. Davis[3], J. Cummings[4], K. Coleman[5], V. Quinn[5], K. Schenk[5], J. Madden[6] and M. Lakoma[6], (1)*Kaiser*

Permanente Division of Research, (2)*Kaiser Permanente Center for Health Research*, (3)*Kaiser Permanente Center for Health Research Southeast*, (4)*Emory University*, (5)*Kaiser Permanente Research and Evaluation*, (6)*Harvard Pilgrim Healthcare Institute*

Background: While the numbers of individuals with Autism Spectrum Disorders (ASD) continues to grow and new interventions and treatments are introduced, effectiveness studies of autism treatments remain sparse. The major limitations to conducting such studies include locating, characterizing, and enrolling sufficiently large and representative ASD patient samples.

Objectives: To create a large, comprehensive and dynamic ASD registry across several integrated health systems participating in the NIMH Mental Health Research Network (MHRN). This registry will enable rapid identification and enrollment of patients into future large-scale comparative effectiveness studies testing treatment and preventive and services interventions, as well as future pharmacogenomic and etiologic investigations.

Methods: The MHRN includes nine public-domain research centers based in integrated not-for-profit HMOs. Combined, the MHRN serves a diverse patient population of 10 million people in 11 different states. The ASD registry is based in five of the nine participating MHRN sites: Kaiser Permanente (KP) Northern California, KP Southern California, KP Northwest, KP Georgia, and Harvard Pilgrim Health Plan. ASD registry investigators have developed case-finding algorithms in order to identify children with ASD from electronic medical records and health claims data. ASD diagnoses are validated using structured record review followed by expert review. Diagnostic and demographic data recorded in health plan electronic databases from 1995-2010 on all 0-17 year olds who were health plan members as of December 2010 were used to calculate preliminary estimates of ASD prevalence across all 5 participating sites.

Results: Among the 2,049,442 pediatric patients receiving health care at one of the five participating sites as of December 2010, 23,811 children with an ASD diagnosis were identified. The overall prevalence of ASD was 1.2%, and ranged from 0.86% to 1.6% across the five sites. As of December 2010, most ASD cases were 10-14 years old (36% across all sites, range: 35%-41%) or 5-9 (35% across all sites, range: 30%-36%). Fewer cases were seen in the 15-17 age group (18%, range: 16%- 22%) and the 0-4 age group (11%, range: 7%-12%). The ratio of male to female cases was 4.29 across all sites (range: 3.71-5.11). The majority of children diagnosed with an ASD were diagnosed with Autistic Disorder (n=14,061, 59% across all sites, range: 33%-71%).

Conclusions: Diversity of member demographics, insurance coverage, and organization of health services make this registry an ideal environment for studying variation in care, comparing effectiveness and cost of treatments across practice environments, and studying dissemination of information and health policies related to autism. Future aims include conducting web-based surveys of the parents of children affected by ASDs to identify use of services not provided by HMOs. Additional aims include collection of genetic material from individuals with ASD's and from family members, and harmonization of data from birth certificates, census information, standardized ASD assessment protocols, claims data, and EMR data.

121.159 159 Potential Effect of DSM-5 Diagnostic Criteria on ASD Prevalence Estimates. M. J. Maenner*[1], C. E. Rice[2], C. L. Arneson[1], A. V. Bakian[3], L. A. Carpenter[4], C. M. Cunniff[5], R. T. Fitzgerald[6], R. S. Kirby[7], L. Miller[8], C. Robinson[9], L. A. Schieve[2], K. Van Naarden Braun[10] and M. S. Durkin[1], (1)*University of Wisconsin-Madison*, (2)*National Center on Birth Defects and Developmental Disabilities*, (3)*University of Utah*, (4)*Medical University of South Carolina*, (5)*University of Arizona College of Medicine*, (6)*Washington University School of Medicine*, (7)*University of University of South Florida*, (8)*Colorado Dept of Public Health and Environment*, (9)*University of Colorado Denver School of Medicine*, (10)*Centers for Disease Control and Prevention*

Background: The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (*DSM-5*) will present revised diagnostic criteria for autism spectrum disorders (ASD). Previous modifications of the ASD diagnostic criteria are thought to contribute to temporal changes in ASD prevalence.

Future changes to ASD criteria have important implications for research, public health monitoring, clinical evaluation, and service delivery.

Objectives: To assess the effect of the *DSM-5* criteria on previous ASD prevalence estimates based on *DSM-IV-TR* criteria. A second goal was to compare children meeting the ASD case definition under both *DSM-5* and *DSM-IV-TR* coding schemes with children meeting the ASD case definition under the *DSM-IV-TR* scheme only.

Methods: The Autism and Developmental Disabilities Monitoring (ADDM) Network estimated ASD prevalence among a population of 308,038 8-year-olds in 11 US communities in 2006, using information abstracted from health and/or educational records. Trained clinicians systematically reviewed the abstracted information and determined case status using a coding scheme based on *DSM-IV-TR* criteria for autistic disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS). Of the 2,757 children that met the ADDM ASD case definition, 75.4% had a clinical diagnosis and/or a special education classification of autism/ASD noted in their records. We operationalized several different coding schemes for the *DSM-5* ASD criteria, and applied each scheme to the children meeting ADDM ASD case status. We compared the characteristics of those who met *DSM-*5 criteria to those who did not.

Results: Using the best-fitting and most "inclusive" *DSM-5* coding scheme, 21.5% (593 of 2,757) of children classified by ADDM as having ASD did not meet *DSM-5* criteria for ASD. Children meeting ADDM criteria for autistic disorder were more likely to meet *DSM-5* criteria than children meeting ADDM criteria for PDD-NOS (89.6% vs 40.0%). Children classified by ADDM as having ASD who had a previous clinical diagnosis or special education classification of autism were more likely to meet *DSM-5* criteria than those without a previous diagnosis or classification (83.0% vs 64.5%). The male:female ratio was slightly higher among children meeting than not meeting *DSM-5* criteria (5.0:1 vs 4.0:1). Children classified by ADDM as having ASD with IQ≤70 were more likely to meet *DSM-5* criteria than those with IQ>70 or unknown IQ (85.0% vs 78.6% vs 71.3%).

Conclusions: The changes to the ASD *DSM* criteria have the potential to affect many findings observed in epidemiological studies, to alter how clinical diagnoses are made, and have policy implications for using an ASD diagnosis as a criterion for services. Although the *DSM-5* ASD criteria do not differentiate between "subtypes" of ASD (i.e., Asperger syndrome, autistic disorder), the *DSM-5* ASD criteria appear more similar to the current criteria for autistic disorder than PDD-NOS. Further work is needed to operationalize specific *DSM-5* criteria for surveillance purposes and to ensure comparability across time points in surveillance systems.

121.160 160 Sensitivity of Autism Spectrum Disorder Prevalence Estimates to Private and Home School Enrollment and Denominator Choice in North Carolina. A. E. Kalkbrenner*[1], S. Watkins[2], K. Hoffman[2], P. Bell[2] and J. L. Daniels[2], (1)*University of Wisconsin at Milwaukee*, (2)*University of North Carolina*

Background: Accurate estimates of the prevalence of autism spectrum disorders (ASDs) over time are important for planning services and generating hypotheses about causality. The Autism and Developmental Disabilities Monitoring (ADDM) Network has generated population-based prevalence estimates bi-annually since 2000. ADDM methodology is considered to be more complete than individual administrative data sources, in that standardized criteria are applied to existing developmental evaluation records of children from both health and public educational settings without requiring a previous diagnosis. Still, limitations arise from incomplete enumeration of children with an ASD because not all agencies serving such children can be included. Limitations also arise from misspecification of the underlying population denominator; ADDM uses the number of 8-year old children projected by the US census.

Objectives: We evaluated the degree to which ASD prevalence estimates from North Carolina (NC) ADDM were influenced by 1) under-counting of children with an ASD in private and home-school settings, and by 2) using previously-considered alternate denominators.

Methods: We estimated ASD prevalence in 8 counties in central NC for 8 year olds in 2002, 2004, 2006, and 2008. Children meeting the NC ADDM case definition for ASDs were

classified based on whether their composite developmental record included a public school contribution, indicating public school enrollment. Denominators were derived using 1) birth counts based on NC birth certificates and 2) total school enrollment counts available from NC administrative data summing 8-year old children in public, private, and home school settings.

Results: NC ADDM measured an ASD prevalence of 9.8/1000 children during this period, including 738 children with an ASD with a public school record and 82 without. The number of 8-years olds in a private or home-school (non-public) setting was estimated to be 10,097 (12.4% of all school enrollment). If the true proportion of ASDs in the non-public setting equaled that in the public setting, 104 children with an ASD would be expected (leading to a 3% increase in overall prevalence). To increase the overall ASD prevalence by 10%, the proportion of children with an ASD coming from the non-public sector would need to be 16.2/1000. Using alternate denominators resulted in small increases in ASD prevalence estimates, which were 5% higher using birth cohorts and 3% higher using school enrollment data.

Conclusions: In NC, ADDM prevalence estimates of ASDs may underestimate true prevalence. Prevalence estimates would be 3-5% higher if birth cohorts or school enrollment counts more accurately enumerated the underlying population. Assuming that children with an ASD are just as likely to be in private or home school settings as in public schools, prevalence may be 3% higher if developmental evaluation records from these settings could be included. To have a substantial impact on overall prevalence (> 10%), the proportions of children with an ASD in the non-public setting would need to be > 1.6 times as high as what we observed among children with public educational contact. Studies that directly ascertain the extent of ASDs by educational setting would be needed to inform whether this increase is likely.

121.161 161 Does a Claims Diagnosis of Autism Mean a True Case?. J. Burke*[1], M. Kaiser[2], A. Jain[3], J. Marshall[3] and C. J. Newschaffer[4], (1)*Optum Insight*, (2)*University of Miami*, (3)*The Lewin Group*, (4)*Drexel University School of Public Health*

Background: Although Autism spectrum disorders (ASD) affect a large and heterogeneous group of children and adolescents, most studies of health outcomes in ASD to-date have included relatively small clinical and research samples, limiting their generalizability. Thus secondary analysis of a large administrative dataset containing medical, pharmacy and behavioral health claims for children with ASDs may be potentially useful for carrying out observational research studies. The extent to which claims-based approaches for identifying ASD cases in administrative data are accurately identifying true ASD cases has not been well-studied.

Objectives: To conduct a validation study of claims-based ASD case identification against medical charts.

Methods: From a large cohort of children enrolled in a large private health plan for 6 months between 2001-9 we sampled 1) children with 2+ claims with an ASD ICD-9 (n=180); 2) children with 1 claim with an ASD ICD-9 (n=180); and 3) children without claims with ASD ICD-9 codes who did have at least one claim for a neurodevelopmental condition (e.g., developmental delays, intellectual disabilities, language disorders) (n=58). Within each group the sample was further stratified for age (<8 years and >8 years), length of enrollment (<18 months and >18 months), and provider type (ASD specialist vs. other specialist vs. primary care). With provider consent, a single chart from a single provider was available for analysis limited to the time period of enrollment in the database/health plan. Following a protocol modeled after that used by the CDC ADDM Network, charts were examined and abstracted for information related to ASD diagnosis (including behavioral descriptions, history of developmental delay, referral for ASD assessment, evidence of developmental plateau or regression, tests or assessments for ASD, and other health conditions or concerns). Review of abstracted information was conducted by an experienced clinician also following the CDC ADDM protocol classifying children as confirmed ASD cases, suspected ASD cases or not meeting criteria. Results: Preliminary results are available on the first 111 (out of 418)

abstracted and reviewed charts. Positive predictive value having 2+ claims with an ASD ICD-9 codes was 88.9% [95% CI 79.6, 98.2] while the positive predictive value of having just one claim with an ASD ICD-9 was 68.3% [95% 53.4,83.4]. Predictive value was negative in the sample for children without ASD ICD-9 codes but with other ICD-9 codes for neurodevelopmental conditions. Only 4.5% of the subjects found not to meet chart review criteria for either confirmed or suspect ASD had clear ASD rule-out information in the medical chart.

Conclusions: An ASD case finding approach relying on the presence of 2 or more claims with ASD ICD-9 shows promise as a valid means to identify true ASD cases without bringing in substantive numbers of false positives.

Epidemiology Program

122 Social Risk Factors and Influences On Phenotype

122.162 162 Driving and Young Adults with ASD: Parents' Experiences. N. B. Cox*[1], R. E. Reeve[2], S. M. Cox[2] and D. J. Cox[2], (1)*Curry School of Education at the University of Virginia*, (2)*University of Virginia*

Background:

Learning to drive an automobile is an important step toward independence for most young adults. Social, vocational, and educational opportunities are substantially enhanced when individuals are able to transport themselves to and from activities. Given the symptoms with which they often present, individuals with Autism Spectrum Disorders (ASD) may experience an unusual degree of difficulty in acquiring driving skills, thus potentially limiting their independence. While driving challenges in youth with ASD are a fairly frequent concern expressed by parents, a review of the literature yielded only one empirical study specifically addressing this issue (references available upon request). This preliminary research provides evidence that individuals with ASD may encounter substantial challenges in learning to drive, and thus may require specialized training to drive safely.

Objectives:

Given the paucity of research regarding driving skills and individuals with Autism Spectrum Disorders (ASD), the current study sought to gain a better understanding of the process of learning to drive with ASD. In order to improve our understanding of the nature and extent of the difficulties individuals with ASD experience in learning to drive, we conducted an on-line survey of parents of adolescents/ young adults with ASD who were currently engaged, or had recently participated, in the process of learning to drive.

Methods:

The research team created an anonymous and voluntary Internet survey entitled “Learning to Drive with ASD” via Survey Monkey. The research team developed the survey questions based on similar driving surveys created by one of the authors for different populations (e.g., novice drivers with ADHD). Links to the survey were disseminated to a variety of regional and national ASD-related organizations that interact with parents of adolescents/young adults with ASD. These organizations then distributed the survey link to their constituents via email, website, social networking site, blog, discussion forum, email newsletter, and/or physical flyers.

Results:

Results from 123 respondents provide clear evidence that gaining the skills necessary to drive a car is a significant challenge for many adolescents and young adults with ASD. While individual skills such as speed control and maintaining lane position are relatively easier, more complex skills, such as merging into traffic or multi-tasking, are very challenging for the sons/daughters of most respondents. In response to open-ended questions regarding beneficial strategies, participants provided suggestions that may be useful to others who seek to teach these skills. Furthermore, a majority of respondents indicated that their son/daughter with ASD does not consider their condition as having a significant impact on driving. This suggests that teens and young adults with ASD may not be willing or able to monitor and modulate their actions according to varying driving environments and road-way conditions.

Conclusions:

Given the characteristics of individuals with ASD, parents and others involved in driving instruction may need to be particularly aware of the difficulties these individuals experience in the following: interpreting the actions of other drivers (e.g., reading their non-verbal social cues), managing unexpected changes in the driving environment (e.g., encountering road-way hazards), and sustaining attention throughout an extended drive.

122.163 163 Family Burden Among Latino Families with Children on the Autism Spectrum. K. Lopez[1] and S. Magana*[2], (1)*University of Michigan*, (2)*University of Wisconsin-Madison*

Background: Growing diversity among children identified with autism illustrates the need to consider variation in the experience of raising a child with autism among racial/ethnic groups (Higgins, Bailey, & Pearce, 2005). Latino children face numerous challenges including poverty, environmental hazards, and restricted access to health care that put them at higher risk for developmental disabilities (Flores, Abreu, & Kastner, 1998). The available research about Latino caregivers of children with developmental disabilities suggests family problems constitute a unique contributor to the experience of Latino caregivers and families raising a child with intellectual impairment (Magaña, Seltzer, & Krauss, 2004; Magaña, Schwartz, Rubert, & Szapocznik, 2006). However, little is known about the experience of Latino families raising children with autism across parent and family outcomes.

Objectives: We aimed to compare mother-reported pessimism and family burden among Latino and non-Latino White families raising children with autism. Second, we aimed to determine the impact of child, caregiver, and family factors on mother-reported levels of pessimism and family burden.

Methods: Forty-eight Latino caregivers and 59 non-Latino White caregivers were administered a questionnaire on their experiences with their child's diagnosis and service use. Families were recruited through service agencies and support groups in Wisconsin. Children were between 3 and 21 years of age (μ=9.6; *SD*=4.5) at the time of the study. Pessimism and family burden were measured with the Questionnaire on Resources and Stress (QRS-FR; Friedrich, Greenberg, & Crnic, 1983). T-tests and Chi-squares were conducted to identify differences between Latinas and non-Latina Whites on variables correlated with pessimism and family burden. Linear regression was used to test child, mother, and family factors as predictors of pessimism and family burden.

Results: T-tests indicated that Latina mothers reported lower levels of pessimism μ=5.11(2.06) than White mothers μ=6.56(3.46). A similar pattern was found for family burden, with Latina mothers μ=5.35(3.88) reporting lower levels of family burden than White mothers μ=8.16(3.63). Regression analyses were used to assess the ability of child, parent, and family factors to predict pessimism and family burden. Being Latina and higher levels of family cohesion predicted lower levels of pessimism. Increases in maternal age predicted higher pessimism. More child behavior problems, increased maternal age, higher levels of maternal education, and higher family income predicted higher levels of family burden. Being Latino and higher levels of family cohesion predicted lower family burden. Family cohesion accounted for the largest amount of variance for both pessimism (*adjusted R square*=.206) and family burden (*adjusted R square*=.133).

Conclusions: Contrary to research on parents of persons with ID, Latina mothers reported lower pessimism and family burden than White families in this study. The results suggest a need to explore how Latinos conceptualize autism, as it may affect caregiver and family experience. Analyses also indicated that child, caregiver and family factors were predictive of mother-reported pessimism and family burden. Given that family cohesion largely contributed to both outcomes we suggest a family systems approach to working with children on the spectrum and their families.

122.164 164 The Effect of State Mental Health Parity Laws on Financial Burden and Unmet Needs for Children with Autism Spectrum Disorder. L. A. Bilaver* and N. Jordan, *Northwestern University*

Background:

State mental health parity laws have been enacted over the last several decades to ensure coverage for mental health treatments. The laws vary considerably in their provisions as well as the specific health conditions they cover. Autism

spectrum disorder (ASD) is one condition that is not uniformly covered by state mental health parity laws. Although previous research has looked broadly at the impact of state parity laws on unmet need for mental health services and financial burden, there is no empirical evidence of the effect of state parity laws on these factors for children with ASD.

Objectives:

The purpose of this analysis is to study the financial effects and impact on unmet need of state mental health parity laws on children with ASD.

Methods:

Ordinary least squares regression is used to measure associations in the National Survey of Children with Special Health Care Needs (NS-CSHCN), 2005-2006. The subpopulation examined in this analysis includes all children aged 3 and older with private health insurance. Because the passage of state mental health parity laws may be endogenous with the study outcomes, we use state political characteristics as instrumental variables in the same manner as Barry and Busch (2007). Estimates from the OLS regressions are compared with those from a 2-stage estimation procedure while incorporating survey weights for the subsample.

Results:

Thirty-nine percent of the 982 children in the subsample with ASD were living a state that had a parity law that implicitly or explicitly covered ASD. Ordinary least squares estimates indicate that living in a parity state was associated with some measures of financial burden but not unmet need for mental health services. For each of the measures of financial burden (out of pocket spending exceeding $1,000, report of needing more money for care, report of financial problems due to special need) children with ASD living in a parity state were more likely to report such burdens compared with children not living in a parity state. The opposite was true for children without ASD living in a parity state; these children were less likely to report financial burden compared with children who did not live in a parity state. After accounting for endogeneity in the parity state estimates, we found that the direction of the effects for children with ASD living in parity states changed and increased in magnitude. In all cases, these children were less likely to report financial burden compared with children not living in parity states although the effects were only statistically significant for children living in ASD parity states. The type of parity law, however, was not associated with a significant difference among children with ASD.

Conclusions:

There is some evidence that in terms of financial burden, families of children with ASD benefited from living in states with mental health parity laws that covered ASD. This analysis adds to the evidence that insurance mandates can affect the financial burden associated with health care costs of children with special needs.

122.165 165 Idiopathic Toe Walking in Autism Spectrum Disorders and Associated Clinical Features. L. B. Krantz*[1], T. N. Takahashi[2], K. Hughes[2], M. O. Mazurek[3] and K. Sohl[2], (1)*Thompson Center for Autism and Neurodevelopmental Disorders*, (2)*University of Missouri - Thompson Center for Autism and Neurodevelopmental Disorders*, (3)*University of Missouri - Columbia*

Background:

Previous research and clinical observations have indicated that children with autism spectrum disorders (ASD) often exhibit motor impairments and gait abnormalities. Among these, idiopathic toe-walking (ITW) appears to occur at a particularly high rate. However, few studies have specifically examined the incidence, prevalence, or associated features of ITW in this population. Idiopathic toe-walking is generally defined as toe-walking that persists for longer than 3 months after independent walking begins—with all other physiological and anatomical causes being excluded.

Objectives:

The primary purpose of this study was to examine the prevalence of ITW among children with varying ASD subtypes. Our second objective was to determine whether toe-walking is correlated with differences in specific clinical features and measures of severity among children with ASD.

Methods:

Retrospective data were examined from 829 children and adolescents with ASD seen in an outpatient autism specialty clinic between 1994 and 2010. Participants ranged in age from 3 to 20 (average age of 8.0 years). Regarding diagnosis, 57.5% met diagnostic criteria for Autistic Disorder, 27.6% for PDD NOS, and 14.8% for Asperger's Syndrome. Toe-walking was determined from a parent-report history questionnaire completed at intake. Possible non-idiopathic causes of toe-walking were excluded by excluding children with abnormal MRIs or extreme prematurity. For a subset of the population, additional measures of associated clinical features were examined. Measures included Full Scale IQ (n=257), Social Communication Questionnaire (SCQ) (n=150), Vineland Adaptive Behavior Scale – 2nd Edition Communication Subscale (n=228), Child Behavior Checklist Externalizing (CBCL) Symptoms subscale (n=209), and Short Sensory Profile (SSP) (n=189).

Results:

Results indicated that prevalence of idiopathic toe-walking was high (40.5%). Autistic Disorder had the highest overall prevalence (45.1%), with a lower prevalence among those with Asperger's Syndrome (30.1%). Differences between children with and without a history of ITW were examined using ANCOVA analyses controlling for age. Children with a history of ITW had significantly higher scores on the SCQ ($p < .01$) and CBCL Externalizing Scale ($p < .05$) and significantly lower IQ ($p < .01$) and SSP scores ($p < .01$). No significant differences were found on the Vineland Communication Scale. Logistic regression analysis was used to examine subscale scores of the SSP, and results indicated that the "under responsiveness/sensation seeking" category was a statistically significant predictor of history of ITW.

Conclusions:

The results of the current study show that a history of idiopathic toe-walking is very prevalent in children with ASD. ITW is associated with greater autism severity, and those with a history of ITW had lower cognitive functioning, greater difficulty with behavioral regulation, and more impaired sensory processing. These findings indicate that ITW may be a biomarker of poorer outcomes for children with ASD. Future studies using prospective, longitudinal designs and standardized measures of motor impairment would be helpful to more fully investigate these issues.

122.167 167 The Prevalence of Bullying in Children with Autism Spectrum Disorders. B. Zablotsky*[1], C. P. Bradshaw[1], C. M. Anderson[2] and P. A. Law[2], (1)*Johns Hopkins Bloomberg School of Public Health* , (2)*Kennedy Krieger Institute*

Background: Bullying has become one of the most frequent forms of school violence with nearly 30% of children involved either as bully, victim or bully and victim (Bradshaw, Sawyer, & O'Brennan, 2006). Children who are bullied report higher levels of depression and lower levels of self-esteem (Seals and Young, 2003). In more extreme cases, victims present with suicidal thoughts and actions (Arseneault et al., 2010). The majority of studies dedicated to the prevalence and consequence of bullying have been limited to the regular education population, with few studies dedicated to bullying and children with ASDs. ASD-focused studies have been restricted by small clinical samples and particular age groups and ASD diagnosis types. These studies, however, speak to a notable increased risk of bullying in ASD children (e.g. Little, 2007). The present study intends to determine the prevalence of bullying using the largest and most diverse clinical population of children with ASDs to date.

Objectives: 1) Determine the prevalence of bullying in a sample of ASD children. 2) Identify risk factors for being bullied.

Methods: Parents were recruited from the Interactive Autism Network (IAN), an online, national voluntary registry of families who have children with an ASD. Five hundred parents, with children aged 6-15 years, completed a survey dedicated to their child's school experiences (the full sample of 2100 parents will be presented at the conference). As a control group, parents were also asked to comment on the school experiences of any non-affected children. Basic tablatures were used to calculate the prevalence of bullying in the sample, and a multiple logistic regression was used to estimate the Odds Ratios (ORs) of being bullied in the past month by child and school characteristics.

Results: At the time of the analysis, 70% of parents reported that their child had been bullied in their lifetime, while 42% had been bulled in the past month. In comparison, 43% of non-affected siblings were bullied in their lifetime and 9% were bullied in the past month. The adjusted multiple logistic regression model revealed children with Asperger's to be more likely to be bullied than children with other ASDs (OR=3.01, 95% CI: 1.77-5.16, p<0.001). Demographic differences included children in elementary school being more likely to be bullied than children in high school (OR=3.34, 95% CI: 1.42-7.82, p=0.006), while children in public schools were more likely to be bullied than children in private schools (OR=2.22, 95% CI: 1.01-4.89, p<0.05). Children who received free or reduced breakfast or lunches were also more likely to be bullied (OR=2.61, 95% CI: 1.54-4.41, p<0.001). Finally, males were less likely to be bullied in the past month than females (OR=0.52, 95% CI: 0.30-0.91, p=0.02).

Conclusions: Children with ASDs were bullied at rates higher than the general education population and their non-affected siblings, warranting the need for interventions against bullying that take into account this vulnerable population. Children with Asperger's were at the greatest risk of being bullied, perhaps a consequence of these children being the most likely to attend public, regular education schools.

122.168 168 Maternal Exposure to Intimate Partner Abuse Prior to Birth Is Associated with Risk of Autism In Offspring. A. L. Roberts*[1], K. Lyall[2], J. W. Rich-Edwards[3], A. Ascherio[1] and M. G. Weisskopf[1], (1)*Harvard School of Public Health*, (2)*University of California, Davis, MIND Institute*, (3)*Connors Center for Women's Health and Gender Biology, Brigham and Women's Hospital*

Background: Exposure to psychosocial stressors during pregnancy has been hypothesized to increase risk of autism spectrum disorder in offspring, yet existing evidence is contradictory. Intimate partner abuse is a severe psychosocial stressor, thus maternal exposure may increase risk of autism.

Objectives: To determine whether maternal exposure to i) injurious physical abuse in pregnancy or ii) fear of partner or sexual, emotional, or physical abuse prior to the birth of the child increases risk of autism in a large community-based cohort.

Methods: Participants were women in the Nurses Health Study II (97% White) and their children born 1962 to 2003 (54,512 without autism spectrum disorder (autism), 451 with autism). We calculated risk ratios (RR) for autism diagnosis reported by mothers (validated by Autism Diagnostic Interview-Revised in a subsample), adjusted for maternal age at birth, birth year, sex of child, and maternal childhood socioeconomic status.

Results: Injurious physical abuse during pregnancy (reported by 2.4% of women) was not related to autism. In contrast, autism risk was increased in children of the 11.7% of women who reported fear of partner or emotional, physical, or sexual abuse in the two years before the birth year. Risk ratio for autism was 2.23 (95% confidence interval (CI)=1.48, 3.36) for exposure to abuse in the year before the birth year and 2.62 (95% CI=1.59, 4.33) for exposure in both of the two years before the birth year, compared to women unexposed. Exposure in the 3 to 10 years before the birth year, the year of birth, and the 4 years following the birth year was not associated with autism.

Conclusions: Although exposure to injurious physical abuse during pregnancy was not associated with autism risk, fear of partner or emotional, sexual, or physical abuse in the years immediately before the birth year may be associated with risk of autism spectrum disorder in children.

122.169 169 Regression Rates Differ According to the Operational Definition Employed and ASD Subgroup Status. B. Barger*[1], J. Campbell[2], A. Dubin[2] and J. Donald[2], (1) *University of Georgia*, (2)*University of Georgia*

Background: A recent meta-analysis reported different rates of regression depending on whether the term regression was operationalized as encompassing mixed, language, social, or language/social (Barger, Campbell, & Donald, 2011). This work is extended by investigating whether reported regression rates differ between subgroups of children with autism spectrum disorder (ASD) for each of these operationalized regression terms.

Objectives: We performed meta-analyses of the literature to determine whether (a) reported rates of regression differed for children with a diagnosis of Autism (N= 3149), Pervasive Developmental Disorder (PDD, N=1650), and Asperger's (N=610) and (b) reported rates of regression differed between girls (N=652) and boys (N=3,050) with autism spectrum disorders (ASD).

Methods: Autism diagnosis and regression data were extracted from 21 published studies across 5,771 participants. Twelve studies reported data on mixed, 11 studies reported data on language, 1 study reported data on social, and 1 study reported data on language/social regression. Gender and regression data were extracted from 19 published studies across 3,702 participants. Ten studies reported data on mixed, 8 studies reported data on language, 1 study reported data on social, and 3 studies reported data on language/social regression.

Results: Regarding regression and diagnostic status, across all regression types, children with a diagnosis of Autism had a higher rate of reported regression (31%) than those with a diagnosis of PDD (26%) or Asperger's (14%). This same pattern was found for mixed (autism=39%; PDD=31%; and Asperger's=19%) and language (Autism=36%; PDD=25%; and Asperger's=13%) regression. Prevalence of social and language/social regression could not be calculated due to a lack of data. Furthermore, reported rates of mixed and language regression did not differ statistically for children with Autism (39% and 36% respectively), but reported rates of mixed regression were higher than language regression for both children with PDD (31% and 25% respectively) and Asperger's (19% and 13% respectively). Regarding regression and gender, across all regression types, girls (31%) did not differ from boys (34%). This same pattern was found for language (girls=31%; boys=33%) and language/social (girls=53%; boys=41%) regression; however, genders did differ in regards to rates of mixed (girls=37%; boys=43%) regression. Data were insufficient to calculate social regression. Furthermore, for girls with an ASD, rates of regression were higher for language/social (53%) compared to rates of mixed (37%) and language (31%) regressions, which did not differ from one another. For boys with an ASD, rates of regression were lower for language regression (33%) compared to rates of mixed (43%) and language/social (41%) regression, which did not differ from one another.

Conclusions: These findings indicate that reported rates of regression may differ among and within subgroups of children with ASD, depending on the operationalization of the term regression. Across regression types, children with autism had a higher rate of regression compared to PDD and Asperger's, which did not differ from one another.

122.170 170 Migration and Autism Spectrum Disorders. C. Magnusson*[1], D. Rai[1], A. Goodman[2], M. Lundberg[1], S. Idring[1], A. Svensson[1], I. Koupil[3], E. Serlachius[1] and C. Dalman[1], (1)*Karolinska Institutet*, (2)*London School of Hygiene & Tropical Medicine*, (3)*Stockholm University*

Background: Migration is associated with a range of biological, psychological and sociocultural stressors. Parental migration has been implicated as a risk factor for offspring autism, but the evidence is limited and inconsistent.

Objectives: To investigate the relationship between parental migration status and risk of autism spectrum disorders (ASD), taking into consideration the importance of region of origin, timing of migration and possible discrepancies in associations between autism subtypes.

Methods: The Stockholm Youth Cohort is a record-linkage study comprising all individuals aged 0-17 years, ever resident in Stockholm County in 2001-2007 (N=589,114). Cases (N=4,952) were identified using a multisource approach, involving registers covering all pathways to ASD diagnosis and care, and categorized according to presence of co-morbid intellectual disability. Extensive and prospectively recorded information on parental migration status and other potential risk factors were retrieved from national and regional health and administrative registers.

Results: Children of migrant parents were at increased risk of ASD with comorbid intellectual disability (odds ratio [OR] 1.5, 95% confidence interval [CI] 1.3-1.7); this risk was highest when parents migrated from regions of low human development, and peaked when migration occurred around pregnancy (OR 2.3, 95% CI 1.7-3.0). A decreased risk of ASD

without intellectual disability was observed in children of migrant parents, regardless of area of origin or timing of migration. Parental age, income or obstetric complications did not fully explain any of these associations.

Conclusions: Environmental factors associated with migration may contribute to the development of autism presenting with comorbid intellectual disability, especially when acting during fetal life. ASD presenting with and without intellectual disability may have partly different etiologies, and should be studied separately.

122.171 171 Translation and Validation of Autism Screening and Diagnostic Tools in to Hindi and Bengali. A. Rudra*[1], S. Banerjee[2], N. Singhal[3], M. Barua[3], S. Mukerji[2] and B. Chakrabarti[4], (1)*University of Reading*, (2)*Creating Connections*, (3)*Action for Autism, National Centre for Autism*, (4)*Autism Research Centre, Department of Psychiatry, University of Cambridge*

Background: There is a serious dearth of epidemiological research on Autism Spectrum Conditions (ASC) in South Asia. The availability of standardized screening and diagnostic instruments in principal regional languages constitutes a necessary first step to addressing this gap. Hindi and Bengali are two of the most widely spoken languages of this region (number of speakers > 371 million). Standardised screening tools in these languages would be crucial for further ASC research in this region, and can lead to better diagnostic facilities for ASC children.

Objectives: To translate and validate screening and diagnostic tools for ASC in Hindi and Bengali in two Indian cities (Delhi and Kolkata).

Methods:

TRANSLATION: Five widely used and standardized instruments for screening and diagnosis were translated into Hindi and Bengali by individuals familiar with ASC: Ten Questions (TQ) (Durkin et al 1995), Social Communication Disorders Checklist (Skuse et al 1995), Social Communications Questionnaire (SCQ) (Berument, Rutter et al 1999), Autism Observation Schedule (ADOS) (all 4 modules). Blind back translation was carried out by a language expert, and this cycle was repeated until the backtranslation was approved by the creator/ copyright holder of the respective instruments. VALIDATION: 45 children with ASC and 43 control children (between 4-7years of age) were recruited in Kolkata for validation of Bengali questionnaires. 40 ASC and 42 Control children in the same age range were recruited in Delhi for validation of Hindi questionnaires. All cases had a ICD-10/DSM-IV based diagnosis from a recognized clinician, and this was confirmed by a child psychiatrist where necessary. The translated ADOS modules 1 and 3 were administered on 20 cases and 20 controls each by a trained ADOS administrator in both cities.All data was analysed using SPSS.

Results:

Hindi : 86.67% of the children with ASC and 41.86 % of controls met the cut off of 9 on the SCDC and 73.8% of children with ASC & none of the controls met the cut off of 15 on the SCQ. On the ADOS 77% of cases, and none of the controls met the cut off score of 12. AQ-C scores were significantly different between cases (Mean = 81.53) and controls (Mean=45.54) ($p<0.001$).TQ scores were significantly higher for cases than controls ($p<0.001$).

Bengali: All of the children with ASC and 0.67 % of controls met the cut off of 9 on the SCDC and 85.1 % of children with ASC and none of the controls met the cut off of 15 on the SCQ. On the ADOS all of the cases, and none of the controls met the cut off score of 12. AQ-C scores were significantly different for cases (Mean = 85.86) and controls (Mean=39.93) ($p<0.001$). TQ scores were significantly higher for cases than controls ($p<0.05$).

Conclusions:

Screening and diagnostic tools translated into regional languages and validated in a case-control sample were found to show similar properties to the original instruments. This has direct implications for improving diagnosis of ASC by clinicians in both rural and urban areas in South Asia.

122.172 172 Parent-Teacher Agreement on An Autism Screener in An Underserved Preschool Population. J.

Harris*, Y. Janvier, L. Walpin and L. Blann, *Children's Specialized Hospital*

Background: The importance of early diagnosis of autism spectrum disorders is well-established. Despite published guidelines for early screening for ASD, screening is not widespread in healthcare settings. This is especially true for impoverished children who may not have a regular source of care. Preschool and daycare programs, therefore, may be an important additional venue for screening. Review of the literature suggests that utility of preschool teacher screenings has not been explored. This study compared, in a traditionally underserved sample, parent and teacher responses on commonly used autism screening tools, with subsequent comparison to clinical diagnosis of autism.

Objectives: The objectives are to 1) measure agreement between parents and teachers on commonly used autism screening tools, 2) explore concordance between screening results and subsequent clinical diagnosis, and 3) identify factors that are associated with concordance.

Methods: Six cities in New Jersey with large low-income, minority populations were selected. Preschools in target cities were invited to participate in the study. Preschool staff received training on the symptoms of autism. Parents and teachers were asked to complete the Modified Checklist for Autism in Toddlers (M-CHAT) and/or Social Communication Questionnaire (SCQ). Children screening positive on either instrument received follow-up phone interviews to clarify responses. Those who screened positive on the follow up interview were offered a clinical evaluation that included Autism Diagnostic Observation Schedule (ADOS) and cognitive screening. Results were analyzed to determine parent and teacher agreement between raters for each instrument and pattern of agreement between screening results and clinical diagnosis.

Results: Results for both parent and teacher M-CHATs were obtained for 190 children. Completed results were obtained for an additional 405 children having both parent and teacher SCQs. Screened negative rate by parent report was 81% for the M-CHAT and 92% for the SCQ. Screened negative rate by teacher report was 79 % for the M-CHAT and 93% for the SCQ. Agreement between parent and teachers was 76% for M-CHAT; 90% for SCQ. For parents and teachers, positive predictive validity (PPV) of M-CHAT was 44% and 58%, respectively; PPV of SCQ was 40% and 41%; sensitivity of M-CHAT was 50% and 100%; sensitivity of SCQ was 36% and 78%; specificity of M-CHAT was 50% and 37.5%; and specificity of SCQ was 65% and 37.5%.

Conclusions: Relative merit of these screening tools and influence of demographic factors will be discussed. Findings suggest that parents in this underserved population poorly identify cases at risk for autism, whereas preschool teachers are good at identifying cases at risk for ASD but not as accurate identifying those children not at risk. Thus, including both parent and teacher screening reports increases the accuracy of finding cases of ASD in a preschool population.

122.173 173 Underdiagnosis of Autism Spectrum Disorders in Individuals with Intellectual Disabilities. H. Roeyers* and M. Thys, *Ghent University*

Background: Only a limited number of studies examined the prevalence of autism spectrum disorders (ASD) within the population with intellectual disabilities (ID) and even less studies tried to estimate the proportion of missed diagnoses of ASD in individuals with ID. It is however of great importance that the co-occurrence of ASD is recognized with a view to improving the quality of life of individuals with ASD and their social environment.

Objectives: The first goal of this study was to estimate the prevalence of ASD in a very large sample of individuals with ID. A second and equally important goal was to identify the proportion of overlooked diagnoses in various settings for individuals with ID.

Methods: The sample comprised 2798 individuals with ID and 322 individuals with borderline intellectual functioning from the 5 provinces of Flanders, the Dutch-speaking part of Belgium. The mean age was 25.6 years (SD=16.42), ranging from 1 tot 81 years. 52% of the sample was older that 18. Subjects were screened with the Scale of Pervasive Developmental Disorder in Mentally Retarded persons – Revision, a screening

instrument with excellent sensitivity and specificity (Kraijer & de Bildt, 2005).

Results: 633 children and adults were classified as having ASD. This is 21.1% of our sample. When the subgroup with borderline intellectual functioning was excluded, the prevalence rate increased to 22.2%. The male-female ratio was 2:1. Occurrence of ASD was higher in subgroups with more severe forms of ID. 40% of the individuals with an ASD classification had no official diagnosis previously and another 22% was only suspected to have ASD. The proportion of supposedly missed diagnoses was significantly higher in females than in males. ASD was also significantly more often overlooked in adults compared to children. In addition, diagnoses were more likely to be missed in case of an associated genetic disorder such as Fragile X or Down syndrome, a comorbid psychiatric disorder or a severe visual impairment.

Conclusions: This is, to our knowledge, the largest sample of individuals with ID that was ever screened for ASD. Our study confirms that a substantial subgroup screens positive for ASD and that the diagnosis is often missed. Late diagnosis, or the failure to diagnose at all, may have unfavorable and long-standing effects for those affected and their families. For professionals in facilities and schools for individuals with ID it would seem important to bear the possibility of co-occuring ASD in mind. The recognition of ASD could lead to a better understanding of the overall problems of the clients and to more appropriate care and treatment.

122.174 174 Racial Disparity in Administrative Autism Identification Across the United States From 2000 to 2007. E. A. Boutot*[1] and J. Travers[2], (1)*Texas State University*, (2)*University of Massachusetts-Amherst*

Background:

Epidemiological studies have found that autism is not predicted by race, ethnicity, or socioeconomic status (Fombonne,2003; 2005; 2007), but studies of administrative identification have found differences in identification of autism according to race (e.g., Mandell et al., 2010). Travers, et al. (2009) examined national population data from public education for trends in identification from 1997 to 2004, finding persistent under-identification of autism among Hispanic and Native American/Alaska Native students when compared to White students. They also discovered a trend from over- to under-identification of Black students with autism from 1997 to 2004. However, it was unclear if national trends in the U.S. were reflective trends among regions of the U.S. as well as individual states. **A thorough examination of the patterns and trends in prevalence rates by race and across states was an important next step in this line of research.**

Objectives:

This study examined trends in state-level administrative identification of autism under the U.S. Individuals with Disabilities Education Act (IDEA). The purpose was to determine if and to what extent state-level administrative prevalence of autism differed by race from 2000 to 2007.

Methods:

Prevalence rates and odds ratios were calculated for each U.S. state using enrollment count data from the IDEA Annual Reports to Congress and National Center for Education Statistics for years 2000 and 2007. We used logistic regression analysis, with confidence levels set at 95%, to understand difference in prevalence of autism according to race as well as changes in the prevalence by race over time.

Results:

Results indicated increases in administrative prevalence of autism for all racial groups from 2000 to 2007, but increasing under-identification of Black and Hispanic students in 2007 compared to White students. Variability existed in the identification of autism among Black and Hispanic students across states over time.

Conclusions:

We found a) the odds of being identified with autism was predicted by year and b) a nearly three-fold increase in prevalence between 2000 to 2007. When we analyzed differences by race, we found odds ratios for Black students that decreased over time and odds ratios for Hispanic students that remained consistently lower than their White counterparts.

We found substantial differences in prevalence rates by state as well as by racial category. Prevalence rates for Hispanic and Black students were lower, sometimes substantially, than prevalence rates for White students in most states. We also found prevalence rates of autism in 39 states for year 2007 that were lower than the 2006 epidemiological prevalence rates reported by the CDC. **As expected, the prevalence rates for all three racial groups and all states increased over time. However, we found that the disparity between White and minority students increased over time. We found that the states that over-identified autism among Black and Hispanic students in 2000 had under-identified them in 2007. Furthermore, nearly every state that had proportional representation of students in 2000 under-identified Black and Hispanic students in 2007.**

122.175 175 Knowledge of Autism in Parents of Typically-Developing Children. L. C. Newell*[1] and L. Knight[2], (1)*Indiana University of Pennsylvania*, (2)*Indiana University of PA*

Background:

There is a discrepancy between the emergence of characteristics (as early as 12 months) and age of diagnosis (3 to 4 years or later) of autism that leaves a gap in time when the child is not involved in early intervention services. One factor that may contribute to this discrepancy is that parents are unaware or misinformed of the early characteristics of ASD and thus, miss warning signs in their child's development. There has only been one study to date that has assessed the general population's understanding of the etiology and treatment of ASDs (Furnham & Buck, 2003) and the results suggested that their participants were somewhat accurate in their understanding of these areas. However, no study has looked at parents' knowledge of characteristics of individuals with an ASD, the kind of knowledge that would assist in identification of at-risk children and diagnosis of ASDs.

Another factor in delayed diagnosis may be that parents have inaccurate information. With the increased incidence of ASDs, there has also been an increase in public discussion about the causes and treatments of ASDs. In many cases the information is inaccurate or false, leading to misunderstandings about the disorder that have potentially serious consequences for children. Parents are often the individuals who alert medical/educational personnel to potential developmental delays in their children; therefore, it is very important that parents have access to accurate information about ASDs, including current information about the factors that do and do not contribute to the development of ASDs.

Objectives:

The current study was designed to assess the knowledge base of parents of typically-developing children regarding ASDs. A broad range of topics were assessed, particularly areas in which much misinformation is being discussed in the mass media.

Methods:

A questionnaire was developed which included 80 statements about the causes, diagnosis, treatment, characteristics, development, outcomes and epidemiology of autism spectrum disorders. Participants were asked to endorse items on a 5-point scale (1=strongly disagree, 5 = strongly agree). Participants included parents of at least one typically-developing child five years old or younger, with no children on the autism spectrum.

Results:

Preliminary results indicate the most parents have an understanding of autism that matches the research literature, with a high level of agreement among participants. However, several issues emerged that consistently showed disagreement among participants. The topics that received the most conflicting responses included 1) whether vaccinations were related to autism, 2) whether there is an autism epidemic, 3) the use of dietary restrictions to treat autistic symptoms, 4) the genetic basis of autism, 5) the role of prenatal care in the development of autism, and 6) social behaviors of individuals with an ASD.

Conclusions:

Parents of young, typically-developing children are most confused about autism in the areas where there has been a lot

of public controversy and the areas which support early diagnosis (e.g., characteristics in infants and toddlers). Public outreach measures need to be developed to better educate parents about the causes, treatments, and characteristics of autism.

122.176 176 Autistic Traits in Patients within Secure Forensic Mental Health Settings. E. L. Woodhouse[1], K. L. Ashwood*[1], A. Hammon[1], S. Young[1], D. Perkins[2], D. G. Murphy[1] and P. Asherson[3], (1)*Institute of Psychiatry, King's College London*, (2)*Broadmoor Hospital*, (3)*Institute of Psychiatry, Kings College London*

Background: Previous research has reported a higher prevalence of Autism Spectrum Disorder (ASD) in forensic settings compared with the general population. There has been a gradual shift to a broader conceptualisation of the autism phenotype incorporating both categorical and dimensional approaches. However, there is limited research into autistic traits within forensic mental health settings, and few studies have evaluated profiles of traits within this sample.

Objectives: The aim of the study was to examine the prevalence of autistic traits in a forensic population by systematically screening for ASD in medium and high secure forensic mental health services.

Methods: Clinicians responsible for wards within Broadmoor Hospital and River House at the Royal Bethlem Hospital identified eligible cases according to inclusion and exclusion criteria. The sample consisted of male inpatients with mental health problems (MHP) such as paranoid schizophrenia and/or Personality Disorder (PD) such as anti-social or borderline. 131 individuals were screened using the self-report Autism Quotient (AQ) comprising 50 items, including 10 questions assessing five different subscales of functioning (social skills, communication, switching attention, attention to detail, imagination) which were summed to give a total AQ score, with a maximum possible score of 50. Higher AQ scores represent a higher number of ASD traits. The recommended cut-off scores for further evaluation are 32 in the general population and 26 for clinical populations.

Results: A previous study used the AQ to screen males in the general population and this data was used as a comparison sample. Examining the distribution of AQ scores revealed that 11 (8%) of the total sample had scores of 32 or above, and 31 (24%) had scores of 26 or above. One sample t-test analysis indicated that the sample AQ scores were significantly greater than the general male population score of 17.8 (M=20.74, SD=6.88, t(130)=4.90, p<.001, d=.4). Significant differences were also found between the forensic sample and the general population for all five subscales of the AQ. Forensic patients showed significantly higher AQ scores compared with the general male population on all areas of functioning except for attention to detail (all p≤.05).

Conclusions: The prevalence of autistic traits in the current sample of forensic patients is greater than that reported for the general male population. The findings also provide a provisional AQ profile for forensic populations, as results revealed poorer social and communication skills, poorer imagination and attention switching, but less focused attention in the forensic sample compared with the general male population.

122.177 177 Assessing Medication Adherence in Autism Spectrum Disorders. S. L. Logan*, J. S. Nicholas, L. B. King, J. Charles, W. Jenner and L. A. Carpenter, *Medical University of South Carolina*

Background: More than half of children with autism spectrum disorders (ASD) are prescribed psychotropic medication for treating problem behaviors. To date, only one study has assessed any treatment adherence in ASD (Moore 2011), even though adherence is an important predictor of treatment outcome. Adherence research in other chronic conditions suggests that medication adherence is poor among young children, particularly those with chronic or mental health conditions.

Objectives: This study will describe multiple measures of medication adherence and identify predictors of poor adherence to medications among Medicaid-eligible children with ASD.

Methods: Medicaid-eligible children who were identified with an ASD by the South Carolina Autism and Developmental Disabilities Monitoring Network (SCADDM) across 5 study years (2000, 2002, 2004, 2006, and 2008) were included. All

confidentiality procedures were followed and appropriate regulatory approvals were granted. Data linkages were made using unique identifiers common to both datasets; protected health information was removed following this linkage, resulting in a completely de-identified database.

Child characteristic variables included age, race, gender, intellectual disability, co-occurring conditions, ASD diagnostic history, and indicators of behavioral and emotional problems (e.g., the presence of associated features such as tantrums, self-injurious behavior, hyperactivity, etc and DSM-IV diagnostic criteria). Medicaid data included for each child the individual eligibility status, county of residence, amount paid per claim, dispense date, drug name and therapeutic class, dosage, quantity, days supply, and prescribing provider type. The primary outcome measure was adherence, measured by the validated (Karve 2008) Medication Possession Ratio (MPR) and defined as the number of days supply in the index period divided by the number of days in the study period. Additional outcome measures included the proportion of days covered (PDC), and the refill compliance rate (RCR). To quantify the complexity of medication regimens and the impact on adherence, a modified version of the Medication Regimen Complexity Index (MRCI) (George 2004) was used. This index includes the total number of medications, dosing schedule, dosing form (e.g., pill, liquid, etc), and special instructions (e.g., "take on an empty stomach"). Categorical and continuous variable differences were assessed using chi-square or t tests respectively.

Results: Medication adherence is a complex phenomenon that appears to be best represented via multiple methodologies. Patient-related factors (e.g., knowledge of the condition as evidenced by a documented formal diagnosis), condition-related factors (e.g., associated features, co-occurring mental health disorders), and medication regimen-related factors (e.g., medication regimen complexity index) are among the most robust predictors of adherence.

Conclusions: Results provide a more complete and precise estimate of medication adherence in ASD by combining population-based data and Medicaid. Appreciating factors associated with poor adherence could lead to targeted interventions aimed at improving medication-taking habits, and ultimately improving treatment outcomes.

122.178 178 Autism Spectrum Disorders in India: A Comprehensive Review of the Literature. T. C. Daley*[1], N. Singhal[2] and M. Barua[2], (1)*Westat*, (2)*Action for Autism, National Centre for Autism*

Background:

As autism awareness continues to grow globally, a burgeoning research literature is emerging from countries in which previous studies and reports of ASD were limited. A review of literature within a specific country or region is an excellent way to synthesize often disjointed areas of work, and can serve as a useful tool for researchers both in that country and working in other areas. In contrast to many low and middle income countries, India has an extensive research literature on ASD dating back more than 50 years, and provides rich data for a literature review.

Objectives:

This study presents a comprehensive review of published literature related to India dating between 1944 and 2010, and provides a detailed protocol for researchers interested in using a similar approach in other areas of the world.

Methods:

We performed a comprehensive review of all journal articles by researchers in India, appearing in Indian journals, or using an Indian population. In order to include articles that appeared in journals that were not indexed or that pre-dated indexing, four key Indian journals were manually reviewed at libraries in India from the beginning of their publication. Dimensions were developed for coding for salient characteristics of the publications, including the type of publication, origin of publication; authorship; type of study; characteristics of participants; terminology used; and process and criteria used to confirm diagnosis of ASD, among others. Interrater reliability was used to establish consistent coding for all dimensions that involved subjective judgment.

Results:

A total of 167 articles were identified for inclusion in this review. Publications appeared in 82 journals, 33% of which were based outside of India. The majority of publications (70%) involved participants, with sample sizes ranging from 1 to 150 people with ASD (M=27.1, SD=3). An additional 19% of publications were theoretical or overviews, and the remainder were letters or responses. Study types were varied, and included experimental designs, psychometric, genetic, epidemiological, descriptive and health systems research, among others. Studies frequently included participants spanning a broad age range, but more than half (54%) focused on children between 2-11 years old. Adult populations were virtually unstudied. Diagnostic criteria to confirm ASD were not reported in one third of the studies involving subjects. For studies reporting criteria, approximately 61% relied on the DSM, 30% on the ICD, and 40% on an ASD-specific tool (a third of studies used more than one tool). 20 different studies reported using the CARS, either alone or with other criteria.

Conclusions:

These and related findings provide insight into the growth of ASD in a non-Western setting through the lens of research. As interest in conducting research in low and middle income countries increases, conducting a review of the literature in these areas is an invaluable resource prior to entering the field. Synthetic reviews help investigators build on existing information rather than replicate well documented findings. Moreover, information from this rich source of information can be used to expand our global clinical picture of autism in the absence of large population studies.

122.180 180 Sex Differences in Extended Pedigrees with ASD. A. Thompson*[1], P. Szatmari[1], V. Vieland[2], J. Piven[3], B. A. Fernandez[4], K. Walters[5], M. C. Parlier[3], I. O'Connor[6] and K. Whitten[7], (1)*Offord Centre for Child Studies, McMaster University*, (2)*The Research Institute at Nationwide Children's Hospital & The Ohio State University*, (3)*University of North Carolina, Chapel Hill (UNC-CH)*, (4)*Disciplines of Genetics and Medicine, Memorial University of Newfoundland and Provincial Medical Genetics Program, Eastern Health*, (5)*Nationwide Children's Hospital*, (6)*McMaster University*, (7)*Eastern Health Centre*

Background: The sex ratio of four boys to every girl with ASD is well known but little understood. Several theories have been advanced to explain this discrepancy including reduced penetrance in girls of a rare dominant genetic variant, hormonal influences during pregnancy, and epigenetic variants, though little evidence exists for any of these models. Several studies have shown that girls with ASD show fewer repetitive stereotyped behaviours than boys. But more convincing evidence of reduced penetrance would require large families with many affected individuals.

Objectives: The objective of this presentation is to investigate the sex ratio in large extended pedigrees with multiply affected individuals with ASD. Relatives are stratified into those that are affected with ASD, those that are identified as having broader autism phenotypes (BAP) and those that are assumed to be "obligate" carriers of a genetic risk variant from a common relative.

Methods: Twenty-seven extended pedigrees were identified through an on-going family-genetic study of ASD conducted at McMaster University, Memorial University and the University of North Carolina. An extended pedigree was defined as a pedigree with at least three affected individuals from three separate nuclear families within that pedigree. Cases of ASD were diagnosed using the ADI-R, ADOS and clinical best-estimate. Relatives with the BAP were identified by using the self-report and/or informant versions of the Broader Autism Phenotype Questionnaire. An individual scoring above the self-report, informant or best estimate (the mean of the self-report and informant scores) thresholds on the aloof, pragmatic language or rigid subtests was classified as having the BAP. Obligate carriers were identified by isolating pairs of nuclear families with ASD relatives. The relatives connecting those ASD individuals were identified as "obligate carriers". If a relative was classified as both BAP and an obligate carrier, the classification as obligate carrier took precedence so no relative was counted twice.

Results: Among the 27 pedigrees there were 89 males and 23 females with ASD giving a sex ratio of 3.9 males to 1 female. Among adult relatives with the BAP, there were 18 males and 21 females, (ratio: 0.9:1). Among obligate carriers, there were 28 males compared to 45 females (ratio: 0.6:1). The sex ratio

varies significantly as a function of classification as affected, BAP or obligate carrier (chi-square=35.12, df=2, p<.001).

Conclusions: In these highly familial pedigrees with ASD, there is a clear gradient in the sex ratio going from affected status to BAP to obligate carrier. The sex ratio among affected cases was as expected. However, there were an equal number of males and females with the BAP and most obligate carriers were female. Assuming a model of autosomal dominant inheritance, this would suggest reduced penetrance in female relatives allowing for an increased number of those relatives to become obligate carriers with or without the BAP. The study of extended pedigrees with ASD has the potential to shed considerable light on the genetic architecture of this disorder including the investigation of protective factors among female relatives.

122.181 181 Autism Spectrum Disorders & Regression: Findings From a Population Based Study. H. Patel*, J. Shenouda and W. Zahorodny, *UMDNJ-New Jersey Medical School*

Background: Developmental regression is among the hallmarks of Autism Spectrum Disorder (ASD). Estimates of the prevalence of regression have varied, ranging from 10% to 50%. In part, this variation may be due to the definition of regression itself. Several studies have suggested that a more specific definition of regression is associated with lower prevalence of regression.

Objectives: This study investigated regression in a population of ASD children residing in New Jersey to determine the occurrence of regression, average age of prevalence, and whether if there are systematic differences in characteristics of ASD children with regression as compared to ASD children without regression, with respect to age of sex, race, ASD diagnosis age, and DSM-IV-TR features.

Methods: Data were collected as part of a population-based ASD surveillance investigation carried out in Essex, Union, Hudson and Ocean Counties. ASD ascertainment was by an active, retrospective, multiple-source, case-finding method, developed by the Centers for Disease Control and Prevention (CDC), based on review and analysis of information contained in health and education records. Demographic variables and case-specific data, including information on regression were analyzed. Current findings represent 8-year olds (1998-born), in 2006. Regression was defined as loss of either language or social skills, or both. T tests, Chi-square, and ANOVA were used to test associations.

Results: In a sample of 533 ASD children, 72 children (13.5%) were found to have experienced developmental regression in early development by parent report. Average age of regression was 25.3 month. Overall, regression distribution in this group did not vary significantly by race or sex. There was no significant association between the occurrence of regression and intellectual disability (ID). 68 children with a history of regression (94.4%) met the criteria for Autistic Disorder (AD), and 4 children with a history of regression (5.6%) met the criteria for ASD-NOS. In contrast, 345 children with no history of regression (74.8%) met the criteria for AD, and 116 children with no history of regression (25.1%) met the criteria for ASD-NOS (p<.001). On average, children with a history of regression were diagnosed with ASD by one year earlier than children with no history of regression (43 months and 55 months respectively, p<.001). Interestingly, 11 children with a history of regression (14.9%) had no clinical ASD diagnosis.

Conclusions: Our estimate of regressive ASD falls in the lower end of previously reported estimate of regression prevalence. A history of regression may lead to earlier identification of ASD, and that children with a history of regression are more likely to satisfy the criteria for AD than ASD-NOS. Further research is necessary to understand the causes of regression.

122.182 182 Maternal Psychiatric History: Implications for Autism Severity. E. Allain*, C. M. Brewton, E. Gonzalez and G. T. Schanding, *University of Houston*

Background: Past research has demonstrated an association between maternal psychiatric history and the incidence of having a child with an Autism Spectrum Disorder (ASD; Daniels et al., 2008; Larsson, 2004). Moreover, mothers and other first-degree relatives of children with ASD have been found to have higher rates of major depressive disorder, social phobia, anxiety, and Obsessive-Compulsive Disorder (OCD) than those of children with other disabilities (Bolton, Pickles, Murphy, and Rutter, 1996; Piven & Palmer, 1999). While recent research has found that maternal depressive symptoms may

be contingent on child ASD symptom severity, research in this area is very limited and further research is necessary to explore potential associations between child characteristics and maternal psychiatric well-being (Ingersoll & Hambrick, 2011). This poster will be a partial replication of the Ingersoll and Hambrick (2011) paper and will add to the literature by: (a) including a broader range of current maternal psychiatric diagnoses and (b) examining how adaptive functioning of children with ASD may be associated with maternal psychiatric diagnoses.

Objectives: To partially replicate the findings of the Ingersoll and Hambrick (2011) article by investigating potential associations between 14 different maternal psychiatric diagnoses (i.e., depression, anxiety, social phobia, OCD, Attention Hyperactivity Disorder) and child adaptive functioning.

Methods: Participants are children with ASD from the Simons Simplex Collection (SSC; https://sfari.org/simons-simplex-collection), which contains children between the ages of 4 and 18 years. All have received clinical diagnoses of ASD via administrations of the *Autism Diagnostic Interview—Revised* (ADI-R; Rutter et al., 2009) and the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2000). Additional participants will include the biological mothers of the children with ASD. Demographic information will include participant sex, age, and race/ethnicity. Child ASD adaptive functioning will be assessed through the *Vineland Adaptive Behavior Scale-Second Edition* (VABS-II; Sparrow, Cicchetti, and Balla, 2005) adaptive behavior composite score. Maternal psychiatric history will be determined through an SSC-specific measure called the Medical History Interview (MHI) and will include reported incidence of 14 different diagnoses including depression, anxiety, social phobia, OCD, and attention deficit hyperactivity disorder. All data for this project have been collected via the SSC.

Results: An analysis of variance (ANOVA) test will be conducted to determine if there are differences in child adaptive functioning across the various maternal psychiatric diagnoses. If significant differences are discovered, appropriate post hoc analyses will be utilized.

Conclusions: Findings from this study may add to the findings from the Ingersoll and Hambrick (2011) article and may further reveal the importance of understanding the potential impact maternal psychiatric history may have on children with ASD.

122.183 183 Prevalence of Co-Morbid Psychiatric Conditions In Men and Women with Autism Spectrum Disorder. A. Shahidiani*[1], C. M. Murphy[2], C. Ecker[3], E. C. Wilson[4], N. Gillan[4], S. Coghlan[2], D. Spain[2], G. Roberts[2], M. A. Mendez[4], N. Hammond[5], D. M. Robertson[2] and D. G. Murphy[3], (1)*Centre for Neuroimaging Sciences, King's College London*, (2)*Behavioural Genetics Clinic, Maudsley Hospital, London*, (3)*King's College London, Institute of Psychiatry*, (4)*Institute of Psychiatry, King's College London*, (5)*South London and Maudsley NHS Foundation Trust*

Background:

Autism spectrum disorder (ASD) is recognised as a predominantly male disorder with associated co-morbid mental health difficulties. There is a large body of literature that includes male children with ASD. However, there is limited investigation of co-morbid difficulties of adults with ASD, and in particular, female adults.

Objectives:

The primary objective of this study is to elucidate the prevalence and type of co-morbid mental health disorders in adult males and females with ASD.

Methods:

A retrospective review was completed of 527 adult patients (78% male; mean age: 31years, SD: 12 years and 22% female; mean age: 31years, SD: 10years) diagnosed with ASD at the Behavioural Genetics Clinic, a specialist clinic providing gold-standard assessment of ASD in adults at the Maudsley Hospital, London. Diagnostic assessment included a detailed neuropsychiatric interview, the Autism Diagnostic Observation Schedule (ADOS) and / or Autism Diagnostic Interview-Revised (ADI-R), depending on consent to contact parents/ parental availability, and a physical examination. Co-morbid mental health diagnoses were made in accordance with ICD10 criteria (with the exception of adult Attention Deficit

Hyperactivity Disorder (ADHD), which was assessed using DSM IV, in line with UK guidelines.

Results:

60% of men and 49% of women diagnosed with ASD also met diagnostic criteria for at least one other co-morbid mental health condition. The most common of these was depression in men (22% compared to 17% women), and Generalised Anxiety Disorder in women (18% compared to 12% in men). Obsessive Compulsive Disorder was diagnosed in 18.9% and 16.4% of men and women respectively. The occurrence of social phobia (11%) and Agoraphobia (9%) was the same for both groups.

The rates of different co-morbid conditions were contrasted between the genders using Pearson's chi-square test. The most striking difference between male and female groups was in Schizophrenia and Psychosis. Over 4% of men received a confirmed diagnosis of Schizophrenia or Psychosis, but these disorders were not confirmed in any women ($p = 0.04$). However, a significantly higher fraction of women (3.4%, in comparison to only 0.25% of men) exhibited psychotic features related to depression and /or other mood disorders, or sub-threshold psychotic features ($p = 0.009$). There were no significant differences in rates of any other co-morbid conditions between the genders.

Conclusions:

These results show a high incidence of co-morbid affective disorders (depression/ anxiety/OCD) in both male and female adults with ASD, but suggest a gender difference in vulnerability to psychosis in adult males. Our findings have both clinical and health economic implications for service development and treatment, and highlight the need for improved recognition and treatment of co-morbid mental health difficulties in both adult males and females with ASD.

122.184 184 Relationship Between the Quality of the Home Environment and Developmental Status of Children with Autistic Disorder in Jamaica. M. Samms-Vaughan*, J. A. T. Reece, S. Pellington and S. C. Smile, *The University of the West Indies*

Relationship between the quality of the home environment and developmental status of children with Autistic Disorder in Jamaica

Background: At least two-thirds of children diagnosed with autistic disorder are known to have cognitive impairment, with some having severe and global developmental delay. Intensive behavioural intervention and structured early intervention are known to impact developmental and behavioural outcomes positively. In resource-limited countries, where such interventions may not be widely available and/or accessible, children with autism may be totally dependent on their home environment for stimulation.

Objectives: The aim of this study was to determine whether the quality of the home environment has an impact on the developmental status of children with autism.

Methods: The Jamaica Autism Database (JAD) contains 500 children diagnosed at Jamaica's main referral centre for autism, the University Hospital of the West Indies (UHWI), since 1999. Ninety Eight (98) children under the age of 6 years, who were diagnosed with autistic disorder, using DSM IV criteria and a standardised tool, the Childhood Autism Rating Scale (CARS), since 2002, were included in this study. We evaluated the impact of socioeconomic status (as measured by ten durable goods in the home), maternal age, maternal education and children's demographic factors (age at diagnosis, gender) on children's development. Developmental Quotients (DQs) were assessed at the time of diagnosis by a single examiner, using four sub-scales of the Griffiths Mental Development Scales: Personal-Social (PS), Hearing and Speech (HS), Eye Hand Co-ordination (EHC) and Performance or Non-Verbal Reasoning (PE). Data were analysed using descriptive statistics and Linear Regression Modelling.

Results: There were 83 males (84%), the mean age of the population was 4.7 years (SD 1.8). Fifty-six (56%) of the mothers had secondary education or less; forty-four (44%) had tertiary education. The mean number of household possessions was 7.7(SD 1.6). Mean DQs for PS (55.5, SD 19.7), HS (42.6, SD 17.0), EHC (56.6, SD 18.8), PE (59.6, SD 22.3) were well below test norms of 80-100. In the regression

model, maternal education was positively associated with HS (B=-9.43, p=0.006), PS (B=-8.25, p=0.042) and PE (B=10.93, p=0.02). The number of durable goods was positively associated with HS only (B=2.44. p=0.034). No other factors were significant.

Conclusions: In resource-limited countries, the developmental status of children with autism is associated with the quality of the home environment, as measured by maternal education, and to a lesser extent, the physical resources in the home. This is also true of typically developing children. Though changes in maternal education, as measured by educational attainment, are not easily effected, improving the quality of the home environment by providing early intervention training and support to parents may improve the developmental status of children with autism, particularly those of low socio-economic status.

122.185 185 Use of a Large Administrative Dataset to Examine Health Outcomes in Children with Autism Spectrum Disorders. D. Spencer*[1], J. Marshall[2], T. Dennen[2], G. Yang[2], C. J. Newschaffer[3], L. J. Lawer[4] and A. Jain[2], (1)*Optum Insight*, (2)*The Lewin Group*, (3)*Drexel University School of Public Health*, (4)*University of Pennsylvania*

Background: Autism spectrum disorders (ASDs) affect a large and heterogeneous group of children and youth. Most studies of health outcomes in ASD to-date have included only relatively small or narrow clinical samples limiting their generalizability.

Objectives: To use a large administrative dataset to further our understanding of how children/youth with ASDs differ from those without ASDs in terms of health outcomes and related enrollment and demographic information.

Methods: We conducted a non-concurrent prospective analysis of administrative data maintained by a large private health plan. We considered medical, behavioral health and pharmacy claims and health plan enrollment information from January 2001 to December 2009. From this dataset, we identified subjects aged 0-21 with at least one Autism, Asperger's Syndrome, or Pervasive Developmental Disorder not otherwise specified (PDD-NOS) ICD-9 diagnosis code and a like-aged cohort without these diagnoses. Subjects with Rett Syndrome and Childhood Disintegrative Disorder diagnoses were excluded. All included subjects had at least one six-month or longer period of continuous enrollment in the health plan. Results include two databases, only one of which was potentially linkable to family health information and to an external consumer database of socioeconomic data. We conducted descriptive analyses characterizing demographics, extent of longitudinal data available, socioeconomic variables when available and frequency of select health outcomes across the cohorts.

Results: The ASD cohort and comparison cohorts comprised 79,994 and 240,165 children/youth respectively. For 46,236 children with ASDs and 138, 876 comparison children, sibling and parent health information was also available. Children with ASDs averaged 39.2 and 41.8 months of continuous enrollment (differed in the two databases) and the comparison group averaged 30.5 and 29.9 months of enrollment. Thirty nine percent of the cohort of children with ASDs had claims for Autistic Disorder only, 41% for Asperger's/PDD-NOS only, and 21% for both. As expected 80% of the ASD cohort were male. In one database, race/ethnicity and household income data were available for ~60% of the ASD cohort and half of the comparison cohort. Of these, 85% of the ASD and 79% of the comparison cohort were White while 16.5% of the ASD and 24.1% of the comparison cohort had household income <$50K. Health outcomes were classified using AHRQ's clinical classification software. The top ten morbidity areas in the two cohorts overlapped considerably (e.g., common childhood infections, eye and ear conditions) with the expected exception of increased morbidity in developmental, neurologic and behavioral disorders among the children with ASDs. Morbidity frequency was higher in the children with ASDs for all diagnostic areas, however, some of which may be explained by surveillance bias. The cohort of children with ASDs averaged 14.9 health care encounters annually compared to 4.4 in the comparison cohort.

Conclusions: Large cohorts of children with ASDs and comparison children/youth can be identified from private insurance claims. General descriptive analyses suggest increased morbidity among the children with ASDs but more detailed analyses will reveal if the increases persist after

careful consideration of sociodemographic and medical surveillances differences across the two groups.

122.186 186 Covariates Associated with Dental Problems in Children with Autism Spectrum Disorders. O. Ly-Mapes*[1], J. M. Karp[2], T. Smith[1] and S. L. Hyman[1], (1)*University of Rochester Medical Center*, (2)*Eastman Institute for Oral Health*

Background: Children with autism spectrum disorders (ASDs) often have atypical oral sensations and behaviors that interfere with oral hygiene efficacy and compliance with professional services in the dental office. These challenges place children with ASDs at high risk for dental problems.

Objectives: To examine the rate of and covariates for dental problems in children with ASDs.

Methods: A retrospective review of children ages 3 to 15 years who were enrolled in our local ATN site between March 2009 and April 2011 was performed. Parents completing the ATN Registry Parent Baseline Assessment and the Sensory Profile were questioned about past or current dental problems, activity in behavioral and educational interventions, presence of sensory differences and abnormal feeding behaviors especially pica. Demographic and questionnaire data for children with versus those without a dental problem were compared using descriptive statistics, chi square analyses, and t-tests. Statistical significance was set a priori at $p<0.05$.

Results: One hundred seventy children (146 males, 24 females) were enrolled during the study period and subject to chart review. Fifty six of 170 children (33%) were reported to have a dental problem. Dental caries (34%), orthodontic concerns (21%), and tooth grinding (18%) were most commonly recorded. Dental problems were more frequently reported when children needed occupational therapy but did not receive speech therapy ($p<0.01$). Children scored as having definite differences in the tactile subscale of the Sensory Profile were more likely to have dental problems ($p=0.05$). Other covariates including ASD diagnosis, use of medications, presence and severity of sensory, attention, and hyperactivity problems, participation in pica, and differences in the taste/smell, movement, and visual subscales of the Sensory Profile were comparable among the groups. Only one child reported to have a dental problem was listed for subspecialty referral to a dentist.

Conclusions: Dental problems, as described by parents of children with ASDs, are similar to those expressed by parents of children without ASDs. The high rate of dental problems reported in this study supports greater involvement of dentists in interdisciplinary team care for children with ASDs. The impact of concurrent occupational and speech therapy on the prevention and management of dental problems warrants further study.

122.187 187 Telehealth-Based Systems for Diagnosis, Management and Treatment of Autism Spectrum Disorders. F. Angjellari-Dajci*, *MCG*

Background: Over the last two decades, ASD prevalence in the US has been steadily increasing, which has raised significant public health concerns given the shortage of trained specialists in the treatment of ASDs, especially in rural areas. Such prevalence increase has implications for the annual and lifetime per capita societal costs incurred.Currently, the in-person service delivery is the prevailing system for diagnosis, treatment and management of ASDs in the US. Such a system has been unable to address: (1) the increasing gap between service delivery supply and demand, (2) the increasing societal costs for those served, and (3) the unattained societal benefits for those not diagnosed early enough or not offered any early and intensive behavioral intervention treatments, which has been proven to produce substantial benefits over the long run.

Objectives: Evaluate how telehealth for diagnostic evaluation and ASD treatment to date has resolved any of the problems highlighted above. Economically evaluate: (1) whether telehealth service delivery offers greater societal net benefits (the difference between societal economic benefits and societal economic costs) than in-person delivery, (2) the threshold volume of telehealth encounters required for the telehealth delivery to reach a zero societal net benefit, and (3) a systematic evaluation of the cost of the transition process from in-person to telehealth service delivery which will include a schemata for reallocation of provider hours.

Methods: We build a theoretical model to capture telehealth system's potential in reaching ASD screening market equilibrium under the constraint of full utilization of provider hours and other stylized facts

Results: We estimate the market demand for ASD screening in the US for year 2011. We present an application that summarizes our progress with a case study that focuses on the potential impacts of increased access to care of technology based telehealth in Georgia-South Carolina border. We use social network analysis to envision the future of telehealth service delivery for ASDs.

Conclusions: Comparative full economic evaluations need to be conducted in order to evaluate whether telehealth systems will bring societal cost savings over the long run, and economic benefits from clinical (quality of life adjusted health measures) and socio-economic outcomes exceed economic costs, and are comparable to traditional in-person service outcomes. It is important that economists are involved in the very beginning stages of any individual interventions for proper data collection. In addition, from a system's perspective, economists need to be involved in assessing and evaluating the advantages and obstacles related to the telehealth and in-person systems becoming complementary and eventually competing systems, in face of the several problems the in-person system has been unable to address.

122.188 188 Evidence of Increasing Socioeconomic Disparity in the Prevalence of Autism Spectrum Disorder Among U.S. Children. M. S. Durkin*[1], M. J. Maenner[2], C. L. Arneson[1], C. DiGuiseppi[3], M. S. Wingate[4], C. E. Rice[5], S. Pettygrove[6], L. C. Lee[7], J. N. Constantino[8], R. Fitchgerald[9], J. Nichols[10] and L. A. Schieve[5], (1)*University of Wisconsin-Madison*, (2)*Waisman Center, University of Wisconsin-Madison*, (3)*University of Colorado Denver*, (4)*University of Alabama at Birmingham*, (5)*National Center on Birth Defects and Developmental Disabilities*, (6)*University of Arizona*, (7)*Johns Hopkins Bloomberg School of Public Health*, (8)*Washington University School of Medicine*, (9)*Washington University*, (10)*Medical University of South Carolina*

Background: Previous studies have shown significant positive associations between autism spectrum disorder (ASD) prevalence among children in the U.S. and indicators of socioeconomic status (SES), raising the possibility that there is under-ascertainment of ASD in less socioeconomically advantaged children. An analysis of data from 12 Autism and Developmental Disabilities Monitoring (ADDM) Network sites for the combined years of 2002 and 2004, for example, found ASD prevalence to increase in a stepwise manner from 4.8, to 6.5 and 8.1 per 1,000 children in the lowest, middle and highest SES tertiles, respectively.

Objectives: To replicate the previous ADDM Network study using comparable data for the year 2006, and evaluate the hypothesis that the SES disparity in ASD prevalence would be reduced in 2006 relative to 2002. Support for this hypothesis would be consistent with the possibility that awareness and identification of ASD among children of low SES have improved over time, and have contributed to ASD prevalence increases.

Methods: A cross-sectional study was implemented combining data from all 10 ADDM Network sites that participated in both the 2002 and 2006 study years of the ADDM Network. The ADDM Network is a multiple source surveillance system that incorporates abstracted data from health care providers and school records to determine the number of 8-year-old children meeting *DSM-IV TR* criteria for autistic disorder or other ASD. In 2006, the population base for this study included 287,606 8-year-old children. This population was defined by geographic boundaries that were common across the two study years, 2002 and 2006. Within this population, 2,446 children were found to meet diagnostic criteria for ASD in 2006. Census block group-level SES indicators were used to compute ASD prevalence by SES tertiles of the population.

Results: The prevalence of ASD in the combined study area in 2006 was 8.5 per 1,000 children, a 51% increase relative to the same study area in 2002. In addition, similar to 2002, the prevalence per 1,000 children increased stepwise with increasing SES, from a low of 5.5 in the lowest SES tertile to 9.3 in the middle SES tertile and 11.7 in the highest SES tertile. Although prevalence increased over time in all three SES

tertiles, the magnitude of the increase was greatest for high SES children, resulting in an increase rather than a decrease over time in the magnitude of the SES disparity. The prevalence ratios for the highest versus lowest SES tertiles increased significantly ($p<0.05$) between the two study years, from 1.74 (95% confidence interval 1.54, 1.96) in 2002 to 2.13 (95% confidence interval 1.92, 2.36) in 2006.

Conclusions: The SES disparity in ASD prevalence has increased during a time period of increasing overall prevalence of ASD. Because surveillance in this study was based on review of health and educational records, these results point to possible under-ascertainment and lack of access to services for children with autism who are socioeconomically disadvantaged. Further research is needed to monitor and understand the sources of the SES disparity in ASD prevalence.

Services Program

123 Use, Access and Evaluation of Services

123.189 189 The Influence of Parents and Researchers on Policy-Making for Children with Autism Spectrum Disorders in Canada. C. Waddell*, C. Shepherd and S. Gatto, *Simon Fraser University*

Background: In Canada, policy-making for children with autism spectrum disorders (ASD) has been singularly contentious — with parents organizing and even taking provincial governments to court to pursue public funding for new interventions. This determined advocacy has pushed ASD higher on the public agenda, posing a serious challenge for policy-makers who must consider the needs of all vulnerable children. Meanwhile, the role of researchers has been unknown in this mix.

Objectives: This qualitative study investigated the perspectives and experiences of parents, researchers and policy-makers to ascertain: the influences on the policy process for children with ASD, and the implications for improving outcomes for these and other children in Canada.

Methods: Our sample comprised three groups of knowledgeable participants from regions across Canada: *parents* involved with community or advocacy organizations for children with ASD; *researchers* specializing in ASD within universities; and *policy-makers* responsible for ASD services within provincial governments. 36 semi-structured interviews have been completed (12 interviews per group, approximately 90 minutes per interview). Interviews have been recorded and transcribed. An interdisciplinary team has conducted qualitative data analysis using constant comparative methods, including making essential comparisons within participant groups, between groups and across regions. Data have been corroborated in comparison with recent policy documents and participants are being invited to provide feedback on preliminary findings.

Results: Despite new funding and new interventions in many provinces, parents expressed serious ongoing concerns about the needs of children with ASD. While there was diversity in parents' responses, most felt it was urgent to intervene early — with some holding out hope for "recovery" — while also meeting the needs across the lifecourse. Parents spoke of the personal toll in caring for their children, many of whom had extraordinary needs, while also playing an advocacy role. Most began by advocating for their own children, then progressed to advocating for others. Researchers in turn conveyed deep commitments to children with ASD, often born of longstanding research and clinical relationships wherein they developed considerable empathy for these children and their families. Many researchers therefore felt compelled to help improve services, participate in public debates, and even engage in the policy process at times. Meanwhile policy-makers also described longstanding commitments to children with ASD, most having dedicated their careers to serving children. Many therefore found conflicts with parents distressing. They also spoke of tensions arising from their mandate to serve children who had other mental health or developmental problems but who lacked strong advocacy, particularly given limited resources for children's services overall. Policy-makers appreciated researchers who were willing to contribute in the unusually volatile policy milieu associated with ASD.

Conclusions: Parents of children with ASD have been highly effective as advocates, often with the support of researchers. ASD constitutes an exemplar, demonstrating that parents and researchers can significantly influence the policy process

when they align around common goals. The potential gains for children with ASD need to be evaluated and then translated — not only into further gains for these children, but also into gains for other vulnerable children.

123.190 190 Evaluation of a 5 Day Autism Training Model in India. C. Flint*[1], K. Hench[1], K. Johnsen[2] and J. Salt[2], (1)*Aaction Autism*, (2)*HAVE Dreams*

Background: Throughout India, Autism is a little understood phenomenon. People with autism are routinely regarded as 'mentally subnormal' or mentally ill. However, more parents and professionals are becoming familiar with the unique characteristics of Autism Spectrum Disorders. As part of that movement, Aaction Autism, a U.S. based non-profit organization dedicated to worldwide awareness through training, partnered with Action for Autism and Open Door school in New Dehli, to provide a 5 day intensive training based on structured teaching principles. Structured teaching is a specific instructional strategy designed to accommodate the characteristic strengths and neuropsychological differences of those with autism. Our week long, interactive training provides an opportunity to receive in-vivo supervision and feedback from experienced trainers. Through lectures, hands-on construction of visual supports and materials, participants create a classroom and work with children with ASD based on the pyramid model of physical structure, individual schedules, independent work systems, routines and strategies, and visual organization. The U.S. model for the training program has been evaluated and proven to be successful (Imfar, 2009; BPS 2010). However, the implementation of the training model in India is unknown, due to more limited resources, potential language barriers and different expectations by parents and teachers of individuals with autism.

Objectives: This study investigated the preliminary effectiveness of the training model for instructing parents and teachers to set up structured teaching programs in India. The study addressed (i) knowledge of structured teaching gained across the 5 day training period and (ii) the satisfaction with the training model.

Methods: Participating teachers and parents (n= 26) who attended the hands on 5 day training workshop completed a structured questionnaire pre and post training. The questionnaire was developed and piloted by the lead trainers to assess key aspects of structured teaching practice and principles. The final questionnaire had 10 questions, with a maximum total score of 40. The questionnaire was piloted on several India residents for ease of readability and cultural sensitivity.

Results: i) T-test revealed that there was a significant ($p<.05$) increase in knowledge of structured teaching scores pre and post training. (ii) Satisfaction with the training model was very high. Using a 5 point Likert scale, 85% (n=22) rated the training at its highest point 'excellent' with the other 15% (n=4) rating the training at point 4 "good". 100% (n=26) of responders felt more prepared to address the needs of individuals with ASD having attended the training.

Conclusions: The 5 day autism training program was successfully translated to the Indian subcontinent. Participants significantly increased their knowledge of structured teaching practices by attending our training. Both parents and teachers satisfaction with the training was very high. These results indicate the preliminary effectiveness of our training program. A more rigorous methodology is needed to extend confidence in these evaluation results.

123.191 191 An Exploration of Families' Motivations for Participating in Genetic Research for Autism. M. Trottier*[1], W. Roberts[2], I. E. Drmic[3], S. W. Scherer[4], R. Weksberg[2], C. Cytrynbaum[3], D. Chitayat[5], C. Shuman[3] and F. A. Miller[4], (1)*Hospital for Sick Children, University of Toronto*, (2)*The Hospital for Sick Children*, (3)*Hospital for Sick Children*, (4)*University of Toronto*, (5)*Mount Sinai Hospital*

Background: In recent years, there has been an expansion in research focused on uncovering the underlying biological and genetic causes of autism. This research depends on the willingness of families with autism to participate; thus, there is a duty to ensure that participants' needs are met throughout this process.

Objectives: The purpose of this study is to explore families' motivations for participating in genetic research for autism, and the expectations that participants place on actual or

hypothetical genetic information. In doing so, we hope to inform researchers about participants' needs and concerns, and to gauge whether or not their expectations are in line with those of researchers and are being met.

Methods: We utilized a qualitative approach to explore participants' experiences with genetic research for autism. We conducted semi-structured interviews with 9 parents who have one or more children with autism enrolled in genetic research through the Autism Research Unit at the Hospital for Sick Children in Toronto, Canada. Sampling was purposeful for variability across four dimensions: 1) Long-standing versus recent involvement in genetic research, 2) one versus more children with ASD in the family, 3) severity of the diagnosis on the autism spectrum, and 4) whether or not families have received genetic results from the research study. Respondents also completed a validated questionnaire that gauges tolerance for ambiguity as a general personality trait. Ambiguity may have particular relevance for individuals participating in genetic research since results can be marked with vague, inconsistent, incomplete, probable, or unclear meanings and prognoses.

Results: Motives for participating were classified as benefitting 'self' or 'others', although these were not mutually exclusive. Interestingly, while respondents discussed their interest in obtaining a genetic research result, they also valued aspects of participation that were distinct from this. Information in general helped maximize certainty and provided a sense of control over their current situation. A pattern emerged where the values placed on the act of participating in genetic research for autism were distinct from the values placed on having genetic information. The former was seen as beneficial for forming a connection with autism experts, networking with other families with autism and providing hope, while the latter alleviates feelings of guilt, raises awareness and validates the medical nature of autism. A separate area of discussion was respondents' expectations of how they would to be able to use genetic information. With advances in technology, this has evolved from being simply informative to hoping to tailor interventions to an individual child's genetic 'brand' of autism and for family planning purposes.

Conclusions: The results of this study highlight the complex factors involved in the decision to participate in genetic research for autism and the value of genetic information. It provides points to consider in order to ensure that research participants are treated respectfully, that their expectations are addressed properly, and that their needs for care throughout this process are met.

123.192 192 Autism Genomics Research Is Not Only about Autism Genomics: A Qualitative Study of Parent Participants. R. Z. Hayeems*, F. A. Miller and J. P. Bytautas, *University of Toronto*

Background: Autism genomics research aims to understand the genetic underpinnings of a complex phenotypic spectrum. The nature of the developmental and behavioral challenges with which families contend coupled with barriers to specialized care in many jurisdictions, further complicates the role of research for the community it engages.

Objectives: In light of the putative obligation to report genetic research results to individual study participants, we sought to understand researchers' and participants' experiences with and expectations of autism genomics research in general. Herein we report on the experiences of parent participants.

Methods: We conducted a qualitative study in 2006 and 2007 with researchers and research participants involved in autism genomics research. We report on data from 4 focus groups with 34 parents of minor or adult children with autism spectrum disorders (12 mothers, 4 fathers, 9 couples) who were participants in and recruited through relevant research groups in Southern Ontario. We also conducted 23 semi-structured interviews with parents (18 mothers, 1 father, 3 couples) recruited through the same research groups, and a Canadian autism advocacy organization. Discussions explored respondents' motivations for participating in autism genomic research and expectations about receiving genetic research results and other types of information through research participation. Interviews averaged 1 hour, focus groups 2 hours; each was tape-recorded, transcribed verbatim and entered into a qualitative database. We analyzed coded sections of each transcript in which parents discussed motivations for participating in and expectations of genomic research in autism, seeking to identify thematically coherent

interpretations of parents' experiences. We achieved qualitative saturation both across and within transcripts. We used an iterative and constant comparative analytic method with a reflexive approach to data interpretation to guide our understanding of the data.

Results: Parents expressed feeling motivated to participate in autism genomics research because they anticipated that valuable scientific knowledge would emerge, they trusted the researcher(s), and they hoped, albeit modestly, for knowledge relevant to their own child's health. Parents valued researchers' commitment to reciprocity in the form of aggregate data presented through newsletters and workshops. In addition, parents attributed value to 'meaningful' individualized genetic results. Beyond the potential to gain aggregated or individualized genetic insights, many parents viewed research as a mechanism for mobilizing diagnostic and therapeutic support, as well as general advocacy, for their child(ren).

Conclusions: Parents value individually-relevant knowledge and clinical services that may not be specific to genetic etiology, but may be difficult to obtain outside the context of autism genomics research. From an ethics perspective, while a beneficence impulse is well-suited to clinical care, invoking this impulse in the context of research with an at-times under-served population warrants caution. From a research governance and health care policy perspective, these data expose a tension between the financing and delivery of health care and health research.

123.193 193 Positive Partnerships: The Parent Advisor Model of Participatory Research with Parents of Children with ASD. B. E. Drouillard*[1], M. N. Gragg[1], H. E. Jones[2], R. T. Miceli[3], D. D. Barrie[1] and L. K. Miron[2], (1)*University of Windsor*, (2)*The Summit Centre for Preschool Children with Autism*, (3)*St. Clair College*

Background: Although there is now a large body of research concerning best practice guidelines for working with children with ASD and their families, this research could do more to take into account parents' perspectives. Since parents spend more time around their children with ASD than do professionals and are responsible for making important decisions on behalf of their children, participatory research offers invaluable information which can be used to develop best practice guidelines with "real world" utility. Conducting participatory research with parents of children with ASD is a significant step towards ensuring that research is accessible, relevant, and meaningful to these parents and their families.

Objectives: To describe a Parent Advisor Model of participatory research with parents of children with ASD. Parent and professional perspectives on the functions, benefits, and drawbacks of Parent Advisors in ASD research will also be outlined. Finally, recommendations will be offered for how researchers can integrate the Parent Advisor Model in their own ASD research.

Methods: Participants were 3 parents of children with ASD who routinely collaborate in ASD research in their community and 3 researchers who routinely collaborate with parents of children with ASD in their research. They offered their perspectives on the functions, benefits, and drawbacks of Parent Advisors in ASD research and proposed the Parent Advisor Model of participatory research.

Results: Parents and researchers reported parental involvement in a broad range of functions in research, such as offering first-hand perspectives on topics of investigation, advising research panels on participant selection, editing research materials and findings to increase accessibility, involving their own children in research, and disseminating results in academic and community settings. Parents commented that they benefitted by seeing positive research results, giving voice to other parents of children with ASD, hearing researchers' perspectives, and facilitating participant recruitment. Researchers reported benefitting by producing more accessible and parent-relevant research, increasing their sensitivity to parents' experiences, fostering egalitarian relationships with parents, and improving other parents' attitudes toward research. Both parents and professionals mentioned only minor possible drawbacks of participatory research with parents, including practical drawbacks such as difficulty scheduling meetings and that some outside researchers may dismiss parents as "non-academics".

Conclusions: A Parent Advisor Model of participatory research involving parents of children with ASD is proposed.

Both parents and researchers report numerous benefits to this model of research, including: giving voice to parents of children with ASD in research, producing more relevant and accessible studies, facilitated recruitment of participants, and improved dissemination of results. Recommendations are offered for researchers interested in incorporating the Parent Advisor Model into their own research.

123.194 194 Parents' Perspectives on Screening for Developmental Disabilities Including Autism At 12-Month Preventative Care Visits. E. Crais*[1], C. McComish[2], B. P. Humphreys[3], L. R. Watson[1], G. T. Baranek[1], J. S. Reznick[4], R. Christian[2] and M. Earls[5], (1)*University of North Carolina at Chapel Hill*, (2)*University of North Carolina*, (3)*University of New Hampshire*, (4)*University of North Carolina - Chapel Hill*, (5)*Guildford Child Health*

Background: The typical age of diagnosis is somewhere between 3-4 years of age (Mandell et al., 2005). Yet symptoms are present as early as 12 months and many parents identify concerns by 14 months (Baranek, 1999; Chawarska et al, 2007; Ozonoff et al., 2010). Primary Care Providers (PCPs) are key in the lives of infants and their families through preventative care visits (PCVs). Screening of toddlers for ASD at preventative care visits is now recommended (Johnson & Myers, 2007), but few PCPs are screening for ASD below 18 months. Further, little information is available about parent's perspectives on screening for ASD at younger ages.

Objectives: To explore parents' perspectives of primary care providers screening for developmental issues, including ASD at 12-month PCVs.

Methods: Three focus groups were held with 21 parents whose child had recently (within 3 months) had a 12-month PCV. A grounded theory approach was used in this qualitative study. Sessions were audio-recorded, transcribed, and analyzed using Atlas.Ti software. The research team reached consensus on 5 primary open codes and 25 axial codes. Open codes focused on issues related to interpersonal interactions, tool design, procedures, context, and ethical/moral dilemmas. Codes with the highest frequencies were determined most salient in this analysis and were further examined for themes and patterns.

Results: Parents' most frequently discussed topics included (a) interpersonal issues, especially a need for clear evidence, and (b) tool design. With respect to the "Need for Clear Evidence", parents expressed a range of perspectives about developmental and ASD screening at 12-month PCVs. Parents with concerns about their child's development said they were open to screening and wished their PCP had screened their child. Other parents were hesitant about ASD screening and the possibility of alarming parents unnecessarily. Parents also had questions about how definitive an ASD screening at 12 months could be, and several confused screening with diagnosis. With respect to "Tool Design", parents showed preferences about the type of screening tool and process they preferred. For example, some parents who had experienced questionnaires preferred specific questions (e.g., Does your child use certain sounds, number of words) rather than "yes/no" questions (e.g., Does your child use words?) or being asked broadly about their "concerns." Others liked "just having a conversation" with the pediatrician about what the child was or was not doing. Other information was gained about parents' preferences related to screening and will be provided.

Conclusions: The results of this study can be used by researchers, primary care providers, and families to reflect on parents' perspectives on developmental surveillance and ASD screening at 12-month PCVs. It can also be a vital component of comprehensive continuing education efforts aimed at providing up-to-date information on ASD screening. Designing and implementing screening tools that are effective and accepted by PCPs and parents may be key to the actual use of screening tools to detect ASD in young children in primary care settings.

123.196 196 Outcomes of Early Intervention for Families of a Child with ASD: Perceptions of Parents and Professionals. B. Elbaum*[1], D. M. Noyes-Grosser[2], S. R. Rosas[3], R. G. Romanczyk[4], E. H. Callahan[4] and R. L. Carter[5], (1)*University of Miami*, (2)*Bureau of Early Intervention, New York State Department of Health*, (3)*Concept Systems, Inc.*, (4)*State University of N.Y. at Binghamton*, (5)*University at Buffalo*

Background: Both research and policy mandates have recently focused on identifying desired outcomes of early intervention (EI) for participating families. Given the unique needs of families of a child with an autism spectrum disorder (ASD), it is important to identify outcomes that may be specific to these families.

Objectives: The purpose of this study was to identify desired outcomes of EI for families of children with ASD and to examine whether parents of a child with ASD differ from ASD professionals (researchers, service providers, EI agency personnel) in their perceptions of the relative importance of identified outcomes.

Methods: As part of a larger study, diverse EI stakeholders in the state of New York and national experts in ASDs participated in a two-phase Concept Mapping process (Kane & Trochim, 2007). In the first phase, participants generated n = 354 items reflecting desired outcomes of EI for families of a child with ASD. A subset of participants from the first phase (n = 74) then rated a reduced set of 51 items in terms of their importance and likelihood of being accomplished.

Results: Principal Components Analysis of importance ratings by all participants: Five components comprising a minimum of 4 items each and collectively explaining a total of 58% of the variance could be clearly interpreted. Findings suggested that EI should accomplish the following important outcomes for families of children with ASD: families will (a) have the knowledge and skills needed to participate in decisions about services and treatments for their child; (b) be connected with other ASD families and the community; (c) have specific skills related to parenting a child with ASD; (d) be able to deal effectively with challenging behaviors that affect their child's and family's participation in typical activities; and (e) have stronger bonds within the family.

Importance ratings: Mean item ratings by parents (n=23) correlated $r = .75$, $p < .001$ with mean item ratings by professionals (n=50; one individual did not specify his/her role), indicating relatively high agreement. Notable differences emerged, however. The items showing the most discrepant ratings across groups, with parents rating the importance over 0.5 point higher (on a 5-point scale) than professionals, had to do with families being able to explain their child's unique qualities to professionals ($t(1,72) = 2.7$, $p < .01$) and parents becoming knowledgeable about different treatments for ASD ($t(1,72) = 2.8$, $p < .01$).

Conclusions: There are at least five distinct and important categories of outcomes for families of children with ASD; EI providers should be cognizant of these so as to better ensure that they will be achieved. Differences in importance ratings by parents and professionals suggest that in their interactions with parents, EI professionals may put greater effort into drawing out what parents perceive to be unique information about their child and may provide parents with more information about the effectiveness of different treatment options.

Kane, M., & Trochim, W. M. K. (2007). Concept mapping for planning and evaluation. Thousand Oaks, CA: Sage Publications, Inc.

123.197 197 Investigating the Efficacy of Parent Training Service Delivery Models. A. L. Wainer* and B. Ingersoll, *Michigan State University*

Background: The prevalence of an autism spectrum disorders (ASD) diagnosis has increased, yet there has not been a corresponding growth in the dissemination of evidence-based interventions for children with ASD and their families. This has created a substantial service-need discrepancy for this population. Training parents in evidence-based intervention techniques is one way to increase access to services; however, there continue to be significant barriers associated with traditional clinic-based parent training models. As such, it is critical to explore adaptations of traditional service delivery systems in order to improve the reach and accessibility of evidence-based ASD parent training programs.

Objectives: The current study evaluated the efficacy of two different delivery formats of Project ImPACT, an evidence-based social communication parent training curriculum. In particular, this study investigated the effect of the traditional twice per week training format and a condensed once per week training format on the implementation of intervention techniques and program satisfaction.

Methods: Two multiple-baseline, single-subject design studies were conducted to assess the effect of two different delivery formats on participant behavior and experience. The first study investigated the efficacy of a traditional twice-a-week parent training format in 5 parent-child dyads. The second study examined the efficacy of condensed once per-week training format in 3 parent-child dyads. Participants in both groups were video-recorded practicing the intervention techniques at the end of each training session. Videos were coded for changes in parents' fidelity of implementation of the intervention techniques. Additionally, data examining parents' perception of the acceptability, usability, and effectiveness of the program and training format were collected.

Results: Results suggest that parents in both training formats demonstrated gains in fidelity of implementation from baseline to training sessions. Additionally, participants indicated high satisfaction with both training formats.

Conclusions: Project ImPACT is an effective curriculum for improving parents' ability to implement evidence-based intervention techniques for children with ASD. Both the traditional twice per-week, as well as the condensed once per-week, training formats are effective service delivery systems. Creating and evaluating various service delivery models can help surmount significant barriers and improve the accessibility and impact of intervention programs.

123.198 198 Conceptualizing Early Intervention Outcomes for Young Children with ASDs and Their Families. D. M. Noyes- Grosser*[1], S. R. Rosas[2], R. G. Romanczyk[3], B. Elbaum[4], E. H. Callahan[3] and R. L. Carter[5], (1)*New York State Department of Health*, (2)*Concept Systems, Inc.*, (3)*State University of N.Y. at Binghamton*, (4)*University of Miami*, (5)*University at Buffalo*

Background: Scientific evidence demonstrates autism spectrum disorders (ASDs) can be diagnosed in children as young as 18 months of age and that evidence based early intervention services can have a significant impact on children's development. Given the import and resources allocated to early intervention services in the United States and elsewhere, systematic evaluation of program impact is needed to inform stakeholders and guide quality improvement efforts.

Objectives: A multi-year study is being conducted to evaluate the impact of early intervention services on children with ASD and their families. In Phase I, Concept Mapping (Kane and Trochim, 2007) was used to answer the question, "What are the outcomes that stakeholders (national experts, families, service providers, government administrators, advocates) expect children with ASD and their families to achieve as a result of their participation in early intervention services?"

Methods: Concept Mapping is a mixed methods planning and evaluation approach that integrates familiar qualitative group processes (brainstorming, categorizing ideas, and assigning value ratings) with multivariate statistical analyses to help groups describe their ideas on any topic of interest, and represent these ideas visually through a series of related maps. To facilitate the collection of meaningful input, the research team developed two focus prompts: "As a result of early intervention services (a) families of children with autism spectrum disorders will..." and (b) children with autism spectrum disorders will..."

Results: A diverse group of stakeholders (parents of children with ASDs, n=84; service providers, n=40; local administrators, n=40; state officials, n=57; and, national experts, n=70) were invited to participate in concept mapping activities. Stakeholders generated 370 ideas related to outcomes for children with ASD and 354 ideas related to outcomes for families. A review of these statements for relevance, redundancy, and clarity of meaning yielded a final statement set of 105 distinct outcome ideas (54 child and 51 family outcomes). From the sort data, concept maps were created to show the relationships among outcome statements. Further analysis suggested that parents of toddlers with ASD consider child and family outcomes in fewer, broader categories, whereas professionals involved in ASD services make a greater number of conceptual distinctions among the same set of outcomes. Professionals organized outcomes into eleven idea clusters (including adaptation/school readiness, cognitive/behavioral skill building, social awareness/engagement for child outcomes clusters, and connections/supports for family wellness, family empowerment, family education and support, supporting social development for family outcomes clusters) compared

with seven idea clusters for parents (including expressivity/interaction, behavioral/cognitive development, socialization/engagement for child outcomes clusters, and anticipating child's needs/behavioral challenges, skills/knowledge to support child development, and advocacy/collaboration with professionals for family outcomes clusters).

Conclusions: Concept Mapping was successfully used with stakeholders to yield a rich set of early intervention outcomes specific to children with ASDs and their families that are differentiated from general outcomes currently applied to EI program evaluation. This work forms the basis for further research to develop and validate measures to evaluate the impact of early intervention services on young children with ASDs and their families.

123.199 199 Adherence and Psychological Evaluation Recommendations for Young Children with ASD. C. R. Newsom*[1], A. Vehorn[2], E. H. Dohrmann[1], J. L. Taylor[3] and Z. Warren[2], (1)*Vanderbilt University*, (2)*TRIAD, Vanderbilt Kennedy Center* , (3)*Vanderbilt Kennedy Center*

Background: American Academy of Pediatrics [AAP] guidelines endorse universal screening for Autism Spectrum Disorders (ASD) at 18- and 24-months of age, and at any point the caregiver expresses concerns (Johnson & Myers, 2007). These screenings, in combination with campaigns aimed at increasing awareness of the earliest signs of ASD, (CDC, 2010) are intended to enable parents and clinicians to act on developmental concerns early (Warren & Stone, 2011). Al-Qabandi, Gorter & Rosenbaum (2011) reviewed the early ASD detection literature and concluded there was not sufficient evidence to support routine population-based screening programs for young children with ASD. The authors reported that accessing and initiating effective therapies within communities might prove difficult given cost and time barriers. Additionally, they noted the dearth of published studies addressing families' and children's adherence with recommended interventions (2011).

Objectives: The current study represents a brief empirical evaluation of the ability of a clinical sample to implement recommendations following an ASD diagnosis.

Methods: This sample was drawn a larger study examining family functioning following an ASD diagnosis (see Taylor & Warren, in press). We examined not only the types of interventions implemented but also the association of implementation with parenting distress. Seventy-five mothers of young children diagnosed with ASD through a university-based preschool autism clinic completed surveys regarding access to recommended services as well as maternal mental health and distress.

Caregivers were presented with a list of common clinic interventions and asked indicate the specific recommendations they had implemented. Original recommendations made by the diagnosing clinician were extracted from evaluation reports by blinded research assistants. An overall non-weighted percentage of recommendations implemented variable was calculated.

Mothers were asked to complete the Center for Epidemiological Studies – Depression Scale (Radloff, 1977) the Beck Anxiety Inventory (Beck et al., 1988), and the Parenting Stress Index–Short Form (Abidin, 1995) to measure psychological and parenting distress.

Non-parametric correlations were conducted to determine bivariate relations between percentage of services implemented and measures of parental anxiety, depression, and parenting stress.

Results: A substantial majority of mothers (72%) were able to successfully implement most interventions (i.e., >75% of offered recommendations). Mothers reported considerable success in implementing educational and/or early intervention services (Individualized Education Program, 85.7%; Individualized Family Service Plan, 95.5% and conducting specific readings, 94.5%). Mothers reported moderate success implementing autism clinic follow-up visits (74%), speech/language intervention (74.2%), occupational therapy (67.7%), and medication consultation (66.7%). Only a minority of families reported the ability to implement recommendations regarding ABA based intensive intervention (42.1%), sleep evaluations (30.8%), and genetic testing (29.6%). Challenges implementing recommendations within this sample were not

significantly associated with differences in maternal depression, anxiety, or parenting stress.

Conclusions: Results suggest that despite numerous and significant barriers toward accessing some recommended services following diagnosis of ASD, many families will be successful in implementing many core services. While some categories of service appear very challenging to access (e.g., intensive levels of ABA-based intervention), failure to implement services may not always be powerfully related to caregiver distress.

123.200 200 Treatment Adherence in Families of Children Diagnosed with Autism Spectrum Disorders. R. Hock*[1], A. Kinsman[2], T. P. Cross[1] and J. Kellett[1], (1)*University of South Carolina*, (2)*Greenville Hospital System*

Background: Parents of children with autism spectrum disorders (ASDs) are commonly called to implement and maintain an array of complex behavioral interventions and medication regimens to manage their child's condition. Autism intervention research indicates that parent implementation is a critical component to achieving positive outcomes from both medical (Arnold et al., 2010) and behavioral interventions (Levy et al., 2006). A limited number of studies have examined parents' implementation of prescribed treatments within the context of specific training conditions (Crockett et al., 2007). However, little is known about a) the extent to which parents adhere to treatment recommendations on a day to day basis in the absence of clinician or provider supervision, or b) what child, parent, family, and provider factors may influence treatment adherence for families of children with ASDs. One study with this population indicated greater adherence to medical treatment than behavioral treatment recommendations, and greater adherence to reinforcement-based recommendations than punishment-based recommendations (Moore & Symons, 2009). The current study will extend these findings by considering the influence of a broader set of variables linked to treatment adherence in the medical literature, including parent and relationship factors, child characteristics, and select contextual factors.

Objectives: *Aim 1* is to determine patterns of treatment adherence among the parents of children with ASD. *Aim 2* is to examine the social context of treatment adherence among parents of children with ASD. *Aim 3* is to elicit parents' perceptions of their treatment services and how systems of care can be improved.

Methods: This study uses mail and online questionnaires to survey parents of children with ASD who are currently receiving ASD-related treatments. The questionnaire includes measures of parent stress, parent sense of competence, depression, coparenting, family management, social support, child diagnosis and symptom severity, and demographic characteristics. In addition, treatment adherence is measured within four treatment categories: Behavioral, medical, developmental, and alternative treatments. Respondent are recruited from treatment providers, support groups, and the SC Department of Disabilities and Special Needs.

Results: Data collection is currently underway and is scheduled to end in early March, 2012. In order to address Aim 1, descriptive statistics will be computed for all adherence measures. We will compare rates of specific adherence behaviors across treatment categories to determine if parents are more likely to adhere to certain types of treatments more than others. In order to address Aim 2, multiple regression analyses will be used to determine the degree to which parent, child and relationship variables predict parent treatment adherence by treatment type. Aim 3 will be addressed by compiling all qualitative responses in NVivo 8 software and conducting thematic analyses within and across questions.

Conclusions: Understanding the rates of treatment adherence and the factors that predict adherence will inform efforts to create family-centered models of care for individuals with ASDs. In addition, the results gained as part of this project will assist intervention providers in working with families to mitigate the barriers to treatment adherence, which will increase the likelihood of treatment success.

123.201 201 Assessing and Responding to Autism in Underserved Populations. M. M. McCloat*, *Autism Speaks and College of the Holy Cross*

Background:

Autism Speaks Global Autism Public Health Initiative (GAPH) is a program designed to strategically determine the unique needs of autism communities around the world, striving to better understand and develop approaches to addressing challenges in autism awareness, research, and services in autism communities around the world. As the reported prevalence of autism continues to rise around the globe, so does the demand for information about and services to treat the disorder.

Objectives: The aim of the current project is to make recommendations for GAPH based on the successful elements of existing health service programs in other disorders that can potentially inform the development of autism-specific programs and ultimately provide sustainable healthcare programs for underserved communities, both in developed and developing countries.

Methods:

Specifically, an extensive literature review on existing autism services research and, more broadly, services research in other health conditions including non-communicable diseases, mental health, and developmental disabilities was conducted to identifying successful and potentially transferable elements of these programs.

Results:

The results of this project included the identification of common barriers prohibiting autism program development in underserved communities, including access issues, lack of education, cultural stigma and language barriers. Thus possible solutions to developing successful programs that reach underserved communities around the globe may include community-centered kiosks to improve screening, urban and rural healthcare partnerships between academic centers and primary care providers, community representatives and tracking databases.

Conclusions:

Additional recommendations include the alliance of local autism community stakeholders including government to prioritize, develop and support innovative solutions that successfully and sustainably increase access to autism specific programs among the underserved. This report will allow Autism Speaks to make strategic funding decisions in supporting programs that will be most effective and have the greatest reach globally.

123.202 202 Service Use and Needs Among People with ASD During the Transitional Years From Adolescence to Young Adulthood. H. L. Hayward*[1], N. Gillan[1], T. Cadman[1], H. Eklund[1], D. Howley[1], J. Findon[1], H. Clarke[1], J. Beecham[2], K. Xenitidis[3], D. G. Murphy[1], P. Asherson[4] and K. Glaser[5], (1)*Institute of Psychiatry, King's College London*, (2)*London School of Economics and Political Science*, (3)*South London and Maudsley NHS trust*, (4)*Institute of Psychiatry, Kings College London*, (5)*Kings College London*

Background: Although many studies have investigated service use and needs of children with developmental disorders (e.g. ASD) to date little is known about this issue for these groups as they reach adolescence and young adulthood. Also, the lack of adult services for those with ongoing needs and functional impairments mean that family members become integral to the care of these clinical groups. Hence, research into the needs of young adults with an ASD (and their carers) is important in order to design and implement appropriate and effective care programmes.

Objectives: To investigate needs and other correlates of service use (e.g. medical and demographic) among those diagnosed with ASD who are now at transition from child to adult services.

Methods: An observational study was conducted with young people (aged 14 to 24) with an ASD (n=85, diagnosed using the ADI) and with their parents or partners (usually mothers) (n=98). Face-to-face interviews and questionnaires were used to assess needs, as well as demographic and health factors associated with service use (e,g. psychiatric symptoms and medication use) and the transition from child to adult services.

Results :. All young people met diagnostic threshold for an ASD and yet 44% were not receiving any kind of services. Participants reported an average of 9.4 total needs (an average of 3.2 of those were unmet needs) with the most frequently reported needs concerning exploitation risk (reported by 84% of participants), ability to get and prepare enough food (74%), money budgeting skills (72%), looking after the home (64%) and social relationships (63%). Total need was associated with overall service use amongst this clinical group.

Conclusions: Adolescents and young adults with autism reported high levels of total and unmet needs; however, only around half were being helped by services. Our findings suggest that appropriate lifetime services are required to meet the needs of people with ASD.

123.203 203 Increased Emergency Department Use for Mental Health Problems Among Children with Autism Spectrum Disorders: A Population-Based Study. L. Kalb*[1], R. A. Vasa[1], E. Stuart[2], B. H. Freedman[3] and B. Zablotsky[4], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins School of Public Health*, (3)*University of Delaware*, (4)*Johns Hopkins Bloomberg School of Public Health*

Background: Little is known about the use of emergency department (ED) services among children with an Autism Spectrum Disorder (ASD). Given the high rates of psychopathology in this population, coupled with a severe shortage of child and adolescent psychiatrists in the United States, these children may be at an increased risk of utilizing ED services for mental health problems (Gabel & Sarvet, 2011; Simonoff et al., 2008). To date, no line of research has explored this question, especially in a nationally representative sample.

Objectives: 1) To compare the prevalence of ED visits between children with and without ASD where the primary indication of the visit was a psychiatric concern; and 2) to examine the number and type of psychiatric diagnoses in mental health related ED visits by children with ASD.

Methods: Pediatric data from the 2008 National Emergency Department Sample (NEDS), the largest all-payer ED database, were examined. The weighted study sample, which represents all ED visits in the United States, consisted of 17,517,397 visits for children ages 3 to 17 years (M = 10.0; SD = 4.72 years). All diagnoses in the NEDS are coded using the ICD-9-CM. ASD-related visits were identified using 299.XX. ED visits were considered primarily psychiatric in nature if the principal diagnosis represents a DSM-IV-TR Axis I psychiatric disorder. If the primary diagnosis was an ASD (n=418), the secondary diagnosis was used. A survey weighted logistic regression model, which controlled for child, ED visit, and hospital-related characteristics, was used to examine if ED visits among children with ASD were more likely to be for psychiatric reasons compared to visits by children without ASD. Among these psychiatrically-related ED visits, a similar, albeit poisson, model was used to determine if visits by children with and without ASD differed in the number of psychiatric comorbidities reported.

Results: Children with ASD had a total of 59,187 ED visits (weighted prevalence of .003%). Of all ASD-related visits, 13% were related to a primary psychiatric concern, as compared to 2% of all visits by children without ASD. After adjustment for socio-demographic variables, visits by children with ASD were over 8 times more likely to be for psychiatric reasons compared to visits by children without ASD (OR: 8.38, 95%: 7.89 – 8.89). Psychiatric visits by children with ASD involved a greater number of psychiatric diagnoses compared to similar visits of children without ASD (β = .09, 95%: .07 -.12) (all p < .001). The most common principal diagnoses reported among these visits in children with ASD were behavioral (43%), mood (37%), anxiety (11%), and psychotic (8%) disorders as well as suicide and intentional self-inflicted injury (1%).

Conclusions: This is the first study to demonstrate high rates of ED use for psychiatric evaluation in children with ASD. Consistent with the ASD psychiatric comorbidity literature, children with ASD visiting the ED for mental health problems were more psychiatrically complex than their peers. These findings underscore the acuity of psychiatric problems seen in this population and the urgent need for stronger community-based mental health resources.

123.204 204 Children with Autism Spectrum Disorders and Utilization of Emergency Department Services. Y. Lu, K. Smith*, M. Kipke and L. Yin, *Keck School of Medicine of USC*

Background: The high prevalence of Autism Spectrum Disorders (ASD) has significant implications and presents challenges to the health care system. Increased utilization of emergency department (ED) services adds extra burden to an already overstretched health care safety net.

Objectives: To determine the frequency of visits, most common diagnoses, distance traveled, and time of day children with ASD utilized emergency department services.

Methods: Descriptive analysis of ED administration data from 2006 – 2009. The setting was an urban, tertiary children's hospital, with a Level I Trauma Center, and ED visits over 60,000 visits annually. The patinets were 169,948 children accounting for 246,385 visits; primarily Hispanic from low income households. The main outcome measure was the number of ED Visits per child, per calendar year, and whether an ED visit resulted in hospital admission. ED administration data provided patient demographics, principle diagnoses and time of arrival. Numbers of visits per patient, per year was calculated based on unique individual identifiers. ASD related ED visit was defined if the discharge diagnosis included an ASD ICD-9 code.

Results: Children with ASD visited the ED 20% more; were older, occurred during weekday hours, and were less likely to result in hospital admission; the top 3 diagnoses made were identical to children without ASD.

Conclusions: Children with ASD use the ED for typical, routine childhood illnesses during times when most primary care providers are available. Our data suggests further training of primary care providers to recognize the presentation of common illnesses among children with ASD may be needed.

123.205 205 Predictors of Inpatient Admission for Adults with and without Autism Spectrum Disorders. C. A. McMorris*[1], A. M. Palucka[2], P. Raina[2] and Y. Lunsky[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Compared to the general population and to individuals with Intellectual Disabilities (ID), individuals with Autism Spectrum Disorders (ASD) have increased rates of mental health disorders, and thus might be at greater risk for psychiatric hospitalization. Previous research indicates that a diagnosis of autism is one of the strongest predictors of psychiatric hospitalization in adults with ID (Cowley, et al., 2005). Additionally, studies have shown that specific demographic factors (e.g., age, residence) and clinical variables (e.g., age of ASD diagnosis, co-morbid psychiatric diagnoses, and aggression) are strongly associated with psychiatric hospitalization in children with ASD (Mandell, 2008). However, no studies have considered predictors of admission in adults with ASD. Thus, the present study aims to provide further insight into what demographic and clinical variables predict inpatient admission in a Canadian ASD sample compared to a non-ASD sample.

Objectives: The present study has two objectives: 1) To determine whether a diagnosis of ASD predicts inpatient admission in a clinical sample of adults with ID; and 2) To determine whether predictors of admission in adults with ASD differ from predictors for adults without ASD in the same inpatient unit

Methods: Data was obtained from an electronic clinical database that contains information on clients who were referred to a tertiary level mental health service for people with ID. The present study utilized information available at intake for patients referred during the period from April 2006 - April 2011. During this period, 326 adults, 73 with ASD, were seen in this mental health service. In addition to ASD status, variables predicting admission will include, demographic variables (e.g., age, gender, referral source, reasons for referral, residence at the time of referral, as well as forensic involvement, severity of ID, and verbal ability), as well as clinical variables (e.g., psychiatric and medical diagnoses, psychotropic medications, and risk behaviours). Scores on screening measures of maladaptive behaviour, the Reiss Screen of Maladaptive Behaviour and Aberrant Behaviour Checklist, will also be used to predict inpatient admission in the ASD group.

Results: Data are collected and currently being analyzed. In those with ASD, predictors of admission include age, gender, and use of antipsychotic medication, with level of ID approaching significance. Further analyses are currently being conducted to determine predictors of admission in those without ASD. A final analysis will be conducted to explore whether ASD predicts admission, when other variables are taken into account.

Conclusions: The findings from the current study will aid in the identification of the individual variables that predict inpatient admission in adults with ID, and specifically with ASD and ID. Furthermore, it will provide a better understanding of the specific treatment and support needs of this population in order to prevent future inpatient admission.

123.206 206 The Medical Home: Impact on Children with Autism Spectrum Disorders and Their Families. J. E. Farmer*[1], M. J. Clark[1], W. A. Mayfield[1], N. C. Cheak-Zamora[1], J. K. Law[2], A. R. Marvin[2] and P. A. Law[2], (1)*University of Missouri*, (2)*Kennedy Krieger Institute*

Background: Parents of children with autism spectrum disorders (ASD) describe numerous problems accessing specialized services and family supports compared to other children with special health care needs (CSHCN) (Kogan et al., 2008; Krauss, Gulley, Sciegaj & Wells, 2003). These challenges often result in family strain due to high out-of-pocket costs for unfunded services, demands on parental time to seek and coordinate services, and the need to reduce work hours or stop working because of the child's condition.

Objectives: This study's purpose was to examine the relationship between having a primary care medical home and two potential family stressors: (1) unmet child needs for specialized care, and (2) family strain associated with time spent coordinating care, reduced hours of employment, and financial concerns. The study hypothesis was that having a fully functional medical home as described by the Child and Adolescent Health Measurement Initiative (CAHMI, 2009) would reduce both of these stressors. Possible moderating factors such as child age, diagnostic category, physical health status and functional level were also examined.

Methods: A 73-item *Access to Care Questionnaire* was designed for this study, with most questions taken from the 2005/06 National Survey of Children with Special Health Care Needs. The sample was drawn from families who were enrolled in the Interactive Autism Network (IAN), a national online autism registry. A link to the questionnaire was emailed to 2,422 enrolled families, and the survey remained available for parents to complete for a 5 month period. There were 376 respondents in total (16% response rate). Mean child age was 9.7 years (*SD* = 3.9); 82% were male; 19.5% of children in the sample had a fully functional medical home. Two hierarchical regression analyses were conducted to examine predictors of unmet child needs and family strain (n = 308), using a prediction model that included demographics, child characteristics, family characteristics and the five key components of the medical home.

Results: Overall regression models were significant for unmet child needs (R^2 = .42, p = .000) and family strain (R^2 = .39, p = .000). Predictors of unmet child needs included child characteristics (worse physical health, total number of needs) and family characteristics (total number of unmet family support needs). After controlling for demographic, child, and family characteristics, the five medical home components predicted unmet child needs; significant components were having a usual source of care and family-centered care.

In the second regression, two child factors predicted higher family strain: lower functional level and worse physical health. After controlling for demographic, child, and family characteristics, the medical home components also predicted family strain. Specifically, family-centered care was associated with lower family strain.

Conclusions: Family-centered care provided through the primary care medical home may increase access to specialized care for children with ASD and reduce the impact of the condition on the family. More research is needed to determine whether quality improvements in primary care service delivery will enhance child and family outcomes.

123.207 207 Parent and Physician Perceptions of Medical Home Needs for Children with Autism in Kentucky. P. G. Williams*[1], S. D. Tomchek[2] and R. Grau[1],

(1)*University of Louisville*, (2)*Weisskopf Child Evaluation Center*

Background: The medical home concept (AAP, 2002) proposed that care of children be accessible, continuous, comprehensive, family centered, coordinated, compassionate and culturally effective. The medical home is the model of care for children with special health care needs such as autism, but is often difficult to implement. Children with special health care needs are more likely to have delayed care, care coordination needs, and referral problems. Although few studies have specifically addressed medical home implementation for children with autism, barriers may include lack of reimbursement for coordination efforts, family attitudes toward vaccines and traditional medicine, and use of alternative medicine.

Objectives: This study surveyed parents of children with ASD and pediatricians in the state of Kentucky to determine needs in establishing comprehensive medical homes for children with autism.

Methods: A parent survey was distributed to the list serve of the Kentucky Autism Training Center and was completed by one hundred parents of children with autism via Survey Monkey. A physician survey was distributed to members of the Kentucky Chapter of the AAP and twenty-five physicians completed the survey.

Results: The majority of parents of children with ASD were satisifed with the routine medical care provided by their pediatricians, but reported inadequate discussion of autism treatment and community resources. Most pediatricians felt comfortable providing routine health care to children with autism but were uncomfortable addressing associated conditions such as sleep and behavioral concerns, alternative biomedical treatments and educational intervetnions. Of particular concern was the finding that less than half of physicians routinely administered autism specific screening tests at 24 months, as recommended by the AAP.

Conclusions: Feedback from parents of children with ASD and pediatricians indicated general satisfaction with routine health care, but deficiencies in early identification and guidance on autism specific issues, such as sleep, behavioral concerns, Individuals Education Plans and community resources. Increased national and regional resources in autism, as well as physician education and outreach, will be needed to address these barriers to providing comprehensive medical homes for children with ASD in the state of Kentucky

123.208 208 Family Experience of Navigating Systems of Care for Young Persons with Autism. D. McConnell*[1], S. Hodgetts[1], D. B. Nicholas[2] and L. Zwaigenbaum[1], (1)*University of Alberta*, (2)*University of Calgary*

Background: Families provide the majority of care for young persons with autism, yet there is little research investigating the shifting needs of, hence potentially changing services required for, young persons with autism as they transition from childhood to adolescence and young adulthood. Current literature focuses on child-directed treatment of specific behaviors rather than family-focused treatment and adaptive behaviors, which is surprising because family-centered care is considered best practice in child health care. The pervasive impact of autism on individual and family functioning and the cumulative societal costs associated with autism argue for concerted efforts aimed at improving systems of care to enhance outcomes.

Objectives: This study investigated the processes by which families experience and navigate systems of care for young persons with autism over time and across health, education and social service sectors.

Methods: This data represents the qualitative component of a larger, mixed-methods study. In-depth, semi-structured interviews were conducted with 20 families with a child, adolescent or young adult with autism. Purposive sampling ensured diversity in age of the child (from 3 to 29 years old), urban/rural location, symptom severity, and family demographics. Interview transcripts were content analyzed, assisted by NVivo software. Established grounded theory constant comparison analysis methods were used to yield a data generated theoretical model demonstrating component elements and processes depicting family outcomes over time and development.

Results: Several themes were common to the parents' experiences regardless of the age or developmental level of

the young person with autism. Pervasive themes included: (1) the mother's life revolved around child's care needs, including navigation of supports and services; (2) the need for consistent, reliable respite care; (3) a high staff turnover for education and social sectors, blamed on inadequate wages; (4) a worry about their child's future; (5) the importance of informal supports, including extended family and friends, for parental well-being; (6) the importance of service providers that treated parents with respect, and worked in collaboration with parents; (7) inadequate educational and recreational/leisure programs, and; (8) a focus on social services offered in the home and community, because parents felt that was where they had the most input and control, and could tailor services to match their values. Parents provided several suggestions on ways that systems of care could be most improved. Pervasive themes included: (1) improved consistency of professionals; (2) qualified and consistent respite care; (3) improved integration and coordination of services within and across sectors; (4) increased funding and availability of formal supports and services for adolescents and young adults; and (5) adequate housing, vocational and leisure opportunities for older adolescents and young adults with autism.

Conclusions: This study identified critical strengths and limitations of current systems of care over time, as well as suggestions for how to best improve supports and services grounded in the experiences of families of young persons with autism. This information can be used to improve systems of care across service sectors for young persons with autism and their families.

123.209 209 DEVELOPMENT of the Pathways AUTISM SERVICES Log (PASL). R. A. Stock*[1], J. Volden[2], S. Georgiades[3], M. Alexander[4], T. Bennett[3], L. Colli[5], K. MacLeod[6], I. O'Connor[5], C. Shepherd[7], M. Steiman[8], P. Szatmari[3], S. E. Bryson[9], E. Fombonne[8], P. Mirenda[1], W. Roberts[10], I. M. Smith[9], T. Vaillancourt[11], C. Waddell[7] and L. Zwaigenbaum[2], (1)*University of British Columbia*, (2)*University of Alberta*, (3)*Offord Centre for Child Studies, McMaster University*, (4)*Glenrose Rehabilitation Hospital*, (5)*McMaster University*, (6)*Isaak Walton Killam Hospital*, (7)*Simon Fraser University*, (8)*Montreal Children's Hospital*, (9)*Dalhousie University/IWK Health Centre*, (10)*The Hospital for Sick Children*, (11)*University of Ottawa*

Background: The "Pathways in ASD" study is a large longitudinal study examining the developmental trajectories of children with ASD. Approximately 420 children in Halifax, Montreal, Hamilton, Edmonton and Vancouver have been assessed four times in the period between their receiving a diagnosis of ASD (2-4 years of age) and their entrance to school (6 years of age).

At each assessment, participating families provided information on the type, duration, and intensity of services provided to their child and family during that period.

Objectives: To describe the development of the Pathways Autism Services Log (PASL), an instrument for the systematic coding of a diverse range of services data by both type and intensity/dosage.

Methods: Ten representatives from the five sites held regular teleconference meetings and generated criteria for 8 initial service type categories. Two coders from each site then coded their local data sets and calculated reliability, with a goal of 90% agreement. A 10-point coding scheme was finalized by consensus after three rounds of trial coding and conference calls to discuss and resolve coding challenges. Codes for type of service include: 0 = No Services (e.g., waitlist/seeking services); 1 = Behavioural/Structured; 2 = Integrated/Mainstream group-based without support; 3 = Integrated/Mainstream group-based with support; 4 = Specialized Group; 5 = Other services; 6 = Language & Communication; 7 = Occupational Therapy & Physical Therapy; 8 = Community/Recreation without support; 9 = Community/Recreation with support; 10 = Mental Health. Site-specific "local rules" were also developed to address idiosyncratic differences across sites.

A 4-point scale was then developed for categorizing the dosage (hours per week) of reported services, based on the distribution of services dosages in the data: one for services with higher weekly dosage (0-5, 6-10, 11-20 and >20) and one for services with lower weekly dosage (<1, 1, 2-5 and >5). This final coding system was approved by the investigators of the Pathways study and then applied to each site, again with two

coders coding data from their own site and calculating reliability for both service type and dosage. Following another teleconference meeting that identified remaining coding inconsistencies, the primary coder at each site met with the co-coder to resolve the existing discrepancies using agreed-upon rules.

Results: Multiple rounds of coding and a pre-specified process of reaching a consensus led to the development of the Pathways Autism Service Log (PASL), a new instrument for coding autism-related services data. Inter-rater reliability of 91% was achieved for the coding of the entire Pathways in ASD study data set.

Conclusions: The PASL is a comprehensive and reliable instrument that can be used for coding service type and intensity data on autism-related services. This measure will be used to quantify the services data to support the investigation of the impact of services on the developmental trajectories of children with ASD.

Sponsor: Canadian Institutes of Health Research (CIHR), Autism Speaks, Government of British Columbia, Alberta Innovates Health Solutions and the Sinneave Family Foundation.

123.210 210 Canadian Services for Young Children with Autism Spectrum Disorder (ASD): A Preliminary Overview. J. Volden*[1], S. Georgiades[2], M. Alexander[3], T. Bennett[2], L. Colli[4], K. MacLeod[5], I. O'Connor[4], C. Shepherd[6], M. Steiman[7], R. A. Stock[8], P. Szatmari[2], S. E. Bryson[9], E. Fombonne[10], P. Mirenda[8], W. Roberts[11], I. M. Smith[9], T. Vaillancourt[12], C. Waddell[6], L. Zwaigenbaum[1] and T. Pathways in ASD Study Team[4], (1)*University of Alberta*, (2)*Offord Centre for Child Studies, McMaster University*, (3)*Glenrose Rehabilitation Hospital*, (4)*McMaster University*, (5)*Isaak Walton Killam Hospital*, (6)*Simon Fraser University*, (7)*Montreal Children's Hospital*, (8)*University of British Columbia*, (9)*Dalhousie University/IWK Health Centre*, (10)*McGill University*, (11)*University of Toronto*, (12)*University of Ottawa*

Background: Anecdotal descriptions suggest that type and intensity of service provision vary radically from one Canadian province to another for children diagnosed with ASD, but empirical data have been lacking.

Objectives: To provide an overview of type and amount of services provided to young children with ASD in five Canadian urban sites (Halifax, Montreal, Hamilton, Edmonton, and Vancouver). We examined: (1) the percentage of children who received each of 10 types of service; (2) the percentage of children who did not receive any service; and (3) the intensity of services received We also examined variation in service use by site and by time (across four assessments, T1-T4).

Methods: Parents completed a questionnaire about the type and amount of service provided to their children at each assessment (i.e., within one month of the child's diagnosis at age 2 to 4, at 6 and 12 months following diagnosis, and at age 6). Using the Pathways Autism Services Log (PASL), parents' responses were coded into 10 types of service with four possible levels of intensity for each. Teams of two researchers at each of the five sites coded data from their sites according to criteria developed by the whole group. Inter-rater reliability was 91%.

Results: Data were collected from 377 families. Across all sites, the highest percentages of children received "language and communication services" at T1 (64%) and T2 (54%) (i.e., within six months of diagnosis), but by T3 (i.e., within a year), 63% of the children were receiving "behavioural/structured therapy". Proportions of children receiving each type of service varied across sites and assessments. For example, at T1, four sites reported "language and communication services" as the service type received by the highest percentages of children, (ranging from 100% to 34%), while another site reported "supported mainstream group-based activities" as the service received by the highest proportion (54%). However, by T2, two sites reported "behavioural/structured therapy" (100%, 73%), two cited "language and communication" (61%, 57%), and one reported "supported group activity" (33%) as received by the greatest percentage of children. Proportions of children not receiving any service also varied. At T1, 23% of families reported that their child was not receiving any service, but this decreased to 3% by T4. Service intensity also varied across assessments. For example, at T1, the highest proportion of

children received "behavioural/structured therapy" for 6-10 hours per week versus 11-20 hours per week at T3.

Conclusions: Preliminary descriptive analysis using the PASL revealed both similarities and differences in service provision from province to province and over time. Overall, "behavioural/structured therapy" and "language and communication services" were the service types received by the largest percentages of children. In addition, services appeared to become more available over time. Detailed discussion of variation across sites and assessment times will be presented.

123.211 211 Parents' and Professionals' Perspectives on Autism Services in Alberta. S. Hodgetts*[1], L. Zwaigenbaum[1] and D. B. Nicholas[2], (1)*University of Alberta*, (2)*University of Calgary*

Background: For families, a child with autism may necessitate supports and services on a daily basis and across the lifespan. Families provide the majority of care for young persons with autism, yet there is a dearth of research addressing the supports and services that families with children with autism require to foster best outcomes across the lifespan. Furthermore, limited research has investigated perspectives of family-centered care, considered best practice in child health care, from multiple stakeholders including both parents and professionals. Perspectives from multiple stakeholders will help tailor services to best meet families' needs.

Objectives: This study will: (1) determine current fit between services received and family values across service sectors [i.e., health, education, social (home/community)], and (2) identify perceived strengths and gaps of current systems of care from the perspectives of both families and professionals.

Methods: 135 surveys from parents and 160 surveys from professionals are completed to date. Parent perceptions of family-centered care were measured with the Measure of Processes of Care (MPOC) completed separately for each sector from which the family receives care. Professionals reported on the implementation of family-centered care using the Measure of Processes of Care – Service Providers (MPOC-SP). Detailed demographics were collected to describe the sample. Open-ended questions addressed perceptions of strengths, gaps, and ways to improve current systems of care for persons with autism and their families. Descriptive statistics will summarize data, and we will examine potential covariates (e.g., age of child, geographic location, type of professional). In addition, we will examine parents' perception of receiving and professionals' perceptions of providing family-centered care based on service sector. Responses to open-ended questions will be content analyzed to identify strengths, weaknesses, consistencies and discrepancies among respondent groups.

Results: Data collection is underway.

Conclusions: Findings from this study will identify critical strengths and limitations of current systems of care from the perspectives of those directly involved in care: parents and professionals. It will also identify salient child, family and environmental factors that impact experiences with and perspectives of current systems of care, providing the opportunity to guide supports and services to improve child and family experiences and outcomes.

123.212 212 An Updated Evaluation of the Autism Ontario Realize Community Potential Program. M. Thompson[1], J. H. Schroeder*[2], J. M. Bebko[2], M. Spoelstra[1], S. Duhaime[1], K. Manuel[1] and L. Verbeek[1], (1)*Autism Ontario*, (2)*York University*

Background: The *Realize Community Potential (RCP) Program* was developed to directly support parents of children with ASD through: greater access to information, direct contact between parents and Autism Ontario chapters, improved access to experts in local communities, and increased community-based learning opportunities for children with ASD. The RCP program started in 2007 as a pilot program through 6 community chapters, was expanded to a 7th chapter in 2008, and will be expanded across the province of Ontario in 2012. A Knowledge Project evaluation team has been a part of the program since its inception. This presentation is a follow-up three years after an earlier presentation at IMFAR in 2009.

Objectives: Major goals of this evaluation are to determine the ability of the RCP program to meet the stated objectives.

Methods: Baseline and follow-up questionnaires were administered to compare chapter activity before and after the inception of the RCP program. Short-term stress surveys were completed during contacts with families. A longer-term stress measure evaluated parents' perceived ability to navigate the system and act as a child's advocate, and their perceptions of severity of child symptoms and stress associated with those symptoms at first contact, and at 18-36 month follow-up. Francophone families completed a separate/different survey about services and barriers to accessing services.

Results: There was a substantial increase in the number of chapter events offered since inception of the RCP program, with almost 90% of participants indicating that their expectations were met or exceeded. Event topics of most interest to families included: behaviour, social skills development, and communication.

The average number of calls to RCP chapters per month has significantly increased. Top reasons for contact were related to Autism Ontario services, school issues, and community services. Overall, families showed a very modest decrease in stress during their contacts with chapters, but those rated as being 'in crisis' when first contacting the RCP coordinator were rated as a having the greatest decrease in stress at the end of the contact period.

Parents' reports on the longer-term stress measures were not significantly different from baseline to follow-up; however they are reporting higher quality of life and showing improvements in their perceived abilities to advocate for their child and to navigate the system of services.

Language was the third most commonly reported reason for Francophone families being unable to access services; almost half reported not accessing at least one type of service because it was not available in French. The services most frequently not accessed due to language restrictions were: special leisure activities, registered behaviour management services, and regional IBI programs.

Conclusions: Program evaluation is a critical element in evaluating the impact of programs, particularly those funded by government. The RCP evaluation has been important in identifying effective components to guide future program development and allocation of funding resources.

123.213 213 Outcomes of a Specialized Inpatient Psychiatric Hospital Care for Pediatric Patients with Autism Spectrum Disorders. R. L. Gabriels*[1], J. A. Agnew[2], C. Beresford[3], J. Barnes[4] and C. Karlsson[4], (1) *Childrens Hospital Colorado*, (2)*Children's Hospital Colorado / The University of Colorado at Denver and Health Sciences Center*, (3)*The University of Colorado Denver and Health Sciences Center*, (4)*Children's Hospital Colorado*

Background:

There is a need to expand awareness and understanding of the unique psychiatric health care needs of pediatric patients with autism spectrum disorders (ASD) and/or intellectual disabilities (ID). This population is at risk for psychiatric hospitalization due to high rates of co-occurring affective and anxiety disorders. However, there are few specialized hospital-based psychiatric care program options in the U.S. for these individuals. General psychiatric hospital environments are not adapted for the unique learning styles, needs, and abilities of this population. Untrained psychiatric personnel present a risk for inaccurate assessment of presenting crisis behaviors of this population, inappropriate care, and excessive use of seclusion/restraints and medications. A previous study by these authors (In Preparation) compared outcomes of patients diagnosed with an ASD and/or ID treated in a general psychiatric program to those of a specialized short-term inpatient and intensive day treatment hospital-based psychiatric program (Neuropsychiatric Special Care; NSC), indicating improved outcomes for patients in the specialized care program (e.g., decreased patients' recidivism rates from 64% to 14% and decreased average length of stay from 58 to 13 days).

Objectives:

This follow-up study extends the previous evaluation of the NSC program for an additional six months and examines patient demographics, medication use, and aberrant behavior

data collected at patient admission and discharge. The objective is to compare admission-to-discharge reductions in polypharmacy and aberrant behaviors for ASD patients who were treated in both the inpatient and day treatment programs with ASD atients who only attended the inpatient program.

Methods:

Psychiatric medical records are being reviewed for NSC patients ages 4 to 17 years with a diagnosis of ASD and co-occurring psychiatric and/or medical diagnoses admitted to the NSC inpatient program between July 2010 and December 2010.

Abstracted clinical data include patients' gender, age at admission, diagnoses, length of hospital stay, medications at admission and discharge from the NSC program and Aberrant Behavior Checklist-Community (ABC-C) forms completed by a consistent caregiver for patients at admission and discharge. Excluded are patients only admitted to the NSC day treatment program and patients without an ASD diagnosis.

Results:

It is anticipated the final poster will report the number of novel admissions to the NSC inpatient program and the percentage of those patients who stepped down to NSC day treatment, along with demographic data about those two patient populations (age at admission, gender, co-morbid psychiatric and medical diagnoses, average length of stay, recidivism rates, and admission to discharge in ABC-C scores and medication usage).

Conclusions:

The NSC is an innovative specialized psychiatric program designed to improve assessment and treatment of etiologies underlying presenting crisis behaviors in the ASD population. This is accomplished by providing a structured environment within the hospital setting with predictable routines, visual cues and a multidisciplinary staff trained to implement positive/proactive behavior management strategies. Program outcome data has far-reaching implications for developing hospital-based psychiatric care programs for the ASD/ID population.

123.214 214 Autism Comes to the Hospital: Experiences of Hospital Care From the Perspectives of Children and Adolescents with Autism Spectrum Disorders, Their Parents and Health Care Providers. B. Muskat*[1], D. B. Nicholas[2], W. Roberts[3], K. Stoddart[4], L. Zwaigenbaum[5] and P. Burnham Riosa[3], (1)*Hospital for Sick Children*, (2)*University of Calgary*, (3)*The Hospital for Sick Children*, (4)*Redpath Centre*, (5)*University of Alberta*

Background: Children and adolescents with Autism Spectrum Disorders (ASD) are a complex, vulnerable and rapidly increasing population who experience a multitude of mental health, developmental, and health challenges. Because of the complex presentation of ASD, these children and adolescents and their families visit a variety of medical settings, for both health and mental health purposes. Moreover, children and adolescents with ASD tend to have a number of special needs that may be particularly acute during hospital visits. Currently, there is a dearth of research examining children's experiences with hospitalization and even less on the unique hospital experiences of children and adolescents with ASD and their families.

Objectives: The purpose of this study is to examine the lived experiences of children and adolescents with ASD who have been hospitalized for a medical procedure, their families, as well as those of pediatric health care providers involved in their care. The ultimate objective is to utilize the findings to inform policy and best practice approaches to the delivery of pediatric hospital-based health and mental health services adapted to this unique and under-served segment of the population.

Methods: Semi-structured interviews are conducted with purposively selected children and adolescents with ASD (n = 20), parents/care givers (n = 20), and pediatric health care providers (n = 20) who were central to their care at either The Hospital for Sick Children, Toronto or Stollery Children's Hospital, Edmonton. Interpretive description, a qualitative methodology used to explore health research phenomena, is used to guide the analysis.

Results: Preliminary findings indicate that children and adolescents with ASD who are hospitalized for a medical procedure face unique challenges. Health care providers who make efforts to understand the uniqueness of these children, and who created small, yet meaningful accommodations for these children were highly valued by parents. In contrast, parents expressed frustration when reported symptoms were automatically attributed to the ASD diagnosis. Health care provider participants were aware of the challenges faced by these families and were open to further training opportunities to enhance their care for these children and their families.

Conclusions: Children and adolescents with ASD, parents, and health care providers expressed both positive and negative experiences of hospitalization. The implementation of simple accommodations along with an understanding of ASD as a diagnosis and appreciation for the uniqueness of the specific needs of individual children may enhance these families' hospitalization experiences.

123.215 215 Evaluating S.A.F.F.E. A Program for Families with Children Who Have ASD. T. Todd*[1] and G. Rieck[2], (1)*California State University*, (2)*California State University, Chico*

Background: Research has demonstrated that parents of children with autism spectrum disorder (ASD) experience higher levels of stress, lower levels of well-being, and lower levels of family harmony than parents of children without ASD or any other type of disability (Baker-Ericzen et al., 2005; Perry et al., 2004). The long-term effect of having a family member with ASD has not been documented; however, increase in parental stress, decrease in family harmony, and higher divorce rates (Hartley et al., 2010) indicate that there is an overall impact on the family. Regular exercise (Ratey, 2009) and social support can reduce stress (Meadan et al., 2010). Unfortunately the unique blend of challenges faced by children with ASD makes family outings difficult to impossible. This decreases the potential for exercise and social support for parents. Literature suggests that families who use active coping strategies, for example social support and exercise, experience decreased levels of stress and increased family cohesiveness (Meadan et al., 2010).

Objectives: To evaluate S.A.F.F.E. (Supporting Active Families in a Friendly Environment), a pilot university-based program designed for families of children with ASD. The program was evaluated to understand if i) exercise and social contact decreased perceived stress, ii) increased family quality of life (QOL), and iii) family programs reduce barriers to participation in leisure activity.

Methods: Eight families who have a child with ASD participated in an 11-week exercise program run by exercise physiology and adapted physical education students (14 parents, 15 children). Time spent exercising was recorded using a seven day recall at the beginning and end of the program. Parents completed a questionnaire which assessed family quality of life and answered an open ended question regarding barriers to participation in leisure type programs. The age range of the parents was 39-56 years old with a mean age of 42.4.

Results: Families of children with ASD increased the time spent exercising per week during the course of the program ($F=5.83$, $p<0.04$). All participants increased the number of days per week they completed 30 minutes or more of exercise. Participants indicated that they agreed (60%) or strongly agreed (40%) that exercise and social contact with other families of children with ASD reduced stressed and increased family QOL. Twenty-eight percent of the parents reported that the major barrier to participation in family activities in the community was the inflexibility of the child with ASD. The second most common barrier (27%) was time demands related to the child with ASD (therapy, home work). Work commitments (18%), fatigue, injury, and amotivation were also reported as barriers.

Conclusions: Parents of children with ASD spend more time with childcare and household chores, have more work interruptions, experience more fatigue, have less time for leisure and self-care than parents of children without disabilities (Smith et al., 2010). It is vital to the well-being of children with ASD that family QOL is targeted. The S.A.F.F.E. pilot program was successful in supporting families of children with ASD and reducing parental stress which in turn increased family well-being.

123.216 216 Do Physicians and Parents Communicate about Complementary and Alternative Treatments for Children with Autism Spectrum Disorders?. A. M. L. Wilms Floet*[1], K. Kosztyo[2], A. Moylan[3], K. Boswell[1] and L. Kalb[4], (1)*kennedy krieger institute*, (2)*Loyola University of Maryland*, (3)*University of Maryland*, (4)*Kennedy Krieger Institute*

Background: Complementary and Alternative Medicine (CAM), including dietary interventions, are highly prevalent in children with Autism Spectrum Disorders (ASD). Parent surveys estimate that 52-95% of these children are treated with CAMs and diets (Harrington et al, 2006; Wong et al. 2006).While CAM use among this population appears ubiquitous, no data exist on how autism specialists document the topic or discuss use of CAMs or specialty diets in their clinical encounters with these families.

Objectives: To examine: a) the prevalence of CAMs and dietary treatments; and b) the concordance between parent - and clinician documentation of CAM and diet use in children with ASD.

Methods: Data from 160 children, ages 2 to 16 years (M = 5.6y; SD = 3.2y), who were enrolled in a local-registry project at an urban outpatient autism center, were used for this study. All children in this study have an ASD diagnosis confirmed by a clinician and the *Autism Diagnostic Observation Schedule* (Lord et. al, 2002). Parent's documentation of CAM and diet use in their children was gathered from a custom form which captured up to 6 dietary and 15 CAM treatments. Clinician documentation of such was gathered via chart review from appointments between 2008 and 2010. Bivariate analyses were employed to examine demographic differences between children that were and were not using these treatments. Positive predictive value (PPV) was calculated to examine the proportion of subjects using CAM/diets via parent-report that were also documented by clinicians.

Results: A total of 23 (15%) and 24 (15%) parents reported CAM and/or diet use among their children, respectively. Of these, 19 (47%) were only using 1 CAM or diet, 13 (32%) were receiving 2, and the remaining 8 children were using 3 or more (max = 13). The most common CAMs and diets reported by parents were vitamins, and gluten- and casein-free diets (both n=14), respectively. No demographic differences (age, gender, race/ethnicity, education) were found between children using CAMs compared with those children who were not. However, children on specialty diets were significantly younger than those not receiving the intervention ($t = 2.87$, $p < .01$). Of those with parent-reported CAM use, 60 % was also document by clinicians. For children using a specialty diet, 54% was reported by clinicians. This resulted in a PPV of 56% and 54% for CAM and diets, respectively.

Conclusions: Prevalence of CAMs and dietary treatments were far less than those reported in the literature. However, these data are consistent with those collected by Coury et al. (2010, 2011) using a similar, albeit, much larger sample. Low concordance between clinicians and parents was observed when the parent reported CAM and/ or dietary intervention. Taken together, these findings indicate that a substantial proportion of children may be being treated with CAM and/or diets either without the clinician's knowledge or documentation of such. This could potentially lead to missing harmful treatments and/or interactions using current or prospective medical intervention by the treating provider or other providers who rely on this documentation.

Keynote Address Program

124 Common and Rare Genetic Variants In the Etiology of Asd; Where Is the Field Heading?

Speaker: B. Devlin *University of Pittsburgh School of Medicine*

This presentation will summarize our current understanding of the genetic architecture of ASD focusing on recent studies from the Simons Simplex Collection and the Autism Genome Project highlighting the role of common and rare genetic variants. Important evidence gaps will be identified and exciting new approaches outlined that might address those gaps. The potential for translation of these findings into changes in clinical practice will also be described.

124.001 Common and Rare Genetic Variants in the Etiology of ASD; Where is the Field Heading?. B. Devlin*, *University of Pittsburgh School of Medicine*

This presentation will summarize our current understanding of the genetic architecture of ASD focusing on recent studies from the Simons Simplex Collection and the Autism Genome Project highlighting the role of common and rare genetic variants. Important evidence gaps will be identified and exciting new approaches outlined that might address those gaps. The potential for translation of these findings into changes in clinical practice will also be described.

Invited Educational Symposium Program
125 Biology-Based Classification and Prediction In Autism Spectrum Disorders: Promises and Pitfalls
Chair: N. Lange *Harvard University Schools of Medicine & Public Health*

The symposium will teach participants the basics of a wide variety of quantitative methods in present use, as well as potential future directions of this burgeoning research area, guided by leading researchers and educators in autism psychiatry, genetics, imaging and behavioral-cognitive measures. Each speaker will be knowledgeable in broader aspects of this field beyond their own scientific and clinical contributions, and be excellent teachers of general audiences with diverse backgrounds. Their intentions will be, as the title indicates, two-fold: promises and pitfalls. Ethical reporting issues involving scientists, parents and individuals with the disorder, and the media, will also be addressed.

125.001 Critical Clinical Needs In Classification and Prediction for Older Children, Adolescents and Adults with Autism. J. E. Lainhart*, *University of Utah*

Autism is a complex disorder of brain connectivity and organization. Many genes and their interactions with the environment appear to lead to abnormalities in early brain development and also dynamic aberrations of late brain development and maturation. The result is significant lifelong disability and impairment, often despite islets of significant ability. Major advances in the application of computer technology across all levels of analysis, from genes to brain and behavior, have begun to provide statistical tools that have potential to discern the “signature” of autism at a systems level from many interdisciplinary perspectives. When successfully translated into clinical and community care, biology-based classification and prediction have the potential for major beneficial impact on the lives of affected individuals, their families and communities. Autism research may be on the verge of such a major advance, but still has a long way to go to get there. In this talk I will discuss categorization and prediction, what they are, why they are important, and how they are used in clinical medicine. I will discuss the pathway from conceptualization to use in the clinic, and present a scientific framework for the evaluation of new methods of classification and prediction that involves the assessment of their analytic validity, clinical validity, clinical utility, and consideration of their ethical and social implications.

125.002 Analysis of Imaging Patterns Using Pattern Recognition Methods: Application to Development of Imaging-Based Biomarkers for Autism. C. Davatzikos*, *University of Pennsylvania*

This talk reviews relatively state of the art image analysis methods for understanding imaging patterns that reflect underlying structural and functional differences between autistic and TDC children. Special emphasis is given on pattern analysis and classification methods, which utilize nonlinear multivariate machine learning principles to determine distinctive imaging phenotypes/biomarkers that can be used for classification of individuals. The talk will discuss conventional measurements of brain volumes and regions of interest, it will then present new opportunities provided voxel- and pattern-based morphometry. The talk will then discuss pattern classification methods, their potential emanating from their ability to measure complex and subtle imaging phenotypes, and their pitfalls related to their high dimensionality and the frequently improper use or evaluation of these methods. Examples from other neuropsychiatric and neurologic disorders, and particularly schizophrenia and AD, in which these methods have been used more extensively, will also be used to demonstrate the potential of these methods, especially from the perspective of predictive imaging biomarkers. Finally, we will discuss the potential of jointly using functional, structural and connectivity imaging biomarkers to achieve higher classification accuracy.

125.003 A Cognitive Neuroscience Approach to the Early Identification of Autism. C. A. Nelson*, *Children's Hospital Boston/Harvard Medical School*

Autism spectrum disorder (ASD) is a complex, highly heritable disorder that involves primary impairments in language and communication. The disorder is heterogeneous, longer-term outcomes vary considerably, and in families that have a diagnosed child, other relatives may share some behavioral features without meeting diagnostic criteria. At around 12 months of age, delays in major language and communication milestones are first reported for children later diagnosed with ASD, but thus far, relatively little is known about signs that may be detected during the first year of life. In this talk I will focus on a research program being conducted with Helen Tager-Flusberg designed to address this important clinical and theoretical issue by investigating the early development of infants at risk for this disorder. Here we define risk as having an older sibling with the disorder. After briefly reviewing the extant literature on the study of so-called "infant sibs," I will turn my attention to an ongoing longitudinal study focused on infants with and without an older sibling with an ASD. This research is based on the premise that because the behavioral repertoire of the infant is so limited, we are unlikely to observe behavioral signs that predict autism. Thus, we seek instead to examine neural manifestations of the disorder. In this context I will review our EEG, ERP, fNIRS and eye tracking findings to date, which collectively have permitted us to distinguish high vs. low risk infants and possibly predict who among the high risk infants develop an ASD.

125.004 Biology-Based Candidate Intermediate Phenotypes In Autism Research: Hope or Hype?. N. J. Minshew*, *University of Pittsburgh*

Many research reports claim the potential of findings for improving diagnosis if not also treatment of ASD. Such claims have been made for IQ profiles, motor skills, various neuropsychological or cognitive findings, gaze or scan path patterns, and now neuroimaging. All of these past findings led to their premature application in clinical practice for diagnosis until their validity was refuted. Some of these findings became the basis for treatments arising in the community and advertised to families as supported by these scientific findings with no evidence of the validity of such claims or the efficacy of the treatments. Perhaps the largest contributor to the misinterpretation and misuse of science is the media, which typically rely on hyperbole to create drama and rely on the 30-60 second format. Clinicians providing direct care for individuals with autism often do not read the scientific literature in which these findings are published but rely instead on the primary journal for their particular field. Even if they access the original articles, they lack the expertise to judge and critique such reports. One tragic example of the serious consequences of the unbridled distortion of science and the scientific process was the vaccine debacle initiated by poor judgment in the publication of the original paper and sustained by the frenzy of a media that gave equal or more credibility to the perspectives of lay people as they did to science. The autism community has been embroiled in one "cure" after another that ultimately were put to rest by the scientific process. However, the outcome is that parents and their children invested their time and finances in unworthy efforts, and lost the opportunity to pursue better avenues. The poverty of universal diagnostic and assessment standards and of interventions to address the myriad of issues that arise in daily life has left families feeling neglected by and skeptical of science. While there have been important scientific advances, they have not fulfilled their potential for improving lives. Better communication on many fronts and from many sources, and support for translational science that achieves solid advances from basic investigation to clinical research to clinical practice and education is urgently needed. This talk will focus on recognizing the scope of the problem, the forces that are driving it, and possible solutions.

Genetics Program

126 Genetics I

Chair: L. Gallagher *Trinity College Dublin*

This session contains new advances in genetic studies related to the etiology of ASD.

126.001 Results of the PGC Autism GWAS and Combined Autism-Schizophrenia Meta-Analysis: SNPs in Three Regions Are Associated with ASD and Schizophrenia. S. L. Santangelo*, *Harvard Medical School/Massachusetts General Hospital*

Background: The hope and promise of genome-wide association studies to yield common variants for autism remains largely unfulfilled. Under the assumption that the extant autism GWA studies suffer from inadequate power, the Autism Working Group of the Psychiatric GWAS Consortium (PGC) has assembled a large sample of autism spectrum disorder (ASD) trios for meta-analysis. Autism was once considered childhood schizophrenia and, although they have been considered distinct disorders since the 1970's, more recent evidence has highlighted phenotypic and genetic overlap between autism and schizophrenia.

Objectives: To identify common genetic variants underlying ASD by conducting a GWAS in a large, more adequately powered sample by combining ASD cases and trios from several studies and consortia. In addition, we aimed to explore the potential for genetic overlap or pleiotropy by searching for significant common variation shared between autism and schizophrenia.

Methods: We conducted a GWAS analysis for ASD in a data set comprising 3338 ASD trios, 161 cases and 526 controls. In addition, an analysis of "polygene scores" suggested that the bulk of SNPs showing association to risk for schizophrenia also showed some, albeit modest, association to risk for ASD. Therefore we carried out analyses to test whether and which risk SNPs identified as significant by GWAS of schizophrenia samples (i.e., 9394 cases and 12462 controls assembled by the PGC) showed association for ASD.

Results: Even in this large ASD sample, the GWAS meta-analysis revealed no genome-wide significant loci for ASD. However, when we examined the top hits from the PGC schizophrenia GWAS in the autism data set, we found that the direction of effects was the same in 37 out of 53 independent SNPs (p=0.00274). Additional analyses suggest that SNPs in three regions are highly associated with risk for both schizophrenia and ASD. These SNPs fall in or near *mir137*, *TCF4*, and *MAD1L1*, which will be described in detail.

Conclusions: Although we were not able to identify significant common variants for ASD alone, this PGC combined meta-analysis identified significant genetic overlap and specific markers shared by ASD and schizophrenia.

126.002 Use of Common Genetic Variants to Identify Risk of Autism in Siblings of Children Diagnosed with Autism Spectrum Disorders.

F. Liebaert*[1], B. A. Dombroski[2], G. D. Schellenberg[2], T. Rio Frio[1], J. Carayol[1], C. Amiet[3], B. Génin[1], C. Vazart[1], K. Fontaine[1], C. Marcaillou[1], F. Rousseau[1], E. Couchon[4] and G. Dawson[5], (1)*IntegraGen SA*, (2)*University of Pennsylvania School of Medicine*, (3)*APHP, GHU Pitié-Salpêtrière*, (4)*IntegraGen, Inc*, (5)*Autism Speaks, UNC Chapel Hill*

Background: Autism spectrum disorders (ASD) are among the most common forms of severe developmental disability and are characterized by a 4:1 male:female ratio and a sibling recurrence risk estimated to 18.7%. Since multiple studies have shown that early intervention leads to a significantly improved long-term outcome, early identification of children at higher risk of ASD is a key goal. The inheritance pattern of ASD in most families is complex and not compatible with simple mendelian inheritance. While genetic testing for autism is primarily limited to the identification of copy number variants (CNVs) which may be causal for autism, autism associated CNVs are only found in a limited percentage of affected individuals. Recently, a number of common genetic variants or SNPs (single nucleotide polymorphisms) conferring autism risk have been identified. While individual SNPs are not on their own sufficient to be causal, recent studies have shown that the combination of autism associated SNPs allows for the identification of increased ASD risk in siblings of affected children.

Objectives: To focus on the emerging role of common genetic variants and how the identification and the combination of risk-associated common variants in ASDs can lead to identification of siblings of children with ASD who are at higher risk of autism.

Methods: Two sets of multiplex families were used: an "exploratory population" consisted of 544 families from the Autism Genetic Resource Exchange repository (AGRE, www.agre.org) and a "replication population" consisted of 668 families from the University of Pennsylvania combined with a different subset from the AGRE repository. SNPs associated with an increased risk of autism were identified by performing

gender-based genome-wide association (GWA) studies on the "exploratory population". SNPs associated with autism were prioritized using relevant biological and functional data for genes where SNPs were located. The ability of highly prioritized SNPs to maintain their association with autism was determined in both "exploratory" and "replication populations" through a reproducibility index estimated using a resampling approach. A gender-specific genetic score, the sum of individual risk-associated alleles, was then constructed. The ability of these gender-specific genetic scores to discriminate siblings with or without ASD was evaluated in the "exploratory population" and in the "replication population".

Results: Thirty eight SNPs were found to maintain their association with autism following reproducibility studies. Genetic scores (GS) were constructed for 1,974 children with autism and 584 unaffected siblings. In males GS of 23 was associated with an 90% specificity (95%CI:86-94), a 30% sensitivity (95%CI:27-41), and a 51% (95%CI:45-55) positive predictive value (PPV). In females, a GS of 28 was associated with a 81% specificity (95%CI:75-85), a 50% sensitivity (95%CI:45-56), and a 22% PPV (95%CI:18-26).

Conclusions: Our findings demonstrate that a combination of multiple risk-associated common variants in a gender-specific genetic score allows for the identification of siblings of children with ASD who have a significantly higher risk of developing autism.

126.003 Variable Phenotypic Expressivity of Specific Copy Number Variants and Single Gene Mutations in Autism and Other Neurodevelopmental Disorders. S. M. Myers*[1], A. Moreno de Luca[1], T. D. Challman[1], G. S. Gerhard[1], D. W. Evans[2], P. T. Orr[1] and D. H. Ledbetter[1], (1)*Geisinger Health System*, (2)*Bucknell University*

Background: Autism spectrum disorders (ASD), like intellectual disabilities, can be caused by many different highly penetrant genetic abnormalities, including mutations and genomic imbalances. These variants are individually rare but collectively common; even though no single genetic variant accounts for more than 1-1.5% of ASD, together they currently explain the etiology of approximately 15% of cases. However, it is also becoming apparent that identical variants may lead to ASD in some individuals and to other neurodevelopmental disorders in other individuals, including members of the same family.

Objectives: The objective of this literature review was to examine the variable phenotypic expression of selected DNA copy number variants (CNVs) and single-gene variants that are known to cause autism spectrum disorders (ASD).

Methods: In a case-control study involving 15,749 cases and 10,118 published controls, the International Standards for Cytogenomic Arrays (ISCA) consortium identified 14 recurrent CNV regions in which pathogenic deletions and/or duplications occur frequently in association with abnormal clinical phenotypes including ASD and developmental delay or intellectual disability (DD/ID) (Kaminsky et al., 2011). CNVs in 13 of these regions (1q21.1, 3q29, 5q35, 7q11.23, 8p23.1, 15q11.2-q13, 15q13.2-q13.3, 16p11.2, 16p13.11, 17p11.2, 17q12, 17q21.31, and 22q11.2) have been associated with ASD. We sought to determine how commonly CNVs in these 13 regions have been associated with the following phenotypes in addition to ASD: DD/ID, schizophrenia (SZ), and epilepsy (EP). We searched the English-language literature pertaining to the 26 distinct recurrent variants (13 deletions and 13 duplications) to determine which of the clinical phenotypes of interest have been associated with each CNV. In addition to these relatively large CNVs, which contain multiple genes, single gene variants have been implicated in ASD. To assess whether 6 single gene variants (mutations or CNVs) with robust association with ASD (CNTN4, CNTNAP2, NLGN4X, NRXN1, SHANK2, and SHANK3) have also been implicated in other phenotypes (DD/ID, SZ, EP, and Tourette syndrome [TS]), we again searched the literature.

Results: All 26 (100%) of the recurrent CNVs examined have been associated with ASD, some more robustly than others. The vast majority of these ASD-associated CNVs (21/26 = 81%) have also been reported to be associated with at least 2 of the 3 other phenotypes (DD/ID, SZ, and EP), and 9/26 (35%) have been reported to be associated with all 4 phenotypes. Among the 6 single gene variants examined, 5/6 (83%) were associated with at least 2 of the 4 other phenotypes (DD/ID, SZ, EP, and TS) in addition to ASD. 2/6 (33%) were

associated with at least 3 of the 4 other phenotypes in addition to ASD, and one (17%) was associated with all 5 phenotypes.

Conclusions: Recurrent CNVs and mutations that cause autism also cause other neurodevelopmental disorders, including intellectual disability, schizophrenia, epilepsy, and Tourette syndrome. The substantial etiologic overlap among what have been defined clinically as distinct disorders raises questions about diagnostic classification systems and poses challenges and opportunities for future research. It is possible that identifying the mechanisms that underlie variable expressivity might lead to novel therapeutic interventions.

126.004 Genetic Study of Asperger Syndrome and Autism Cases That Segregate in a Brazilian Family. C. M. Ribeiro*[1], V. N. Takahashi[2], D. P. Moreira[1], M. G. Rodrigues[1], K. Griesi-Oliveira[1], C. Rosenberg[1], D. R. Bertola[1], E. Vasdasz[3] and M. R. Passos-Bueno[1], (1)*University Sao Paulo, Biosciences Institute*, (2)*Human Genome Center, University of Sao Paulo*, (3)*Institute of Psychiatry, Hospital of the Faculty of Medicine, University of Sao Paulo*

Background: We report a case of a teenager (16 years, RBR) boy with the clinical diagnosis of Asperger syndrome. RBR presents anxiety, hyperactivity, severe impairment of social interaction, restricted and repetitive patterns of behavior, interests and activities, marked deficiency in the use of nonverbal behaviors, failure to recognize and to use the conventional rules of conversation, failure to recognize the use of irony, slang, sarcasm and metaphors. No significant dysmorphic features were noted and anthropometric measurements were within normal range. During the anamnesis the family reported that RBR has one first (SMRF) and two second degree (VRPA and MRPA) males paternal cousins with similar phenotype. These affected individuals were later evaluated and we verified that SMRF had also been previously diagnosed with Asperger syndrome, with a phenotype very similar to RBR. On the other hand, MRPA, previously diagnosed as autistic, differs from RBR by the manifestation of aggressive behavior, stereotyped and repetitive motor mannerisms, and lack of verbal communication. VRPA, has yet to be evaluated by us but his parents reported that his behavior is different from other boys of his own age. VRPA presents difficulties in social interaction, restricted pattern of interests, elaborate speech and remarkable ability to perform mathematical calculations.

Objectives: To investigate the causative genetic mechanisms of the phenotypes of the individuals in this family.

Methods: Patients were previously excluded for Fragile X syndrome. To screen for causative chromosome imbalances, we did MLPA (*SALSA MLPA KIT P343 AUTISM-B1-1 and SALSA MLPA KIT P070 HUMAN Telomere-5-HOLLAND MLPA MRC*), customized CGH-microarray (*Agilent Techonologies _8x60K format*) and SNP-array (*GeneChip Human Mapping Affymetrix 500K Array Set*) techniques.

Results: The custom array-CGH revealed a deletion of the gene *IMMP2L* (IMP2 inner mitochondrial membrane peptidase-like) in subject RBR. This deletion was confirmed by the use of the SNP-array technique. In addition, no other mutation was observed. This gene encodes a protein involved in processing the signal peptide sequences used to direct proteins to the mitochondria. The encoded protein resides in the mitochondria and is necessary for the catalytic activity of the mitochondrial inner membrane peptidase (IMP) complex. Genetic variation in *IMMP2L* has previously been associated with autism. The mutation seen in the individual RBR was inherited from his father and is also present in his paternal cousins SMRF and MRPA, but not in VPRA.

Conclusions: The results obtained so far provide evidence that the *IMMP2L* deletion may be partially responsible for the subject's phenotypes.

126.005 Shared Neuronal Pathways Affected by Common and Rare Variants in Autism Spectrum Disorders. E. Ben-David* and S. Shifman, *The Hebrew University of Jerusalem*

Background:

Recent studies into the genetics of Autism spectrum disorders (ASD) have implicated both common and rare variants, including de-novo mutations, as risk factors for ASD. However, how much of the genetic risk can be attributed to rare versus common alleles is unknown. Furthermore, the genes already

known to be disrupted by rare variants still account for only a small proportion of the cases. This genetic heterogeneity constitutes a considerable obstacle to establishing a thorough understanding of the etiology of ASD.

Objectives:

We used a system biology approach to address several fundamental questions regarding the genetic architecture of autism. First, can we identify gene networks that are perturbed by rare variations that in turn lead to ASD? Second, can we identify gene networks that are perturbed by common variations? Third, do rare and common variations converge on the same molecular pathways or do they represent diverse biological etiologies? Lastly, are genes in these modules expressed during specific periods in life which represent significant time points in the development of ASD?

Methods:

To answer these questions we first constructed a gene network using a WGCNA approach based on a widespread survey of gene expression undertaken by the Allen Human Brain Atlas project (http://www.brain-map.org). This survey of gene expression includes 1340 microarray measurements, representing the entirety of the adult human brain. Then, the network was integrated with results of a published autism genome-wide association study (GWAS), as well as with a database of known rare mutations in ASD. In order to identify the expression pattern of the modules during brain development, we used data from the BrainSpan database (http://developinghumanbrain.org/), including 492 microarray measurements of individuals ranging from 8 weeks post-conception to 40 years of age.

Results:

The constructed network included modules associated with specific cell types and processes. These include two neuronal modules that were found to be enriched for both rare and common variations that are potentially associated with ASD risk. The enrichment for common variations in these modules was validated in two independent cohorts. The module showing the highest enrichment for rare and common variants in ASD included highly connected genes that are involved in neuronal plasticity, and are expressed mainly in areas associated with learning and memory. Additionally, we found that the level of expression of the most connected genes in this module increases in the brain during fetal development, with a peak during the first year of life.

Conclusions:

Taken together, these results suggest a common role for rare and common variations in
autism, and illustrate how rare and de-novo mutations, in conjunction with common variations,
can act together to perturb key pathways involved in neuronal processes, and specifically
neuronal plasticity. Furthermore, the modules found in this study may serve as starting points
for designing potential therapeutic interventions for ASD.

126.006 New Insights Into Autism From the Candidate Genes-Centered Interactome. R. Corominas*[1], X. Yang[2], G. N. Lin[1], S. Kang[1], Y. Shen[3], S. A. Wanamaker[3], S. Tam[2], M. Rodriguez[3], M. Broly[3], J. Sebat[1], K. Salehi-Ashtiani[3], D. E. Hill[3], M. Vidal[3], T. Hao[3] and L. M. Iakoucheva[1], (1)*University of California San Diego*, (2)*Dana-Farber Cancer Institute*, (3)*Harvard Medical School*

Background: Autism is a neurodevelopmental disorder with strong genetic basis. The number of genes that have now been firmly established as strong risk factors for autism is large, and these genes are functionally heterogeneous. Hence, it is important to understand how these multiple genes and their protein product interact within the context of cellular pathways.

Objectives: We have investigated autism from a systems biology perspective with the aim of defining protein interaction networks/pathways/functional modules that connect this diverse set of genes.

Methods: Our integrative approach consisted of (1) cloning autism candidate genes from normal adult and fetal brain RNA; (2) Screening these genes against the hORFeome (~15,000 clones) by yeast-two-hybrid (Y2H) experiments to detect protein-protein interactions; (3) building interactome of

autism candidate genes; (4) interactome analysis to define key functional modules.

Results: (a) We selected 191 autism candidate genes and successfully cloned 124. We added 45 clones from the hORFeome collection; (b) We performed Y2H for 169 genes and detected interactions between 75 autism candidate genes and 272 human proteins that were retested positively four times; (c) We have constructed autism interactome with 492 unique interactions; (d) 93% of the detected interactions are novel and have not been previously reported in the public databases.

Conclusions: (a) We have detected interaction partners (preys) that are shared between autism candidate genes, thereby implicating new gene targets in autism; (b) We have detected new interactions between well-known autism candidate genes; (c) We have identified preys that connect genes from different autism CNVs on a protein level; (d) Autism network is enriched in preys with autism CNV membership; (e) Autism network is significantly enriched in co-expressed genes; (f) Autism network is enriched in differentially expressed genes, specifically in down-regulated genes.

Our new autism interactome represents a valuable resource for the research community and for future autism studies.

126.007 Identification of Protein Subnetworks Implicated in Autism Spectrum Disorders (ASD). C. Correia*[1], Y. Diekmann[2], J. B. Pereira-Leal[2], G. Oliveira[3] and A. M. Vicente[1], (1)*Instituto Nacional de Saúde Dr. Ricardo Jorge*, (2)*Instituto Gulbenkian de Ciência*, (3)*Hospital Pediátrico de Coimbra*

Background: Although ASDs are a highly heritable neuropsychiatric disorder, genome-wide association studies (GWAS) met limited success in the identification of common risk variants. This suggests that ASD, like most complex diseases, may result from the interaction of many variants with small individual risk, which cannot be detected in single SNP analysis. Therefore, alternative analytic approaches are needed to increase the power of GWAS, shifting the focus from individual markers to the study of the cumulative effect of multiple genes acting on the same biological process. The availability of molecular interaction data enabled the development of network-based approaches, which may successfully be used the identification of biologically meaningful subnetworks with a high prediction performance.

Objectives: Based on the hypothesis that there are variants with small effect confined to a limited number of biological pathways, which are not detected by Transmission disequilibrium Test, we applied a network-based approach to the Autism Genome Project (AGP) consortium GWAS to indentify biological networks associated with ASD risk and high priority candidate genes.

Methods: We combined family-based association data from 2258 ASD families genotyped in the Illumina 1M SNP, as part of the AGP GWAS, with Human Protein-Protein interaction (PPI) data compiled from public databases. Various association *P*-value thresholds were analyzed to check if potential relevant risk genes can still be identified within higher significance levels using network properties, such as the percentage of direct interactions and the size of the largest connected component (LCC) of the network. A sample of 943 ASDs families from the Autism Genetic Resource Exchange genotyped using the Illumina HumanHap550 BeadChip (Wang *et al,* 2009) was used for replication. The networks identified in the 2 datasets were compared and a functional enrichment analysis was performed.

Results: By comparing the network properties of our data with random samples, we determined a *P*-value of 0.01 as the threshold for which we can still infer meaningful biology from the data. Selecting genes including SNPs with $P<0.01$, we found that 50% of the proteins directly interact with each other ($P=5\times10^{-5}$) and were connected in a subnetwork of 453 proteins ($P<0.001$). Using the same threshold, these observations were replicated in the independent dataset, with 219 proteins interconnected in the LCC ($P<0.001$) and 39.4% of proteins directly interacting ($P=0.008$). The proteins of the largest connected component of the two datasets are mainly localized in the synaptic compartment and expressed in the brain. Both are enriched in pathways related to focal adhesion, with 64 genes in common, including 5 established autism candidate genes.

Conclusions: Using the AGP GWAS we showed that network analysis is an effective strategy to uncover, from a GWAS, low effect sizes *loci* that cannot be detected using single SNP analysis. We found that there are many potentially relevant susceptibility *loci* with $P<0.01$ that are being overlooked and should be further explored. Using two independent autism GWAS datasets we found that autism-associated proteins are functionally related and involved in a small number of interconnected biological processes. The overlapping genes between the analyses are being further explored for specificity for autism.

126.008 Gene Network Analysis of Autism and Autoimmue Disorders. J. Y. Jung* and D. P. Wall, *Harvard Medical School*

Background:

Autism is highly heritable, but the genetic risk factors of autism are still largely unclear and considered to be very heterogeneous. There are several family cohort studies suggesting shared genetic etiology between autism and autoimmune disorders, but detailed comparative studies have not yet been done. In this context, we compared candidate susceptibility gene sets between two groups and verified our findings with postmortem gene expression data.

Objectives:

To identify shared candidate genes between autism and autoimmune disorders and to verify them by differential expression patterns in autism patients' brain.

Methods:

We used an autism candidate gene set (717 genes) retrieved from our autism-specific knowledge base, Autworks (http://autworks.hms.harvard.edu), and ten autoimmune disorders including ankylosing spondylitis (AS, 249 genes), autoimmune thyroid disorder (ATD, 227 genes), celiac disorder (CD, 582 genes), inflammatory bowel disorder (IBD, 859 genes), multiple sclerosis (MS, 1463 genes), psoriasis (PS, 829 genes), rheumatoid arthritis (RA, 1814 genes), systemic lupus erythematosus (SLE, 1258 genes), spondylitis (SP, 313 genes), and type I diabetes (T1D, 1575 genes) identified through our cross-disorder knowledge base called Genotator (http://genotator.hms.harvard.edu). For verification, we obtained whole genome, brain tissue expression data of 19 autistic patients and 17 control samples from Gene Expression Omnibus (GSE28521). Networks of candidate risk genes were obtained from STRING database (http://string.embl.de) with a very rigorous confidence score threshold (0.9, max score 0.99).

Results:

We identified 294 common risk genes between autism and the set of autoimmune disorders. Thirty of these genes were significantly differentially expressed in the cerebellum of case with autism. These genes include RNA binding proteins (RBFOX1), GABA receptor genes (GABRA1, GABRB3), and MHC specific genes (HLA-A). We also identified 8 possible novel candidate genes for autism, by analyzing autoimmune risk genes that have strong association with known ASD candidate genes and are differentially expressed in the autism patient samples. These genes include heat-shock protein (HSP90AA1), lymphocyte antigen (LY96), and nuclear receptor co-activator gene (NCOA1).

Conclusions:

We examined a group of autism candidate genes that may share common genetic risk factors with autoimmune disorders. Of interest, RBFOX1 gene was common in MS and SLE, and RARA gene, which falls in 17q21 region, was common in MS, PS, and T1D. We also identified possible novel autism candidate genes by network analysis including NCOA1 which interacts with RARA and differentially expressed in autistic patient samples. These results reinforce the idea of common genetic pathologies between autism and autoimmune disorders.

Brain Imaging: fMRI-Social Cognition and Emotion Perception Program

127 Brain Imaging: fMRI-Cognition, Motion Perception and Function, and Reward Processing

Chair: M. Dapretto *University of California, Los Angeles*

fMRI studies of cognition, motion perception, sensorimotor processing, and reward processing

127.001 Using Visual Strategies to Remember Verbal Information: An fMRI Study of Working Memory in Children with and without Autism. E. J. Carter*[1], D. L. Williams[2], J. F. Lehman[1] and N. J. Minshew[3], (1)*Carnegie Mellon University*, (2)*Duquesne University*, (3)*University of Pittsburgh*

Background: Previous fMRI research suggested that adults with autism performed a verbal working memory task with individual letters using regions related to visual-processing rather than the expected language regions (Koshino et al., 2005, *NeuroImage*). We expanded this research to children and adolescents with autism using a verbal working memory task with two-letter words that might be more likely to trigger the use of encoding with language; we also included a comparison visual working memory condition.

Objectives: To compare the fMRI brain activity of children with and without autism in response to working memory tasks for two-letter words and simple visual patterns and determine whether visual or verbal strategies are used.

Methods: Twelve 8- to 15-year-old children with autism and twelve age- and IQ-matched typically developing children (TD) who were good readers successfully participated in this IRB-approved fMRI study. Nine task blocks included a 0-back working memory task (i.e., comparing each item to the first item viewed) and a 1-back memory task (i.e., comparing each item to the previous item) and for two types of stimuli: (1) two-letter words and (2) patterns consisting of four angled bars. Each item was displayed for 2s and no feedback was given. Each block lasted 66s with 5s of instructions to indicate the task (and the originating pattern for the zero-back task) and 20 stimulus trials with 1s inter-trial intervals. All of the children had a minimum score of 70% correct with no performance difference between the groups.

Results: For the combined visual tasks versus fixation, both groups showed activity in bilateral occipital cortices (BOcc), superior parietal lobe, and inferior temporal gyri. For the combined verbal tasks versus fixation, the autism group showed BOcc activity and a very limited area of activity in left Broca's area (LBA). This LBA activity was found only in the verbal 1-back task. TD children showed activity in BOcc and extensive activity in LBA as well as right middle superior temporal gyrus. LBA activity was present for both the 0- and 1-back verbal tasks in this group. When directly comparing the verbal and visual tasks, the autism group only showed significantly increased activity in a limited area of BOcc, whereas the TD group also showed increased activity for the verbal task in LBA and bilateral middle temporal gyrus (BMTG). Group comparisons showed that the TD group had higher LBA and BMTG activity than the children with autism when comparing the verbal tasks to the visual tasks. There were no group differences for the visual > verbal contrast.

Conclusions: The children with autism relied more heavily on visual strategies to perform working memory tasks for two-letter words, particularly for 0-back task, whereas typically developing children used the expected linguistic strategies as indicated by the activation of left Broca's area. The children with autism demonstrated some use of this region in response to increasing task demands in the verbal 1-back condition, suggesting that cognitive resources from this region could be elicited when needed to accomplish the task.

127.002 Increased Attentional Activation During Reading in ASC: An fMRI Study of Visual Language. J. R. Cooperrider*[1], J. A. Nielsen[1], J. S. Anderson[1], A. Froehlich[1], M. B. DuBray[1], A. Cariello[1], A. Alexander[2], E. D. Bigler[3], N. Lange[4] and J. E. Lainhart[1], (1)*University of Utah*, (2)*University of Wisconsin*, (3)*Brigham Young University*, (4)*Harvard University*

Background: A core deficit of Autism Spectrum Conditions (ASCs) is language impairment. While data exist about the brain basis for auditory language comprehension, little is known about whether differences exist in brain activation patterns during reading in ASC.

Objectives: The objective of this study was to compare regional brain activity between individuals with an ASC and typically developing (TD) controls during a visual language task.

Methods: Functional magnetic resonance imaging (fMRI) was performed on a 3-Tesla Siemens Trio MR scanner of individuals engaging in a visual language task. Participants in the study were 22 high-functioning ASC males (aged 12-42 years, mean age of 23 years, 1 left-handed) and 29 TD males (aged 8-39 years, mean age of 21 years, 1 left-handed). The visual language task consisted of alternating blocks of fixation on a crosshair and sentence reading, with each block lasting for 20 seconds, for a total task time of 4 minutes. The sentences in each sentence reading block were presented individually, where each sentence contained a blank that represented a missing word at the end. Participants were instructed to read each sentence presented on the screen via LCD projector and to think, not speak, the word they thought best completed each sentence. Data processing and analysis was performed using SPM 8 in Matlab.

Results: When comparing brain activity during sentence reading to that during fixation/rest across all participants, similar patterns of activity were observed between the two groups, with activation in brain regions typically associated with reading, such as Broca's (left inferior frontal gyrus) area, Wernicke's (left laterosuperior temporal) area, supplementary motor area, lateral premotor cortex, and the cerebellum, based on family-wise error (FWE) corrected p-values less than or equal to 0.05. Both groups were strongly left-lateralized in Broca's area, Wernicke's area, and lateral premotor cortex. No regions showed significantly higher activity for control than for ASC participants, but significantly increased brain activity was found in ASC relative to control participants in bilateral area MT (V5), bilateral frontal eye field, and left intraparietal sulcus (IPS). The left IPS cluster was significantly different after FWE correction for $p<0.05$ and all clusters showed differences with uncorrected $p<0.001$.

Conclusions: Because increased brain activity was found in brain regions associated with the attention network in the ASC group, one possible conclusion is that ASC individuals use more attentional resources or concentration while reading than do TD individuals. This increase might be a compensatory mechanism for the language deficits commonly found in ASCs or might indicate a failure of ASC individuals to disengage attention to external stimuli while reading [1-3].

1. Anderson JS, et al. *Decreased left posterior insular activity during auditory language in autism.* AJNR, 2010. **31**(1):131-9.

2. Kleinhans NM, et al. *Atypical functional lateralization of language in autism spectrum disorders.* Brain Res, 2008. **1221**:115-25.

3. Kennedy DP, Redcay E, Courchesne E. *Failing to deactivate: resting functional abnormalities in autism.* Proc Natl Acad Sci U S A, 2006. **103**(21):8275-80.

127.003 Diagnostic Utility of Brain Mechanisms for Processing Biological Motion. N. Wang*, M. Björnsdotter, K. A. Pelphrey and M. D. Kaiser, *Yale University*

Background:

Using functional magnetic resonance imaging (fMRI) data, we have previously identified specific brain areas in which children with autism spectrum disorder (ASD) exhibit hypoactivation in response to biological motion compared to their typically developing (TD) counterparts (Kaiser et al., 2010, *PNAS*). Follow-up studies using limited sample sizes have shown that such state regions have promising utility as a diagnostic marker (Kaiser & Pelphrey, 2011, *DCN*).

Objectives:

In order to build upon our preliminary study, we aim to evaluate the power of the biological motion paradigm as a diagnostic tool by applying it to a full Replication cohort of children with and without ASD.

Methods:

Our analysis included a Discovery cohort with 17 ASD children (mean age = 10.93±3.09 years) and 22 TD children (mean age = 12.51±3.67 years) and a large Replication cohort with 37 ASD children (mean age=11.26±3.34) and 38 TD children (mean age=11.52 ±2.91). Children with ASD were diagnosed using ADOS, ADI-R, and expert clinical judgment. Subjects watched coherent and scrambled point-light displays of

biological motion during fMRI acquisition. Individual general linear model T-maps (biological > scrambled motion) were computed. Using a whole-brain clustered subsampling approach, we identified regions-of-interests in which a support vector machine classifier that was modeled using Discovery cohort T-maps could predict the diagnosis of the children in the Replication cohort. Finally, we tested the effect of Replication cohort size on the reported accuracy of the classifier model by varying the number of children included.

Results:

The classifier obtained a peak sensitivity (percentage of children correctly identified as ASD) of 78%, and a specificity (percentage of correctly classified typically developing children) of 71% for a total classification accuracy of 75%. The most predictive clusters were located in the right fusiform gyrus, corroborating a previously defined state region (Kaiser et al., 2010, *PNAS*). The classification accuracy varied dramatically as a function of Replication cohort size, with classification accuracies over 85% for 30 subjects and less; for 60 or more subjects, however, the classification accuracy stabilized around 75%.

Conclusions:

We replicated our finding that biological motion processing is abnormally processed in the right fusiform gyrus in children with ASD. In addition, we demonstrated that it is feasible to use Discovery cohort data in this region to construct an ASD classifier that can distinguish between subjects with and without ASD in a large Replication cohort. Our study demonstrates the robustness of fMRI as a predictor of ASD and paves the path for future use of fMRI as an early diagnostic tool.

127.004 Atypical Evidence Accumulation in Global Motion Decisions in Autism: Brain and Behavior. C. E. Robertson*[1], C. Thomas[1], D. Kravitz[1], E. Dixon[1], G. L. Wallace[1], A. Martin[1], S. Baron-Cohen[2] and C. I. Baker[1], (1)*NIMH, National Institutes of Health*, (2)*Autism Research Centre, University of Cambridge*

Background:

Numerous studies have reported a deficit in coherent motion perception in autism spectrum conditions (ASC). Research on motion perception has identified a neural circuit in which primary motion signals represented in middle temporal area (MT) are integrated in the banks of the lateral intraparietal sulcus (LIP) over time towards a decision-bound. According to this model, a deficit in global motion perception should more strongly manifest with shorter than longer stimulus durations.

Objectives:

To investigate neural and behavioral differences in rate at which motion signals are integrated towards a global percept in ASC.

Methods:

36 adult participants (19 ASC) performed a forced-choice motion discrimination task manually indicating the global direction of motion (left/right) of a field of dots. Stimulus duration varied between blocks (200/400/1500ms). Coherence level (4-75%) and dot direction were randomly chosen on each trial. An additional 39 adult participants (20 ASC) also performed an event-related fMRI version of the motion coherence task.

Results:

Coherent motion perception thresholds were significantly higher in the ASC group ($p<0.05$) only at the shortest duration (200ms). ASC and control performance at the longer durations were identical. We replicate these results in the independent sample of individuals who participated in our fMRI study. Turning to the functional data, we observed an overall reduction in the activation of the autistic MT across all coherence levels, but critically, this reduction was greater at the shorter stimulus durations. This reduction may lead to worse performance by slowing the formation of a decision variable and reducing its reliability. Results of decoding analyses, in comparison with magnitude analyses, will also be discussed.

Conclusions:

We report a robust behavioral deficit in coherent motion perception in ASC when sensory integration time is limited, which is largely absent at longer stimulus durations. These results point to atypical accumulation of motion signals in ASC: individuals with ASC require more evidence to reach a decision threshold than controls. Further, we have shown that this atypical accumulation is reflected in the reduced activation of the autistic MT. This result may provide insight into higher-order cognitive and social deficits that rely on visual integration, such as joint attention.

127.005 Symptoms of Sensory Sensitivity and Anxiety As Predictors of Amygdala and Hippocampus Activation to Sensory Stimuli in Youth with and without ASD. S. A. Green*[1], N. L. Colich[2], J. D. Rudie[3], D. Shirinyan[3], M. Dapretto[4] and S. Y. Bookheimer[3], (1)*UCLA*, (2)*Stanford University*, (3)*University of California, Los Angeles*, (4) *UCLA*

Background: Children with ASD often exhibit sensory over-responsivity (SOR), which may cause them to react negatively to sensory stimuli such as noisy or visually stimulating environments (Liss et al., 2006). Rates of SOR are over five times higher in children with ASD than in typically developing (TD) children (e.g., Baranek et al., 2006; Ben-Sasson et al., 2007) and SOR is associated with increased functional impairment in children with ASD (e.g., Liss et al., 2006; Pfeiffer et al., 2005). SOR has been shown to frequently co-occur with anxiety in children with ASD (e.g., Ben-Sasson et al., 2008). The neural bases for SOR are still unknown, but the high co-occurrence of SOR and anxiety suggests that underlying limbic system abnormalities may put individuals with ASD at risk for both conditions (Green & Ben-Sasson, 2010; Hitoglou et al., 2010; Waterhouse et al., 1996). However, no functional MRI (fMRI) studies have investigated the neural bases of SOR in children with ASD.

Objectives: The purpose of this study was to examine the relationship of parent-reported SOR and anxiety symptoms with brain responses to mildly aversive sensory stimuli in youth with and without ASD.

Methods: Participants were 24 children and adolescents with ASD and 24 typically-developing (TD) controls, between 8-17 years. During fMRI, participants were presented with mildly aversive auditory (white noise) and visual (a continually rotating color wheel) stimuli. Each stimulus trial was 3 seconds long and consisted of either the auditory stimulus, visual stimulus, or both. Each trial type was presented 12 times. Participants' parents rated their symptoms of SOR with the Sensory Profile (Dunn, 1999) and Sensory Over-Responsivity Inventory (Schoen et al., 2008). Scores on the relevant subscales (auditory and visual sensitivity) of these measures were standardized and combined to create a sensory composite score. Parents also rated their children's anxiety symptoms using the Child Behavior Checklist (CBCL).

Results: Amygdala and hippocampus activation across groups during all three conditions was used to create functional masks, and parameter estimates were extracted from these masks for each participant during each sensory condition (auditory, visual, or both) as compared to baseline. Hierarchical regression was used to predict amygdala and hippocampus activation during each condition. Status (ASD vs. TD), a sensory composite score, CBCL anxiety score, and a status by sensory composite interaction term were entered as predictors in four separate steps. Higher sensory composite scores significantly predicted greater amygdala and hippocampus activation in the auditory and joint conditions after accounting for anxiety (DR^s ranged from .09-.14, $p<.05$). The interaction term was not significant.

Conclusions: Findings suggest that SOR is related to hyperactivation of the amygdala and hippocampus and these results cannot simply be accounted for by higher anxiety in children with SOR. The relationship between SOR and amygdala/hippocampus activation appears to be similar across children with and without ASD.

127.006 Social and Monetary Reward Processing in Autism Spectrum Disorders (ASD): Interaction Effects in the Striatum. S. Delmonte*, J. H. Balsters and L. Gallagher, *Trinity College Dublin*

Background: The 'Social Motivation Hypothesis,' suggests that impairments in social interaction which characterise ASD are due to a failure to associate social stimuli with emotional rewards. Previous studies of reward processing in ASD have

shown reduced activity in the ventral striatum in response to social rewards. However, results with reference to monetary rewards have been inconclusive, with regions in the striatum showing reduced activation but regions in the orbitofrontal cortex showing increased activation.

Objectives: The purpose of the current study was to investigate interactions between neural responses to social and monetary rewards in ASD in a whole brain analysis, as well as to examine group differences specific to each reward type. This will help to elucidate whether deficits in reward processing in ASD are specific to social rewards.

Methods: 28 right-handed male participants with ASD and 26 age and IQ matched controls were recruited to the study. 21 participants from each group were included in the final analysis (age; ASD = 17.73 (3.39); CON = 17.00 (3.37): IQ; ASD = 109.38 (15.94); CON = 110.00 (12.53). Participants performed an adapted version of the Social and Monetary Incentive Delay Tasks where accuracy was fixed to ~70%. Three levels of reward were possible, no reward (blurred face/coin), small reward (face small smile/20 cent) and larger reward (face big smile/1euro). Slow responses to small/large cues were presented with no reward feedback. fMRI preprocessing and analysis was carried out in SPM8. Contrasts were generated to examine the effects of postive feedback (small/large reward) modelled over a baseline of correct responses with no reward feedback. An ANOVA was carried to investigate group (ASD/CON) by reward type (Social /Monetary) interactions. In addition two two sampled t-tests were used to exmine group differences specific to each reward type (uncorrected $p<0.001$; extent threshold 10; apriori hypotheses in the striatum was corrected using a bilateral caudate SVC $p<.05$ FWE).

Results: As hypothesised the results revealed a significant interaction between group and reward type in the striatum. The ASD group showed a reduction in activity from baseline in response to social rewards but an increase in response monetary rewards in the left dorsal caudate. Controls, on the other hand, showed increased activity from baseline for social rewards but no increase in activity for monetary rewards in this region. In addition, task specific group comparisons indicated that the ASD group showed reduced activity in the caudate for social rewards but no significant difference in this region for monetary rewards. There were no significant group differences for monetary rewards that survived correction for multiple comparisons in reward related neural circuitry.

Conclusions: The results suggest that the dorsal striatum may be maladaptive in ASD such that it is hyporesponsive to social stimuli whilst remaining responsive to other salient stimuli such as monetary rewards. This contrasts with previous studies which have shown reduced activity in the ventral striatum in response to monetary rewards in ASD. This may be accounted for by the different roles of the ventral and dorsal striatum in reward processing.

127.007 Neural Reward System Response to Food Cues in Autism Spectrum Disorders. C. J. Cascio*[1], J. H. Foss-Feig[2], J. L. Heacock[3] and C. R. Newsom[2], (1)*Vanderbilt University School of Medicine*, (2)*Vanderbilt University*, (3)*Ohio State University*

Background:

Differences in neural reward mechanisms have been hypothesized to play a role in the social symptoms of autism spectrum disorders (ASD). Although a growing number of studies are investigating the neural basis of social and monetary reward in ASD, no studies have yet focused on the neural basis of biological (or primary) rewards. An advantage to studying biological reward is that it does not depend on symbolic representation as monetary reward paradigms do, and therefore may be a better index of non-social reward in people with ASD who may have differences in ability to interpret monetary reward cues. Images of high-calorie foods under conditions of mild fasting have been shown to robustly recruit responses from the reward system in healthy children.

Objectives: To compare children with and without ASD in their neural response to food reward cues.

Methods: A group of 17 children with ASD was compared to a group of 18 children without ASD matched on age, gender, IQ, and body mass index (BMI) in a block design fMRI paradigm during which children were asked to abstain from eating for 4 hours prior to the scan, then to passively view images of appetizing foods. Individual differences in preferred foods and

food aversions were taken into account in the choice of food images. Blood oxygenation level-dependent (BOLD) response to these images was compared to that in a visual baseline condition. To ensure attention to the images in the absence of a task, included children had to perform with greater than 75% accuracy in a memory recognition task after the scan. Analyses were limited to a network of regions known to mediate reward response: the nucleus accumbens, amygdala, insula, ventral prefrontal cortex (including orbitofrontal), and anterior cingulate cortex. An uncorrected p value of < 0.005 and a cluster size of at least 10 voxels were used in combination as a threshold for determining regions with a significant BOLD response.

Results:

Very similar patterns of increased BOLD signal to these images in the two groups were found; both groups showed significant clusters of increased BOLD signal in bilateral amygdala, as well as in nucleus accumbens, orbitofrontal cortex, and insula. Direct group comparisons revealed that the ASD group showed a stronger response to food cues in bilateral insula along the anterior-posterior gradient, and in anterior cingulate cortex than the typically developing comparison group, whereas there were no neural reward regions that showed higher activation for the typically developing comparison than for ASD.

Conclusions:

These results suggest that neural response to biological rewards is intact and may even be enhanced in children with ASD.

127.008 Acute Fluoxetine Leads to Increased Prefrontal Activation in Children with Autism Spectrum Disorder During Tasks of Executive Function. K. Chantiluke*[1], A. Smith[1], N. Barrett[2], P. Santosh[2], V. Giampietro[1], D. G. Murphy[3] and K. Rubia[1], (1)*King's College London, Institute of Psychiatry*, (2)*National Health Service*, (3)*Institute of Psychiatry, King's College London*

Background: Patients with Autism Spectrum Disorders (ASD) have shown abnormal performance and activation in frontal, striatal and parietal regions during tasks of working memory, inhibition and cognitive flexibility. Genetic and biochemical studies have shown that serotonin (5-HT) dysregulation may play a pivotal role in cognition and behaviour in ASD. Furthermore, there is some evidence that Selective Serotonin Reuptake Inhibitors (SSRIs) such as Fluoxetine improve ASD behaviours. In healthy adults, serotonin manipulation has been shown to affect neural networks of inhibition and attention functions. However, nothing is known of the effects of SSRIs on brain function in people with ASD.

Objectives: In this study we therefore aimed to investigate the effect of a single acute clinical dose of Fluoxetine on brain function in children with ASD during disorder-relevant tasks of working memory, inhibition and reversal learning. We hypothesised that the single dose would enhance activation in task-relevant prefrontal and temporo-parietal brain regions.

Methods: Twelve medication-naïve right handed boys with the clinical DSM-IV diagnosis of ASD, aged 10-17, IQ < 70 with no co-morbidities were recruited from local clinics. Boys were assessed using the Autism Diagnostic Interview – Revised (ADI-R) and the Autism Diagnostic Observation Schedule (ADOS) to confirm diagnosis. Each subject underwent two functional magnetic resonance imaging scans (fMRI) (four weeks apart), either under placebo (peppermint water), or a single clinical dose of Fluoxetine (titrated to weight), in a double-blind, cross-over, placebo-controlled design performing 3 executive function tasks: a working memory (WM) (NBack) task, a Stop task measuring motor response inhibition and a Reversal Learning task, measuring cognitive flexibility. The effects of Fluoxetine on performance and brain activation in patients were tested using repeated-measures ANOVAs. The analysis package of XBAM was used for brain image analyses.

Results: No significant performance changes were observed under Fluoxetine. In the WM task Fluoxetine relative to placebo increased rostro-medial and dorsolateral prefrontal (DLPFC) but decreased precuneus activation, which was at a trend-level anti-correlated with DLPFC activation. During successful reversal learning trials, Fluoxetine relative to placebo increased rostro-medial prefrontal while decreasing bilateral striatum activation. During successful inhibition in the

Stop task, Fluoxetine relative to placebo increased activation in right inferior frontal cortex (IFC).

Conclusions: These preliminary findings show that Fluoxetine upregulates activation in task specific, serotonergically innervated prefrontal brain regions, i.e.in right IFC for inhibition, rostromedial PFC for reversal learning; and DLPFC for WM, which are typically abnormally activated in ASD populations. Furthermore, during WM this was also associated with deactivation of default mode regions. Our ongoing work compares the modulatory effect of Fluoxetine in larger samples of ASD to controls and patients with Attention Deficit Hyperactivity Disorder.

Epidemiology Program
128 Epidemiology
Chair: D. E. Schendel *Centers for Disease Control and Prevention*

128.001 Feasibility of Autism Screening in Underserved Populations. Y. Janvier*, P. Hampton, M. Zuniga and G. Cable, *Children's Specialized Hospital*

Background: Research suggests that both racial and income disparities exist in the early detection and treatment of autism. Children's Specialized Hospital developed a program of education about the diagnosis and treatment of ASD among diverse populations for healthcare providers, parents, caregivers, educators, and other community members who have regular contact with underserved populations. Autism screening programs were also instituted within targeted underserved communities with the goal of identifying young children with previously undiagnosed autism spectrum disorders.

Objectives: We present findings of the analysis of the demographic data resulting from our efforts to increase identification of underserved children with ASD in six cities in New Jersey with large, low income, minority populations. Specifically, we provide a breakdown of the demographics of the underserved children and their parents/guardians screened in the six cities.

Methods: The program involved several related activities including: identifying cities and target sites, creating culturally relevant materials for education, and conducting community Autism Screenings in childcare and preschools using M-CHAT and/or SCQ with both parents and teachers. Follow up interviews were then conducted for children with failed M-CHATs, and research evaluations (ADOS & Mullen subtest) for those who failed screenings. In addition, developmental screening training was offered to healthcare providers and autism education materials were created for use in community outreach. Outreach was provided to caregivers of children in these cities and other community members regarding normative child development, behavioral signs of possible developmental delay, and resources. We also established Autism Screening Clinics in federally-funded health clinics in the target cities. Demographic descriptive statistics were calculated for children and parent/guardians and screening results summarized.

Results: 886 Community Autism Screenings were conducted during the first 15 months of the project. Two of the target cities contributed nearly 70% of children who were screened. The median age at evaluation was 56 months (mean=54.4, SD=10.6). Just over 55% of the children screened were male and nearly 45% were female. Over 65% of the children were on Medicaid and nearly 20% had no health insurance. Few had received early intervention program services. The parent or guardian who responded was usually female (78%, with data missing for 341 parents) and just over 68% had a high school diploma or less formal education with over 33% having only some high school (no diploma) or less than a ninth grade education (though data were missing for 380 parents). Six percent screened positive after the M-CHAT follow-up interview (40% of these were lost to further follow up). Nearly half of those receiving follow up who failed initial screening were subsequently found to have autism.

Conclusions: A successful screening program for children in underserved areas was established. Successful access to a pool of underserved children was evidenced by the large majority of children receiving Medicaid or having no insurance, and the large proportion of their parents/guardians who had a high school diploma or less. Challenges

associated with conducting developmental screening in this population will be discussed.

128.002 The Female Protective Effect Against Autistic Behavior: Evidence From Two Nationally-Representative Samples. E. Robinson*[1], P. Lichtenstein[2], H. Anckarsater[3], F. Happe[4] and A. Ronald[5], (1)*Harvard School of Public Health*, (2)*Karolinska Institute*, (3)*University of Gothenburg*, (4)*Institute of Psychiatry*, (5)*Birkbeck College*

Background: Male preponderance in autistic behavioral impairment has been explained in terms of a hypothetical protective effect of female sex, yet little research has tested this hypothesis empirically. Autistic behaviors are highly familial. If more risk factors are required to produce autistic impairments in girls, the family members of affected females should, on average, carry more risk factors than the family members of affected males. In other words, the female protective effect hypothesis predicts that family members of female probands with autistic impairments should have higher autistic trait scores than the family members of male probands.

Objectives: The objective of this analysis was to conduct the first test the female protective effect hypothesis in the general population, using quantitative indicators of autistic impairment in two nationally-representative samples.

Methods: We analyzed data from 3,842 12-year-old dizygotic twin pairs in the Twins Early Development Study (TEDS) and 6,040 9- and 12-year-old dizygotic twin pairs in the Child and Adolescent Twin Study of Sweden (CATSS). Autistic behaviors were measured using the Child Autism Spectrum Test in TEDS (CAST) and the Autism—Tics, ADHD and other comorbidities inventory (A-TAC) in CATSS. To include an adequate number of affected females for statistical comparison, probands were identified as individuals scoring in the top 10% of the overall population distributions of the CAST or A-TAC. We compared sibling autistic impairment between male and female probands.

Results: In both TEDS and CATSS, siblings of female probands had significantly greater aggregation of autistic impairments than the siblings of male probands. Combining the cohorts, the average autistic trait scores of siblings of female and male probands were 0.64 and 0.37 standard deviations above the mean, respectively ($p < .0001$). The siblings of female probands also had greater risk of being in the top 10% themselves in both TEDS and CATSS (combined cohort risk ratio: 1.38, 95% confidence interval 1.11-1.72).

Conclusions: This study provides the first population-based evidence that familial etiologic factors relevant to autism are likely more concentrated in females that manifest the phenotype. This finding suggests that there is a component of female sex that protects girls from ASDs and requires that a greater number of risk factors be present for girls to show autistic behavioral impairment. An understanding of the biology underlying female advantage could greatly aid progress in identifying both causes and prevention factors for ASDs.

128.003 Early Gestational Levels of Persistent Organic Pollutants and Autism in a Finnish National Birth Cohort. K. Cheslack-Postava*[1], P. Rantakokko[2], S. Hinkka-Yli-Salomaki[3], H. M. Surcel[4], I. W. McKeague[1], A. Sourander[3] and A. S. Brown[5], (1)*Columbia University*, (2)*National Institute for Health and Welfare (THL)*, (3)*University of Turku*, (4)*National Institute for Health and Welfare (THL)* , (5)*NYSPI*

Background: Recent research emphasizes the contribution of environmental as well as genetic factors to the etiology of autism but studies testing associations between chemical exposures and autism have been limited. Prenatal exposure to persistent organic pollutants (POPs)—in particular polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT) and its metabolite DDE—has previously been associated with decrements in cognitive and developmental performance indicative of neurodevelopmental impacts. However, studies examining development of autism in relation to prenatal maternal measures of POPs have not to our knowledge been reported.

Objectives: To establish the feasibility of applying an assay for 10 POPs in prenatal maternal serum samples from the

Finnish Prenatal Study of Autism (FIPS-A) and to generate hypotheses on relationships between POPs and autism.

Methods: We conducted a pilot study in the FIPS-A. Seventy-five cases with autism and 75 controls matched on sex, birth year, urbanization and maternal age were sampled from first-born children in the Finnish Maternity Cohort, which includes over 1 million births. The study sample included births occurring from 1991 to 2000. Subjects were followed up for autism through 2007. DDT, DDE, PCB-118, PCB-138, PCB-153, PCB-156, PCB-170, PCB-180, hexachlorobenzene, and BDE-47 were measured in archived maternal serum samples taken during the first trimester of pregnancy using gas chromatography-high resolution mass spectrometry. Correlations between pollutant measures were assessed and mechanistically-related weighting schemes for summarizing PCB levels were compared. Quantile-quantile (Q-Q) plots were used to graphically compare case and control distributions of pollutant levels. Paired t-tests were used to compare mean POP levels between cases and controls, and conditional logistic regression will be used to examine differences at the upper end of the exposure range.

Results: Analytes, with the exception of DDT and BDE-47, were detected above the limit of quantitation in all samples. Correlation between levels of PCB congeners and weighted TEQ measures was high (0.71-1.00). DDE had low correlation with other measures. In preliminary analyses, Q-Q plots showed evidence of threshold associations whereby case values exceeded control values only at the upper end of the distribution (approximately >85th percentile). Paired t-tests revealed no significant differences between cases and controls for log-transformed mean values of any analyte; however, the risk of autism was increased 1.76-fold for subjects with total PCBs above the 90th percentile of control values.

Conclusions: This preliminary study suggests that elevated PCB levels may warrant investigation as a potential risk factor for autism. This hypothesis should be tested in a larger sample to determine the significance of this association.

128.004 Parental Socioeconomic Status and Risk of Offspring Autism Spectrum Disorders. D. Rai*[1], G. Lewis[2], M. Lundberg[1], R. Araya[2], A. Svensson[1], C. Dalman[1], P. Carpenter[3] and C. Magnusson[1], (1)*Karolinska Institutet*, (2)*University of Bristol*, (3)*Avon and Wiltshire Partnership NHS Mental Health Trust*

Background: The over-representation of autism spectrum disorders (ASD) in children of high socioeconomic status (SES) families is one of the oldest controversies in autism literature, but consistently reported in the USA. These findings starkly contrast with SES gradients of many health conditions, and may result from SES inequalities in access to services.

Objectives: To test the hypothesis that children from lower SES families would be at greater risk of ASD, once case-ascertainment biases are minimized.

Methods: We tested this hypothesis in a population-based study in Sweden, which has universal healthcare, free routine screening for developmental problems for all children, and thorough protocols for multidisciplinary diagnoses of ASD. In a case-control study nested in a total-population cohort of children aged 0-17 years, living in Stockholm County between 2001-2007 (n=589,114), we matched ASD cases (n=4709) by age and sex to ten randomly selected controls by age and sex. We retrieved parental SES measures collected at time of birth by record-linkage.

Results: Children of families with lower income, and of parents with manual occupations (OR 1.4 (95% CI 1.3-1.6)), were at higher risk of ASD. No relationship with parental education was observed. These associations were present after accounting for parental ages, migration status, parity, and psychiatric service use, maternal smoking during pregnancy and birth characteristics; and were present regardless of comorbid intellectual disability.

Conclusions: Lower, not higher socioeconomic status was associated with an increased risk of ASD. Studies finding the opposite may be underestimating the burden of ASD in lower SES groups. Social stressors need to be considered in the etiology of ASD.

128.005 Prevalence and Neonatal Factors Associated with ASD in Preterm Infants. M. W. Kuzniewicz, S. Wi, Y.

Qian, E. M. Walsh, M. A. Armstrong and L. A. Croen*, *Kaiser Permanente Division of Research*

Background: Preterm infants have a higher rate of positive results on screening tests for autistic features compared to term infants. However, the prevalence of confirmed diagnoses later in childhood and the neonatal factors that may affect prevalence are unclear.

Objectives: To determine the association between gestational age and confirmed cases of Autism Spectrum Disorders (ASD) and assess risk factors in the neonatal period.

Methods: The study population included all live births occurring at Northern California Kaiser Permanente Medical Care Program hospitals between 2000-2007 who remained in the healthcare system at two years of age (n=177,549). Infants with major congenital anomalies or hypoxic ischemic encephalopathy were excluded. Definite ASD cases were defined as children evaluated and diagnosed with an ASD at a Kaiser Permanente Autism Center through August 2011. We assessed the association between gestational age and other risk factors and a diagnosis of ASD using Cox proportional hazards regressions to account for differential time of follow-up, adjusting for sex, maternal and paternal age, maternal race/ethnicity, maternal education, Cesarean section, and multiple gestation as well as clustering by mother.

Results: The point prevalence of definite ASD cases (N=1286) was 0.72% in the entire study population, 1.08% (147/13,639) in preterm infants (<37 weeks gestation) and 0.69% (1,139/163,910) in term infants (≥ 37 weeks gestation). Among infants with an ASD, the percentage with a diagnosis of Autistic Disorder (AD) was similar in both groups (65% in preterm, 67% in term). Compared to term infants, infants 34-36 weeks (Hazard Ratio (HR) 1.32, 95% CI 1.06-1.63, P=0.01), 27-33 weeks (HR=1.34, 95% CI 0.91-1.98, P=0.14), and 24-26 weeks (HR=2.90, 95% CI 1.43-5.86, P=0.003) were at an increased risk of ASD, although statistical significance was not reached in the 27-33 week group. A 5-minute Apgar score of <6, being small or large for gestational age, bacteremia, inotropic support, necrotizing enterocolitis, surfactant administration, blood transfusion, intraventricular hemorrhage grade >2, cystic periventricular leukomalacia, and a discharge diagnosis of maternal chorioamnionitis were not independent risk factors for ASD in preterm infants. There was a trend toward those who received mechanical ventilation being at higher risk for ASD (HR=1.72 95% CI 0.94-3.17, P=0.08).

Conclusions: Preterm delivery is a risk factor for the diagnosis of ASD later in childhood; however, the magnitude of the increased risk was substantially lower than the 4- to 5-fold increase in positive screening prevalence reported previously. This suggests that a significant percentage of the positive screens in preterm infants may be due to developmental impairments related to their prematurity rather than to ASD. No specific diagnoses or interventions in the neonatal period were associated with an increased risk of a diagnosis of ASD. While infants 24-26 weeks were at a significantly increased risk, this finding should be interpreted with caution given the small number of infants (n=222), 6 with an ASD diagnosis.

128.006 Gene-Environment Interaction: Impact of MET Gene on Traffic Exposure From Freeways As a Risk Factor for Autism. H. E. Volk*[1], T. Kerin[1], I. Hertz-Picciotto[2], F. Lurmann[3], R. McConnell[1] and D. B. Campbell[1], (1)*University of Southern California*, (2)*University of California Davis*, (3)*Sonoma Technology, Inc.*

Background: Although gene-environment interactions are widely believed to contribute to autism, the evidence for specific gene-environment interactions is sparse. In independent studies, we recently identified (1) increased autism risk among individuals exposed to high levels of traffic related air pollution (TRP) near the time of birth; and (2) increased autism risk among individuals with the C allele of *MET* gene promoter variant rs1858830. Association of the *MET* rs1858830 C allele has been replicated in 5 independent samples, and the allele is known to be functional, decreasing expression of MET protein in brain and peripheral blood.

Objectives: In this study we investigated the relationship between TRP exposure, genotype at the *MET* rs1858830 locus, and autism. Based on animal model studies showing decreased MET protein in brain following prenatal exposure to the TRP component benzo(a)pyrene, we hypothesized a potential gene-environment interaction that could be detected in a human sample.

Methods: This study analyzed data on 165 autism simplex cases and 149 typically developing controls enrolled in the Childhood Autism Risks from Genetics and the Environment (CHARGE) Study. Autism diagnosis was confirmed based on both the ADOS and ADIR while controls were those that scored below the cut-off of 15 on the Social Communications Questionnaire and who did not meet criteria for developmental delay using the Mullen's Scales of Infant Development and the Vineland Adaptive Behavior Scales. The mother's address from the birth certificate was geo-coded and TRP estimates assigned to each location using the CALINE4 line-source air-quality dispersion model. Genotype at the *MET* rs1858830 locus was determined by direct re-sequencing of DNA obtained from blood samples. We examined genotype and TRP associations using logistic regression models comparing autism vs. typically developing controls.

Results: Cases were more likely to live at residences with the highest quartile of TRP exposure, as compared to controls (OR 1.62, 95%CI (0.95-2.79)). Consistent with previous reports in simplex cohorts, no main effect of genotype was observed (OR 0.94, 95% CI (0.56-1.59)). Examination of joint TRP and gene effects indicated that subjects with both the *MET* rs1858830 CC genotype and high TRP exposure were at increased risk of autism compared to subjects with the GG genotype and unexposed to TRP (OR 4.16, 95% CI (1.29-16.21)).

Conclusions: These findings suggest that the joint effects of *MET* rs1858830 CC genotype and TRP exposure increase autism risk among simplex families, demonstrating a gene-environment interaction.

128.007 Autism Spectrum Disorder Reclassified: A Second Look At the 1980's Utah/UCLA Autism Epidemiologic Study.

J. S. Miller*[1], D. Bilder[2], C. E. Rice[3], M. Farley[2], H. Coon[4], E. Fombonne[5], C. Pingree[2], E. R. Ritvo[6], A. Ritvo[7] and W. M. McMahon[2], (1)*Children's Hospital of Philadelphia*, (2)*University of Utah*, (3)*National Center on Birth Defects and Developmental Disabilities*, (4)*University of Utah* , (5)*McGill University*, (6)*UCLA Medical School*, (7)*University of California, Los Angeles*

Background:

Understanding how changes in diagnostic criteria impact identification has important implications for our understanding of ASD trends. Changes in diagnostic criteria are widely understood as a key driving factor behind increased ASD prevalence. However, there have been relatively few empirical studies of this issue. Looking back at earlier work that identified people with an ASD and putting it into a current context can help us understand the extent to which historical work remains relevant today. In the mid-1980's, researchers at the University of Utah and University of California – Los Angeles (UCLA) collaborated to conduct an autism epidemiology study in Utah. People were identified as an ASD case using *DSM-III* criteria and were ascertained through queries to the public, prior study participants, providers, group homes, and schools. The oft-reported prevalence of autism was 4 per 10,000.

Objectives:

This study re-examined diagnostic data from a state-wide Utah epidemiological study of autism conducted in the 1980's with the current *DSM-IV-TR* case definition and record review methods of Autism and Developmental Disabilities Monitoring (ADDM) Network prevalence studies. The purpose of this study was to examine differences in classifying autism based on individuals identified before increased autism awareness or the inclusion of autism as a special education classification starting in the early 1990's.

Methods:

Records were reviewed from 241 participants who were between the ages of 3 and 25 years and were classified as "Diagnosed Autistic" in the 1980's according to *DSM-III* criteria, and also from 108 who were evaluated and classified as "Not Autistic" according to *DSM-III* criteria. We applied the records review method and *DSM-IV-TR* ASD case definition utilized by the Centers for Disease Control and Prevention's Autism and Developmental Disabilities Monitoring (ADDM) Network.

Results:

Of the 108 records re-reviewed in the original "Not Autistic" group, 64 individuals (59%) met the current case definition of

ASD. This represents a significant increase in the percentage of ascertained individuals who met the current case definition for ASD (N=305) compared to the 1980's case definition (N=241) (z=3.93, p<.0001). Contrary to our expectations, however, the average IQ estimate in the reclassified as autistic group (IQ=35.58; SD=23.01) was significantly lower than in the original group (IQ=56.19 SD=21.21; t=5.75; p<.0001).

Conclusions:

The original sample identified through active case ascertainment in the 1980's would meet current *DSM-IV* diagnostic criteria, suggesting that the phenotyping contribution of this early work remains valid. If today's diagnostic criteria had been applied to cases ascertained in the 1980's, even more cases of lower-functioning autism would have been identified. Since the sample was based on people identified in the 1980's, it is likely that additional individuals with high-functioning and milder forms of autism were not even brought to the attention of autism clinicians or researchers in the 1980's and not included in prevalence estimates.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC.

128.008 The Role of Preeclampsia in Autism Spectrum Disorders and Cognitive Function. C. K. Walker*[1], P. Krakowiak[2], A. S. Baker[3], R. L. Hansen[4], S. Ozonoff[4] and I. Hertz-Picciotto[4], (1)*University of Califoornia, Davis*, (2)*University of California, Davis*, (3)*University of Califoornia, Berkeley* , (4)*UC Davis*

Background: Preeclampsia evolves late in pregnancy and is characterized by marked increases in maternal peripheral vascular resistance, vascular permeability and coagulation abnormalities. The resulting physiologic alterations in maternal immune, metabolic and other major organ systems can be substantial and may affect the fetus adversely.

Objectives: This study examined whether fetal exposure to maternal preeclampsia was associated with an increased odds of developing either ASD or cognitive impairments.

Methods: The CHARGE (Childhood Autism Risk from Genetics and the Environment) Study is an ongoing case-control study of the etiology of autism. Data from maternal self-report and medical records documenting maternal conditions during pregnancy were available for the mothers of 517 children with a diagnosis of autism spectrum disorder (ASD) and 350 population-based frequency-matched controls with typical development. We collected demographic data and information about the pregnancy, delivery, and child's early life in the Environmental Exposure Questionnaire, a telephone-administered interview. Covariates related to clinical conditions, therapeutic interventions and the labor and delivery process were abstracted in a systematic fashion from medical records. All children were scored on both the Vineland Scales of Adaptive Behavior (VABS) and the Mullen Scales of Early Learning (MSEL), and we performed the Autism Diagnostic Interview–Revised and the Autism Diagnostic Observation Schedule to confirm the diagnosis of ASD. Cognitive function among children with ASD was categorized as follows: low (<70 on MSEL and VABS), mixed (<70 on either MSEL or VABS), high (>70 on MSEL and VABS). Adjusting for maternal education, delivery payer, parity, obesity (body mass index > 30), and frequency-matching variables child's age at study entry and Regional Center catchment, we developed logistic regression models to examine the relationships between preeclampsia and (1) case status and (2) ASD cognitive function level.

Results: Women with preeclampsia had a nearly three-fold increased risk of having a child with ASD compared to women without this condition (adjusted odds ratio [aOR] 2.75, 95% confidence interval [CI] 1.30, 5.80). The association between preeclampsia and ASD was only detected among children with low cognitive function compared to children with typical development (aOR 2.75, 95% CI 1.27, 5.97).

Conclusions: We propose multiple mechanisms for the role preeclampsia in the pathogenesis of ASD with low cognitive function. Inadequate placentation results in insufficient circulation leading to progressive hypoxia and oxidative stress

in the placenta and fetus. Further, generalized systemic maternal endothelial activation exacerbates the maternal systemic inflammation and insulin resistance seen in normal pregnancy.

129 Innovative Technologies Demonstration Session

129.001 1 Building a Data Warehouse Describing the Autism Research Community in a New Way: Extract, Load and Transform (ELT). C. Tirrell[1], M. Peddle[1], S. B. Johnson[2], C. D. Walentas[3], O. McGettrick[1], B. Lawlor[1], H. Agnew[1], D. Voccola[1] and L. Rozenblit*[1], (1)*Prometheus Research, LLC*, (2)*Weill Cornell Medical College*, (3)*Self*

Background: Understanding the scope of research activities in a scientific community requires leveraging data from multiple public and private sources. However, data from different sources, such as PubMed and NIH RePORTER, may be difficult to link because data are organized differently, are of inconsistent or poor quality or lack appropriate identifiers. The standard solution to these challenges is to use an Extract, Transform and Load process (ETL), which pulls the data out of the original data source, changes its structure and content, then stores it in the target database. However, ETL processes tend to be brittle, expensive, and difficult to run. We needed a data-integration solution that would remain flexible and inexpensive, and would support an expanding list of ad hoc data sources to support decisions about scientific funding.

Objectives: We set out to build a process that could inexpensively integrate data about autism research projects from multiple sources into a unified data warehouse. Our initial sources included a grant management system (proposalCENTRAL), PubMed, and NIH RePORTER, but our long-term goal was to integrate additional sources at linear cost. Unified data would yield insights about grant applicants' public and private funding history, publication trajectories, and collaborations. This data warehouse would enable science officers to discover new researchers who should be targeted for funding or could serve as reviewers on grant applications.

Methods: We altered the usual Extract, Transform and Load (ETL) sequence to Extract, Load and Transform (ELT). Data were first extracted from the source system and immediately loaded, without any transformation, into a "loading zone" of the data warehouse. Modular transformation rules were written in a high-level query language (HTSQL) and saved using the saved-query mechanism of our system, where they remained available for automated testing. To improve transparency and testability, complex transformations were done in multiple stages that produced intermediate data models. We found that HTSQL was sufficiently powerful to handle all desired transformations, allowing us to use a single technology for the ELT process. Uniquely identifying scientists and institutions across data sources posed an additional set of challenges. Disambiguation and reconciliation algorithms were developed to handle the majority of cases, with a subset of low-certainty cases requiring manual inspection.

Results: The ELT approach proved successful in combining the initial three data sources (proposalCentral, PubMed, NIH RePORTER) into a unified data model. It also demonstrated flexibility in adapting to changes in the data structure of grant management data. We believe it is sufficiently flexible to incorporate numerous other data sources in the future.

Conclusions: The innovative ELT approach was effective largely because of an enabling technology, HTSQL, a high-level query language. The unification of the first three data sources created a valuable resource for making decisions about research funding. Automatic disambiguation of scientists and institutions, and reconciliation of objects across data sources remains a major challenge and will require additional work.

129.002 2 Hypertext Rapid Application Framework (HTRAF): An Innovative Application-Development Layer Enables Rapid Delivery of Web Applications for Autism Research and Autism Funding Decisions. O. McGettrick, O. Golovko, B. Lawlor, D. Voccola and L. Rozenblit*, *Prometheus Research, LLC*

Background: Despite tremendous progress in web-development technologies, building custom data-driven web applications remains out of reach for most research programs. Application development costs too much, takes too long, and requires too many technical skills. A technology platform that significantly speeds and simplifies development would bridge the gap between limited budgets and capabilities and

researchers' need for powerful web tools for interacting with data.

Objectives: We set out to create a Hypertext Rapid Application Framework (HTRAF) that would allow non-programmers to produce data-driven web-based applications in a matter of hours, with little technical skill and at low cost, putting web-tools within reach of most research programs. To meet this ambitious goal, HTRAF had to (1) include a Visual Application Builder (VAB) that non-programmers could use to build and modify applications, (2) be sufficiently flexible to pull data from diverse data sources, and (3) combine the simplicity of meta-data-driven development with the ability to create custom overrides to meet specialty requirements.

Methods: We built HTRAF as a jQuery-based JavaScript framework that can access relational databases and other data sources, pull data into HTML page elements, and allow the data in these different elements to interact. HTSQL is the primary method for retrieving data from relational databases, selected because a single HTSQL URL can retrieve both the data and the meta-data that allows HTRAF to display the data properly. A Visual Application Builder (VAB) allows non-developers to drag and drop data-enabled objects into HTML pages, and to set attributes of each element.

Results: We used HTRAF to rapidly develop the front-end tools for a sophisticated decision support system for funding decisions built on top of a data warehouse. HTRAF delivered better-than-expected results. We were able to build seven prototype tools, with three complete designs for each tool (a total of 21 screens), in under two weeks. We achieved similar speed with applications built on top of a research-data management system. Modifications to the tools following user-testing were incorporated in a matter of hours. Data queries used by the tools could be modified in real-time by updating the HTSQL used to access the data. Non-developers were able to use the VAB to build simple tools. We have not yet attempted to have non-developers build complex tools.

Conclusions: The early results with HTRAF are encouraging and indicate that the technology can be extended to allow typical research lab staff to create and modify powerful, data-driven web applications with minimal web development support. Currently HTRAF still requires someone with web development knowledge to complete the creation of a complex tool, however, non-developers trained to use the VAB and HTSQL can already quickly build simple tools that are immediately useful. HTRAF is open-source, royalty-free, and can deliver value quickly in any organization that wishes to build web applications on top of a relational database. Natural extensions include supporting non-relational data sources. HTRAF is a promising framework that can transform how researchers access and use data in data-intensive fields such as multi-disciplinary autism research.

129.003 3 The Simons Scientific Information Management System: Supporting Scientific Decision Making in Autism Research Using a Light-Weight Web-Development Methodology. L. Rozenblit*[1], O. McGettrick[1], C. Tirrell[1], M. Peddle[1], H. Agnew[1], B. Lawlor[1], N. Sinanis[1], D. Voccola[1] and S. B. Johnson[2], (1)*Prometheus Research, LLC*, (2)*Weill Cornell Medical College*

Background: Making decisions about scientific direction, such as funding of research programs, requires a variety of information sources. Science officers require knowledge of multiple internal sources about grants, as well as multiple external sources about grants and publications. Access to a wide range of systems can increase costs and reduce the speed of decisions. Different kinds of tasks (use cases) often result in very different software solutions, such as customized "dashboards". These attempts usually fail due to long delivery times, measured in months or years. By the time the dashboard is delivered, decisions and data have changed. Our approach is to produce a platform for rapidly configuring decision support dashboards that can be delivered in a matter of days or hours.

Objectives: Our goal was to produce a decision support platform with the following capabilities: 1. Build a typical dashboard in hours, with more complex dashboards taking a few days. 2. Build most dashboards without any programming, using configuration by science officers or business process analysts. 3. Use standard components and web technologies to simplify maintenance and improve interoperability. 4. Provide flexible access to data for new software modules. 5.

Support sophisticated and intuitive searching, with support for querying by terms meaningful to users.

Methods: We designed a data warehouse with an extensible data model for storing a wide variety of data about scientific research, and defined lightweight methods for extracting and loading data from internal and external sources. Next, we added a robust, web-native data-access layer (HTSQL), a rapid web-application development framework (HTRAF), and, finally, a visual application builder (the HTRAF VAB). The first pass at semantic search was handled via AlchemyAPI web service.

Results:
We developed the platform using an agile methodology over 10 weekly iterations. We then took two weeks to configure the first prototype of a decision-support tool suite: a set of interconnected dashboards for reviewing grants and grant applications and making decisions about their status. The prototype included the following screens: application dashboard, grant dashboard, publication dashboard, scientist profile, collaboration dashboard and home/search page. We were able to deliver three complete designs of the suite (a total of 21 different screens) for a usability review. Data provided by the prototype was judged useful for helping science officers make decisions about grant applications, and one design was selected as the most intuitive. Preliminary semantic search functionality showed some promise, but was too immature to evaluate.

Conclusions:
A well-designed generic platform can facilitate inexpensive and rapid delivery of tools to support a wide range of decision-making tasks. The largest challenge was successfully integrating data sources with various degrees of cleanliness and completeness. Data cleaning and normalization are likely to remain challenging, as the number of data sources pulled into the platform continues to increase. We expect to make the results of this project available to the research community and believe it will help inform decisions about scientific directions in autism research.

129.004 4 PRIMA PIETRA: Research, Integration, Enhancement, Assistance and Education Program for Autism Services and Rehabilitation Technologies. G. Pioggia*[1], L. Billeci[1], A. Narzisi[2], V. Farruggio[1], A. Arnao[1], G. Tartarisco[1], M. Ferro[3], R. Siracusano[4], E. Germanò[4], M. Deodato[5], G. Tortorella[4] and F. Muratori[2], (1)*Institute of Clinical Physiology, National Council of Research*, (2)*University of Pisa - Stella Maris Scientific Institute*, (3)*Institute of Computational Linguistics, National Council of Research*, (4)*University of Messina, Hospital "G. Martino"*, (5)*Azienda Sanitaria Provinciale*

Background: It is commonly recognized that autism spectrum disorder (ASD) symptoms are as early as 12 months of age and that the best outcomes are often achieved through early diagnosis and early intervention. However, there are many challenges to delivering health care to parents with a child with ASD. Difficulties to service delivery and utilization are more intensified for families living in suburban or remote areas, often resulting in limited access to preventative mental health services in general and parenting ASD interventions in particular. As Vismara an Rogers suggested (Vismara, 2010), the use of technology could support long-distance clinical health care. PRIMA PIETRA Italian project is focused on early diagnosis and intervention providing Early Start Denver Model (Dawson et al., 2009) using tele-rehabilitation. PRIMA PIETRA is a collaborative project supported by the Minister of Health of the Sicilian Region, in collaboration with Basilicata and Tuscany Regions.

Objectives: - The main aims were: (a) to set up a screening methodology that allows an early recognition of ASD; (b) to provide a technological platform for continuous monitoring of the treatment protocol; (c) to improve the quality of life of children with ASD and of their family through a continuous support of patients at their home.

Methods: 30 patients at their first diagnosis of autism will be enrolled in the project and randomly selected half of them treated with the support of technology. The tele-rehabilitation system will be developed so that a remote intervention under the supervision of the parents will be applied. The parents will administer the ESDM through a PC tablet provided with a decision support system and a user-friendly interface. The web-cam of the tablet will be used for the communication

between parents and a remote operator. The observation room at the child's home will be provided with a remote wireless web-cam for the audio/video registration of the therapeutic sessions. A wearable multisensory platform will be used for the acquisition of behavioural and physiological signals of the child during the treatment. Data will be collected in a web-service able to store them in a remote database and presented to the remote operator by a dedicated interface.

Results: The preliminary result of the study is the activation of a web platform for autism remote treatment (https://primapietra.ifc.cnr.it/) where therapysts have the opportunity to insert results of the on going assessment of children in an on line shared database. Wearable technologies have been already developed and tested with autistic children. They allow to acquire in a non-invasive way physiological and behavioral parameters useful to infer the emotive state of the child and objectivize the evaluation of the effect of the therapy.

Conclusions: The development of a web platform for the collection of data during the treatments sessions will allow a more accurate individualization of treatment. Moreover the use of tele-rehabilitation system could increase the effect of the therapy involving parents in the administration of a continuous intervention and so that parents, as results of Vismara pointed out, will implement the ESDM more skillfully.

129.005 5 Demonstrating Cloud Computing Capabilities Using NDAR, Piplines and the Autism Informatics Grid. D. Hall*[1], R. Stoner[2], B. Koser[3], S. Novikova[4], M. McAuliffe[5] and G. F. Farber[3], (1)*National Institute of Mental Health (NIMH)*, (2)*University of California, San Diego*, (3)*National Institute of Mental Health*, (4)*NIMH*, (5)*NIH Center for Information Technology*

Background: The scientific community, through the National Database for Autism Research (NDAR) has harmonized and shared genomic, clinical, and imaging data on over 22,000 research participants, with many thousands more expected annually.

Objectives: We present a new model of data processing using commercially available cyberinfrastructure (e.g. cloud computing) to carry out high performance computing workflows against curated data sets within NDAR.

Methods: During the session, we will demonstrate the use of the autism informatics grid, now established, to access and process large volumes of data using generally available processing pipelines.

Results: Discussion of the steps to set up and automate a pipeline, the benefits of this approach over more traditional computational techniques, its cost, and any barriers encountered will be provided.

Conclusions: Cloud computing infrastructure and very large datasets, both readily available to the autism research community, provide unprecedented opportunities for discovery. By demonstrating these capabilities in real time, we will outline the framework needed for the research community to adopt similar methods in helping to accelerate scientific discovery.

129.006 6 "Is All Autism Local?" the Value of Functional Regional Registries and Data Systems. A. Vehorn*[1], E. Dykens[2] and Z. Warren[1], (1)*TRIAD, Vanderbilt Kennedy Center* , (2)*Vanderbilt Kennedy Center*

Background: The inherent, profound genetic and behavioral heterogeneity of ASD highlights the potential value, and likely necessity, of evaluating and following extremely large samples of children and families with ASD over time. Numerous research initiatives have attempted to acquire larger samples either through consortiums or accumulating larger numbers from many different sites on similar protocols (AGRE, AGP, ATN, SSC). More recently, online registries have been developed (IAN) and implemented, yielding very large numbers of registrants, across a geographical range, based primarily on self-report information. Despite successes, such registries face significant challenges related to infrastructure maintenance, variability and reliance on parent report, as well as cost-efficient methods for detailed and rigorous longitudinal follow-up.

Objectives: The Vanderbilt Kennedy Center / Treatment and Research Institute for Autism Spectrum Disorders (VKC/TRIAD) regional autism registry was initiated as an

attempt to create a large-scale functional regional database capable of providing and following large numbers of well-indexed families in future investigations, as well as an efficient system for linking unique families across varied protocols. Specifically, the registry was designed to utilize resources from our local CTSA (Vanderbilt Institute for Clinical and Translational Research) and IDDRC (VKC) to offer simple and fluid entry to families participating across all affiliated autism networks and ATN, BSRC, SSC, clinical programs of the Vanderbilt Children's Hospital Division of Developmental Medicine.

Methods: The regional autism registry is an online database developed using REDCap, a secure web-based application which allows for initial data entry to occur across the university, individuals to be followed longitudinally, and specific surveys to be created and electronically sent out to targeted participants. Communication about projects and IRB consent for future research can be presented in person across programs, as well generated and dispersed electronically, allowing for efficient re-contacting for both the researcher and families. Unique identifiers (both NDAR GUIDs and local GUIDs) are generated for all registry participants with the capabilities of connecting and communicating across local and national database structures.

Results: From September 2010 to October 2011, 1290 families consented to have their clinical data added to the registry and to be contacted for future research. This number includes 965 children with ASD and 113 "baby" siblings. The database has aided in targeted recruitment for studies in genetics, neurology, imaging, engineering, special education and psychiatry, representing 10 investigative teams during the past year. All research studies requesting targeted recruitment make a commitment to add updated clinical information as well as any new families back into the database. The database continues to grow at a rate of 10 -15 new individuals per week. Tracking of recontacting yield and percentages are under way. In addition, a formal annual recontacting initiative is also in process.

Conclusions: Given concerns about diagnostic heterogeneity and accuracy in self-report databases, as well as resource limitations for consortium projects in terms of effectively indexing and recontacting families, functional regional registries may provide an important vehicle for advancing our understanding of the causes and optimal treatments of ASD over time.

129.007 7 Connecting the Genetic Dots of Autism Through Systems Biology. D. P. Wall*, J. Y. Jung, T. Nelson and K. St. Gabriel, *Harvard Medical School*

Background:

Although it is clear that autism is one of the most heritable mental disorders, the genetic etiology of autism remains elusive. More than 700 genes have been tied to autism, each of which is involved in numerous biological pathways and a variety of different protein and gene level interactions. It is difficult for a single researcher to grasp the complexity of the autism gene space. Given this, comparing autism susceptibility genes with candidate genes of other disorders having shared phenotypic traits with autism can shed light on our understanding of molecular mechanisms of autism.

Objectives:

To build and visualize the genetic system of autism within the context of all other human diseases and conditions, principally including neurodevelopmental disorders that share behaviors with autism, and to leverage the similarities and differences to generate and test hypotheses related to the genetic causes of autism.

Methods:

We built a web resource called Autworks. In Autworks, we combined gene/protein interactions, gene-disease associations and cross-disorder information with powerful visualization and computational tools. We integrated and cross-checked candidate gene information and their interactions from twelve external resources including PubMed, GeneCards, HuGE, and protein interaction databases. For cross-disorder analysis, we computed the enrichment of genetic overlap between candidate genes identified with autism and those linked to over 3,700 other human disorders. Each disorder or cluster of disorders can be further investigated as lists of genes and gene properties (biological processes, variants with known deleterious phenotypes, etc.)

or visualized as entire networks of interacting proteins. Sophisticated graph analytics enhance the power of Autworks' network visualization tools. Researchers can upload their own gene sets to test hypotheses using the tools provided by Autworks.

Results:

Autworks' enrichment results enable researchers to identify disorders with statistically significant genetic similarity to autism, visualize the network of interacting genes within these disorders, and analyze their own sets of genes using the same tools. These features enable rapid hypothesis generation and hypothesis testing. Both are key to prioritizing known autism candidates and identifying new candidates worthy of further experimentation.

Conclusions:

Despite decades of research, we still do not understand the causes of autism. What we do know is that autism has a strong genetic component and that its genetic roots are both numerous and variable. We have has designed a research tool to harness this genetic complexity and to place it within the context of other, related human disorders. This context helps gauge the importance of known genes while pinpointing new genes worthy of further study. With Autworks it is possible to search through all genes that have been implicated in autism to-date, to examine the complete genetic system of autism at once, or to study autism within a network of human diseases and disorders. Each path may help our community better understand the genetics of autism and may reveal new insights that lead to diagnostic markers and targets for therapeutic intervention. Autworks is accessible here: http://autworks.hms.harvard.edu.

129.008 8 Development of A Training Video to Teach Best Practices for Delivering An ASD Diagnosis to Families.

H. Austin*[1], T. Katz[2] and J. P. M. Reyes[3], (1)*University of Colorado Denver*, (2)*University of Colorado*, (3)*University of Denver*

Background: During training, clinicians learn how best to review evaluation results, deliver an Autism Spectrum Disorder (ASD) diagnosis, and discuss recommendations with families. This part of the evaluation visit is often referred to as the "feedback session". To date, materials in existence for teaching effective feedback practices have been in written format only. We hoped to enhance the learning experience by creating a video on this topic.

Objectives: To develop a training video and accompanying materials that outline and review best practices for delivering feedback to families after an evaluation for an ASD. We intended these materials to be used in LEND programs at other UCEDDs for teaching fellows about how to deliver effective feedback after an evaluation.

Methods: LEND faculty at University of Colorado School of Medicine collaborated to develop the feedback training materials. We discussed and outlined a list of the steps and activities integral to providing effective feedback to families whose child is receiving an ASD diagnosis and developed a checklist to assess the quality of a feedback session. We then scripted and filmed a video that incorporates the advice and real-life experiences of clinical psychologists and parents. An instructor's manual was also developed as a written guide to the best practices presented in the video.

Results: The result is a training video of an hour and 20 minutes in length. The video is divided into 4 separate chapters for ease of downloading and viewing. 1: The Importance of Feedback; 2: Preparing for the Feedback Session; 3: Providing the Diagnosis; 4: Recommendations and Next Steps. The instructor's manual, which discusses each segment of the feedback session, includes specific instructions and strategies for making the session a productive and positive experience for the family. The manual ends with an extensive bibliography on this subject. The quality checklist presents an efficient way of reviewing the most important components and clinician qualities demonstrated during an effective feedback session. The checklist is meant to be used by trainees and their mentors to rate feedback sessions and enhance student's learning of best practices.

Conclusions: We have developed a video and manual for teaching clinicians how to deliver effective feedback to a family receiving an ASD diagnosis.

Acknowledgements: The Feedback Training Video/Manual was supported by a grant from the Autism Treatment Network, a program of Autism Speaks, and was funded in part by cooperative agreement UA3 MC 11054 through the Health Resources and Services Administration (HRSA).

129.009 9 Facilitating Parents' Collection of in-Home Behavior Specimens. N. Nazneen[1], G. D. Abowd*[1], R. Oberleitner[2], S. Pharkute[2] and R. Arriaga[1], (1)*Georgia Institute of Technology*, (2)*Behavior Imaging Solutions*

Background:

Direct observation, either in the clinic or in the home, is considered the gold standard for problem behavior assessment. However, it can be costly, intrusive, and may cause behavior reactivity. In addition, it is common for families to be on a long waiting list in order to schedule an appointment in the clinic. The problem is that the behavior may not be observed. In some cases the clinic sends a behavior analyst to observe the behavior at home. This option can also have negative implications, for example the analyst's presence may impact the child's behavior.

Our research has shown that technology can alleviate some of the challenges by allowing parents to capture child problem behaviors for retrospective video analysis by behavior analysts. In our earlier work we showed that parents are able to flag at least one sample of their child's problem behavior.

We are designing, SmartCapture, a capture and access system that works on a commodity mobile phone. SmartCapture is a store and forward telemedicine tool integrated with a teleconsultation platform for data sharing with caregivers and behavior analysts in the clinic. The goal is to ship SmartCapture to parents and use it to collect relevant *behavior specimen*s of their child's problem behavior.

Objectives:

To explore and validate the concept of in-home collection of problem behaviors using a commodity phone-based system.

Methods:

The study has 4 phases. Phase 1 and 2 were concerned with understanding the needs of the users in regards to deploying mobile phone based technology while phase 3 and 4 were user studies with SmartCapture. Phase 1 consists of semi structured interviews of teachers, parents and caregivers of children with developmental disabilities. During phase 2 we conducted 4 homogeneous focus groups with 5 parents, 5 special education teachers, 3 behavior analysts and a heterogeneous one with 3 parents, 3 special education teachers and 3 behavior analysts. In Phase 3 a think aloud protocol was used to explore user interaction. Participants in this phase were 4 parents, 3 grandparents and 3 special education teachers. Finally in Phase 4 we asked four families to use SmartCapture in their home and share their experiences.

Results:

Our studies resulted in seven design recommendations for future iterations of SmartCapture, these are: 1) Design for simplicity and autonomy, 2) Maintain privacy, 3) Design for multiple family users, 4) Allow text and voice-based annotations, 5) Integrate with social networking sites, 6) Allow quick search on captured data 7) Include reminder.

Conclusions:

The contribution of this work is to explore and validate the concept behind a system that facilitates in-home capture of problem behaviors. The findings of our user study in which we elicited the information needs of various stakeholders can enable designers to understand the nuances involved in supporting those needs. Based on these finding we derived 7 design recommendations. Future research will involve exploring the utility of the data collected through SmartCapture by investigating its impact on waiting list time and assessment of problem behaviors.

129.011 11 SocialMirror: A Specialized Social Networking Service to Promote the Independence of Young Adults with Autism. H. Hong*, J. G. Kim, G. D. Abowd and R. Arriaga, *Georgia Institute of Technology*

Background: The rise in the number of children diagnosed with autism began in the early 1990s. Since then, these

individuals have transitioned from a protective school system to a much less protective adult world. The successful transition to adulthood requires that they become independent. However, young adults with autism face challenges in self-care and social communication that adversely impact the attainment of independent functioning. Social support can be crucial for achieving independence. Individuals have access to trusted social networks that may include parents, siblings, friends, volunteers, residential staff, herapists, and other professionals. These care networks can play a key role in their personal growth, the acquisition of new skills, expanded social benefits, and access to community resources.

Objectives: An evolving aspect of technology is that it is *socially empowering*; such technologies harness on-demand human intelligence, empower individuals to contribute to a community, and leverage distributed networks for the collective social good. The increasing proliferation of socially empowering technology such as an online social networking service allows individuals with autism to leverage their personal contacts and gain access to a distributed care network that provides on-demand contextual help. Our research raises the following question: *How can technologies that promote the independence of individuals with autism be socially empowering?* We address this question by designing an application that will leverage the relationships young adults with autism have with members of a trusted network of caregivers and allow them to practice life skills by facilitating quick responses from the network.

Methods: We first identify design principles by integrating theoretical and empirical investigations of the challenges and opportunities of social networking to support the individuals with autism. Second, we propose to design a social technology called *SocialMirror*, which leverages natural social networks and promotes collective care. SocialMirror consists of two parts. First, an interactive display integrated into a mirror provides the opportunity to ask and receive advice with an attached day's calendar. Second, the system is connected to an online social network that sends questions to a trusted set of family, friends, and professionals.

Results: We conducted focus group interviews with 11 adults with autism and four caregivers. The interviews revealed that SocialMirror has a potential to prompt independent behavior among individuals and in turn foster collaboration among a more distributed network of caregivers. The central features of the SocialMirror include a natural form factor, blended functionality and sociability, and community empowerment leveraged by the distribution of labor associated with supporting an individual. We concluded that the SocialMirror could be socially empowering because it runs with the help of the collective intelligence of the network of caregivers.

Conclusions: Our research was aimed at providing young adults with autism in transition to adulthood with a responsive social network that allows them to get information and advice about their everyday life. Our study investigated the potential for a social networking system that promotes independence and facilitates collaboration. In so doing, independent living can become a reality for other segments of the population who require extended support.

129.012 12 Collaborative Collocated Technologies to Promote Social Communication in Children with HFASD. E. Gal*[1], S. Eden[2], M. Zancanaro[3] and P. L. Weiss[1], (1)*University of Haifa*, (2)*Bar Ilan University*, (3)*Bruno Kessler Foundation*

Background:

Many interventions for children with High functioning Autism Spectrum Disorders (HFASD) focus on the promotion of social and communication skills, core symptoms of the diagnosis of ASD. Since these children face great challenges in coping with social interactions, they often prefer to engage in solitary, computer-based activities. Technologies that support collaboration rather than isolation are, therefore, of unique benefit for those with HFASD.

Objectives:

To present a colocated collaborative prototype called *No-Problem!* And aimed at improving social conversation skills, and the results of a formative study designed to provide end user feedback on the prototype.

Methods:

Following guidelines for software design and incorporating feedback from end user focus group discussions, the *No Problem!* prototype was programmed to train social conversation skills. Based on a Cognitive Behavioral Therapy (CBT) approach, *No Problem!* includes a learning part and an experience part. In the learning part pairs of children, guided by a faciltator, explore the four stages of a social conversation: initiating, maintaining, switching topic and closing the conversation. The children explore alternative solutions or suggest new ways of managing each phase. The experience part consists of a recording tool for the faciltator to involve the children in a role playing session, video-recording their performance and reviewing it together with them.

We examined the usability of the prototype when run on two different platforms: a tabletop touch-based device and a multi-mice desktop version. Nine boys and one girl with HFASD, aged 9-13 years, enrolled in special education classes (Grades 2-5) within a mainstream elementary school, participated in a single session. Three questionnaires, the Scenario Experience Feedback Questionnaire (SEFQ), the Scenario Learning Feedback Questionnaire (SLFQ) and Intrinsic Motivation Inventory (IMI) were used to query the children's interest in and enjoyment of the task, perceived competence, perceived choice and feelings of tension, and how well they understood and felt about the problem and solution parts of the task. They were administered to the children after the sessions. In a qualitative part of the study, the children were interviewed about what they learned from the session and about their preferences related to using the DT versus the multi-mice desktop computer.

Results:

The results suggest that children were motivated by the task, both when presented on the DT and the multi-mice platform. They felt competent doing it, perceived that they could make choices during the task, and felt minimal tension. They understood the main aims of the conversation tasks, and the various phases. Most of the children preferred using the tabletop rather than the computer, but enjoyed both of them.

Conclusions:

The results of the current study have helped to ensure that No Problem! is a usable and enjoyable application and suitable to achieve its therapeutic goals. While it seems to be more appealing when used on the tabeltop device, it appears to be also beneficial when implemented via a less costly and technically complex platform.

129.013 13 Exploring the Use of Cross-Cultural Parameterised Avatars in Virtual Learning Environments for Social Competence of People with Autism Spectrum Conditions. M. Habash*, D. Moore and C. Pattinson, *Leeds Metropolitan University*

Background: Emotions recognition and social competence are key features of autism spectrum conditions. Deficiency in emotion recognition leads to lack of social interaction and communication. This study explores the impact of using cross-cultural and features-augmented avatars within a virtual learning environment on the recognition of emotions.

Objectives: A prima facie case for a parameterised expressive avatar and virtual environment approach is developed including an argument that there is a great value of the additional set of features: ethnicity, gender, and age together with presentation of variant strengths of emotions by the avatar within a social context.

Methods: A social-context rich collaborative virtual environment is developed and involves a set of expressive avatars with cross-cultural and variant features. A preliminary empirical study involves the use of this system by eighteen participants with confirmed autism spectrum conditions diagnosis in the a cross-cultural setting in the Middle-East.

Results: This is an ongoing study at this time and results are being collected and analyzed at the current time. The final paper will include the results and analysis

Conclusions: It is argued at this stage that the addition of the use of ethnicity, age, gender, and variable strengths of expressions to the expressive avatars makes participants better recognize the emotional representations of the avatars and make elicit the right selections when faced with social situations within the virtual environment.

129.014 14 Promoting Social Communication in Children on the Autism Spectrum Through a Virtual Learning Environment (ECHOES). K. Guldberg*[1], A. Alcorn[2], M. Mademtzi[1] and H. Pain[2], (1)*University of Birmingham*, (2)*University of Edinburgh*

Background: ECHOES is a technology-enhanced learning environment for young children on the autism spectrum, set in a virtual "Magic Garden", with a programme of learning activities that are presented on a large, multi-touch screen. Within the ECHOES environment the child collaborates with a virtual character (VC) to complete different activities that target social communication, particularly joint attention. The design of the learning activities and planned agent-child interactions within ECHOES are based on goals in the SCERTS (Social Communication, Emotional Regulation and Transactional Support) model (Prizant et al., 2005).

Objectives: The work reported explores whether there were differences in the type and frequency of children's social communication behaviours, particularly joint attention, over the course of their participation in a programme of ECHOES activities. Between activity variation is also considered.

Methods: Summative evaluation studies were conducted in four UK schools and included 43 children in total. We report here on two schools: participants were 6 children with autism and 6 typically developing children (aged 5-6) at a mainstream primary school, and 3 children (aged 7-8) with autism at a special school for children with moderate learning difficulties. All children completed the BPVS and SCQ before the study. They participated in 7 to 11 sessions in the ECHOES environment, each between 10 and 20 minutes duration. The study used a single-subject design looking for within-child differences during first, middle and final sessions. Both qualitative and quantitative data were collected in order to investigate whether children's communication skills and joint attention improved within the ECHOES environment. Initiation and response to joint attention, reciprocal interactions, imitative behaviours, and other forms of social communication were examined in relation to both the VC and the human social partners working with the child. An adapted version of the SCERTS Assessment Protocol (SAP) was used as a framework for coding children's interactions. Interviews were conducted with teachers and support staff about participating children and the overall study.

Results: Results reflect within-subject outcome data during and at the end of the study. Analysis is ongoing and will be reported in full shortly. Preliminary results reveal promising changes in the children's joint attention over the course of their interaction within the ECHOES environment, with the biggest change seen in the initiation of social communication both to the human social partner and the VC. Initial results also suggest that different types of activities varied in their effectiveness in promoting initiation. Post-study interviews suggest that in some cases an increase in specific behaviours was observed outwith the ECHOES environment.

Conclusions: The present study supports previous research (Robins, Dautenhahn, Boekhorst and Billard, 2005; Robins, Dickerson, Stribling and Dautenhahn, 2004) that technological intervention may contribute to the improvement of children's social communication. The results of this investigation highlighted that a virtual environment can facilitate joint attention and social interaction, for children with autism. The VC may additionally serve as a 'social mediator' (Konstantinidis et al., 2009; Fabri, 2006).

129.015 15 Surprising Events within a Virtual Environment: A Catalyst for the Initiation of Spontaneous Social Interactions by Children with ASD. A. M. Alcorn*[1], H. Pain[1], J. Good[2] and G. Rajendran[3], (1)*University of Edinburgh*, (2)*University of Sussex*, (3)*Strathclyde University*

Background: Children with ASD are known to have problems with social communication skills. Virtual environments (VEs) and virtual characters (VCs) have been identified as a promising support tool: they can be highly structured and predictable, and potentially less threatening than direct interaction with a human partner. Little is yet known about which *specific* virtual elements may best support social communication, especially spontaneous initiation (e.g. sharing interest, affect, and events) which is generally agreed to be disproportionately difficult for this population compared

to *responding* to others' initiation; its absence is an important diagnostic criterion (DSM-IV, 1994).

Objectives: The ECHOES technology-enhanced learning project has developed a multi-modal, touch screen based, virtual learning environment to support social communication in young children (aged 5-8) with and without an ASD (see www.echoes2.org). A childlike VC models game-like activities in a 'Magic Garden' setting, collaborating with the child to complete them. Activities emphasise joint attention skills and the initiation of social interactions.

Methods: 15 children with ASD participated in the formative evaluation of early ECHOES activities. A further 28 children with ASD from 4 UK schools participated in the summative evaluation, completing multiple 10-20 minute sessions with ECHOES. A researcher at a side screen controlled transitions between activities, gave support (e.g. clarifying task instructions), and could be an additional social partner. The ECHOES touch-screen with VC, child and researcher were videoed in order to capture their social interactions.

Activities deliberately introduced novel elements and behavioural fantasy, such as "pulling" flowers to transform them into bubbles, or visual "fireworks" rewarding task completion. Intermittent software errors yielded *unintentional* surprises by altering the environment's customary behaviour and violating child expectations. For example, the VC might correctly demonstrate a sorting activity, but later try to put an item in the wrong box. Balls usually bounced within the screen, but a specific touch action sent them soaring off-screen instead.

Results: Researchers observed that novelty and surprises frequently resulted in spontaneous child initiations towards the VC or researcher. These ranged from sharing gaze and positive affect to overtly directing the partner's attention and/or commenting. Novel elements eventually stopped eliciting initiations, but unplanned surprises—particularly regarding VC behaviour—continued to elicit child interest and initiations even over multiple sessions. Especially noteworthy were instances where children spontaneously indicated the correct action to the VC after his mistake or told him to "try again."

Conclusions: The rigidity of thought and desire for routine which characterise ASDs might yield predictions that novelty and surprises within VEs would be upsetting. Instead, they have repeatedly catalysed initiations with human and virtual social partners. The "boundedness" of the VE may be a factor in these events being perceived as fun, rather than as threatening disruptions. Building expectation-violating events into future VEs could be a tool for supporting spontaneous and positive social initiations from children with an ASD, and generally heightening interest and engagement.

129.016 16 A Simon-Says Robot Providing Autonomous Imitation Feedback Using Graded Cueing. D. Feil-Seifer* and M. J. Mataric, *University of Southern California*

Background:

Various methods are used to structure therapy session interactions between healthcare providers and children with autism spectrum disorders (ASD). One such method is graded cueing (Toglia, 1996), a structure for providing feedback starting from most general, to very specific, and finally to re-framing the problem in a simpler way.

Objectives:

This work demonstrates an autonomous socially assistive robot used to recognize correct and incorrect imitation behavior of a child (while seated in a chair, and moving its arms to imitate arm gestures of the robot) and employ a graded cueing approach to provide feedback to improve such imitation behavior. The robot required no instrumentation of the child and could autonomously determine whether the child was imitating and whether the imitation was correct.

Methods:

We implemented an autonomous socially assistive robot system that employed graded cueing feedback during a Simon-Says game. To evaluate the performance of the system, we posited the following hypotheses:

H1: A robot system can engage in a model-based imitation and turn-taking interaction.
H2: A child with ASD will be able to participate in an imitation

task with a robot.
H3: A robot system can recognize breaches in turn-taking and imitation behavior and take appropriate action to repair the turn-taking interaction.

We recruited two participants with ASD (1 male, 1 female; average age 11 years) who interacted with a humanoid robot for two sessions about five minutes in duration each, playing Simon-Says. In the first session, the robot employed graded cueing to train the child in the imitation task; in the second session, the robot only stated verbally whether the child's imitation was correct or incorrect.

Results:

Overall, the robot achieved a 96.3% correct recognition rate, in support of hypothesis H1. The children participated in 71 out of 75 interactions (94.7%), in support of hypothesis H2.

One child was fully able to imitate the robot, correctly imitating the robot 63.4% of the time (26 out of 41 arm poses) on the first attempt, and was able to successfully repair the imitation interaction 100% of the time using graded cueing (8 out of 8 attempts) or giving feedback that the pose was incorrect (7 out of 7 attempts). The second child had more difficulty, correctly imitating the robot 20.7% of the time (6 out of 23 arm poses) . The robot employed graded cueing to successfully correct the imitation 52.9% of the time (9 out of 17 attempts); when the robot merely provided correct/incorrect feedback, the robot was able to repair the interaction 0% of the time (0 out of 6 attempts). These data are in support of hypothesis H3.

Conclusions:

This exploratory research aimed to evaluate the performance of a socially assistive robot that utilized graded cueing feedback in a Simon-Says game, demonstrating its feasibility for further investigation. Any results need to be verified with a sufficiently sized pool of participants. The largely correct performance of the robot on the Simon-Says task, and the childrens' positive response to the robot together indicate that a larger follow-up study would be appropriate.

129.017 17 Using Robot Assisted Therapy Tools in Rhythm and Locomotion Intervention Contexts with Typically Developing Children and Children with Autism. T. Gifford*[1], C. Wanamaker[1], D. Dotov[1], G. Dressler[2], S. Srinivasan[1], M. Kaur[1], K. Marsh[1] and A. Bhat[1], (1)*University of Connecticut*, (2)*UConn*

Background: Typically developing children and children with autism spectrum disorder respond well to interactions with robots. This provides an opportunity to use robots as facilitators for various treatments. Robots systematize treatment by providing consistent repetitive training that is also spontaneous and interactive. Robots can also help the therapist by off-loading treatment demands such as heightened engagement and physical activity during interactive play.

Objectives: Our goal is to create a deployable robotic therapy system based on commercial off-the-shelf robots and custom-developed software. This system is easy to use and robust in the treatment environment. Our goal is to support multiple therapy techniques. It will provide the basis for activities that promote joint attention, verbalization, imitation skills, bilateral coordination and intrapersonal/interpersonal synchrony. The system should be applicable to multiple adult-robot-child contexts. The system must be programmable by clinicians, highly portable, and easy to set up and operate.

Methods: We began by designing a series of imitation-based activities that would support the clinicain's treatment goals. These included movement games, locomotion games, and rhythmic activities (including drumming). We then identified robotic actions that supported these activities. We looked at available robots and identified three units for development. *The Isobot* from Tommy, Inc. which has an inexpensive humanoid form with preprogrammed behaviors. *The Rovio* from WowWee is a wheeled robot platform that supports the locomotion context. *The Nao* from Aldebaran is a highly sophisticated and robust humanoid platform that provides direct control of multiple facets of its behavior.

We then created a unified software platform that would control all three robots. We use an embodied music therapy approach to facilitate social communication skills in typically developoing children and children with autism wherein the robot progresses from whole body rhythmic actions to finer

drumming actions. A variety of simple to complex behaviors were triggered during the training sessions using a session controller software that simplified the operation for the adult trainer. 12 typically developing children and 4 children with ASDs interacted with *Nao* across 12 rhythm-training sessions within a robot-child-child context. Pre-, mid- and posttest data have been collected to examine the child's social and motor skills during whole body rhythmic actions and drumming. We integrated various hardware components to allow the computer to communicate with the different robots.

Results: We have created a portable system that has been deployed in two studies. With this system researchers were able to create systematized therapy sessions using repetitive and dynamic actions in varying sequences without any programming. Preliminary analyses are currently ongoing. We hypothesize that, with training, the children will improve their intralimb and interlimb coordination during rhythmic actions such as marching, clapping, and drumming. We also hypothesize that social interactions such as conversation bouts and rates of joint attention bids will increase across training sessions.

Conclusions: Overall, we believe that the rhythm intervention context developed with the *Nao* robot and the locomotion intervention context developed with the *Rovio* are highly engaging context for children to facilitate their social communication and motor skills.

129.018 18 Robot-Mediated Adaptive Response System in Joint Attention Task for Children with Autism Spectrum Disorders. E. T. Bekele*[1], A. Swanson[1], A. C. Vehorn[1], J. A. Crittendon[2], Z. Warren[1] and N. Sarkar[1], (1)*Vanderbilt University*, (2)*Vanderbilt Autos Lab*

Background: Best practices in autism treatment call for intensive and individualized interventions. The human resources (20-25 hours) required to achieve this intervention, however, are expensive. Further, the number of children who need intensive services is increasing. The field of robotic science may expand the capabilities of humans in several ways. Research shows that for children with ASDs, human therapists may evoke less frequent and shorter durations of attention than do robots. Incorporating robots in intervention may lead to an increase in engagement making intervention more efficacious. Also, robots may be capable of micro level behavior discrimination beyond that of human capacity, making robot-assisted intervention more efficient.

Objectives: To determine the feasibility and potential value of humanoid robotic intervention system we developed a co-robotic system capable of administering joint attention tasks to young children with ASD.

Methods: We developed a test-bed that consisted of a humanoid robot NAO, 4 Infrared (IR) cameras mounted on the wall and ceiling, and networked computer monitors that displayed task stimuli. A baseball hat with arrays of IR LEDS was employed to determine the child's gaze. We compared performance and gaze detection for a sample of 6 children with clinically confirmed ASD diagnosis and 6 typically developing (TD) children (all ages 3-5). A series of joint attention prompts were administered via either a human (x2) or the humanoid robot (x2) with randomized presentation. The child sat in a chair across from the robot or interventionist and was instructed through a hierarchy of prompts (i.e., gaze shifts, pointing prompts, prompts with target activation) to look to a target.

Results: The system registered gaze across all trials, looks to target (monitor on wall), and provided reinforcement for target responses (i.e., verbal praise and onset of animation on monitor). Data suggested children with ASD spent 27% more time looking toward the robot administrator than the human administrator and did not fixate on either robot or target. Across all 48 trials with the robot, children with ASD successfully responded to the target hierarchy correctly in 95.83% of trials, a rate equal to TD success. In terms of intervention feasibility, we anticipated that many children would not tolerate wearing the LED cap; completion rates of 60% (ASD) and 80% (TD) were observed.

Conclusions: Data indicated preschool children with ASD directed their gaze more frequently toward the humanoid-robot than human administrator and were capable of correctly responding to target. As such, system enhancements successfully pushing toward correct orientation to target with systematically faded prompting and embedded coordinated action with human-partners could take advantage of baseline

enhancements in attention and systematically incorporate more intrinsically interesting elements of the humanoid robot itself in order to enhance skills related to coordinated attention. Tolerance rates for wearing the LED hat highlight the need for the development of a non-invasive system for realistic extension on use with a young ASD population.

129.019 19 Case Studies on the Feasibility of Exergaming to Enhance Physical Activity in Youth with Autism Spectrum Disorders. A. C. Foran* and S. A. Cermak, *University of Southern California*

Background:

Exergames (or active videogames) may be especially applicable to youth with Autism Spectrum Disorders (ASD) because they allow the individual to see him/herself projected on the screen interacting with the game environment, a feature not available in traditional videogames. When players can see themselves on the screen, they are better able to understand that they are causing the actions and movements they see, unlike other videogames, which are often too abstract for youth with ASD to understand. In addition, because players use their body to control the exergame, no hand-held controller is needed, so users are not limited by decreased fine motor and eye-hand coordination which could impede their ability to play typical videogames. No known studies measuring the effects of exergaming on PA in youth with ASD currently exist.

Objectives:

This series of individual case studies examined the effect of exergaming on youth with ASD. The case studies explored the feasibility of using an exergaming system with youth with ASD, including their ability to learn to use the system and how much assistance was required, their level of enjoyment/motivation, and the physiological effects of playing such as change in heart rate (HR), energy expenditure (EE), and coordination.

Methods:

With researcher support, youth with ASD (age 10-14) participated in exergaming 1-2 times per week for approximately 45 minutes each session (total of six sessions over the course of 3-6 weeks, depending on family schedule and availability). The sessions took place either in the participant's home or in a University research building.

Results:

Qualitative analysis was conducted on written and videorecorded data, and presented in a case-series format. Analysis included a summary of the level of assistance each subject needed to participate in exergaming, learning effect over the course of the program, and subjects' enjoyment and perceived exertion after exergaming. The predictive powers of level of assistance, enjoyment, and perceived exertion on PA level were examined. Descriptive statistics were used to present quantitative data such as average HR and EE, and simple correlations were performed to explore the relationships between PA levels and parameters such as enjoyment and demographic profile. Transcripts and field notes were read through to uncover emergent themes. Because no studies have been reported on the use of exergaming to improve the fitness of with youth with ASD, this series of case studies will serve to inform future research that will potentially contribute to obesity prevention and health promotion for this population.

Conclusions:

The benefits of exergaming for youth with ASD who may not typically have access to organized sports programs and other opportunities for PA in the community are reported. Results of this study are valuable for the development of more accessible exergaming systems, as describe the ability of youth with ASD to learn exergaming, how much assistance is required, levels of enjoyment/motivation, and physiological effects of exergame play. For youth who are primarily sedentary, exergaming may be a socially and developmentally appropriate activity that can increase daily PA and assist in weight management.

129.020 20 MindGamers in School. R. H. Rice*,

Background:

MindGamers™ *in School* is a role-playing videogame with physiological controllers that integrates cognitive-behavioral (CBT), narrative (NT) and biofeedback (BF) strategies for use by health care providers who work with young people with

autism spectrum disorders. By combining these proven approaches with customizable and culturally-syntonic interactive media, *MindGamers™ in School* will create efficiencies in the therapeutic process. *MindGamers™ in School* is intended to augment therapy by engaging young people who experience anxiety and repetitive behaviors characteristic of autism spectrum disorders.

Objectives:

This project's purpose is to receive feedback on the ease and consistency of use of a therapeutic videogame platform with physiological controllers from an N of users diagnosed with an autism spectrum disorder.

Methods:

a) Sample. Approximately 100 young people diagnosed with an autism spectrum disorder will participate in this study.

b) Measures. The first and second prototypes for *MindGamers in School* will be the primary measures used for this study. It is estimated that approximately 50 subjects will get to play prototype 1 and 50 subjects will get to play prototype 2. An online survey will serve as the third measure and method for gathering feedback from subjects.

c) Procedure. Subjects will play the game for approximately 20-minutes with the assistance of the PI or Co-PI. After playing the game, the subject will be asked to complete the online survey. The entire study session will last 30-minutes.

d) Analytic Plan. Quantitatively, comparative analyses will be made by means of an analysis of variance (ANOVA) for all continuous variables. As part of these analyses, the variables of age, gender, and diagnosis will be used as control variables in an effort to reduce their impact on the results. If the sample size permits, these analyses will be further validated with exploratory factor analyses to identify the dimensions of variance represented in the data. Qualitatively, the feedback received from subjects will be used to further refine game mechanics and feel, with particular attention given to the feedback provided by individuals reportedly experiencing anxiety. All of the analyses will be performed by the PI and Co-PI, with the help of the game development team.

e) Dissemination. The feedback received through this study will be used to further refine *MindGamers in School*. The project is a collaborative between St. John Fisher College and the Rochester Institute of Technology. The hoped for outcome is a therapeutic videogame prototype that is ready for a more comprehensive clinical trial.

Results:

At the conclusion of the research, data will be used to refine game mechanics and feel to best meet the needs of children and adolescents with various manifestations of anxiety and repetitive behaviors.

Conclusions:

This research is on-going. Presentation at the International Meeting for Autism Research would involve a demonstration of the game and the results of the research to that point.

129.021 21 Influencing Gaze Behavior and Expression Recognition. M. Eckhardt*[1] and M. S. Goodwin[2], (1)*Massachusetts Institute of Technology, The Media Laboratory*, (2)*Northeastern University*

Background:

Autism Spectrum Disorder (ASD) is a complex and heterogeneous condition characterized in part by difficulty with social and emotional cue recognition and expression. These social-emotional processing differences make recognizing subtle social-emotional cues difficult for persons with ASD. Persons with ASD typically perform worse than age-sex matched neurotypical individuals in recognizing facial expressions, especially when recognition is dependent solely on information surrounding the eyes. This may be due, in part, to an aversion to eye contact and/or atypical scanning behavior of the face by those with ASD. However, eyes provide a valuable source of social-emotional information during social and communicative interaction. Therefore, it is important that we develop methods and tools to help people

with ASD better recognize and understand social-emotional cues from the face and eyes.

Objectives:

To demonstrate through undirected play with a tangible-digital puzzle game, Frame It, that we can influence social gaze behavior and expression recognition in children with ASD. Frame It required players to attend to details of the human eyes region on a computer in order to correctly construct, match, and then assign expression labels to corresponding physical puzzle pieces of eyes.

Methods:

The Frame It intervention was conducted over a five-week period at a school for children and adolescents with ASD. Pre- and post-intervention measures of gaze behavior and expression recognition were used to analyze within subject change. All phases of the study were carried out in the children's school to maximize their comfort and ability. The intervention was conducted with 10 children (two female) aged seven to eighteen years old (mean = 12yrs) during school hours. Each child in the study was seen two to four times per week for up to 15 minutes per session. In total, 11 sessions per child were analyzed. Gaze behavior was measured using a Tobi eye tracking system. Basic expression recognition performance was measured by correct multiple-choice responses to an expression image set presented on a computer.

Results:

Results indicated statistically significant changes in both gaze behavior, with more looking at the face, and improvement in recognizing fear, sadness, and surprise in post-intervention tests.

Conclusions:

The changes observed in this study are encouraging given the relative brevity of the intervention, 11 sessions over 5 weeks. We feel the engagement and fun of playing a physical-digital game had a significant influence on facilitating positive gains. Although this work resulted in measurable benefits and accomplished its initial goals, it also revealed further questions and considerations. Future studies will assess whether gains persist over time and across settings. We are also interested in replicating findings in an independent sample, and thus are working on scaling up the intervention so a larger group of users can access it.

129.022 22 Automated Detection of Mutual Eye Contact and Joint Attention Using a Single Wearable Camera System. Y. Han[1], A. Fathi*[2], G. D. Abowd[1] and J. Rehg[1], (1)*Georgia Institute of Technology*, (2)

Background:

Typically developing toddlers use means such as eye gaze, sound and gesture to express social interactions and joint attention. Autism is often characterized by pervasive differences in communication and social interaction, particularly in terms of visual attention patterns. Thus, when a child is evaluated for developmental progress, a clinician will examine the child's patterns of mutual eye contact and joint attention. Our goal is to explore how automated techniques of mutual gaze and joint attention can be developed for use in real physical settings. Current commercial mobile eye tracking solutions offer an interesting opportunity to explore this challenge. There have been attempts on automating the detection of joint attention using audio and video processing technologies mainly by instrumenting the environment with microphones and cameras. However, it is very hard to capture the patterns of kid's and examiner's attention simultaneously using cameras mounted on tables or the ceiling. A wearable camera not only always captures where the examiner is attending and records her interaction with the toddler, but also provides an accurate estimate of what are the important events and objects in the scene to which examiner is looking.

Objectives:

We combine a current commercial mobile eye tracking solution with gaze estimation technology to automatically detect patterns of mutual eye contact and joint attention. This solution only requires one person in a dyadic interaction to wear the system.

Methods:

Current commercial mobile eye-tracking solutions provide continuous estimations of the visual gaze patterns of the wearer. In our experiments, an adult wears the eye-tracking technology while interacting with a child in the semi-structured RapidABC protocol. We further process the video recorded from the camera mounted on the eye-tracker, continuously estimating the child's face orientation. We then analyze adult's and child's gaze patterns to identify mutual eye contact. These computed mutual gaze instances are then compared against ground truth data from the adult as well as third party observers. Similarly, we can monitor patterns of gaze to estimate when the child and adult shift between periods of looking towards each other and then towards a common area.

Results:

We have recorded a number of mock RapidABC sessions with the adult wearing the Tobii mobile eye-tracking glasses. Our preliminary results show that a combination of the Tobii eye-tracking data and standard computer vision algorithms result in reasonable estimates of mutual eye gaze. We are in the process now of collecting RapidABC sessions with a trained evaluator and children ranging in age from 9 to 30 months. We will use ground truth indications of mutual gaze and joint attention indicated by the adult during the session.

Conclusions:

In this work we use a single wearable eye-tracking camera for detecting patterns of mutual attention and eye contact between an adult and a child. Our preliminary results show the promise of applying this technology towards the study of dyadic interactions in physical space. This should lead to valuable extensions of the study of contingent mutual gaze in behavioral science.

129.023 23 Viewing Patterns of Adults with Autism During a Community Art Recreation Activity. E. S. Kim*, A. Naples, B. Reichow, E. B. Gisin, M. G. Perlmutter, F. R. Volkmar and F. Shic, *Yale University School of Medicine*

Background: Understanding how adolescents and adults with ASD respond to programs in their community is a critical, yet understudied area of research (IACC, 2011). Recently, we have sought to examine the heterogeneity of social interactions in young adults with ASDs during their participation in cooperative activities during a community-based art recreation program (Artism; Rudne, 2011). To examine their real-world social interactions we developed a head-mounted eye-tracking system modeled after low-cost custom built eye-tracking technologies (Kowalik, 2010; Li et al., 2006). By utilizing off-the-shelf components, we were able to extend this technology to be completely untethered, portable, effective, and easily tolerable for long periods of time by adults with ASD.

Objectives: To examine viewing patterns of young adults with ASDs participating in social interactions during a community art recreational program.

Methods: Participants in this study were 6 (4M, 2F) young adults 18-21 years old with higher-functioning ASDs. Data were collected during the Artism program, which consisted of weekly 90 min sessions that allowed social opportunities for the participants as they completed art-related activities. Participants all wore eye-trackers concurrently in a 30 minute pilot session aimed at testing the feasibility and potential of these systems. This abstract presents preliminary findings of 4 of these participants (2M, 2F) involved in a single session, using interval coding from the scene camera. During this session, participants were paired in dyads to complete an activity. By collecting data on the participants simultaneously, we were able to observe the participants engaging in within dyad peer-to-peer interactions, across dyad peer-to-peer interactions, and peer-to-instructor interactions.

Results: Participants largely worked with their partners independently of other pairs. We examined periods in which participants were involved in conversation with one another or the instructors, operationally defined as being either the target of someone speaking or speaking to someone else. Participants spent half their time in conversations (M=49%, SD=9%). They spent one third of this time looking at their conversational partners centered in their field of view (M=29%, SD=13%), looking at them peripherally (M=33%, SD=14%), or not looking at their partner (M=38%, SD=7%). Participants spent a small time looking other others while not engaged in conversation (M=15%, SD=10%), and overall spent a third of their time looking at others (M=31%, SD=8%). We additionally

examined a brief lecture episode in which the instructor provided instruction regarding the upcoming project. Though there was a large amount of variability in participant's behavior, the correlation between participants' proportion of centered looking at either conversational partners or the instructor in the lecture episode was r=.76. This was not significant (p=.24) due to the small number of participants.

Conclusions: Though highly preliminary, these results suggest that low-cost, "home built", head-mounted eye-tracking systems are a viable technology for use with young adults with ASD in relatively unconstrained natural interactions and in community settings. Further work will refine our technology and investigate the utility of these devices for observational and experimental paradigms as well as their potential for tracking the effects of interventions.

129.024 24 Analyzing the Physiological Synchrony of Children with Autism and Their Parents with Signal Processing Techniques. T. Chaspari*, C. C. Lee, M. P. Black and S. S. Narayanan, *Signal Analysis and Interpretation Laboratory (SAIL), University of Southern California*

Background:

Child-parent synchrony has been broadly studied in psychology (Field 1994, Cole et al 2004, Lindsey and Caldera 2006). There are indications that synchrony between a child and his/her caregiver is also present in physiological mechanisms and is affected by various pathological conditions (Feldman 2007). Children with autism tend to be less expressive than their typically developing peers and have difficulty exchanging information and conveying their affective state. Studies have indicated that overt signals of these children might be inconsistent with their physiology (Goodwin et al., 2006, Picard 2009). In light of this observation, analyzing child-parent physiological synchrony could provide new insights into the mechanisms of their interaction and affectivity, which are not always obvious through traditional observational methods.

Objectives:

Electrodermal Activity (EDA) is a physiological signal linked with the sympathetic nervous system and measured by the electrical changes of the skin surface. Our goal is to analyze physiological signals of children with ASD with relation to the corresponding signals of their parents when interacting with and without the presence of an Embodied Conversational Agent (ECA), using novel signal processing techniques.

Methods:

The data for this study come from the "USC Rachel ECA Interaction Corpus," which contains recorded interactions between a child, his/her parent and an ECA named "Rachel." The experiments were designed to elicit affective and social behavior of children with autism. They include four sessions, each separated into a Rachel- and a parent- moderated part. To measure physiological signals, we used two pairs of Affectiva Q Sensors for the child and his/her parent, worn on the opposite wrist and the ankle of each person. The sensors provide measures of EDA, temperature and x,y,z-axis acceleration. Our goal is to get informative features by applying noise removal techniques and deriving descriptive features of those signals, such as statistical moments, derivatives, number of zero-crossings and peaks. We examine child-parent physiological synchrony by using correlation and coherence metrics and measures related to information theory, like mutual information.

Results:

We have collected data from 9 verbally fluent subjects (7 boys, 2 girls). Our results indicate that there is significant amount of physiological synchrony between child and parent in both interaction conditions (ECA presence vs. absence), suggesting that data collected from ECA interactions are representative of natural child-parent interactions. These findings are similar to those of a related study on the same corpus based on expressive communication cues (Mower et al. 2011). The measured internal child-parent synchrony in the ECA presence condition implies that the parent is also actively engaged in the experiment even though the ECA is designed to interact with the child directly. A detailed description of our findings will be discussed at the conference.

Conclusions:

Technology has the potential to measure and interpret physiological signals of children with ASD, signals which are not expressed through verbal, non-verbal, or gestural channels. In this research, we automatically sense, process and model physiological signals to analyze the synchrony measures between a child with ASD and his/her caregiver. This work is supported by NSF and NIH.

129.025 25 E-Mintza: A Free Application for Augmentative Communication. J. Fuentes*[1], N. Azpiazu[1], A. Basurco[1], I. Lazkoz[2], F. Sánchez[3] and B. Villamía[4], (1)*Policlinica Gipuzkoa*, (2)*GAUTENA Autism Society*, (3)*Nesplora Technology & Behavior*, (4)*Fundación Orange*

Background:

Communication difficulties are essential aspects of Autism Spectrum Disorders (ASD). It has been estimated that one third of the people with ASD do not use speech to interact with others. Many of these persons have both good motor skills and visual abilities. Because of these aspects, visually-based augmentative communication has been used in the form of exchange pictograms and photographs. The advancement of technology allows now creating new systems that will promote successful communication for this population.

Objectives:

To design an application that could be freely downloaded from a non-lucrative web page and that would convert a PC or a tablet into an augmentative communication system, that could be fully individualized and accessible in four languages (Spanish, Basque, English and French).

Methods:

A team of clinical, research and technological experts from Spain worked together with a group of twenty persons with ASD and their families for two years, to design and test a software application that would combine intuitive use by the client and the supporting person programming the application, as well as complete flexibility for individualization. The application includes hundreds of free pictograms, but allows insertion of thousands of personalized pictograms or photographs. It permits to insert videos as well. Different designs were tested and modifications were based on practical trials in different environments, and on the advice of the ultimate users (professionals and family relatives). Community people donated their voices, to produce words in Basque and in Spanish, leaving the support person to choose from a repertoire of male/female, child/adult. Diverse technological systems were tested, with the goal of creating an application that would function in diverse hardware systems.

Results:

The team succeeded in creating e-Mintza (electronic language, in Basque) that is now freely accessible in Spanish, in Basque or in bilingual version for Windows, Mac or Android. For the time of IMFAR 2012 free versions in English and French are anticipated. The feedback from users was extremely positive and other population, besides persons with ASD, will be benefiting form this application. Although the consumers have been involved from the beginning of the project, there are two limitations that most likely will be tackled during the year 2012: the adaptation of the application for iPad and the initiation of an effectiveness trial with young children in the Basque Country of Spain.

Conclusions:

The transformation of analogical communication books into digital communication systems is possible and empowers both persons with ASD and their partners to communicate better. The support of public agencies allows partnerships that produce significant advances in this area. The multilingual e-Mintza system may prove to be a significant contribution to many people in the world.

129.026 26 Infusing Speech Output Technology Into the Picture Exchange Communication System for Children with Autism. O. Wendt*[1], M. C. Boesch[2], A. Subramanian[1], N. Hsu[1] and K. M. Johnstone[3], (1)*Purdue University*, (2)*University of Northern Texas*, (3)*Illinois State University*

Background: Two popular interventions in augmentative and alternative communication (AAC) for prelinguistic children with autism are the picture exchange communication system

(PECS) and speech-generating devices (SGDs). While PECS is appropriate to teach prelinguistic skills such as requesting, the learner depends on the communication partner to facilitate exchange procedures. SGDs allow more independent communication as soon as mastery of symbol discrimination and selection is reached. This project sought to modify the traditional PECS protocol for infusion of an SGD.

Objectives: were to evaluate effects of a modified PECS protocol on requesting skills, social-communicative behaviors, and emerging speech.

Methods: Three boys, 9-11 years with severe autism and no functional speech participated. A multiple baseline design across participants evaluated treatment effects. The intervention was split into PECS and SGD phases, followed by a maintenance phase. Dependent measures were: (a) number of correct requests during a 20-trials session; (b) number of responses including eye contact, physical orientation towards communication partner, and displaying positive affect; (c) number of word vocalizations/approximations.

Intervention materials consisted of a traditional PECS book with PCS symbols for desired items and and two types of SGDs, the ProxTalker and the iPad with IPAAC app. The SGDs were taught at the stage of picture discrimination.

Reliability for dependent and independent variables was established by re-scoring 40% of sessions. Mean agreement was 99% for requesting, 90% for social-communicative behavior, and 92% for emerging speech. Treatment integrity was 98%.

Data were graphed using Excel and visually inspected for changes in level and trend. Effect sizes were estimated via Percentage of Non-overlapping Data (PND) and the Non-overlap of All Pairs index (NAP).

Results: Children 1 and 2 mastered all five phases of the modified protocol, whereas child 3 only achieved phase 3. Acquisition rates varied, with children 1 and 2 needing on average 6 sessions to mastery, and child 3 needing 7 sessions. The largest gain appeared for requesting: For child 1, requesting improved from a baseline mean of 0.25 to a maintenance mean of 17.75; for child 2 from 1.1 to 17.5; and for child 3 from 0.6 to 11.3. PND/NAP scores indicated "highly effective" for all. Varying results were obtained for social-communicative behavior: Child 1 improved from a baseline mean of .5 to a maintenance mean of 11.5; child 2 from 15.8 to 23.5; and child 3 from 7.3 to 13.6. PND/NAP scores were "fairly effective" to "highly effective" for children 1 and 2; but yielded "questionable effectiveness" for child 3. Results differed the most for emerging speech: only child 1 made noticeable gains. PND/NAP scores were "fairly effective" for child 1, and "ineffective" for the others.

Conclusions: Results suggest a smooth transition from the traditional PECS to an SGD is possible, if protocol is implemented with high fidelity. Children may not be able to complete all stages, and for child 3, this could be due to comorbid, severe intellectual impairment. Treatment effects are most noticeable for functional communication and social-communicative behaviors. A facilitative effect on speech development cannot necessarily be expected.

129.027 27 Naturalistic Daylong Audio Monitoring Using LENA: Current and Potential Applications. J. A. Richards*, D. Xu and J. Gilkerson, *LENA Research Foundation*

Background: In-depth research on children's behavior in their regular environments, critical to a comprehensive understanding of children with autism, typically incorporates audio and video sampling and transcription and is resource-intensive. However, recent studies have demonstrated that with some limitations audio recording alone can provide richly detailed information and that such data can be obtained efficiently and unobtrusively using wearable recorders. The LENA framework utilizes lightweight audio recorders and incorporates signal processing and pattern recognition technologies to achieve automatic information extraction and analysis of daylong recordings in the home and other environments. This massive-sampling approach provides stable, reliable and accurate macrostatistical characterizations of child and caregiver behavior and environments. Even so, current implementations constitute only first approaches; there remain numerous domains into which this technology may be extended.

Objectives: We summarize empirical findings from current research utilizing LENA methodology with an emphasis on strengths and limitations. We discuss potential approaches for extending the utility of this technology currently being explored as well as future applications, including, e.g.: the use of multiple recorders in one environment; enhanced recognition of "key-adult" speech; identification of specific key words, music, etc.; vocal emotion detection; and the synchronization of audio data with multichannel sources of physiological and other information. We provide an interactive demonstration of the complexity of information obtainable using these technologies.

Methods: The current LENA framework consists of a single digital recorder worn by a key-child plus processing algorithms that discriminate human speakers from other environmental sound. It generates phonetic-based characterizations to estimate adult word and child vocalization frequencies, quantify interaction patterns and identify unique acoustic features of child vocalizations shown to relate to developmental disorders such as autism. This technology has been used successfully in home, classroom and other environments with a variety of child populations (e.g., typically developing, language-delayed, hard-of-hearing, autism) to provide a deeper understanding of their impact on child development.

Results: Beyond its use as a parent-training and feedback tool, current applications of this technology include autism screening research, home and classroom monitoring, intervention evaluation and monitoring, social interaction in geriatric populations, assessment of hearing-aid efficacy, and acoustic evaluation of classroom design. It has been utilized in collaborative studies with senior investigators representing numerous research sites across the US (e.g., IBIS Network, University of Kansas, UNC-Chapel Hill, Johns Hopkins, Omaha BoysTown, University of Chicago, University of Colorado, UCLA, JFK-Partners Denver) and the globe (Riyadh, Saudi Arabia; Shanghai, China). Preliminary work suggests this framework may be extended and enhanced by bolstering algorithmic recognition of keywords and emotional valence and by exploring multichannel approaches that incorporate multiple recorders and sensors geared toward other modalities (e.g., physiological signals such as skin conductance). As well, the development of utilities to transmit audio recordings via broadband internet for "cloud-based" processing will simplify data collection in remote areas.

Conclusions: This demonstration illustrates current applications of naturalistic audio recording and automated analysis using existing LENA technology and introduces the potential for expansion into multichannel explorations. Audio-based macrostatistical data can be a valuable adjunct to traditional measures.

129.028 28 Validation of Language Environment Analysis (LENA) Systems in Arabic-Speaking Individuals. M. Aldosari*[1], A. Almuslamani[1], F. Wilson[2] and J. Gilkerson[3], (1)*King Faisal Specialist Hospital and Research Center*, (2)*Speech Pathology, KFSH&RC*, (3)*LENA Foundation*

Background:

Language ENvironment Analysis (LENA) system is a tool that parents, pediatricians, speech language pathologists and researchers use to obtain information about a child's language environment and language development. It is a digital language processor that children wear in the pocket of custom-made clothing. The audio file is transferred to a computer where the LENA System software automatically analyses it, providing an estimate of the child's expressive language using the Automatic Vocalization Assessment (AVA).

Objectives:

The main objectives of the current study are to validate the use of LENA for both typically developing children as well as children with language delay or disabilities, including ASD and to provide pilot study data in its utility in aiding the diagnosis of language delay and in accelerating language development for the Saudi Autistic children. The study will also help in making this technology available for researchers and clinicians in Saudi Arabia and the Middle East.

Methods:

The current English version of LENA Pro would be used to gather three "baseline" recordings of 60 children in their home

environment. The children would be selected to have an age span of 6 months to 3 years of age, with 40 being typically developing children with no known language delay and 20 children with or at risk of ASD. The recordings will be processed using the LENA software to create the output statistics including word counts, conversational turns, and child vocalizations. A portion of the recordings will be listened to and transcribed by Saudi researchers and statistical information will be generated including counts of words, conversational turns, and child vocalizations which will then be checked against the counts generated from the LENA software to determine its accuracy.

Results: We are presenting the preliminary results which are very encouraging as LENA seems to be a valid system in Arabic language, opening the doors for many other studies utilizing the unique characteristics of LENA for early diagnosis and in guiding and evaluating interventional programs.

Conclusions:

The current study is the first validation and experimentation study of the Language ENvironment Analysis (LENA) Systems in the Arabic language. This study is expected to pave the way toward more applications of this technology to aid the evaluation, characterization and treatment of a wide spectrum of language disorders, such as those associated with Autism

129.029 29 Towards A Tool to Support the Authoring of Social Skills Instructional Modules. F. A. Boujarwah, H. Versee*, G. D. Abowd and R. Arriaga, *Georgia Institute of Technology*

Background:

Individuals with autism often have difficulties with social skills that interfere with their educational experience and everyday life. Social Stories is a paradigm that is commonly used to address these difficulties. Our goal is to develop adaptive technology that would assist caregivers of these individuals to create customized social skills instructional modules that augment this paradigm.

Objectives:

Refl-ex is a tool that helps individuals practice social skills by presenting them with a social scenario. Here an unexpected obstacle arises, and the system guides them through the process of overcoming the obstacle. The introduction of an obstacle is an important part of our approach, and differentiates us from existing social skills software; however, it makes the modules difficult and time consuming to author. Our current goal is to build a tool, called REACT, which will make it easier for parents of children with autism to create and share these modules.

Methods:

REACT takes parents through the steps of authoring an instructional module that describes the process of completing an everyday task (e.g. going to a movie with a friend). Throughout the authoring process, the parent is provided with suggestions for information to include in their module. Last year, we described the process we used to generate a knowledge base that included the steps a person can take to complete a particular everyday task, obstacles that can arise and potential solutions to those obstacles. This knowledge base enables REACT to provide the author with the suggestions.

Once a prototype of the tool was developed, we conducted a study in which 9 parents of children with autism (ages 8-16) were asked to create modules for their child that described the process of going to a fast food restaurant for lunch. The parents were asked to create 2 modules each that described the situation, introduced an obstacle, and presented the child with 3 solutions for overcoming the obstacle. For one module, the parents were asked to create the module on their own without any help. In the other module, the parents were given suggestions from the knowledge base throughout the authoring process. Five parents created the module on their own first, and 4 parents were given the suggestions first.

Results:

We found that the parents' stories varied greatly. Factors such as their experience writing social stories, and the educational approaches used with their child (Floortime, ABA, etc) greatly impacted the quality of the parents' stories. We also found that

while the suggestions did give the parents ideas for information to include in the story, the parents sometimes felt compelled to use suggestions, even when they had better ideas for what to write, and to use the suggestions as is, despite the fact that they knew that they could modify the wording.

Conclusions:

The initial prototype of REACT showed great promise for enabling parents to quickly create complex and customized social skills instructional modules for their child. There is room for improvement; however, in the way the suggestions are presented to the parents.

129.030 30 AMA, a Tool for Annotation, Monitoring and Analysis of Behavioral Activity. J. Hernandez*, A. Sano, M. S. Goodwin and R. W. Picard, *Massachusetts Institute of Technology*

(First and second authors contributed equally to this work)

Background: One of the most disruptive features of Autism Spectrum Disorders (ASD) is the occurrence of behaviors such as self-injury, tantrums and persistent hand flapping. Although some research has suggested that these behaviors are aimed to reduce stress levels, to increase attention or to avoid certain events, there is little research on how problem behaviors are related to the daily environment of each individual. The definition of this relationship is critical for designing personalized behavioral interventions and, consequently, improving the quality of life of people.

In order to understand the behaviors of people with autism, annotation has sometimes been conducted by teachers, therapists and family; however, traditional annotation methods are based on the use of pen and paper. While this methodology is flexible and inexpensive, it is very slow and prone to human error. To address these problems, more automatic annotation tools such as *CareLog* and *BabySteps* have been used successfully in controlled environments (e.g., classroom, home). However, these systems cannot easily be deployed in different settings and modified to incorporate new behavioral annotations.

Objectives: We propose AMA, a new software platform that runs on Android (widely available on low-cost tablets or smart phones) to **A**nnotate, **M**onitor and **A**nalyze the occurrences of problem behaviors easily in real-life settings. This poster describes the Annotation tool that allows teachers, staff, and family members to record multimodal information (videos, audio and images) as well as the occurrence of behavioral annotations (e.g., self-injury, tantrums) to better capture problem behaviors in the field, at the moments they occur.

Methods: We iteratively designed and developed the annotation tool incorporating the advice of behavioral scientists and therapists of the Groden Center in Rhode Island, a non-profit school for people with ASD. We conducted a two-level evaluation: one with users at MIT verifying that the technology worked as designed, and another with therapists assessing usability while working with children with ASD.

Results: We identified and built technology to achieve the following design needs:

- Speed: The tool can quickly annotate events with one or two clicks.
- Customization: The interface and types of annotations can be easily customized by the user.
- Portability: The software installs easily on and is compatible with today's Android devices (cell phones, tablets) to annotate events in real-life settings.
- Cost: The distribution of the software is free through Google's Android Market.

The poster will describe evaluations of the technology, identifying what worked well and what improvements are still needed.

Conclusions: With the collaboration of behavioral scientists and therapists, we have designed and developed a tool for easily annotating problem behaviors in real-life settings. Main capabilities include the possibility to capture multimodal information, and the flexibility to create new types of annotations which are not planned in advance. During the poster session, we will provide details about the design

process, qualitative evaluation and iterative development, and a working demo of the application. Moreover, we will create a website to share the application with the entire community.

Neurophysiology Program
130 Electrophysiology - Early Signs

130.031 31 Do Children with ASD Show An Abnormal Neural Response to Faces At 12 Months of Age?. R. Luyster*[1], J. B. Wagner[1], V. Vogel-Farley[2], H. Tager-Flusberg[3] and C. A. Nelson[1], (1)*Harvard Medical School/Children's Hospital Boston*, (2)*Children's Hospital Boston*, (3)*Boston University*

Background: To date, the effort to understand early development in children with ASD has predominantly focused on behavioral symptoms in the first years of life. However, emerging research points to the importance of exploring a broader endophenotype, including a consideration of neural measures of atypical responses to visual stimuli.

Objectives: To determine whether children with ASD show in neural response to faces early in life; in particular, are there neural markers of atypical response by 12-months?

Methods: Infants were enrolled in a longitudinal study of children at high- and low- risk for ASD (based on family history). High density EEG/ERP data were collected at 12-months in response to images of the infant's mother and a stranger. The components of interest were the face-sensitive N290/P400 complex, measured over the right occipito-temporal region (N290:150-450ms; P400:260-600ms) and the Nc, a negative-going fronto-central deflection (350-700ms). A single electrode was chosen for each component of interest. Mean amplitude in microvolts was calculated for all components; latency in milliseconds was extracted for N290/P400 but not for the Nc due to its diffuse morphology.

Analyses focus on 15 children across three groups; classification to these three groups was based on a follow-up visit at 24-or 36-months and was as follows: (1) children classified as having ASD ('outcome'); (2) children at high-risk for ASD but who have been classified as typically developing ('HRA-'); (3) children at low-risk for ASD and who have been confirmed to be typically developing ('LRC-'). Each child in the outcome group was matched to a child in the HRA- and LRC- group based on initial cognitive ability.

Results: Results comprise a preliminary set of analyses; 10-20 additional children will soon 'age in' to these analyses. For ease of interpretation, analyses focus on infants' responses to mothers. Due to the limited sample size, results will be presented in a descriptive fashion. Mean amplitude of the Nc was similar across groups (ranging from -7.77 to -8.81). However, mean amplitude of the N290 in the outcome group (M=4.42,SD=11.30) contrasted with that of the HRA- and LRC- groups (respectively: M=11.51,SD=10.51;M=13.94,SD=2.48). Similarly, mean amplitude of the P400 was smallest in the outcome group (M=5.81,SD=16.43), followed by the HRA- group (M=10.76,SD=11.33) and the LRC- group (M=16.42,SD=3.61). Finally, whereas the HRA- and LRC- groups showed similar latencies for the N290 (respectively: M=218.40,SD=62.26;M=216.80,SD=20.27), the response was slower in the outcome group (M=312.80,SD=83.44). P400 latency results paralleled those observed in amplitude: the outcome group had the slowest response (M=426.40,SD=73.41), followed by the HRA- (M=400.00,SD=27.13) and the LRC- groups (M=391.20,SD=28.76).

Conclusions: There may be differences in neural response to faces for children later diagnosed with ASD. In particular, by 12-months, response may be smaller and slower than in comparison children. Moreover, there is some indication that there is a combined effect of risk status and eventual outcome: children at high-risk with negative outcomes may show less pronounced but similar patterns of response to high-risk, positive outcome children.

130.032 32 Event-Related Potentials to Known and Unknown Words in 18 and 24 Month Olds At Risk for ASD. A. Seery*[1], M. Ayoub[2], H. Tager-Flusberg[1] and C. A. Nelson[3], (1)*Boston University*, (2)*Harvard University*, (3)*Harvard Medical School/Children's Hospital Boston*

Background: In typical development, the brain's event-related potentials (ERPs) to words becomes increasingly localized and lateralized within the left hemisphere as infants become more proficient with language (Mills et al., 2005). Here, we investigated this developmental process in toddlers who are at

a high risk (HRA) for developing autism spectrum disorders (ASD) due to having an older sibling with an ASD. Converging research suggests that individuals with ASD may show atypical neural response to linguistic stimuli in addition to displaying reversed or dampened lateralization of language networks in the brain. However, it is unclear how early in development these atypicalities are present and whether they are linked specifically to autism symptoms or to more general language impairment. Importantly, while approximately 10 to 20% of HRA toddlers will develop an ASD, a large proportion of those who do not ultimately receive a clinical diagnosis will experience language delay/impairment or subclinical traits of a broader ASD endophenotype. Therefore, this high risk population will allow us to begin to tease apart the effects of language impairment and ASD symptoms on neural response to words and language.

Objectives: To examine whether HRA infants show atypical electrophysiological response to words, and if so whether this is more closely linked to language delay, autism symptoms, or both.

Methods: As part of a larger longitudinal study, we recorded ERPs to words in HRA infants and low-risk control (LRC) infants at 18 (HRA n=26; LRC n=25) and 24 months (HRA n=28; LRC n=18). Participants listened to a stream of words, half of which were known to the infant (confirmed with parent report) and half of which were unknown. The Mullen Scales of Early Learning (MSEL) and Autism Diagnostic Observation Schedule (ADOS) were administered at both ages in order to obtain indices of language ability and autism symptoms.

Results: Grand averaged waveforms revealed a negative inflection maximal over posterior electrodes (N200). A preliminary analysis from a subset of 17 HRA and 10 LRC infants at 18 months indicated that this N200 was larger to known than unknown words in LRC infants over the left parietal region (p=.002). In contrast, this difference was not significant in HRA infants, although they did show a trend in the same direction (p=.095). Planned analyses will examine this component in infants at 24 months and will explore the relationship between N200, language ability, and autism symptoms at both ages.

Conclusions: We have preliminary evidence that HRA infants do not show the same pattern of response to words as LRC at 18 months. This suggests that atypical processing of lexical stimuli may be a trait of the ASD endophenotype. Our work will investigate the nature of this atypical processing with the hope of identifying whether this is driven by infants with delayed language or by infants who are displaying symptoms of ASD.

130.033 33 Resting-State Gamma Power and Early Language Function in Infants At Risk for Autism. A. Norona*, K. McEvoy, C. Shimizu, T. Hutman and S. S. Jeste, *UCLA Center for Autism Research and Treatment*

Background: Oscillatory activity in the gamma frequency range (30-50 Hz) has been linked with various higher cognitive functions (e.g., attention, perception, language, etc.) and is thought to play a critical role in coordinating neural activity across cortical and subcortical networks. There is growing support for the hypothesis that ASD may reflect aberrant functional connectivity and therefore gamma activity may serve as an important marker of this phenomenon. A recent study looked at the development of oscillatory activity across early childhood and found that differences in frontal resting gamma power were highly correlated with concurrent language and cognitive skills at ages 16, 24, and 36 months (Benasich, 2008). Another research group investigated gamma power in high-risk infants and showed that frontal gamma power was reduced in this group compared to low-risk controls (Bosl, 2011). No prior studies have investigated the relationship between gamma and language function in infants at risk for autism.

Objectives: Here, we used resting-state EEG to examine high-frequency cortical activity in infants at high-risk for developing ASD and low-risk, age matched controls. The aim was (a) to examine differences between groups in frontal gamma activity and (b) to study the link between frontal gamma activity and early language function.

Methods: Resting-state EEG was obtained for two minutes while infants were sitting quietly and watching bubbles produced by a bubble machine. EEG data were bandpass filtered from 1 to 50 Hz then divided into 1-second segments. Segments containing artifacts arising from eye-blinks, eye-saccades, and muscle movements were removed from

subsequent analysis. Only subjects with a minimum of 30 seconds of artifact-free data were analyzed. The data were then transformed into the frequency domain using a Fast Fourier Transform. Relative frontal gamma power was calculated for each subject. High-risk infants were compared to low-risk infants. In addition, receptive language and expressive language domains on the Mullen Scales of Early Learning (MSEL) were correlated with relative gamma power within each group.

Results: Six high-risk 6 month-old infants and nine low-risk 6 month-old infants provided a minimum of 30 seconds of resting-state EEG data. The data show significant differences between high-risk and low-risk infants in frontal gamma power, such that the high-risk infants had significantly decreased relative frontal gamma power (p=.025). Furthermore, preliminary data analysis suggests a correlation between frontal gamma power and language ability, such that infants with increased gamma also have higher expressive language scores (p=.018).

Conclusions: Our preliminary data suggest that high-risk infants and low-risk control infants differ in high frequency oscillatory activity. In addition, our data show that frontal gamma activity may be linked with language function in infancy. Data collected from these infants at later time points can provide more insight into the development of gamma oscillations and its potential implications for ASD diagnosis and language acquisition.

130.034 34 Human and Non-Human Action Sound Processing in Toddlers At Risk for Autism. C. Stefanidou*[1], R. Ceponiene[2] and J. McCleery[3], (1)*School of Psychology, University of Birmingham*, (2)*Center for Research in Language, University of California*, (3)*University of Birmingham*

Background:

Previous behavioural studies have revealed difficulties in the comprehension and production of body actions and gestures in children and adolescents with Autism Spectrum Disorders (ASD). In addition, decreased attention to other people as well as gestural communication delays have been observed in high-risk infant siblings of children with autism, including those later diagnosed with the disorder. The neural mechanisms underlying the perceptual processing of visual stimuli depicting human gestures and biological motion have also been found to be atypical in individuals with ASD. However, it is not currently known whether similar atypicalities characterise the perceptual processing of human action sounds (i.e., auditory gestures) in ASD.

Objectives:

The aim of the current study is to investigate the perceptual processing of human action sounds in toddlers at risk for autism, using a novel event-related potentials (ERP) auditory-auditory repetition-suppression paradigm.

Methods:

Twenty-one low-risk 2- and 3-year old toddlers and nine high-risk siblings of children with autism, matched for chronological and developmental age, have taken part in this study thus far. The auditory-auditory repetition suppression ERP paradigm included a single block of trials, presenting two types of human action sounds (hands clapping, hands ripping paper) and two types of non-human action sounds (ocean waves, helicopter blades spinning). There were also four different types of trials, which involved the immediate repetition or non-repetition of both human and non-human action sound stimuli. Differences in neural activity elicited by repeated (suppression of brain mechanisms) and non-repeated (release of brain mechanisms) stimuli were examined. Behavioural measures, including the Mullen Scales of Early Learning and the Autism Diagnostic Observation Schedule, were also administered for the behavioural characterisation and matching of the two participant groups.

Results:

Results reveal two negative-going repetition suppression components, peaking at 300ms and 580ms respectively, over the frontal area in response to human action sounds in both groups. However, preliminary results indicate that the latter, N580, component's amplitude was smaller over the right hemisphere in the high-risk toddlers. For non-human action sounds, a positive-going repetition suppression component peaking at 250ms was identified in both groups. However, the

amplitude of this component was found to be smaller over the left hemisphere in high-risk toddlers. Finally, although no lateralisation differences were found for either human or non-human action sound processing in the low-risk toddlers, non-human action sound processing was right lateralised in the high-risk group.

Conclusions:

These results suggest that toddlers at risk for autism present with an atypical pattern of perceptual processing of both human and non-human action sounds. The reduced brain activity observed over right frontal channels in response to body action sounds in the high-risk group provides evidence for a dysfunctional auditory gesture processing mechanism at a late stage of cognitive-perceptual processing. Moreover, reduced activation over the left frontal cortex, in combination with the tendency for a greater right frontal activity, in response to non-human action sounds suggests an atypical neural mechanism associated with the early perceptual processing of non-human action sounds in toddlers at risk for autism.

130.035 35 Abnormal Neonatal Auditory Brainstem Response and 4 Month Arousal-Modulated Attention Are Jointly Associated with Autism Severity Scores in Childhood in NICU Graduates. I. L. Cohen*[1], J. M. Gardner[1], B. Z. Karmel[1], T. R. Gomez[1], M. Gonzalez[1], H. T. T. Phan[1], P. M. Kittler[1], E. M. Lennon[1], S. Parab[2] and A. Barone[2], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*Richmond University Medical Center*

Background:

Early behavioral abnormalities more prevalent in Neonatal Intensive Care Unit (NICU) graduates later diagnosed with Autism Spectrum Disorder (ASD) have been reported by our group (Karmel et al., 2010). One of these was a visual preference for high rates of stimulation (8>3>1Hz.) when less aroused at four months post term age (PTA) (seen in our Arousal-Modulated-Attention (AMA) task); a preference found in newborns. These results suggested early problems with the attention/arousal system in ASD children; a system proposed to be modulated by brainstem function. Accordingly, we examined the extent to which another measure of early brainstem development, the auditory brainstem evoked response (ABR), contributed to the AMA preference in predicting the later emergence of ASD behaviors in NICU graduates.

Objectives:

To evaluate the contribution of both neonatal ABRs and 4 month PTA AMA preferences to later ASD behaviors in NICU graduates.

Methods:

As neonates, three CNS injury groups were defined based on ABR and cranial ultrasound assessments as described in Karmel et al. (2010): 1) No Detectable CNS Insult (n=27); 2) Abnormal ABRs only (n=28); and 3) Mild structural injury (n=22). Visual preference to pairs of checkerboard patterns flashing at 1, 3, or 8Hz were obtained when infants were more and less aroused at 4 months PTA. Type, and severity of autistic behaviors were obtained at a mean (SD) age of 3.4 (1.2) years based on parent PDD Behavior Inventories (PDDBI; Cohen and Sudhalter, 2005) and IQs were obtained around the same age using the Griffiths Mental Development Scales.

Results:

Visual preferences were highly correlated with 5 of 10 PDDBI domain scores (all p values <.001) and 3 of 3 composite scores (all p values <.002) **but these associations were specific to the Abnormal ABR group.** These significant effects were for measures of social communication (rs -.64 to -.73), social pragmatic problems (r=0.63), and arousal modulation problems (r=.59). The Social Discrepancy composite score (which correlates best with diagnosis) showed strong effects (r = -0.74, p<.000); the greater the preference for higher rates at 4 months, the greater the social deficit at 3 years. By contrast, there were no significant correlations with visual preference for the other CNS groups or with performance IQ for any group. Correlational differences across groups were confirmed with separate-slopes GLMs. Ten of 14 children later diagnosed with ASD were in the Abnormal ABR group; 7 of these had strong preferences for the fastest rates. By contrast, the Mild CNS group had 3 ASD cases and the No Insult group had 1 ASD child.

Conclusions:

These findings indicate that the joint occurrences of abnormal neonatal ABRs and preference for more stimulation at 4 months PTA are markers for the development of autistic behaviors in this population; both indices of brainstem maturation problems. Since each is related to autistic behaviors, it not known whether the effects are independent or are sequential. Since abnormal ABRs typically are related to CNS structural injury, the current finding for Group 2 may represent a different development mechanism rooted in very early fetal brainstem development.

130.036 36 Electrophysiological Markers of Social Perception in Infants At Risk for Autism. G. Righi*, C. E. Mukerji, M. Coffman, A. Naples, L. Mayes and J. McPartland, *Yale Child Study Center*

Background:

Perceptual sensitivity to the motion of other people is a fundamental building block of social interaction, present from the first days of life in humans. Infants as young as two days old prefer to view point-light displays depicting human movement (e.g., walking) compared to scrambled motion. Perception of biological motion is linked to specific electrophysiological indexes. It elicits reduction in power in the mu frequency band measured at central electrode sites, a pattern associated with mirror neuron system activity in adults. Biological motion perception also evokes increased activity in the gamma band at parieto-temporal electrode sites; this activation pattern has been associated with top down integrative processes in both children and adults. Electrophysiological markers of biological motion perception reveal neural differentiation of upright and inverted point light walkers in infants as young as 8 months. Though behavioral studies show that toddlers with ASD fail to exhibit a preference for biological motion, little is known about the neural underpinnings of biological motion processing in children with ASD. In the current study, we apply established electrophysiological methods to elucidate early brain development in autism.

Objectives:

The present study investigates the development of neural sensitivity to biological motion during the first 18 months of life in infants at high- and low-risk for ASD and its relationship to behavioral phenotypes.

Methods:

Participants include two groups of infants assessed longitudinally at three-month time points between 3 and 18 months of age. EEG was recorded with a128-channel Hydrocel Geodesic Sensor net while infants viewed point-light displays depicting a person walking (biological motion) and a spatio-temporally scrambled dot array (non-biological motion). EEG data was segmented to the onset of the video displays, and time-frequency domain analyses extracted event-related oscillatory activity in mu (6-9 Hz) and gamma (30-50 Hz) bands across the two experimental conditions. Infants were administered the Mullen Scales of Early Learning at each visit and a comprehensive battery of social and communicative assessments.

Results:

Preliminary analyses in infants at 12 months indicate a distinct response pattern to biological motion in low-risk infants: enhanced mu suppression at ~200ms and greater gamma power at ~170ms. This response pattern is attenuated in the group of high-risk infants. Correlational analyses in progress will examine interrelationships between these distinct patterns of oscillatory activity (i.e., mu and gamma) and social and communicative developmental functions.

Conclusions:

Results demonstrate electrophysiological markers of biological motion perception in infants. These patterns are attenuated in infants at risk for autism, providing promise for a non-invasive biologically-based method of measuring development of brain systems implicated in autism before onset of the disorder.

130.037 37 An Electrophysiological Study of Visual Function in Infants At Risk for An ASD. V. Vogel-Farley[1], K. M. Concannon*[1], S. Spurling Jeste[2] and C. A. Nelson[3],

(1)*Childrens Hospital Boston*, (2)*UCLA*, (3)*Children's Hospital Boston/Harvard Medical School*

Background: Differences in face processing and attentional mechanisms have been found among infants who will later develop autism when compared to typically developing comparison populations (Luyster, et al 2011). Despite these differences it is difficult to determine the precise neural processes that underpin them. While infant studies have investigated later processing (N290/P400 and Nc), it is unknown if differences found in these studies is driven by earlier low-level visual processing differences in high-risk groups. The P1 component reflects the visual processing stream and visual cortex, and is used clinically as a measure of visual function.

Objectives: To date we focused on examining the P1 component, the first positive deflection in the visual ERP, in a population of infants with a known single gene defect who are at elevated risk for developing an ASD– specifically, those diagnosed with Tuberous Sclerosis Complex (TSC) with 40-50% receiving an ASD diagnosis. In the next set of analyses we look to expand our analysis of the PI component to another at-risk group of infants who are high-risk for developing autism by proxy of having an older sibling diagnosed with an autism spectrum disorder. These infants are expected to have a positive ASD diagnosis at a rate of 1:5.The objective is to investigate the functional significance of the P1 in two groups of high-risk infants.

Methods: Infants were presented with visual stimuli of faces (mother/stranger). For the existing analysis we evaluated the P1 data from 45 infants, aged 12-36 months and age-matched between 3 groups [control; TSC- (no comorbid ASD diagnosis); TSC+ (comorbid ASD diagnosis)]. For our further analyses we will evaluate the data from infants, aged 12-36 months who participate in the Infant Sibling Project taking place at Boston University and Children's Hospital.

Results: For the TSC analyses, a repeated measures analysis of P1 amplitude and diagnosis group revealed that the P1 amplitude was larger for infants with TSC who have a comorbid ASD diagnosis than infants with TSC with no comorbid diagnosis, or controls. This finding suggests that early visual function may be impaired in children who go on to develop ASD.

Conclusions: Based upon the differentiation of the P1 between the TSC at-risk group with a positive outcome and those without, we anticipate similar findings among our high-risk infant sibling population. If the high risk infant sibling groups [HRA- (no ASD diagnosis at outcome age); HRA+ (positive ASD diagnosis at outcome age)] show similar findings to the previous analysis, a greater P1 response in the HRA+ group, this will further the evidence that early visual processing may be impaired in at-risk infants who go on to develop ASD.

130.038 38 Neurobehavioral Responses in Fetuses At Risk for Autism. S. J. Sheinkopf*[1], R. A. Barry[2] and A. Salisbury[1], (1)*The Warren Alpert Medical School of Brown University*, (2)*Brown Center for the Study of Children at Risk*

Background: Research has begun to identify neurobehavioral differences in infants at risk for autism. In addition, genetic and biological findings point to prenatal influences on the development of autism. Research has not yet examined prenatal neurobehavioral alterations in infants at risk for autism. However, fetal behavioral and physiological responses in utero can be measured and may reflect the neurobehavioral status of fetuses at risk for autism.

Objectives: To investigate alterations in physiological and behavioral responses and characteristics in fetuses at risk for autism.

Methods: Pregnant mothers were recruited into two groups, those with a first degree relative with autism (Autism Risk group; AR) and those with no family history of autism (Low Risk; LR). Parent reported diagnoses in relatives were confirmed by best estimate clinical diagnosis by a clinical psychologist plus above-threshold scores on the ADOS. Twenty (20) participants have been recruited into this study, including 8 LR and 12 AR. Of the 12 who screened into the AR group, 4 had siblings with confirmed diagnoses. Fetal observations were conducted at 34 – 36 weeks gestational age during a 60 min fetal ultrasound (u/s) session. The session included a baseline period (10-15 min.), playback of a recording of the mother reading a story (2 min), an unfamiliar

female reading the story (2 min), and single administration of a vibroacoustic stimulus. Each stimulus was followed by a 12-minute observation period. Fetal neurobehavioral measures were obtained by ultrasound and actocardiograph. Ultrasounds were conducted using a Toshiba diagnostic u/s machine (SSA-340A with a 3.75 MHz transducer) and a Toitu MT325 actocardiograph. Data from the two machines was synchronized to facilitate later coding and analysis of fetal behavior and HR. Fetal behaviors were coded from digitized recordings using established protocols (Salisbury, 2005). Fetal movements (from actigraphy) and fetal HR were reviewed for artifacts and then summarized within each observational period. Analyses compared the 8 LR fetuses to the 4 AR fetuses with confirmed sibling diagnoses.

Results: The AR and LR fetuses did not differ in fetal heart rate (FHR) during an initial baseline period. But, AR fetuses did have significantly higher FHR than LR subjects in response to the mother's voice ($p = .012$) and to stranger's voice ($p = .021$). The groups did not differ in FHR response to a vibroacoustic stimulus. Groups did not differ on measures of FHR variability, but there was a trend for greater frequency of HR decelerations in the AR group. Behavioral coding indicated that the AR fetuses had higher stress signs as coded from u/s than did the LR subjects (3.4% vs. 0.4% across observation periods). This did not reach statistical significance given our small sample size, and appeared to be driven by one AR participant.

Conclusions: This small and preliminary study suggests that infants at risk for autism may show differences in neurobehavioral responses to in utero stimulation and experience. We will discuss the use of multilevel fetal observation for the study of the early developmental course in autism.

130.039 39 Neural Mirroring System In Young Children: An EEG Study. N. L. Dewaele*, L. Ruysschaert, P. Warreyn, J. R. Wiersema and H. Roeyers, *Ghent University*

Background:

Mirror neurons, discovered in the macaque brain, discharge during both execution and observation of similar actions (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992). An analogous neural mirroring system is believed to be functional in humans (Marshall & Meltzoff, 2011). According to this view, there is a direct match between the observation and execution of actions by which the motor knowledge of the observer is used to understand the observed action. Mirror neuron functioning has theoretically and/or empirically been related to action understanding (Rizzolatti & Craighero, 2004) and various social–cognitive processes such as imitation (Iacoboni, 2005), theory of mind (Iacoboni & Dapretto, 2006), language (Rizzolatti & Craighero, 2004) and empathy (Decety & Meyer, 2008). These specific skills are often impaired in individuals with ASD. This led to the hypothesis of a dysfunctional neural mirroring system in individuals with ASD. However, the findings concerning the role of these mirror neurons in ASD seems controversial and research is inconclusive.

Objectives:

The aim of the current study is to investigate mirror neuron functioning in young children. Suppression in the EEG mu rhythm band is associated with mirror neuron activity and has been investigated in adults and children with and without ASD. In this study, we apply a child-friendly paradigm to investigate mu wave suppression during action observation and action imitation in typically developing children (TD), children with a diagnosis of ASD, and siblings of an older child with ASD (high-risk children). All children were between 4 and 5 years old.

Methods:

Until now, we tested 14 TD children, 13 children with ASD, and 16 siblings. The experiment consisted of 4 experimental conditions during which brain activity was measured with 73 active electrodes. The children observed a moving object (object observation condition) and an experimenter performing hand movements (HM condition). Subsequently, they observed (AO condition) and imitated (AI condition) a goal-directed action. HM condition and AO/AI condition were counterbalanced between subjects. We used brain activity data from electrodes at the positions C3, Cz and C4 for further analyses.

Results:

In line with Marshall et al. (2010), mu wave suppression was calculated as a ratio of the mu wave power in the different conditions. Specifically, we calculated ([A - R]/R)*100 with A being mu power during the experimental conditions (AO, AI and HM condition) and R being mu power during the baseline condition (object movement condition) (Pfurtscheller & Lopes da Silva, 1999). A negative value indicates mu suppression.

Preliminary analyses show mu suppression during all three conditions in TD children, children with ASD and siblings. Full results and group comparisons will be presented at the meeting.

Conclusions:

The results suggest that we developed a useful paradigm for studying mirror neuron functioning in young children. Children with ASD, without ASD and at risk for ASD showed mu suppression during observation of real and mimicked actions. Up till now, we found no evidence for a clear deficit in the neural mirroring system of 4-year-olds with ASD or at risk for the disorder.

Treatments: A: Social Skills; School, Teachers Program

131 Treatment I: Social Skills, Schools, Stress

131.040 40 The Relations Among Language, Behavior, and Social Skills in Children with High Functioning ASD: Exploration to Inform Pivotal Interventions. K. Lierheimer*[1], N. A. Gage[2], M. O. Mazurek[3] and S. M. Kanne[4], (1)*University of Missouri*, (2)*University of Connecticut*, (3)*University of Missouri - Columbia*, (4)*Baylor College of Medicine*

Background: Research indicates that the development of communication, particularly expressive and receptive language skills, has the potential to improve outcomes for children with ASD (Hudry, et al., 2010; Ventner, Lord, & Schopler, 1992). Research substantiates that difficulty with language skills is related to behavioral and social skills problems. However, it is less clear how specific language constructs (i.e. expressive and receptive) are interrelated with behavioral performance areas, particularly for children with high functioning autism (HFA). Specific knowledge about the relations among language skills and behavior could lead to strategic interventions that have the potential to improve outcomes across domains for children with HFA.

Objectives: The purpose of this exploratory study was to examine the relations among functional receptive and expressive language ability, externalizing and internalizing behaviors, and functional social skills among children with HFA.

Specific hypotheses were: (1) functional expressive and receptive language would be negatively associated with externalizing and internalizing behaviors and (2) functional expressive and receptive language would be positively associated with functional social skills.

Methods: The sample included 1,182 children enrolled in the Autism Treatment Network (ATN) registry. The ATN includes 17 centers focusing on best practices and standards of care for children with ASD. Participants were between the ages of 2-17, had a diagnosis of ASD confirmed by DSM-IV-TR criteria and Autism Diagnostic Observation Schedule (ADOS), and obtained a Full Scale IQ score above 75 on standardized measures. Subscales of The Vineland Adaptive Behavior Scales – 2nd Edition were utilized as measures of functional receptive and expressive language and social skills. The Child Behavior Checklist was used as a measure of internalizing and externalizing behavior. A path analysis modeling procedure was utilized to examine the interrelationships among constructs using an *a priori* empirically- and theoretically-derived model.

Results: As predicted results from the path analysis model indicated that functional receptive language was negatively associated with both externalizing behavior (b = -.30) and internalizing behavior (b = -.16). In contrast, functional expressive language was positively associated with externalizing behavior (b = .15), and not significantly associated with internalizing symptoms. With regard to social skills, both functional receptive and expressive language ability were positively associated (b =.26 and b = .39 respectively) with social abilities.

Conclusions: Overall, the results suggest that language abilities are associated with functioning across both social and behavioral domains among children with HFA. Results from our path model suggest that functional receptive language may prove to be a promising area for developing targeted language-based interventions, given its strong relationships with both behavior and social skills. It is possible that interventions targeting this area may provide secondary benefits for both behavior and social interaction among children with HFA. Future research using longitudinal designs and standardized language measures is needed to fully investigate these issues.

We acknowledge the members of the ATN for use of the data and the families who participated in the Registry. The ATN is funded by Autism Speaks and a cooperative agreement (UA3 MC 11054) from HRSA to the Massachusetts General Hospital.

131.041 41 "Look Who's Talking!" Gaze Patterns in Implicit and Explicit Onset Asynchrony Detection. R. B. Grossman*[1], A. Schmid[2], E. Steinhart[2] and T. Mitchell[2], (1)*Emerson College*, (2)*UMMS Shriver Center*

Background: There has been conflicting evidence on whether individuals with ASD can integrate auditory-visual (AV) information for language (van de Smagt et al. 2007, Smith and Bennetto, 2007), but our prior work shows that individuals with ASD are able to use lipreading to recognize auditory-visual asynchrony in an onset asynchrony task (Grossman et al. 2009).

Objectives: We assessed whether implicit vs. explicit task designs affect the looking patterns for in- and out of synch videos in adolescents with ASD and typically developing (TD) controls. We hypothesized that individuals with ASD would have less directed looking patterns than TD participants in an implicit task, but improve their gaze behavior with explicit task instructions.

Methods: We recorded a close-up video of a woman talking about baking dessert and presented the same video side-by-side, with one video delayed by 10 frames. The audio track switched between being in synch with the two sides every 8-18 seconds. Participants were adolescents (ASD=21, TD=26) aged 8-18. In the implicit task, participants were only told to closely attend to the video. After completion of the implicit task and a distraction task, we showed the same video, with explicit instructions to look at the woman speaking in-synch with the audio track. We collected eye-tracking data on participants' fixation patterns during both tasks.

Results: We calculated percent of looking time to regions of interest on the correct and incorrect side (upper face, lower face, eye region, mouth region, and non-face). We conducted a 2 (group) x 2 (task: explicit vs. implicit) x 2 (side: correct vs. incorrect) repeated measures ANOVA for visual fixations. Results show a main effect for side and a main effect for group, with the TD group looking at the correct side significantly more than their ASD peers in both tasks, as well as a task by accuracy interaction and a task by group by accuracy interaction, indicating that the nature of the task revealed significant differences in each group's looking patterns. TD participants looked at the mouth on the correct side significantly more than their ASD peers, while ASD participants looked at the non-face significantly more than their TD peers. No group differences were found for the eye region. TD participants modulated their response based on task instructions by looking significantly more at the incorrect mouth during the implicit task and significantly more at the correct mouth during the explicit task. Participants with ASD showed no differences in looking patterns to the mouth.

Conclusions: Adolescents with ASD, who can accurately detect onset asynchrony of 10 frames (Grossman et al. 2009), do not modulate their looking patterns in response to explicit task instructions, while TD adolescents gaze significantly more at the mouth region of the in-synch face during the explicit, than implicit task. Despite their reported preference for looking at the mouth region of a face, adolescents with ASD looked at the mouth significantly less than their TD peers, and instead focused their gaze on non-face regions of the screen.

131.042 42 Measuring the Effects of Training Parents to Provide Intervention Via Telemedicine. D. Openden*[1], C. J. Smith[2] and A. Boglio[2], (1)*Southwest Autism Research & Resource Center* , (2)*Southwest Autism Research & Resource Center*

Background: With the dramatic increase in children diagnosed with autism spectrum disorders (ASD) has come a shortage of qualified interventionists to provide services. The lack of interventionists is even more of a challenge for those who reside in rural or remote regions. One way to address this growing need is to systematically train parents to implement intervention during natural language interactions with their child. Two previous studies demonstrated that an intensive one-week parent training program is effective for teaching parents to implement Pivotal Response Treatment (PRT) and increasing social communication in children (Koegel, Symon, & Koegel, 2002; Symon, 2005). Following training, parents were required to mail videotapes monthly for 3 consecutive months, and then received feedback via phone calls. While the data suggest that these follow up procedures were efficacious, they lack efficiency considering the technology that is currently available. Further, using technology to provide follow up support may more effectively address the changing needs of children over time.

Objectives: To evaluate the efficacy of using telemedicine (via Behavior Imaging technology) as a tool for providing immediate feedback and continued support for parents within a randomized clinical trial.

Methods: Forty-three parent-child dyads were randomly assigned to treatment and control groups. Both groups received one-week of intensive, in-vivo parent training in PRT at our research center. Consistent with previously published research, the control group (non-telemedicine) mailed a video tape monthly for 3 consecutive months and received feedback via phone calls. The treatment (telemedicine) group uploaded 3 videos per week over 3 consecutive months to Behavior Imaging's secure website, received "tagged" feedback on each video from a PRT therapist, and received feedback via a phone call at the end of each week. Primary dependant measures—parent fidelity of implementation of PRT and functional verbalizations produced by the child—were collected for each parent-child dyad at baseline, post initial in-vivo parent training, and again at follow up. Data on compliance with the follow up procedures (telemedicine vs. non-telemedicine) were also collected. To ensure integrity with treatment protocols, the main analysis was limited to families who demonstrated 75% or better compliance.

Results: While both groups improved significantly on each of the primary dependent measures, no significant differences between treatment and control groups were observed. However, the treatment group (telemedicine) demonstrated significantly better compliance with follow-up procedures.

Conclusions: While differences between telemedicine and non-telemedicine groups were not observed, compliance may be a critical mediating variable. That is, significant improvements in parent fidelity of implementation of PRT and functional verbal utterances produced by the child were observed when parents maintained 75% or better compliance with follow up procedures, regardless of whether telemedicine was used. The data indicating that parents were significantly more compliant in the treatment group suggests that telemedicine technology may improve compliance with treatment protocols, and, therefore, may lead to more reliable treatment gains. The results of this study may also have important implications for delivery of cost-effective and efficacious intervention for families living in rural or remote areas.

131.043 43 How Are Special Educators Using Social Stories™ in Rhode Island?. P. LaCava*, *Rhode Island College*

Background: Carol Gray created the Social Stories™ method in the early 1990s. This method has since become very popular and is often used to help students with autism spectrum disorders (ASD) better understand social interaction, the perspectives of others and to impact behavior. Despite significant research exploring the efficacy of this method, little has been published on this method's implementation in schools. While some have proclaimed this method an evidence-based practice (NPDC, 2009), others remain skeptical (Test et al., 2011). Despite a growing literature, there has only been one peer-reviewed study (Reynhout & Carter, 2009, in Australia) that has surveyed teachers' use of Social Stories. It is therefore vital to understand how this method is being used with American students with ASD.

Objectives: The purpose of this research is to survey special educators and related service providers in Rhode Island to gather information regarding how Social Stories are used in public schools, how effective this method is perceived to be, if Gray's guidelines are being followed, how professionals were trained and other relevant questions.

Methods: A descriptive research design was implemented using both a web-based questionnaire and interviews. The target population was special education teachers and related service providers currently working in Rhode Island public schools. A questionnaire was created using SurveyGizmo and the survey link was sent to Rhode Island special education administrators to send to their personnel. Follow up personal interviews were held with a convenience sample to gain in depth information regarding social story practice.

Results: 84 participants (93% female, 90% Caucasian) completed the questionnaire. Over 70% of respondents who use Social Stories were either special educators or speech-language pathologists working at the elementary level. While 90% use Social Stories with students with ASD, more than 70% also use them with learners with other disabilities. Considering training, only 17% reported being trained via the methods that Carol Gray has outlined and 20% reported having had no training. Also, only 44% said that they follow Gray's methods when writing Social Stories. Finally, more than 90% agreed or strongly agreed that Social Stories help students to change behavior, help students to better understand social interactions and were usually or sometimes an effective intervention. The interview portion of the study is still being conducted (16 interviews have been conducted to date). The findings from these interviews will be shared.

Conclusions: This study provides an initial snapshot of how teachers in Rhode Island are using Social Stories. These results should help practitioners to reflect upon their own use of Social Stories and compare how they may or may not be different. Hopefully this reflective practice will help to improve (a) Social Story training, (b) how stories are written and (c) implementation and thus, as a final outcome, improve the lives of students with ASD. Limitations include a small sample size and possible bias in self-report. Future research is needed to gain the input from students with ASD and their families about this method.

131.044 44 Training High School Students to Provide Behavioral Instruction to Children with Autism. L. Belz*, B. Gorka and K. Kennedy, *Children's Hospital of Michigan*

Background:

Studies have shown that children with autism who receive intensive behavioral therapy can make significant progress in the acquisition of language, social, motor, and academic skills. However, many of the children who make the most progress receive intensive programs that are large in scope, requiring 20-40 hours of therapy weekly over the course of many years. Many families have difficulty finding the financial resources to meet this number of hours, as well as finding personnel with adequate training to administer the intensive therapy.

Objectives:

The focus of this present study is to evaluate the effectiveness of training high school students to provide intensive behavioral therapy to children with autism. Our hypothesis is two-fold: first, the use of high school students would reduce the financial burden of therapy on the parents of children with autism; second, the techniques used to train high school students would enable them to perform Applied Behavior Analysis (ABA) teaching methods to criteria previously established by research (i.e., ability to perform ABA discrete trials independently, with a minimum of 92% accuracy, during the final two sessions of the study).

Methods:

Study participants included eight high school students (mean age = 15.82 years, SD = 0.87) and eight children with ASD (mean age = 4.69 years, SD = 1.02). Children with ASD were recruited for study participation after completion of diagnostic assessment at a hospital-based Autism Clinic. Five children with ASD and seven students completed the study, one child with ASD was excluded and three subjects dropped out (two children with ASD, one student). Study duration was 10 weeks; the first two weeks included baseline sessions and didactic

training, with the following eight weeks consisting of twice weekly individual training sessions with an ABA therapist. A single-subject design was used to measure the effects of the training intervention on the discrete-trial performance of the high school students. To measure intervention accuracy, researchers used a feedback evaluation form to score the first fifteen discrete trials of each session. The feedback evaluation form included eleven different components of the ABA discrete trial. Interrater reliability between two coders was established; reliability was calculated by dividing the total number of congruent items by the total of congruent plus non-congruent items, then multiplying the result by 100 to obtain a percentage.

Results:

By the end of the study, the majority of the high school students performed discrete trials independently, with 90% minimum accuracy (mean = 89%, SD = 1.48). The intertrial interval (i.e, time span between trials) had the greatest impact on the percentage of accuracy. Parent and student satisfaction was reported to be high, based on social validation surveys completed at the end of the study.

Conclusions:

Results of the present study suggest that training high school students may be an effective and cost saving method of providing intensive behavioral therapy to children with autism. Further research is needed to determine the long-term cost-benefits, continued treatment integrity, and analysis of teaching the intertrial interval component of discrete trials.

131.045 45 A Comparison of Social Skills Intervention in Three Different Contexts. G. Mathai*[1], P. H. Hardesty[1], N. J. Cunningham[1] and L. A. Ruble[2], (1)*University of Louisville*, (2)*University of Kentucky*

Background:

Social reciprocity deficits are a core feature of the autism spectrum disorders (ASD) and a major source of impairment regardless of cognitive or language ability (Carter, Davis, Klin & Volkmar, 2005). Since these impairments do not naturally remit with age, it is critical to intervene as early as possible to offset potential risk factors. (Tantum, 2003). Group training approaches provide children with teaching opportunities with other children and allow for the direct instruction of skills within a structured environment (Bellini, Peters, Benner & Hopf, 2007). Research in social skills group research has increased but several questions remain.

Objectives:

This study evaluated the outcome of a social skills curriculum for 37 children between the ages of 8 to 14 years with a diagnosis of ASD within three different treatment contexts, the camp, clinic and combined model. The camp model simulates a natural setting where children with ASD spend 5 hours each day for 10 days where social skills are taught through engaging activities and interactions with peers both typical and with ASD. The clinic model on the other hand is a one hour a week session spread over 10 to 12 weeks where social skills are taught and practiced while parents observe through a one way mirror and are trained on the intervention methods. Both clinic and camp model treatments are then compared with a third group who experience both treatments within the clinic and camp setting.

Methods:

Twelve children between the ages of 8 to 14 years with an ASD diagnosis (Autism, Aspergers, Pervasive developmental Disorder, Not otherwise specified (NOS) received from a psychologist or physician and referred to the clinic for social skills training were selected from each of the 3 treatment modalities: camp alone, clinic alone and from those who had attended both camp and clinic treatments. Before participating in the social skills groups, the children completed a manualized social skills assessment for individuals with ASD (Stone, Ruble, Coonrod, Hepburn, & Pennington, 2002) to ensure that they had appropriate task demand skills.

Two dependent variables were measured at outcome: (a) the Social Responsiveness Scale (SRS; Constantino, Przybeck, Friesen &Todd, 2000), and

(b) the TRIAD Social Skills Assessment (TSSA; Stone, Ruble, Coonrod, Hepburn, & Pennington, 2002). Parents of children completed the SRS, and the TSSA before and after the treatments.

Results:

Results show that the combined context had the highest treatment effects followed by the camp model and finally the clinic model. Analysis of covariance did not show the groups to differ from each other significantly in terms of treatment gains. There was a significant posiitve correlation between intervention time and treatment effect.

Conclusions:

More intervention indicates better treatment effects, especially when treatment allows for skill generalization through parent training, incorporating the natural milieu and typical peers. While the intervention and results are promising, replication with larger samples and use of a control group is needed.

131.046 46 Parent and Family Outcomes of PEERS Intervention. J. S. Karst*, B. Dolan, A. Meyer, K. Schohl, S. Stevens, S. Brockman, N. Fritz, C. Gasaway, G. McDonald, R. Remmel and A. V. Van Hecke, *Marquette University*

Background: The difficulties of children with Autism Spectrum Disorders (ASD) affect caregivers across a variety of domains. The impact of having a child with ASD appears to reverberate throughout the entire family system, and ultimately has transactional effects on the diagnosed child. Interventions for ASD do not necessarily ameliorate, and may even exacerbate, parent and family distress. Thus, comprehensive evaluation of interventions should include assessment of parent and family domains. The Program for the Education and Enrichment of Relationship Skills (PEERS; Laugeson & Frankel, 2009) is a manualized, evidence-based, social skills training intervention for adolescents with ASD. Parents participate in a concurrent, separate group designed to teach PEERS concepts to parents, generalize teen practice of skills outside of group, and troubleshoot issues with assignment completion and development of new teen friendships. Though numerous studies have suggested positive outcomes for teens following PEERS, no research has evaluated parent and family outcomes.

Objectives: The purpose of this study is to understand how participation in PEERS intervention affects parents and families of teenagers with ASD in terms of parenting efficacy, parenting stress, the parent-child relationship, and family functioning.

Methods: Sixteen parent-child dyads were randomly assigned to an "Experimental" (n = 8) or "Waitlist Control" (n=8) group for PEERS intervention. Parents in both groups completed the following measures at pre and post intervention: The parenting efficacy subscale of the Parenting Sense of Competency (PSOC); the Stress Index for Parents of Adolescents (SIPA), the Parenting Relationship Questionnaire (PRQ), and the Parent-Child Relationship Inventory (PCRI). Teenagers with ASD and their parents in the Experimental group then participated in 14 weeks of 1.5 hour sessions focusing on initiating and maintaining friendships. Mixed between-within subjects Analysis of Variance (ANOVA) was conducted to assess differences between groups over time.

Results: Results indicated a significant interaction effect between treatment condition and time, suggesting a reduction in total parenting stress in the Experimental group in comparison to the Waitlist Control group from pre- to post-PEERS intervention, $F(1,13) = 9.74$, $p = .008$, $\eta^2 = .428$. Additionally, there was a trend toward significant interaction effects between treatment condition and time for child autonomy, suggesting an increase in parent ratings of child autonomy within the Experimental group compared to the Waitlist Control group, $F(1,14) = 3.47$, $p = .083$, $\eta^2 = .199$. Finally, main effects analysis indicated that parents across groups experienced a significant decrease in relational frustration, $F(1,13) = 24.13$, $p < .001$, $\eta^2 = .650$, and family chaos, $F(1,14) = 5.34$, $p = .037$, $\eta^2 = .276$; along with a significant increase in parenting efficacy, $F(1,14) = 17.05$, $p = .001$, $\eta^2 = .549$.

Conclusions: These results suggest that significant, positive changes occur in parents and families of adolescents with ASD following involvement in PEERS. Specifically, parents participating in PEERS experienced decreased parenting stress following the intervention. Further, the parent-adolescent interaction following PEERS appears to facilitate increased teen autonomy, a developmentally important trajectory. In conjunction with previous literature on PEERS,

these findings highlight the comprehensive benefits of this intervention.

131.047 47 Executive Functioning Training in ASD. M. de Vries*[1], P. Prins[1], B. Schmand[2] and H. M. Geurts[1], (1)*University of Amsterdam*, (2)*Academic Medical Center Amsterdam*

Background:

There is an urgent need for effective interventions for children with autism spectrum disorders (ASDs). Most intervention studies focus directly on teaching of social and communicative skills. However, as children with ASD are known to show difficulties in executive functioning (EF), training these fundamental abilities might be susceptible for success. In developmental disorders related to autism, especially attention deficit/hyperactivity disorder (AD/HD), executive function interventions have been shown to generalize to domains that were not specifically targeted during the intervention.

Objectives:

The objective is to present the first results of an ongoing randomized clinical trial regarding the efficacy of two executive function interventions for children with ASD; a working memory training (WM) and a cognitive flexibility (CogF) training. The objective of the study is; 1) to improve the trained executive function; 2) to improve related executive functions; 3) that these functions will improve in everyday life; and 4) that this improvement will generalize to other domains, resulting in improvement in day-to-day behavior and quality of life. Currently we will focus on the influence of the two training versions on behavior in day-to-day life.

Methods:

Children with ASD (n=102, 8-12 years, IQ<80, reaching cut off scores on the SRS and ADI-R) will play an EF training computer game (randomly assigned to one of three different conditions; WM training, CogF training, or non-EF training). The training consists of 25 sessions, taking 40 minutes each, performed within 6 weeks. Each session contains two training blocks for each EF. Only the blocks of the trained EF will increase in difficulty; the other blocks will remain at a low level.

Children will be tested on three occasions; a pretest directly before onset of the training; a posttest directly after; and a follow up test six weeks after the training is completed. In children ToM, reward sensitivity, and EF will be examined. Questionnaires concerning EF (BRIEF), reward and punishment sensitivity (BIS/BAS), social behavior (CSBQ), behavioral problems (DBD), and quality of life (PedsQL) will be administered to the parents.

Results:

Currently, 32 children finished the whole game (about 10 in each condition). First analyses of the BRIEF questionnaire revealed that especially the working memory training improved executive functioning in everyday life. For May 2012, about 50 children will be included. Hence, more robust and powerful findings can be presented.

Conclusions:

Preliminary, in the currently analyzed small number of participants, the WM training improved daily life EF in children with ASD. We will analyze the other cognitive, behavioral, and quality of life measurements.

131.048 48 Longitudinal Data On EXECUTIVE Function and SOCIAL Cognition by CHILDREN with AUTISM. E. Thommen*, B. Cartier-Nelles, A. Guidoux and S. Wiesendanger, *University of Applied Sciences Western Switzerland*

Background:

Executive functions are well known abilities that are deficient in persons with autism spectrum disorders (Ozonoff & Jensen, 1999). Evaluating these competences in children with mild intellectual disabilities is still a challenge, generally, research concerns adults without disabilities. Social cognition in autism has been extensively investigated during the last thirty years. Children with autism are generally less good than control groups in theory of mind's tasks (Yirmiya et al. 1998; Peterson, et al. 2005). Emotional understanding is also regularly presented as deficient (Baron-Cohen, 1993; Celani et al., 1999; Thommen et al., 2004).

Objectives:

Our research focused on the evolution of these abilities for a period of one year and an half and analyzed the particularity of this evolution regarding children individually.

Methods:

We presented three executive tasks to 26 children with autism. The tasks come from the BADS-C (Emslie, Wilson, Burden, Nimmo-Smith & Wilson, 2003) and evaluate mental flexibility (Rule Shift Cards test) planification and the self-monitoring (Key Search test) and planification (Zoo Map test). Social cognition is assessed through the french version of the TEC (Test of Emotion Comprehension, Pons & Harris, 2005) and French version of the Tom Storybooks (Blijd-Hoogewys et al. 2003).

The children aged 6 to 14 years old were evaluated twice with an interval of one year and a half. All are evaluated with the Wechsler Nonverbal Scale, the E.CO.S.SE (French equivalent of TROG) and diagnosed with the DSMIV. They present mild intellectual disabilities and follow special school in the french part of Switzerland.

Results:

First results show important difficulties of these children to cope with the executive tasks. Generally they are not able to change their answer in the rule shift cards test nor to plan a route in the zoo map test. On the contrary, comprehension of emotional facial expression is good. Their results on theory of mind and on emotion understanding improve through time. The individual path will be presented at the congress.

Conclusions:

Our research shows that children with autism are able to improve their social cognition even if they present mild intellectual disability.

131.049 49 Increasing Social Interactions Using Typical Peer Training. A. C. Azarbehi* and W. Reeve, *Tyndale University*

Background: Children with Autism Spectrum Disorder (ASD) are often placed in integrated educational and recreational environments in the hopes that this will encourage their social development and provide opportunities for social interaction with typically developing peers. Unfortunately, mere proximity with typical peers is often not enough to produce social integration, and children with ASD often end up socially isolated even in the midst of a large group of peers. Peer training programs are designed to equip typical peers with functional skills that they can use to increase the number of positive social interactions that they have with their peers with ASD.

Objectives: (1) To examine the effectiveness of a peer training curriculum in increasing social interactions between children with ASD and their typical peers in a summer camp environment and (2) to explore what child characteristics might predict success in the peer training program.

Methods: At intake parents of both typical children, and children with ASD, completed questionnaire packages and structured interviews providing information on their child's cognitive, social, and emotional development as well as behavioral profiles. Prior to any peer training being done baseline data was gathered tracking the rate of social interactions between children with ASD and their typically developing peers. Typical peers were then provided with peer-training sessions that employed videos, social stories, direct instruction, modeling, rehearsal, and reward charts to equip them with practical skills that they could use to engage their peers with ASD in social interactions. Following the completion of the peer-training curriculum data was gathered tracking the rate of social interactions between children with ASD and their typically developing peers.

Results: Analysis of the data revealed extremely low rates of social interactions between typical peers and children with ASD prior to the social skills training being implemented, and significantly higher rates of social interactions after social skills training was completed. While the sample size was insufficient for an in-depth statistical analysis of individual typical-peer characteristics that predicted success some interesting trends were identified and explored.

Conclusions: Consistent with previous findings the data from the present study documents how mere proximity to typical peers is not enough to establish successful social integration between children with ASD and their typical peers. A peer training curriculum designed to equip typical peers with practical skills that they could use to socially engage their peers with ASD was found to significantly increase the rate of social interactions between children with ASD and their typical peers. While more research is needed, some interesting trends were identified when child-specific variables were examined in an attempt to predict which typical peers would be most successful at implementing the skills they learned during their peer-training program with their peers with ASD.

131.050 50 A Mixed Methods Analysis of a Social Group Intervention for Adolescents with Social Disabilities and Their Typically Developing Peers. K. Bottema*, *San Francisco State University*

Background: Individuals with autism experience difficulties in social interaction that can manifest in an increased risk for poor life-long outcomes including depression, anxiety, under-employment and a lack of community involvement. Adolescents with ASD experience a pronounced difficulty in engaging with peers as social interactions become more complex, and the likelihood of peer rejection and exclusion increases during this age period. To date, there is little research on social intervention strategies for adolescents with ASD as mandates for early intervention have led to a research focus on younger children.

Objectives: This study explores a social group intervention designed to promote engagement between teenagers with social disabilities and their typically developing peers.

Methods: A within-subjects experimental design was conducted, as well as qualitative discourse analysis procedures. 15 adolescents with autism spectrum or related social disorders and 24 typically developing peers were recruited from a summer sports camp where participants were enrolled in a counselor training program. These participants were divided into eight social groups that included a larger ratio of typically devleoping peers to adolescents who experienced social difficulty. An adult facilitator guided each intervention session, which lasted for one hour each day for a five day period. Quantitative analysis involved two constructs measured on a five point scale; the degree of affective engagement between participants and the 'flow' of interaction. Measurement contexts in the treatment phase included adult facilitated and un-facilitated interactions within the social group.

Results: Analysis revealed that participants with social difficulties made statistically significant gains after a treatment condition as compared to a control condition in the facilitated measurement context along both constructs. Detailed discourse analysis of the social group assessment contexts highlighted facilitation strategies that appeared to be important factors in sustaining interaction. The facilitator ensured that all participants had a relevant role in the activity, filled in gaps to maintain a smoothly flowing interaction, allowed peer culture to emerge by loosening traditional rules, adapted her interaction style to suit the target participant's preferred mode of interaction, and validated participant contributions.

Conclusions: The results of this study deepens current knowledge of social interaction among teens who experience social difficulty and their peers, as well as offers practical guidelines for promoting peer engagement in this population. Social groups that pair adolescents with autism or related social difficulties with their typically developing peers are an efficacious way of promoting quality social interaction.

131.051 51 Mindfulness in Mind-Blindness: What Are the Effects of Mindfulness Training in Teenagers with ASD?. E. I. de Bruin* and S. M. Bogels, *University of Amsterdam*

Background: Autism Spectrum Disorders (ASD's) are characterized by disturbances in social contact, communication, and stereotyped interests. Further, ASD is associated with deficits in theory-of-mind, such as empathy. People with ASD are sometimes considered to be mind-blind and mindfulness might not develop naturally. Further, ASD is also characterized by deficits in executive functioning such as attention, and a weak central coherence which in turn may lead to stress, anxiety and depression. Although impairments are chronic and societal costs of ASD are enormous, hardly

any effective treatments for children are available, and even less so for adolescents with ASD. This project focuses on the potential benefits of a new, innovative form of treatment for these adolescents, mindfulness training, which is shown to have beneficial effects on empathy, attention, stress regulation, and depression in adults from a variety of clinical and non-clinical populations. Mindfulness can be defined as paying attention in a particular way: on purpose, in the present-moment and non-judgmentally. Mindfulness training can be considered an attention training that is originally based on Eastern (Buddhist) meditation practices. Virtually no studies are carried out with respect to mindfulness training in ASD. We are aware of only one preliminary study which has shown positive effects of mindfulness training in adults with ASD, but the effects for adolescents with ASD has never been examined.

Objectives: The aim of this study is to assess the immediate and follow-up effects of mindfulness training in teenagers with ASD.

Methods: Adolescents (n = 12) and their parents participate in parallel eight-week standardized mindfulness training and Mindful Parenting training respectively. A DSM-IV classification of ASD is confirmed by ADOS-G assessment. Pre-intervention, post-intervention, and follow-up intervention (after two months) measurements are made. Assessment of internalizing (CBCL and TOF), externalizing (CBCL and TOF) and ASD related symptoms of difficulties in social interaction or communication (AQ and SRS) is carried out with the adolescent, the mother, the father and the objective research assistant as informants. Further, objective neuropsychological assessment of face and emotion recognition (ANT2.1), as well as attention (ANT) is carried out at the three measurement occasions. The adolescent's level of mindfulness is measured (CAMM and MAAS-A). Last, parent's reports of own symptoms (ASR and AQ), parenting stress (PSI and PS), general mindfulness (FFMQ) and mindfulness related to their parenting (IM-P) is assessed also at all three time points.

Results: This study is currently being carried out. Results will be available from January 2012. Therefore application for poster presentation is made (not oral).

Conclusions: Conclusions will be available from March 2012. Therefore application for poster presentation is made (not oral).

131.052 52 Pivotal Response Treatment (PRT) Is Ideal for Summer Camp, and Summer Camp Is Ideal for PRT. R. E. Daniels and M. Y. Boyars*, *Chicago Children's Clinic*

Background: Past research supports the use of Pivotal Response Treatment (PRT) in school, day care, and home settings with young children. Yet, there is a lack of empirical work addressing PRT's effectiveness when used in a summer camp setting. In addition, few studies investigate the efficacy of any intervention for older children. Summer camp provides the following advantages for studying the effectiveness of PRT: 1) Unlike school, camp activities are designed primarily to provide socialization and recreation opportunities for all participants; there are no academic demands competing for time and attention from the staff or the children. 2) Activities are less structured than at school, allowing accommodations for a child with autism's unique challenges or stereotypical interests. 3) A range of activities are available that provide varying levels of competition and socialization demands over the course of the camp experience.

Objectives: The social demands for 7-12 year-old children differ markedly from preschool-aged children. Consequently, it is necessary to examine whether strategies first developed for use with younger children are effective when applied to older child populations, in natural, inclusive settings. Our goal was to assess the feasibility and clinical benefits of providing PRT in inclusive camp settings with school-aged children.

Methods: A 9 year-old, verbal boy with autism who had never attended an inclusive summer camp was enrolled in a 4-week day camp. An undergraduate was provided a reading list of journal articles and a 2-hour, in-person training in PRT from a licensed clinical psychologist prior to beginning work as the child's social facilitator. Dependent variables included: a. Initiations of conversations and social interaction; b. Responsivity to initiations from adults and peers; c. Synchronous reciprocal social interaction, defined as: i. The children engaged in the same activity. ii. The children are initiating and responding to one another, iii. The interactions

are continuous and related to one another's behavior. Data were collected by in-vivo and videotaped coding of behavior. All video data were reviewed by a licensed clinical psychologist. Reliability between coders was > 90 percent. Additionally, qualitative observations were noted daily.

Results: Comparisons between the child with autism and typical peers indicated that at the beginning of camp, the child with autism demonstrated fewer initiations, had a lower rate of responsivity to adults and peers, and engaged in very low levels of synchronous reciprocal social interaction. As camp progressed, increases in all dependent variables were observed. Qualitative observations suggested that the child gained an understanding of teamwork and competition. In addition, he formed a reciprocal friendship with a non-disabled peer with whom he had two play outings outside of the structure of the camp.

Conclusions: These findings suggest the effectiveness of PRT in a summer camp setting with verbal, school-aged children with autism. Significant improvements were made in a short period of time, at low economic cost, with brief training of an undergraduate social facilitator.

131.053 53 Development of a School-Based Social Skills Program: The Role of Qualitative Data in Participatory Action Research. K. F. Ostmeyer-Kountzman* and A. Scarpa, *Virginia Tech*

Background:

Participatory action research (PAR) is a method used help develop interventions with the direct input of the target population. A primary assumption is that the understanding of a social problem requires the knowledge of directly affected individuals (Brown, 2009). PAR may provide an effective way for researchers to collaborate with their population of interest to develop valid treatments that address the needs of the population.

Social skills are a core deficit of children with autism spectrum disorders (ASD) and intervention is often needed to address these deficits. Unfortunately, services that address social skills are not always available (Rhoades, Scarpa, & Salley 2007). Even when they are, parents may lack the time, knowledge, and funds to pursue empirically-supported interventions (Little, 2003). Including social skills training in schools may help alleviate these problems.

Objectives:

The current study aimed to develop a school-based social skills intervention that could be refined and tested using PAR.

Methods:

Consistent with the first step of PAR design, a local elementary school was approached to assess for interest in a school-based social skills intervention. An intervention was proposed and both quantitative and qualitative data were collected to obtain more information on the nature of intervention desired. Quantitative data assessed perceived importance of an intervention using a rating scale of 1 (strongly disagree) to 5 (strongly agree) from interested school staff (N=14). Qualitative data emphasized feedback on how to best implement the intervention. Data were then reviewed with key staff to develop an intervention that was grounded in scientific theory and could be feasibly implemented.

Results:

Participants indicated that social skills interventions were needed (M=4.86), peers should be educated about ASD (M=4.64), educating peers about ASD would help interactions with ASD peers (M=4.64), peers should learn specific strategies to interact with ASD children (M=4.64), and can help children with ASD develop relationships (M=4.57), social difficulties affect academics (M=4.5), social difficulties affect relationship development (M=4.86), social skills training should be incorporated in schools (M=4.92), and they would be likely to use a social skills training program in the school (M=4.92). However, qualitative data provided information imperative to study findings. Participants indicated that they would prefer not to implement a program that took children out of the classroom. Concerns about lack of time for training and time taken away from academics were expressed. Participants suggested the program would be most successful if presented in a format that teachers can easily implement in the classroom and include the entire class. Based on these

findings, the researchers met with school administrators and key staff to develop a tentative research plan.

Conclusions:

Results of this study underscore the need for both qualitative and quantitative data to successfully perform the first step of PAR. While quantitative data showed strong interest in the program, qualitative data brought out specific concerns and suggestions. The importance of including both qualitative and quantitative data when doing PAR is discussed in regards to developing ASD interventions that are practical and accepted in the real world.

131.054 54 The Outcomes of a Psychosexual Training Program for Adolescents with ASD. E. van der Vegt*[1], L. P. Dekker[2], N. Tick[1], K. Visser[1], F. Boudesteijn[1], F. C. Verhulst[2], A. Maras[1] and K. Greaves-Lord[2], (1)*Yulius*, (2)*Erasmus MC - Sophia's Children's Hospital*

Background:

Individuals with autism spectrum disorders (ASD) are characterized by limited social insight and skills, as well as difficulties with coping with change. Therefore teenage is a difficult time period for such individuals. From the clinical practice it is known that adolescents with ASD can encounter difficulties regarding psychosexual development. The limited literature that is available tells us that these adolescents have similar needs and wants to typically developing adolescents, however that they lack the necessary skills, knowledge and insight to fulfill these needs and longings. Currently no evidence-based training tailored to the needs of adolescents with ASD is commonly available. Therefore an individual training program was developed targeting the psychosexual development of adolescents with ASD; the Tackling Teenage Training.

Objectives:

Our aim was to systematically evaluate the Tackling Teenage Training. This training program was specifically created to meet the needs of adolescents with ASD. Aims are to increase knowledge, skills, and self-esteem as well as to decrease worries regarding future quality of life. We currently examined the results of a pilot study. A full RCT will be started at the end of 2011.

Methods:

Adolescents were included if the training was indicated by a psychiatrist of psychologist of the Yulius Mental Health Centre. Before the training (T1) participating adolescents filled out the Teen Transitions Screen (TTS) adolescent version, a newly developed instrument to assess psychosexual development and identify putative problems. They also performed a knowledge test. Their parents filled in the TTS parent version as well as general characteristics about the family. After the training, both the parents and adolescents filled out the TTS again (T2). Adolescents also again performed a knowledge test. Of 19 adolescents both pre- and post-training data was currently available. Of this group 79% was male (N=15). Average age was 14 years at T1 and 15 years at T2. All IQ's were 75 or higher.

Results:

Both the adolescents and their parents reported an increase in having meaningful friendships. Furthermore, they both reported less difficulty with connecting with peers and forming friendships. Adolescents reported a decrease in their insecurity when connecting with peers as well as maintaining friendships. Parent and adolescent worries about the future generally decreased. However, both adolescents and parents reported more worries about the future autonomy of the adolescent. Knowledge increased significantly with a mean of 26 correct answers at T1 to a mean of 34 correct ($p<0.001$). IQ correlated significantly with the knowledge test results at T1 ($p=0.04$), but not with the scores at T2 ($p=0.20$).

Conclusions:

In general, the Tackling Teenage Training seems to generate a positive outcome regarding knowledge, social skills and worries regarding the future as reported by both parents and adolescents. However, some worries about the future increased. Potentially the training also creates more awareness of the adolescent's shortcomings and putative resulting problems in the future.

131.055 55 Computer-Based Interventions to Improve Social and Emotional Skills in Individuals with Autism Spectrum Disorders: A Systematic Review. S. Ramdoss*[1], W. Machalicek[2], M. Rispoli[3], A. M. Mulloy[4], R. Lang[5] and M. F. O'Reilly[1], (1)*The University of Texas at Austin*, (2)*University of Oregon*, (3)*Texas A&M Univ*, (4)*Virginia Commonwealth Univ*, (5)*Texas State University*

Background:

Regardless of cognitive abilities and severity of symptoms, all individuals diagnosed with an Autism Spectrum Disorder (ASD) experience significant challenges regarding the development of social and emotional skills. Circumventing such challenges often require special and intensive instruction and support. Computer-Based Instruction (CBI) represents a potential instructional method for teaching social and emotional skills to individuals diagnosed with ASD. Further, CBI can be tailored to meet the unique learning needs of individuals with ASD. Given the decent number of studies have been conducted to improve social and emotional skills in moderately large number of individuals with ASD, a systematic review of research is warranted.

Objectives:

The purpose of this review is to provide a systematic analysis of studies involving the use of CBI to teach social and / or emotional skills to individuals with autism spectrum disorders (ASD). This review has three main aims: a) to evaluate the evidence-base regarding CBI, b) to inform and guide practitioners interested in using CBI, and c) to stimulate and guide future research aimed at improving the efficiency and effectiveness of CBI for development of social and emotional skills in individuals with ASD.

Methods:

Systematic search of four comprehensive databases, along with hand searches of major, relevant journals, were conducted to find peer-reviewed intervention studies that were published between 1990 and 2010. This review summarizes, synthesizes, and evaluates intervention outcomes, appraises the certainty of evidence, and describes software and system requirements for each included study.

Results:

The systematic search yielded 11 studies (12 experiments) involving the use of CBI to teach social and emotional skills to a total of 269 participants diagnosed with ASD. Studies that measured the effectiveness of CBI on social skill relevant repertoires (e.g., social competence, social interaction, spontaneous social greetings) reported consistently positive outcomes. However studies that measured the effectiveness of CBI on facial processing skills reported inconsistent outcomes within and across studies. Finally, measures related to effectiveness of CBI on teaching false-belief tasks were inconclusive. Given the heterogeneity of the participants and the wide variety of social and emotional skills targeted for instruction, it is not possible from the existing literature to determine the variables most likely to be associated with effective CBI.

Conclusions:

Experimental measures developed by study authors yielded positive results and larger effect sizes more often than standardized norm-referenced measures. Only three studies reported anecdotal evidence of in-vitro generalization and none of the studies have demonstrated the generalization of acquired skill to everyday life. Outcomes obtained from two studies suggest that the magnitude of improvement in emotion recognition is positively correlated with the number of times the program was used. Finally, possible directions for future research will be proposed in terms of using more rigorous standardized measures, using CBI in conjunction either with a group activity or under the guidance of an adult tutor, and discovering the time course for the plasticity of emotion recognition.

131.056 56 Development of a Novel Social Skills Training Curriculum. R. Shaffer*[1], L. Wink[2], N. Minshawi[2] and C. Erickson[2], (1)*Indiana School of Medicine*, (2)*Indiana University School of Medicine*

Background:

Social skill deficits are a key area of difficulty for children with Autism Spectrum Disorders (ASD). Given the limited attention focused on treating this core feature of ASD, a randomized, placebo-controlled trial of D-Cycloserine was combined with an intensive social skills training curriculum. D-Cycloserine was selected based on prior research that has demonstrated its ability to enhance learning. Few comprehensive social skills programs have been developed for use with children ages five- to eleven-years-old. Therefore, careful consideration had to be given to the type of social skills curriculum utilized in this study.

Objectives:

The objective of this study was the development of a manualized social skills curriculum for use as part of a study of D-Cycloserine.

Methods:

After a thorough search of published curriculums and literature, it was determined that a novel curriculum should be created given that available curriculums did not meet the needs of the specific age group of children included in the study. The next decision was which skills should be taught and the method of teaching. Given the variety of social skill deficits present in children with ASD, this was a very important topic to consider. Whether the manual should be highly structured or more clinician-driven was also an important determination. Another key consideration was whether typical peers should be included in the group and what their role would entail. A final topic of interest was who should be the group providers.

Results:

It was determined that the topics of focus for the curriculum would include greetings, conversations, emotions, and saying good-bye, all of which are basic social skills that are lacking in children with ASD. An Applied Behavior Analysis (ABA) based approach was identified for use in the curriculum based on the empirical support for these teaching strategies within the ASD literature. Teaching strategies such as the use of visual supports, social stories, role plays, and cooperative activities were used to teach and practice each skill. Homework was included in order to help reinforce the materials learned in the sessions and to aide in generalization.

A structured manual designed to meet the needs of the group was determined to be the most appropriate in order to promote consistency and reproducibility. In order to provide models of appropriate behavior, two typical peers were trained and included in each group. Masters or doctoral-level providers with experience in ABA were selected as facilitators given their level of training with children with ASD.

Conclusions:

While the literature on the treatment of children with ASD continues to grow, one area that is particularly lacking is research on the treatment of the core social impairment of this disorder. Social skills training presents with a number of complex study design challenges, all of which must be carefully considered and addressed prior to completion of any social skills research. This curriculum addresses each design challenge and provides a manualized treatment approach for social skills training of five- to eleven-year-old children with ASD. Future research into the effectiveness of this manual is necessary.

131.057 57 Direct and Indirect Changes in Children with Autism Spectrum Disorders and Their Parents After a Social Skills Intervention. M. A. Viecili*[1], S. Robinson[1], J. A. Weiss[1], Y. Lunsky[2] and L. Sloman[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Youth with high-functioning autism spectrum disorders (ASD) have severe deficits in sociocommunicative competence, which can lead to mental health problems and difficulties in school and social environments (Little, 2001). Parents of children with ASD also experience difficulties, and have a higher risk for parenting stress and psychological distress than parents of typically developing children (Baker-Ericzén, Brookman-Frazee, & Stahmer, 2005). It is important to evaluate how social skills programs can benefit both youth and parents.

Objectives: This study examines psychological changes in children and parents following participation in a 10-week hospital based social skills intervention that involves both child

and parents. Areas of anticipated improvement for youth included increases in social skills and decreases in problem behaviours (direct outcomes), and increases in self-esteem and in friendships that formed during group (indirect outcomes). It was hypothesized that parents would also experience a number of indirect outcomes, including being more able to cope with the difficulties associated with raising a child with ASD, increased empowerment, and increased knowledge of ASD.

Methods: Thirty-five youth between the ages of 6 and 14 years of age (M = 10.56, SD = 2.09) and their parents participated in the social skills group. Pre-post data was collected from both youth and parents on measures of social skills and problem behaviors using the Social Skills Improvement System Rating Scales (SSIS; Gresham, & Elliott, 2008). Children also completed the Self-Perceptions Profile for Children (Harter, 1985). Parents completed questionnaires on their own feelings of parenting competence, psychological acceptance, and empowerment.

Results: Children experienced significant increases on the Social Skills Standard score according to both parents, $t(18) = -2.46$, $p = .02$, $d = -.56$, and children, $t(27) = -2.11$, $p = .04$, $d = -.40$. Children reported significant increases in their overall self-worth, and 81% of parents reported that their child had made a friend with another child in the social skills group. Parents did not report significant decreases in child problem behaviour. With regards to parent experiences, parents reported increases in psychological acceptance, $t(24) = -2.50$, $p = .02$, $d = -.50$, and felt significantly more empowered in utilizing services within their communities, $t(25) = -3.05$, $p = .005$, $d = -.60$. Parents did not report a significant increase in their feelings of parenting competence, $t(25) = -.11$, $p = .91$, $d = -.02$, however there was a significant increase in their knowledge of ASD, $t(24) = -3.67$, $p = .001$, $d = -.73$.

Conclusions: There is evidence that social skills groups can be beneficial to children with ASD. The current study suggests that social skills groups can also offer indirect benefits for children and for parents, including increases in child self-esteem, and parent feelings of acceptance and empowerment. Future research is needed to understand the reciprocal nature of child and parent variables in parent-involved social skills training programs.

131.058 58 Emotional Intelligence As a Moderator of Distress in Parents of Children with Autism Spectrum Disorder (ASD). E. Cooper* and A. Perry, *York University*

Background:

Previous research suggests that parenting a child with ASD is typically associated with considerable distress, particularly for mothers, though research on this topic often does not include fathers. Interestingly, research also suggests that some families with a child with ASD do not report increased levels of distress and, further, some research reports positive outcomes. Prior research has explored the impact of child characteristics (e.g., severity of disability), the presence of formal and informal social supports, as well as the influence of parent and family characteristics (e.g., financial resources, coping) on outcome. However, to date, research has not examined the influence of emotional intelligence (EI) on parent outcome. EI refers to the ability to perceive, understand, and manage emotions.

Objectives:

The purpose of the current study was to: 1) examine the EI profiles of mothers and fathers of children with ASD, with a particular focus on which aspects of EI relate to mothers' and fathers' positive and negative outcomes; 2) document the relationship between child-related stressors (age, gender, and child difficulty), and mothers' and fathers' positive and negative outcomes; and 3) investigate whether EI moderates the relationship between child as stressor and these positive and negative outcomes.

Methods:

This project is part of a larger study examining family functioning in families with a child with ASD (Diamond, 2004). One aspect of the larger study involved parents completing questionnaires related to parental distress, positive and negative impacts on family functioning, positive change, and emotional intelligence. Participants were 51 couples raising children with ASD, aged 2 to21.

Results:

Each of the five EI factor scores (Intrapersonal, Interpersonal, Stress Management, Adaptation, and General Mood) were negatively correlated with both mothers' and fathers' ratings of parental distress. Thus, parents with higher EI scores, reflecting greater emotional self-awareness, interpersonal relationships, stress tolerance, problem solving, and happiness, indicate less distress. Two EI factor scores (Intrapersonal and General Mood) were positively correlated with mothers' ratings of positive change, but there were no significant correlations between any of the five EI factor scores and fathers' ratings of positive change. As well, mothers' and fathers' ratings of their child as difficult were positively correlated with their ratings of distress. Thus, the greater parents' perception of their child's difficulty, the greater their reports of distress. Analysis related to EI as a moderator of distress is underway.

Conclusions:

Findings are consistent with research that shows that parents of children with ASD report negative as well as positive outcomes as a result of raising a child with ASD and, further, that their EI is related to these outcomes. These findings have important implications for parents and clinicians. Understanding what factors assist parents of children with ASD in achieving more positive outcomes, while minimizing negative outcomes, may prove helpful particularly when those factors may be, like EI, amenable to intervention.

131.059 59 Predictors of Outcome in a Community Based Parent Training Program. S. Godleski*[1] and A. L. Valentino[2], (1) *Marcus Autism Center, Children's Healthcare of Atlanta, and University at Buffalo, SUNY*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Research that has been conducted on predictors of parent training program effectiveness (e.g., Kaminski, Valle, Filene, & Boyle, 2008) has found predictors of success in regards to the components of the treatment package and training provided. However, there is less research on aspects of parent, child, and family characteristics that may make it more or less likely for a parent training program to be effective despite the potential utility of such information for making treatment decisions. Further, it has been suggested that in research on psychosocial interventions for children with autism spectrum disorders that sources of variation, such as family variables or individual differences (e.g., ethnicity) of children and families, should be considered (Lord et al., 2005).

Objectives: Using data collected as part of a treatment program providing education to families of children with autism spectrum disorders, possible family and individual difference predictors of treatment outcome (i.e., change in problem behaviors) will be analyzed with a relatively diverse sample of children and families using multiple regression and ANOVA statistical procedures.

Methods: Information on ethnicity and child age will be gathered. Further, the General Maladaptive Index of the Scales of Independent Behavior–Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996) will be used as a primary measure of behavior problems exhibited for pre- and post- treatment. This rating scale represents a variety of problem behaviors, such as destructive, disruptive, and inattentive behaviors. Models will also explore subscale index scores (i.e., Internalized Maladaptive Index, Asocial Maladaptive Index, and Externalized Maladaptive Index). Data on parent skill acquisition as well as number of sessions attended will also be used as possible predictors of change in SIB-R scores.

Results: To begin, descriptive statistics and correlations will be explored. Subsequently, two sets of regression analyses will be conducted. Multiple regression analyses will be used to analyze predictors (e.g., age of child, ethnicity, SIB-R score at initial assessment, parent skill acquisition) of change in SIB-R General Maladaptive Index scores across treatment. Changes in the subscale scores will also be explored for those that completed the full treatment package. In addition, predictors of changes in SIB-R scores will also be considered for families that did not complete treatment, with number of sessions considered as a covariate. Finally, group differences will be explored between those who completed treatment and those families that did not.

Conclusions: Data will be interpreted in regards to the importance of including potential covariates or predictors in research on outcomes in parent training programs of children with autism spectrum disorders. In particular, whether change in problem behavior reached levels of clinical significance will be evaluated. Implications for research and practice for parent training programs will be discussed.

131.060 60 Effect of a Short-Term Treatment Program for Anxiety in Children Diagnosed with Autism Spectrum Disorders. W. Noda*[1], T. Hagiwara[2], N. Mochizuki[1], M. Iwasaki[3] and M. Tsujii[4], (1)*Hamamatsu University School of Medicine*, (2)*Hokkaido University of Education*, (3)*Asperger Society Japan*, (4)*Chukyo University*

Background: Children with autism spectrum disorders (ASD) have difficulties in understanding and controlling their emotion. Especially, children diagnosed with high functioning autism and Asperger syndrome have more anxiety problems compared with a community sample (Kim et al., 2000). Furthermore, children with anxiety problems were also rated as more aggressive, and as having poorer relationships with peers and teachers (Kim et al., 2000). Therefore, interventions aimed at reducing anxiety for children with ASD may reduce aggression and improve relationships with family, peers and teachers. Sofronoff et al. (2005) developed a cognitive behavioral intervention program for anxiety in children with Asperger syndrome and demonstrated its effectiveness in randomized controlled trials. However, few anxiety treatment programs for children with ASD have been developed in Japan.

Objectives: The purpose of the present study was to evaluate the effectiveness of a short-term treatment program for understanding and controlling anxiety in children diagnosed with ASD. The program was conducted during a summer camp session of a non-profit organization in Japan.

Methods: Six students with ASD aged 10 to 16 participated in the program. The presence of their anxiety symptoms was reported on parent reports. All children belonged to the NPO, the Asperger Society Japan. This organization runs the 5-day summer camp every year and the treatment program for this study was included in this camp. This program was designed to be highly structured, informative and entertaining. All children received materials for the three two-hour sessions (the second to fourth day of the summer camp) that included information on the relationship among emotion, cognition, and body, 5-point scale of emotion, 5-stage table of anxiety, and 5 cards with anxiety control strategy. In the first session, therapists and children discussed how to understand emotion of themselves through filling out 5-point scale of emotion and watching their own faces by movie. In the second session, the students reviewed a general emotion understanding with video self-monitoring, and then they learned how to understand and control their own anxiety. In the third session, they learned concrete strategy for controlling anxiety through a group-game. The degree of the students' understanding and controlling their anxiety was measured using the Evaluation Sheet for Emotional Control (Myogan, 2009) that was rated by their parents, and observing the use of control strategies generated by children.

Results: Results indicated that all six children recognized the necessity of controlling emotion, controllability of emotion, and how to control emotion after the program; they had not demonstrated these before attending the program. In addition, the number of control strategies generated by children increased, and appropriateness of these strategies changed into more favorable. However, individual differences in understanding and utilizing own strategies existed.

Conclusions:

A short-term summer treatment program for anxiety with children diagnosed with ASD was partially effective but some refinements are still needed. Further research is needed to improve the effectiveness of the program for anxiety in children diagnosed with ASD.

Part of this work was supported by JSPS Grant-in-Aid for Scientific Research (C) (22531048).

131.062 62 SENSE Theatre - Bridging Art and Science to Improve Social Interaction in Autism. B. A. Corbett*[1], C. Coke[2], C. R. Newsom[1], E. Bingham[1], T. Stromp[1], D. Swain[1], C. Taylor[1], L. Wang[1] and Y. Song[1], (1)*Vanderbilt University*, (2)*University School of Nashville*

Background: Deficits in social skills prevent children with autism spectrum disorders (ASD) from achieving age-appropriate developmental milestones and as a consequence, they struggle to establish interpersonal relationships, especially with peers. Furthermore, many children with ASD exhibit notable stress in response to engaging with others.

Objectives: The purpose of the study was to evaluate social interaction skills and stress responsivity in children with ASD before and after a novel intervention, SENSE Theatre, using behavioral and theatrical approaches. A previous SENSE Theatre study occurred over a 3 month span, utilizing a distributed model of the program, whereas the current study used a massed practice model implemented in a two-week intervention summer camp concluding with two public performances of an original play.

Methods: The intervention combined established behavioral strategies (e.g., peer-mediation, video modeling) alongside theatrical techniques (e.g., improvisation, role-play) to target social interaction and stress responsivity. Participants included 11 youth with ASD 7 to 18 years (7 males, 4 females), including nine Caucasian and two African-American children. Neuropsychological and observational measures of social perception and interaction as well as biological (cortisol) and parent report measures of behavioral stress were assessed using a within-group pre-test, post-test design with Wilcoxon signed-rank test for the pairwise comparisons.

Results: Significant changes occurred in social interaction behaviors conducted by two independent raters for mutual planning ($p=0.001$, $r = 0.75$), eye contact ($p=0.002$, $r = 0.37$), negotiation ($p = 0.001$, $r = 0.74$), and sharing ($p=0.002$, $r = 0.79$). There were no changes on neuropsychological measures of social perception over the two week camp (all $p>0.05$). However, significant reductions in stress responsivity (cortisol) were observed on the first day compared to home sampling ($p=0.04$, $r=0.48$). Additionally, there was a significant decrease in behavioral stress (SSS) reported for positive ($p=0.03$, $r = 0.27$) and sensory ($p=0.004$, $r = 0.54$) stimuli.

Conclusions: The findings revealed within-treatment-context change in social interaction skills with peers, a lack of physiological stress and reductions in behavioral stress ostensibly stemming from participation in the two-week intervention. The findings support the incorporation of trained peers in a community service model utilizing theatrical techniques for improving social interaction in youth with ASD.

131.063 63 Phase IV-Community Effectiveness Trial of a Psychosocial Treatment for Children with HFASDs. C. Lopata*[1], J. A. Toomey[2], M. L. Thomeer[1], J. D. Fox[3], D. Meichenbaum[2], M. A. Volker[4] and G. K. Lee[4], (1)*Institute for Autism Research, Canisius College*, (2)*Summit Educational Resources*, (3)*Autistic Services Inc*, (4)*University at Buffalo, SUNY*

Background: Children with high-functioning ASDs (HFASDs) require comprehensive treatments, yet few have been validated in rigorous studies. A NIMH working-group (Smith et al., 2007) proposed a 4-phase model for conducting ASD intervention studies: Phase I–development/testing of new techniques; Phase II–development/testing of a manualized protocol; Phase III–randomized clinical trials (RCT); and Phase IV–community effectiveness studies (implementation by a community agency). Lopata and colleagues developed and evaluated the efficacy of a summer psychosocial intervention in a series of studies (2006; 2008; 2010) that followed NIMH guidelines including a Phase III-RCT (2010) that established the treatment program's efficacy.

Objectives: This Phase IV-community effectiveness trial evaluated the (1) effectiveness of the summer intervention on the ASD-symptoms and social performance of children with HFASDs; and (2) feasibility (satisfaction and fidelity) when administered by a community agency.

Methods:

Participants. Twenty-eight children, ages 7-10 with HFASDs; inclusion criteria – short-form IQ factor score >80; receptive or expressive language score >80; and score meeting ASD criteria on the ADI-R/ADOS/or SCQ.

Outcome measures. Parent and staff ratings – *Social Responsiveness Scale* (SRS; assesses ASD features); *Behavior Assessment System for Children-2* (BASC2; Adaptive Skills and Social Skills subtests). Child testing –

Comprehensive Assessment of Spoken Language (Idiomatic Language subtest); *Diagnostic Analysis of Nonverbal Accuracy2* (Child Faces subtest). Satisfaction measured using parent, child, and staff *Satisfaction Surveys*.

Procedures. Groups included 7 children with HFASDs and 3 staff. The manualized program was implemented 5 days/week, 7.5 hours/day over 5-weeks during the summer. Treatment included (1) social skills instruction, (2) face-emotion instruction, (3) interest expansion activities, and (4) non-literal language instruction, along with weekly parent training. A response-cost system was used to strengthen new skills and reduce problem behaviors. The daily schedule included five 70-minute treatment cycles; each consisting of a 20-minute structured skills group and a 50-minute therapeutic activity. Fidelity was assessed throughout treatment. Efficacy measures were administered pre-post treatment (one-tailed) and satisfaction post-treatment.

Results: Results indicated significant decreases in ratings of ASD-symptoms (SRS parent $t(26)=4.592$, $p<.001$; staff $t(27)=4.178$, $p<.001$) and significant increases in social skills (BASC2 parent $t(26)=-2.505$, $p<.009$, staff $t(27)=-3.890$, $p<.001$) and adaptive skills (BASC2 parent $t(26)=-2.522$, $p=.009$, staff $t(27)=-4.626$, $p<.001$). Child testing indicated a significant increase in understanding of non-literal language (CASL Idioms $t(27)=-8.081$, $p<.001$) and non-significant increase in decoding of facial emotions (DANVA2 Child Faces $t(27)=-1.506$, $p=.072$). Fidelity was 92.3% for skills groups and 93.5% for therapeutic activities. Satisfaction ratings were positive from parents, children, and staff.

Conclusions: Results of this Phase IV-community effectiveness trial suggest that the comprehensive summer program was feasible when conducted by a community agency (high levels of fidelity and satisfaction). Participation in the program was associated with a significant reduction in ratings of ASD symptoms and significant increases in social and adaptive skills. Children with HFASDs demonstrated a significant increase in understanding of non-literal language (idioms). Decoding of emotions in child faces also improved however this was not statistically significant. A large-scale Phase IV-community-effectiveness controlled trial appears warranted.

131.064 64 Can the PEGASUS Psychoeducational Programme Improve the Understanding, Well-Being and Functioning of Young People with ASD Diagnoses and That of Their Families? A Randomised Controlled Trial.

R. K. Gordon*[1], V. Livermore-Hardy[1], O. Baykaner[2], C. Willis[3], L. Roughan[1], M. Murin[3] and W. P. Mandy[4], (1)*Great Ormond Street Hospital*, (2)*UCL*, (3)*Great Ormond Street Hospital for Children*, (4)*University College London*

Background: Despite the increased focus on early recognition and diagnosis of ASDs, very little is known about how to best help children integrate their "label" in a positive way, without negatively impacting on their self-esteem and identity. The very nature of ASDs, associated with impaired communication, insight and self-awareness, present a challenge for clinicians who are approached for advice on how to best communicate the diagnosis to the child. There is anecdotal evidence that person-centred psychoeducation, self management training and support after diagnosis can enable people to develop helpful perceptions of their psychiatric condition, and can alleviate feelings of isolation and stigmatisation (Chowdhury, 2003; Proudfoot, et al, 2009). However, currently there are no evidence-based guidelines for clinicians or parents on how to communicate the diagnosis of ASD to children or their parents. Neither are there any psychoeducational packages available for children that are designed both to prevent negative attributions associated with the diagnosis of ASD, and to increase self-awareness and coping strategies.

Objectives: The study aims to evaluate the efficacy of PEGASUS, a new group psychoeducational programme designed for children with ASD and their parents according to the principals of modified cognitive behavioural therapy (CBT). PEGASUS comprises 6 weekly sessions, each lasting 1.5 hours with separate parallel sessions for children and for parents. PEGASUS aims to enable children to acquire a more balanced understanding of their unique strengths and difficulties and to enhance self-management strategies tailored to the child's individual needs by means of personalised 'toolkits' and, by extension, improve family functioning.

Methods: 48 children (9-14 years) with diagnoses of High Functioning Autism or Asperger's Syndrome and their parents are currently being recruited. These families will be randomly allocated to treatment or control groups. Treatment and control groups will be matched according to age, IQ, gender ratio and degree of autistic impairment. Those in the control group will receive 'management as usual'. Measures of ASD knowledge, self-esteem, functional adaptation and family functioning will be taken at pre-treatment, post-treatment and at 3-month follow-up. Outcome measures will be collected by researchers blind to group allocation.

Results: The pilot study is currently underway involving 5 young children and their parents. Baseline data suggest 3 of the 5 parents were suffering significantly high levels of stress. Qualitatively, other clear themes emerging from parents are their desire and need for more support in explaining the ASD diagnosis to their children and feelings of isolation and helplessness. Groups for the RCT are due to start in January 2012 and pre-post data from three groups will be available for presentation at the conference.

Conclusions: PEGASUS is the first psychoeducational programme for children designed both to prevent negative attributions associated with the diagnosis of ASD, and to increase self-awareness and coping strategies. Furthermore, this is the first study to evaluate the efficacy of a psycho-educational programme around ASD diagnosis for children. This is a unique and potentially important study for evidence-based practise with children with an ASD diagnosis.

131.065 65 PEERS Treatment Leads to Increased Neural Activity in Adolescents with ASD. A. V. Van Hecke*, A. Meyer, S. Stevens, B. Dolan, J. S. Karst, K. Schohl, S. Brockman, R. Remmel, N. Fritz, C. Gasaway and G. McDonald, *Marquette University*

Background:

The Program for the Education and Enrichment of Relational Skills (PEERS), a 14-week, manualized, empirically-validated treatment, focuses on improving friendship quality, decreasing social isolation, and increasing social skills among adolescents with high-functioning ASD (Laugeson et al., 2009; 2010). However, few studies to date have examined neurological change or plasticity in ASD due to intervention, even though evidence increasingly highlights the brain-based nature of the disorder. Plasticity measures would also significantly assist in understanding how and why certain treatments are effective in ASD. Likely candidates for plasticity in ASD include the frontal lobe, a key area of the "social brain" known to contribute to initiation and regulation of social behavior (Adolphs, 1999). Additionally, measures of continuous electroencephalogram (EEG) activity may be especially well-suited to studying overarching changes in neural activation due to intervention, with gamma band activity (30-45 Hz) of particular interest, as activity in this range has been linked to higher-order cognitive function and synchronized neuronal firing (Miltner et al., 1999), processing of faces (Balconi&Lucchiari, 2008), and response to emotion (Li & Lu, 2009), all of which likely contribute to social behavior.

Objectives:

The objectives of this study were to examine changes/plasticity in EEG gamma activity, and behavioral correlates of neural change, in adolescents with ASD who underwent PEERS treatment.

Methods:

Forty 11-15 year-old adolescents with ASD were recruited and randomly assigned to either an Experimental Treatment Group (EXP) or a Waitlist Control Group (WL).Pre- and post-PEERS (pre- and post- a 14-week delay for the WL group) measures included parent report of symptoms of autism, via the Social Communication Questionnaire (SCQ: Rutter, Bailey, & Lord, 2003). Pre- and post-PEERS continuous EEG activity was collected from adolescents during a 3-minute resting, eyes open condition, using an Electrical Geodesics amplifier and 64-channel net. Artifact-free activity from left (9, 10/FP1, 11, 12/F3, 13, 17, and 18/F7) and right frontal hemisphere (1, 2, 3, 5/FP2, 58/F8, 59, and 60/F4) electrodes was epoched and averaged in the spectral domain using a Fourier transform in Neuroscan Edit 4.5, with gamma activity defined as 30-45 Hz.

Results:

Preliminary results include available data from the EXP group(n = 10). A significant time x hemisphere interaction, F (1, 9) = 10.238, p< .05, partial eta^2 = .53, indicated that both left and right frontal hemisphere gamma power increased from pre- to post-treatment, with more dramatic increases in left versus right hemisphere. Increases in left and right frontal EEG gamma activity after PEERS were significantly associated with parent-report of fewer autistic symptoms on the SCQ at post-treatment, r = -.63, p< .05.

Conclusions:

Initial results suggest that adolescents who complete PEERS intervention show evidence of increased higher-order neural activity in the frontal lobe. An increase in frontal lobe activity was also associated with fewer symptoms of autism at post-treatment. Ongoing analyses will include additional participants in the EXP group, add the WL group data, and analyze additional data from other cortical sites, frequency bands, and EEG connectivity (coherence).

131.066 66 Replicating the PEERS Program in a Public School Classroom. L. Hall*[1] and B. Kraemer[2], (1)*San Diego State University*, (2)*SDSU*

Background:

The Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010) is a manualized social skills curriculum for adolescents with autism spectrum disorders and their parents. The program has been demonstrated as effective when implemented by clinicians in an outpatient setting (Laugeson, Frankel, Mogil, & Dillon, 2009). The focus of this presentation is on the outcomes of a replication of the PEERS model when implemented by a middle school teacher working in a public school. Most adolescents are educated in public schools and youth with ASD can benefit from participation in an effective social skills program.

Objectives:

The purpose of this study is to test the effectiveness of the PEERS curriculum in a school setting using teacher-facilitation.

Methods:

Eight adolescents (5 with ASD; 3 with ID) in the same middle school classroom participated in a 14-week PEERS program conducted in the public school classroom by their teacher trained in the model from the model developers. Handouts with information on the topics addressed were sent to parents weekly. Pre and post program measures were collected on the the *Social Skills Improvement System* (SSIS; Gresham & Elliot, 2008), by parents and the teacher; the *Social Behavior Questionnaire (SBQ)* by the parents and a paraprofessional working with the group; the *Test of Adolescent Social Skills Knowledge* (TASSK; Laugeson & Frankel, 2006) and a *Social Validity Survey* designed for the purposes of this study was completed by each student participant.

Results:

Pre-post intervention measures revealed an improvement in all subdomains of the SSIS as reported by parents with pre-intervention mean scores of 89.29 (*SD* = 16.96) and post-intervention scores with a mean of 95.86 (*SD* =13.64), with a 6-point increase (t= 2.59, p < .05) and a significant improvement on the *Engagement* subscale. The teacher's measures the mean pre intervention standard score was 89.13 (*SD* = 6.85) and post intervention was 96.63 (*SD* = 7.48), with a 7-point increase (t= 2.87, p < .05). Subscale analysis reveals an improvement in all subdomains, with a significant improvement on the *Assertion* and *Self Control* subscales. There was also a significant different in the mean pre and post intervention scores on the TASSK (t = 3.65; p < .01). Seven of the eight students showed improvements on their knowledge of social skills rules taught. The items that showed the largest number of students that perceived self-improvement on the SBQ were: hosting get togethers and letting friend choose the activities, (87% of students reporting perceived self-improvement); when teased, acting like it doesn't bother you, (63% of students reporting perceived self-improvement); not leaving too many phone messages in a row for a peer and the ability to tell when people don't want to talk to you, (50% of students reporting perceived self-improvement).

Conclusions:

This study provides evidence that the PEERS social skills intervention program (Laugeson & Frankel, 2010), can be used within a classroom setting implemented by school staff with demonstrated increased social knowledge and skills by adolescents with ASD.

131.067 67 SOSTA-Net: A Large Scale, Multi-Center, Randomised Controlled Trial of the Autism Specific Social Skills Training SOSTA-FRA. C. M. Freitag*[1], H. Musch[1], L. Elsuni[1] and M. Kieser[2], (1)*JW Goethe University Frankfurt am Main*, (2)*Ruprecht-Karls University Heidelberg*

Background:

Social skills training has strongly been recommended as treatment of choice for children and adolescents with HF-ASD. Most published studies have implemented a pre-post design, and only a few small scale, randomised controlled studies have been performed. Long-term outcome has rarely been assessed.

As HF-ASD individuals suffer from impairments in basic non-verbal and verbal communication skills, social understanding, decoding of emotional expression, self-perception, social perception, planning, problem solving, and impulse control, but on the other hand are strongly interested in contact with peers and friendships, and also have good skills of role-playing and rule-based learning, these aspects were included in the highly standardized and manualized 12-week group treatment program SOSTA-FRA. Homework aims to promote generalization, and positive re-inforcement strategies increase motivation and lead to a positive interaction between group participants.

Objectives:

Here, we describe the manualized training and the study design, and present preliminary descriptive data on the study participants.

Methods:

Two-hundred and twenty HF-ASD individuals, aged 8 – 20 years old, meeting ADI-R and AODS criteria for autism, Asperger Syndrome or PDD-nos, with an IQ > 70 will be included into the study. The following study centres participate: University departments of Child and Adolescent Psychiatry in Aachen, Frankfurt, Homburg, Köln, Mannheim, and Würzburg, Germany. The primary outcome measure is change in parent rated SRS; secondary outcome measures are the teacher rated SRS, CBCL, TRF, SDQ, and DIKJ at post-treatment and after 3 months follow-up.

Results:

To date (November 2011), 135 children have been randomized.

Conclusions:

The manualized social skills training program SOSTA-FRA is a program which is well accepted by children and adolescents with HF-ASD and can easily be implemented in professional settings, where behavioral therapy is practised.

131.068 68 Benefits of a Social Skills Intervention in Residential Treatment Settings for Adolescents with Autism Spectrum Disorders: The UCLA PEERS Program. A. J. Vreeland*[1], E. Laugeson[2], J. Romeyn[3], L. Tucci[4] and R. W. Ellingsen[5], (1)*UCLA Semel Institute for Neuroscience and Human Behavior*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*, (3)*The Help Group*, (4)*The Help Group-UCLA Autism Research Alliance*, (5)*UCLA*

Background: Residential programs for individuals with autism spectrum disorders (ASD) have helped adolescents and adults move toward greater independence from their families. However, little is known about the effectiveness of these programs in the areas of socialization, communication, and peer relations. The UCLA PEERS Program (Laugeson & Frankel, 2010), a social skills group intervention for high-functioning adolescents with ASD, teaches teens ecologically valid rules and steps of social etiquette that target the development and maintenance of friendships. In outpatient mental health settings, PEERS has been shown to increase social engagement and improve overall social skills and social responsiveness in teens and young adults with ASD (Laugeson et al., 2009; Laugeson et al., 2011, Grantman et

al., 2011), but the benefit of this evidence-based program is unknown in the residential treatment setting.

Objectives: This study seeks to examine the effectiveness of improving social functioning in high-functioning adolescents with ASD using the UCLA PEERS Program in a residential treatment setting. Whereas previous PEERS studies have examined parent- and teacher-assisted methods of social coaching, the current study examines the effectiveness of residential therapists as facilitators and social coaches.

Methods: Twelve adolescents with ASD ranging from 15-17 years of age (*M* = 16.33; *SD* = 0.87) residing within Village Glen Commons, a residential treatment facility for children and adolescents with ASD, participated in the study. The structure of the 14-week intervention included 60-minute sessions delivered once a week with an additional 30 minutes of behavioral rehearsal in the milieu. Adolescents and therapists completed a battery of psychosocial tests at pre- and post-intervention to assess social skills. Teen self-report measures included the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson & Frankel, 2009), Friendship Qualities Scale (FQS; Bukowski et al. 1994), Piers-Harris Self-Concept Scale 2nd Edition (PHS; Piers, Harris & Herzberg, 2002), and Social Anxiety Scale for Adolescents (SAS-A; La Greca,. 1999). Therapist measures included the Social Responsiveness Scale (SRS; Constantino, 2005), Social Skills Improvement System (SSIS; Gresham & Elliott, 2008), and Teacher Report Form (TRF; Achenbach, 1991).).

Results: Forthcoming results are expected to suggest that the UCLA PEERS program is effective in improving adolescent knowledge of social skills, self-esteem, and friendship quality according to teen self-report, while therapist report will reveal improvements in overall social skills and social responsiveness and decreased problem behaviors.

Conclusions: Assessment of overall social skill gains will be highlighted. Recommendations for how these findings might inform treatment in residential settings will be discussed.

131.069 69 Examining the Effectiveness of Mindfulness for Treating Children with ASD and ADHD. B. Evans-Smith*, N. M. Russo and J. Johnson, *Rush University Medical Center*

Background: Children with autism spectrum disorders (ASD) and attention deficit disorders (ADHD) often experience significant social impairment and academic challenges. One contributing factor for some of these children is poor regulation of attention, behavior, and emotions (Barkley, 1998; Grossman, Klin, Carter, & Volkmar, 2000; Prizant, Wetherby, Rubin, & Laurent, 2003; Solomon, Goodlin-Jones, & Anders, 2004). Treatments aimed at improving self-regulation have been primarily cognitive and behavioral. Mindfulness is an intervention strategy that has been minimally studied as a means of helping children with self-regulation struggles, but may prove effective for clinical pediatric populations.

Mindfulness is a meditative practice that increases awareness of one's sensory experiences and thoughts, and focuses attention on the present moment (Allen, Blashki, & Gullone, 2006). It has been shown to effectively treat a range of medical and psychological conditions with adults, including chronic pain, stress, anxiety, depression, and eating disorders (Baer, 2003; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987). Studies with neurotypical children reported improved concentration, mood regulation, self-control, and management of anxiety, and pain (Fodor & Hooker, 2008; Greco, Blackledge, Coyne, & Ehrenreich, 2005; Thompson & Gauntlett-Gilbert, 2008). However, its effectiveness in treating self-regulation in children with ASD and ADHD is not yet empirically supported.

Objectives: Our objective was to assess the efficacy of a Mindfulness Based and Stress Reduction (MBSR) intervention for improving self-regulation among children with ASD and ADHD. We conceptualized self-regulation as effective modulation of attention, behavior, and emotions. We hypothesized that children in the treatment group would show improved self-regulation and self-awareness relative to a wait-list control group.

Methods: A day treatment school implemented a nine-week MBSR group intervention. Children (8-12 years) with average intellect and either ASD or ADHD were eligible. The study included two treatment groups split by age and one control group (n=6 each group). Group assignment was determined through a modified randomization process. Treatment groups included mixed diagnoses, with children having either ASD (n=7) or ADHD (n=5); the control group included children with

ASD (n=5) and ADHD (n=1). Outcome measures for attention, behavior/emotion regulation, and self-awareness were measured with standardized direct assessments [Nepsy-II, Test of Everyday Attention for Children (TEA-Ch), Conners' Continuous Performance Test II] and behavior rating scales (Behavior Assessment System for Children, Second Edition, Conners 3; Child Acceptance Mindfulness Measure).

Results: The MBSR group intervention successfully improved attention in children with ASD and ADHD. The treatment group scored significantly higher on self-report of attention at post-test compared to the control group (U=4.0, p=.012, Cohen's *d*=1.21). When looking at within group effects for the treatment group, paired t-tests (pre-to-post) showed significant effects of training on auditory and visual attention measures from both the Nepsy-II and the TEA-Ch ($p \leq .032$, Cohen's $d \geq .3$). Results indicated that pre-to-post treatment effects were primarily driven by improvements within the ASD group.

Conclusions: The MBSR group intervention successfully improved attention in children with ASD and ADHD. These data provide preliminary empirical support for MBSR as an effective intervention to improve attention in pediatric ASD and ADHD populations and ideas for future studies.

131.070 70 Self-Isolation or Self Preservation: Why Are Teens with Autism Often Alone?. S. Mahjouri*[1], C. Kasari[2] and F. Orlich[3], (1)*Weill Cornell Medical College*, (2)*University of California, Los Angeles*, (3)*University of Washington/Seattle Children's Hospital*

Background: Adolescence is a tumultuous developmental period. Social challenges are intensified for those with autism as they lack the acuity to navigate the new expectations placed on them. Unfortunately, current research does not adequately describe the social and emotional experience of adolescents with ASDs, particularly those who are fully included in general education.

Objectives: This study described the experience of fully included adolescents with autism spectrum disorders who were observed to be isolated during most unstructured times in school. Observations yielded compelling accounts of the strategies teenagers use to isolate themselves at school. Considering the phenomenon of *self-isolation* as a coping mechanism provides a unique description of teenagers in an effort to identify appropriate intervention strategies.

Methods: 18 teenagers with autism were observed during unstructured times at school (age M=15.1±2.17; ABIQ M=99.33±17.93). Each participant was observed for two 10-minute periods over the course of one week. Engagement states (Orlich et al., 2010; Kasari et al., 2008) were coded and qualitative notes reflecting where the teenagers were and what they were doing were recorded. Participants also completed several self-report measures assessing depression, anxiety, loneliness, friendships and crowd affiliations.

Results: The teenagers in this study reported average levels of depression and anxiety in spite of high levels of loneliness. No statistically significant relationships were found between any of these constructs. Additionally, 52% of the sample was observed to be isolated during social times and only 20.56% of the sample was engaged with peers. No associations were found between depression, loneliness, anxiety and social isolation. A peer crowd affiliation measure revealed that teenagers with autism desired to be affiliated with academic groups (31%) more than with any other social clique in their school. Qualitative analysis of the observational data revealed that many of these teenagers are *self-isolating* as opposed to being excluded by their peers. Several themes and strategies emerged including actively disengaging to self-regulate by listening iPods or reading, as well as dodging social interactions by spending time in empty classrooms or in the library.

Conclusions: Given the lack of associations between negative emotional states and isolation, it may be that *self-isolation* serves a specific need for teenagers with autism. Perhaps it is a way for them to decompress from the social challenges present in school. Another potential explanation could be that the methods they employ: spending time in classrooms and the library are ways for them to try to identify with the academic clique. As affiliation with this crowd may require the least amount of social navigation, it seems plausible that some mechanisms of self-isolation are an effort to fit in. These data provide unique insight into the social environment of teenagers with autism, and contribute to

characterizing the potential internal barriers to engaging social experiences.

131.071 71 Tracking Changes in Social Skills: Weekly Behavioral Coding During a Social Skills Intervention Group. C. Hileman*[1] and M. Solomon[2], (1)*MIND Institute, UC Davis*, (2)*UC Davis*

Background:

Social skills interventions for children with Autism Spectrum Disorder (ASD) are often evaluated through child and parent report questionnaires administered pre- and post-intervention. Few studies have used behavioral coding during group time to evaluate the efficacy of social skills interventions.

Objectives:

The aim of this study was to determine whether children with ASD enrolled in a social skills intervention altered the frequency of their vocalizations and social interactions during group time.

Methods:

Fourteen children with ASD, ages 10-16, participated in the current study. Participants attended a clinical social skills intervention for 1.5 hours weekly over 22 weeks. The intervention curriculum was a modified version of the Social Adjustment Enhancement Curriculum (Solomon, Goodlin-Jones, & Anders, 2004). Participants' vocalizations and social interactions were coded weekly during an unstructured game time that involved playing board games and cards with other intervention participants.

Participants' vocalizations were coded as Initiating, Responding, or Other. Vocalizations directed toward another person were coded as "Initiating" in the absence of a conversation and "Responding" in the presence of a conversation. Vocalizations that were not directed toward another person (e.g., self-talk) were coded as "Other". Participants' social interactions were coded by interaction partner: interaction with one peer, interaction with one leader, interaction with a group of peers, interaction with a group of peers and leader(s), or by self (i.e., no interaction partner).

Behaviors were coded in 20-second intervals by a team of trained undergraduate students; inter-rater reliability for the coded variables ranged from acceptable to excellent (alpha = 0.74 – 0.96). Two-level HLM models were used to analyze the data, with weekly behavioral coding scores nested within persons. HLM analyses were run separately for each coded variable, and age, verbal IQ, and gender were evaluated as potential predictors of each coded variable.

Results:

From the beginning to the end of the intervention, participants made fewer Initiating vocalizations, $t(265) = -5.48$, $p < 0.01$, fewer Other vocalizations, $t(265) = -3.31$, $p < 0.01$, more Responding vocalizations, $t(265) = 2.06$, $p = 0.04$, and spent more time interacting with a group of peers, $t(264) = 2.47$, $p = 0.01$. Younger participants showed a steeper increase in the amount of time spent interacting with a group of peers than older participants, $t(264) = -2.73$, $p = 0.01$.

Conclusions:

The observed decrease in Initiating vocalizations, although initially surprising, is coupled with an increase in Responding vocalizations; this finding suggests that participants were more frequently engaged in conversation, potentially resulting in fewer opportunities to initiate new conversations. This increase in conversation and peer interactions suggests the development of more stable interaction groups, or perhaps even friendships. These results demonstrate behavioral changes in interaction dynamics over the course of a social skills intervention; future research should utilize a control group that does not receive the intervention in order to determine the degree to which behavioral changes are driven by the intervention curriculum versus repeated interactions with peers.

131.072 72 Teaching Personal Narrative Skills to Enhance Social Conversation in Children with Autism Spectrum Disorders. M. N. Park*[1], R. L. Koegel[2] and L. K. Koegel[3], (1)*UCLA Semel Institute for Neuroscience and Human Behavior*, (2)*Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*, (3)*University of California, Santa Barbara*

Background: The literature suggests that pervasive and persistent symptoms related to social communication are a hallmark of autism spectrum disorders (ASD). In addition to being core diagnostic symptoms of ASD, these symptoms relate to the extent to which children can engage in interactions that rely on social conversation skills. These pragmatic difficulties are commonly expressed in conversational exchanges that either lack the incorporation of personal narratives or incorporate personal narratives that are deficient or impoverished in nature. This is in contrast to neurotypically developing children who acquire personal narrative skills in early childhood, and use these skills as an essential tool in their social interactions. The literature indicates that self-management strategies are effective in improving a range of social communication skills.

Objectives: Given the current body of literature, pervasive nature of social communication impairments, and the documented impact of conversational competence on later outcomes, the objective of the current study was to examine whether self-management procedures targeting increased responsiveness to conversational bids for personal narratives led to improvements in conversational skills in children with ASD. Further, this study assessed the extent to which the improvements resulted in meaningful outcomes in ratings of overall verbal pragmatic ratings during conversation.

Methods: A non-concurrent multiple baseline across participants experimental design was used to evaluate the effectiveness of the self-management intervention. Three children diagnosed with ASD between the ages of 5 to 8 participated in this study. Five dependent measures were used to assess the effects of self-management in ameliorating social communication deficits by targeting the integration of personal narratives during reciprocal social conversation. The dependent measures were: (a) percent of responses to conversational bids with personal narratives, (b) mean number of personal narrative details, (c) percent of synchronous responses, (d) quantitative measures of overall language production, and (e) global pragmatic ratings of verbal conversational behaviors as measured by the Pragmatic Protocol (Prutting & Kirchner, 1987). Effect sizes were also calculated. Data were analyzed using representative five-minute videotaped probes collected throughout all phases of the study.

Results: The results of this study indicate that social communication deficits in children with ASD can be ameliorated with self-management procedures. Specifically, the intervention improved their conversational competence by (a) increasing responsiveness to conversational bids for personal narratives or stories, (b) improving the quality of the personal narratives through greater narrative detail, (c) increasing synchronous discourse, and (d) increasing linguistic productivity. Furthermore, the sustained treatment gains observed at follow-up with novel conversational partners and improvements in global verbal pragmatic ratings suggest that the intervention may have led to meaningful outcomes.

Conclusions: Results from the current study suggest that self-management procedures are effective in improving personal narrative skills during social conversation. These new skills were associated with positive gains in narrative details, synchronous responding, linguistic productivity, and pragmatic ratings. Overall, the findings suggest that social communication interventions focusing on personal narrative skills may contribute to meaningful positive outcomes in children with ASD and should be incorporated as part of a comprehensive intervention program.

131.073 73 Promoting Social Competence in Adolescent Girls with ASD: Evaluation of An Intervention Program. R. Jamison*[1] and D. Kamps[2], (1)*University of Kansas Medical Center*, (2)*University of Kansas*

Background: Individuals with ASD often experience difficulties making friends, navigating social norms, and rate themselves as less socially competent compared to typically developing peers (Matson, Matson, & Rivet, 2007). There is limited research on social skills interventions targeting the adolescent age range, with even less targeting girls with ASD. Strategies such as role-playing, modeling, coaching, and feedback led to improved social skills, enhanced self-esteem, and improved interpersonal skills (Gresham, Sugai, and Homer, 2001; Matson, et al., 2007). Programs implemented in the child's natural environment improve maintenance and generalization (Bellini, Peters, Benner, & Hopf, 2007).

Objectives: Evaluate an intervention program aimed at improving social conversation skills and self-care skills in an understudied population: adolescent girls with ASD. We expected girls with ASD, who complete the intervention would: 1) Improve in specific conversational skills targeted during intervention sessions; 2) Experience the greatest increase in conversational skills following sessions in which the specific skill were targeted; and 3) improve general social skills.

Methods: We used a single subject, multiple baseline design (MBD) across behaviors to determine the effects of the intervention on three specific social conversation skills in four adolescent girls with ASD (ages 14-19 years). The intervention occurred across sixteen, 2 hour weekly sessions, with 3 baseline sessions (no specific strategies) and 13 intervention sessions that promoted acquisition of three specific conversation skills. The intervention targets social conversation skills and self care skills related to hygiene and appearance within age appropriate self care and leisure activities in the natural environment. The primary outcome measure is use of specific social conversation skills during a ten minute period using an interval observation method. Secondary outcomes included measures of general social skills, self perception, quality of life, and satisfaction. Intervention sessions include evidence based strategies (i.e., visual supports, reinforcement of specific behaviors, use of innovative technology, practice in natural settings across a variety of environments and people) to promote skill acquisition.

Results: All participants showed significant improvement in at least two of the three skills following sessions in which the specific skills were targeted, with consistent improvements in the first skill taught (talking about where you are, what you are doing, and exchanging information about each other). Most participants showed improvements in general social skills while only one participant showed significant improvement in self concept. Participants, peers, and parents indicated high satisfaction with program procedures and outcomes.

Conclusions: Pilot data suggest further study is warranted to determine if the intervention program promotes social competence in adolescent girls with ASD. Most participants in this study improved specific conversation skills (at least two of the three skills) following sessions in which they were targeted. Data patterns across participants suggest more focus on maintenance of skills throughout the program. Preliminary results from another pilot study examining peer perceptions of critical components of successful conversation suggest intervention components are ecologically valid. Future directions include a group design to evaluation the efficacy of the intervention program with the target population.

131.074 74 Predicting Treatment Outcomes of a Teacher-Facilitated Social Skills Intervention for Adolescents with Autism: The School-Based UCLA PEERS Program. M. Goodarzi*[1], Y. Bolourian[2], L. Henry[1], R. W. Ellingsen[2], L. Tucci[3], S. Bates[4] and E. Laugeson[4], (1)*UCLA* , (2)*UCLA*, (3)*The Help Group-UCLA Autism Research Alliance*, (4)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

High-functioning adolescents with Autism Spectrum Disorders (ASD) present with an array of deficits, most of them impacting social behaviors. Given the presence of deficits in social behavior and communication in ASD, improvement in social functioning is of paramount importance. Studies investigating the effectiveness of social skills training for individuals with ASD indicate that intervention during childhood and adolescence is critical, yet few programs exist for middle and high school adolescents with ASD. The Program for the Education and Enrichment of Relational Skills (PEERS) is an empirically supported parent-assisted social skills intervention for high-functioning teenagers with ASD that specifically targets ecologically valid friendship skills. Research investigating the effectiveness of an adapted version of PEERS in the school setting revealed significant improvements in social functioning for teens with ASD using teacher-facilitation; however, little is known about the factors that predict treatment success.

Objectives:

The purpose of this study is to investigate the factors that predict treatment outcome in a 14-week teacher-facilitated social skills training program (PEERS) for middle school students with ASD.

Methods:

The intervention took place under the auspices of The Help Group-UCLA Research Alliance. Sixty middle school students with ASD from the Village Glen School at The Help Group participated in the study over a 14-week period. Adapted social skills lessons from the PEERS curriculum were conducted daily in the classroom for 30 minutes at a time by teachers and teacher aides who were trained and supervised on the curriculum.

Targeted social skills included: verbal and nonverbal communication; electronic communication and online safety; appropriate use of humor; expanding and developing friendship networks; peer entry and exiting strategies; organizing and having successful get-togethers; good sportsmanship; methods for resolving peer conflict; and strategies for handling rejection. Measures of social functioning were collected at pre- and post-using the Social Responsiveness Scale-Teacher Report (SRS-T: Constanino & Gruber, 2005) and the Social Skills Rating System-Teacher Report (SSRS-T: Gresham & Elliot, 1990).

Results:

Results reveal that higher baseline scores on the SRS-T in the area of Social Cognition predict improvement in social skills as measured by the difference between post-intervention and pre-intervention Social Skills Total Score on the SSRS-T (p<.05). In addition, higher scores on overall Social Responsiveness and Social Communication predicted improvement in social skills at a trend level (p<.10). The areas of Social Awareness, Social Motivation, and Autistic Mannerisms did not predict change in social skills.

Conclusions:

Perhaps due to the advanced nature of the skills taught in PEERS and the higher demands placed on social communication and perspective taking in this curriculum, findings suggest that the use of the PEERS curriculum in school-based settings is likely to be more beneficial for teens with better social cognition, and possibly greater social responsiveness and social communication skills.

131.075 75 DOES Naturalistic ONE-to-ONE Training without FOCUSED Peer INTERVENTION Have Collateral EFFECTS On PLAY and Peer ENGAGEMENT?. K. Strauss*[1], L. Fava[1], G. Valeri[2], S. Arima[3], L. D'Elia[4] and S. Vicari[5], (1)*Autism treatment and research Center "Una breccia nel muro"* , (2)*Children's Hospital Bambino Gesù* , (3)*University of Rome " La Sapienza"*, (4)*Children's Hospital Bambino Gesù*, (5)*U.O.C. Neuropsichiatria Infantile, Dipartimento di Neuroscienze, Ospedale Pediatrico Bambino Gesù*

Background:

A variety of naturalistic interventions aim to account for an increasing adult's responsiveness to the child and the quality of social engagement with the therapist and parent. Anyhow, social isolation is one of the most enduring challenges facing children with autism spectrum disorders (ASD), experiencing complex social difficulties in school. It is suggested that without direct naturalistic behavior intervention in the school setting, any naturalistic behavior intervention neither professional nor parent-mediated at home may be sufficient to fully engage children in peer activities and as such include them into a social structure.

Objectives:

This study examined collateral effects of staff-and parent-mediated naturalistic interventions without direct milieu teaching in the class room setting on peer interactions and play engagement.

Methods:

The Playground Observation of Peer Engagement (POPE) has been used to obtain information about the nature of child play behaviors and level of engagement of 16 low-functioning children with ASD in the course of 12 weeks. All 16 children followed staff- and parent-mediated naturalistic interventions that yielded remarkable decrease in autism symptom severity, and gains in mental developmental state as well as in early language skills and adaptive functioning. At baseline, and each 4 weeks (4 total measurement-points) children's social play and peer engagement was observed and rated in free play conditions.

Results: Preliminary results give insight in the areas of play and social engagement that can be facilitated by naturalistic adult-mediated interventions, highlighting at the same time skills areas that are lacking benefit and focused peer-mediated intervention is demanded. Play and peer engagement observation show after three month of one-to-one intervention a decrease in non-play behaviors and an increase in play behaviors, with increased quality and duration of functional toy-play while adult prompts decrease. Children demonstrate significant decrease in challenging behaviors such as stereotypes and auto-stimulation during free play, as well as an increase in child initiated interactions and directed communication with functional use of mutual eye contact and response of joint attention initiations. Nevertheless, these increases in pro-social reciprocity are related to social engagement with adults. It was shown that without adult initiation of parallel or group play, children with ASD engage in functional play at a solitary level of engagement.

Conclusions:

The preliminary results verify that adult-mediated naturalistic intervention without focused peer-intervention facilitates the child's functional play and pro-social engagement with limitation to the presence of an adult. Similar, finding to peer engagement are lacking. Anyhow, further analysis will account for the examination of collateral effects of behavior changes resulting from one-to-one intervention on social engagement. We will examine which areas addressed in one-to-one intervention (e.g. communication, cognitive skills, adaptive functioning) leads to collateral changes in non-targeted social engagement skills. Results will be presented at the conference.

131.076 76 Parental STRESS and TREATMENT Priorities In the PROCESS of Parent-MEDIATED EIBI INTERVENTION. L. Fava*[1], K. Strauss[1], S. Arima[2], G. Valeri[3], L. D'Elia[4] and S. Vicari[4], (1)*Autism treatment and research Center "Una breccia nel muro"* , (2)*University of Rome " La Sapienza"*, (3)*Children's Hospital Bambino Gesù*, (4)*Children's Hospital Bambino Gesù*

Background:

Research demonstrated that the inclusion of parents in treatment provision leads to lasting child behavior changes in children with ASD. Although it was shown that parent-treatment provision and parental stress are associated, there are considerable variability of its influence on child outcome. Findings vary from positive child outcome regardless treatment condition of a clinic- or parent-directed treatment, to increased parental stress due to high-intensive treatment provision, leading to reduced child outcomes. We did recently, extend previous research, and demonstrated that high parental stress interferes with professional decision making in treatment planning, leading to reduced behavior target difficulty regardless child's skill level. Anyway, target choice due to parental stress rather than child pathology was shown to be dysfunctional, predicting an increase in child problem behaviors and decreased child performance on behavior targets. Research on parent treatment priorities, indicated that parent selected priorities had not yet been sufficiently effective addressed in treatment planning, with parents following mainly a deficit-based logic rather than a strength-based logic in selecting high priority areas.

Objectives:

The current study investigates (1) the association of parenting stress and selection of parent treatment priorities (2) how this association change in time, in a group of parents that followed a staff-and parent-mediated EIBI model for one year.

Methods:

Children and their parents (N=40) followed a cross-setting staff- and parent-mediated EIBI treatment, following a 1 week center – 3 weeks home rhythm for 10 month. At treatment intake, after 5 month and at termination of treatment, parent identified their treatment priorities in relation to the child's level of ability across a 8 domains of adaptive skills and problem behaviors, and indicated whether or not that skills was currently addressed in their child's treatment program. The treatment priority survey was adapted from Pituch et al. (2011). Further, parents rated their level of parental stress on the Parenting Stress Index, Short Form. At 5 month and at the end of treatment parents rated their satisfaction with treatment on a survey adapted from Ingersoll and Dvortcsak (2006).

Results:

We do expect that parental distress is associated with selection of treatment priorities and respective unmet needs in treatment provision, influencing parent satisfaction with treatment. It is supposed that an increase in parenting stress is related to a deficit-based selection of treatment priorities and related amount of unaddressed skills in the child's treatment program, whereas a decrease of parental stress is only achieved when the introduction of program targets are in accordance with parents indicated treatment needs.

Conclusions:

Results offer insight in the relation of parental stress and the inclusion of parent-selected treatment priorities in treatment planning, deepen the current knowledge of a negative influence of parental stress on professional behavior target choice. Further analysis needs to examine a probable lack of concordance in selecting treatment priorities between staff and parent's selection progress and how such lack of concordance counteract professional decision making in choosing appropriate treatment objectives.

131.077 77 Is CBT As Effective for Treating Anxiety Disorders in Children and Adolescents with ASD As for Typically Developing Children, Also in the Long Term? Preliminary Results of a Controlled Clinical Trial. F. J. van Steensel* and S. M. Bögels, *University of Amsterdam*

Background: Anxiety disorders are highly common among children with autism spectrum disorders (ASD). Although several studies have demonstrated the effectiveness of Cognitive Behavioral Therapy (CBT) for the treatment of anxiety disorders in children with ASD, little is known about (1) the effectiveness in the long term, (2) the factors that are associated with treatment effectiveness, or (3) how effective CBT is when compared to typically developing children.

Objectives: The aim of this study was to evaluate the (long term) effectiveness of CBT for the treatment of anxiety disorders in children with and without ASD, and to examine which factors are associated with treatment effectiveness one year later.

Methods: In this study, 99 clinically referred children aged 7-18 years, and their parents, participated. The sample consisted of 53 children diagnosed with ASD and comorbid anxiety disorders and 46 children diagnosed with anxiety disorders (without ASD). Interviews assessing anxiety disorders, and questionnaires assessing anxiety symptoms, ASD-symptoms, child psychopathology, parental anxiety, and family functioning were administered at pre- and post-treatment, three months after CBT, and one year after CBT.

Results: According to ADIS-parent report, 71.7% of the children with ASD were free of their primary anxiety disorder one year after CBT against 90.6% of the children without ASD ($p < .05$). For ADIS-child report these rates were 66.7% and 96.3%, respectively ($p < .05$). (Of note, for post-treatment and 3 months after CBT no differences were found). Treatment effectiveness for all anxiety disorders was investigated with repeated measures (M)ANOVA. Results indicated that the total severity of anxiety disorders decreased over time ($p < .05$). Moreover, a significant group effect was found for parental report, indicating that parents of children with ASD report more (severe) anxiety disorders compared to the children without ASD. However, no significant interaction effect was found ($p > .10$), suggesting no differences in improvement between children with and without ASD. Furthermore, it was found that demographic variables (gender and age) did not correlate with treatment effectiveness, whereas several variables of family functioning (measured pre-treatment) did. However, significant correlations between treatment effectiveness and family functioning differed per respondent (child, mother and father) and per group (children with ASD versus children with anxiety disorders). Family un-involvement was negatively correlated with treatment effectiveness for both groups. For the children with ASD specifically, treatment effectiveness was negatively correlated to paternal anxiety, active-reactive orientation and sociability of the family. For the children with anxiety disorders specifically, treatment effectiveness was negatively correlated with a laissez-faire family style, and positively correlated with cohesion and a democratic family style.

Conclusions: At one year follow-up, CBT is less effective for the children with ASD compared to the children without ASD when considering dichotomous outcome measures

(percentage free of primary anxiety disorder). However, considering the treatment effectiveness for the total anxiety severity score, CBT is equally effective for children with and without ASD, also at one year follow-up. In addition, family functioning at pre-treatment may be an important factor for treatment effectiveness in both groups.

131.078 78 The Impact of Teachers' Attitudes towards Evidence-Based Practices on Student Autism Symptom Severity. C. S. Ghilain*, D. C. Coman, A. Gutierrez and M. Alessandri, *University of Miami*

Background: With the increasing prevalence of children diagnosed with ASD comes the need for effective treatment models, therapy approaches, and community-based services for these individuals. Treatment models with sound empirical support should be the "gold standard" for educating children with ASD; however, research and practice are often not well integrated. A current area of research in dissemination and implementation of Evidence-Based Practices (EBPs) in schools is the impact that teachers' attitudes have on student performance in the classroom. It is important to understand the impact of a teacher's attitude on student outcomes, autism severity in this case, so as to provide the best possible educational environment for children with ASD.

Objectives: The goal of this research is to gain a better understanding of how teacher attitudes towards EBPs impact students with ASD. We are particularly interested in better understanding the impact of teacher attitudes on a child's autism severity over time in 3 different public school classroom models for children with ASD; TEACCH, LEAP and BAU(eclectic).

Methods: 49 teachers (16 TEACCH, 15 LEAP, and 18 BAU) implementing classroom models at high levels of fidelity completed the Evidence-Based Practices Attitudes Scale (EBPAS), and 112 children (44 TEACCH, 35 LEAP, and 33 BAU) were administered the Autism Diagnostic Observation Schedule (ADOS) at the beginning and the end of the school year. Preliminary analyses were conducted to understand the relationship between teacher attitudes towards the use of EBPs and student autism severity. Regression analyses were used to understand the change in autism severity over the school year, and whether this change could be predicted by teacher attitudes at the start of the school year. Further analyses including utilizing a Multilevel Modeling (MLM) approach will be conducted to more fully take into account the nested structure of the data, so as to better understand differences of students across classrooms.

Results: Preliminary analyses suggest more positive teacher attitudes towards the use of EBPs at the beginning of the school year predicted a significant decrease from beginning to end of the year in autism severity scores for students in the BAU group ($F(1,32) = 17.300$, $p=.044$, $\beta= -.258$), whereas this difference was not seen in the TEACCH ($F(1,43) = 5.522$, $p = .994$, $\beta= -.001$) or LEAP ($F(1, 34) = 28.260$, $p = .538$, $\beta= .066$) groups. As mentioned above, additional analyses will be conducted to further explore within classroom differences by group.

Conclusions: In BAU (eclectic) classrooms where individual teachers are free to use various EBPs rather than follow a specific classroom model (i.e., TEACCH or LEAP), a reduction in autism severity is seen from the beginning to the end of the school year. This decrease in autism severity is significantly related to a teacher's attitudes towards adopting and utilizing EBPs in his or her classroom. It is possible this finding is due to a teacher's ability to choose the EBPs he or she would like to use in the classroom setting as well as the ability choose whether or not to implement these strategies.

131.079 79 Examining the Maintenance of Effects of a Social Competence Intervention (SCI-A). J. P. Stichter*, M. Herzog, S. D. McGhee and S. Leinert, *University of Missouri*

Background: Youth with ASD experience social competence deficits that impact their ability to make and sustain friendships, initiate and maintain social interactions, and understand emotions in themselves and others. Without targeted intervention services, these youth often exhibit problematic social behaviors and can become socially withdrawn, which negatively impacts their quality of life and can lead to other developmental skill deficits. Research demonstrates that many social skills interventions, although successful, do not demonstrate lasting or generalized outcomes (Bellini, et al., 2007; Stichter, et al., 2007). More

specifically, few studies actually examine the maintenance of treatment effects over time via follow-up assessments.

Objectives: The Social Competence Intervention for Adolescents (SCI-A) is a targeted program designed to meet the specific social needs (see Stichter, et al., 2010 for program description) of youth with ASD or similar challenges. This study examined the potential maintenance of the positive treatment effects noted for SCI-A participants at a 6-month follow-up assessment.

Methods: All participating students (and one teacher per student) completed a battery of assessments two weeks before and two weeks after SCI-A participation (n=24 students). The battery consisted of teacher reports of social behaviors and executive functioning and student performance of facial expression recognition and executive functioning; this battery was repeated at follow-up (the end of one semester after SCI-A; approximately 5-6 months after post-testing). The current sample includes 16 SCI-A participants who consented to complete follow-up assessments. Pre to post assessment scores were examined via paired t-tests. In the cases of significant intervention gains, additional paired t-tests were conducted on pre- and follow-up assessment scores to investigate if students, at minimum, continued to evidence improvements relative to baseline.

Results: The 16 participants included 14 boys and 2 girls (M_{age} at follow-up=13.99 years, SD=1.48). Overall, results indicated significant gains between pre- and post-assessment scores on 14 variables, including teacher reports of social behaviors (SRS Total; t=2.96, p<.05), teacher reports of executive functioning (BRIEF GEC; t=2.59, p<.05), and student performance assessments of executive functioning (e.g., DKEFS Design Fluency; t=3.49, p<.01). Of these, results indicated that scores at follow-up remained significantly better than scores at pre for five assessments (ps < .05). Three assessments showed improvements at the trend level (ps < .10). The remaining six assessments evidenced improved mean scores at follow-up, but these scores were not significantly different from baseline.

Conclusions: This preliminary evidence suggests that students experienced gains in social behavior and executive functioning after SCI-A program participation. Furthermore, students maintain some of these improvements up to six months later. Implications for understanding and promoting maintenance effects will be discussed.

131.080 80 Commitment to Classroom Model Philosophy, Openness, and Teacher Burnout: A Preliminary Investigation of Their Relationships. A. Gutierrez*, D. C. Coman, C. S. Ghilain and M. Alessandri, *University of Miami*

Background:

One of the primary objectives for families of children with autism is to access effective school-based educational services. Some of the most widely used classroom-based models for children with autism include Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), Learning Experiences and Alternative Program for Preschoolers and Their Parents (LEAP), and eclectic models incorporating varied strategies (Business as Usual [BAU] models.) For several decades, however, special education teacher shortages have concerned those who work to recruit and retain special educators (Council for Exceptional Children, 2000). Although the causes of this problem are likely complex, prior research implicates teacher burnout as a relevant factor. Fortunately, prior research also suggests that commitment to model philosophy may mitigate experienced levels of burnout (Jennet, Harris, & Mesibov, 2003). Specifically, teachers who endorse the underlying philosophy of their teaching approach report fewer symptoms of burnout. It may also prove important to investigate factors such as teachers' attitudes towards Evidence-Based Practices (EBPs), as this may elucidate additional aspects underlying these issues.

Objectives:

To explore teacher commitment to classroom model philosophy, openness to EBPs, and their relationships to teacher burnout in TEACCH, LEAP and BAU teachers. A better understanding of these factors may provide school districts and policymakers with salient information regarding helpful adaptations in policy and practice within special education.

Methods:

53 teachers (17 TEACCH, 15 LEAP, and 21 BAU) implementing classroom models at high levels of fidelity completed the Teacher Philosophy Questionnaire-Adapted Version, a demographic form, the Evidence-Based Practice Attitudes Scale, and the Maslach Burnout Inventory-Educators Survey.

Results:

Relative to the other groups, LEAP teachers (M = 0.93) reported significantly higher levels of commitment to LEAP philosophy, $F(2, 50) = 9.16$, $p<.001$, $\eta 2 = .27$, while TEACCH teachers did not report significantly higher commitment levels to TEACCH philosophy. BAU teachers reported similar levels of commitment to both TEACCH and LEAP.

A quadratic relationship between commitment to philosophy and burnout experienced in the middle of the year was also supported, $R2 = 0.43$, adjusted $R2 = 0.22$, $F(14, 38) = 2.04$, $p < .05$. There was no relationship between commitment and openness to EBPs, $F(1, 47) = 2.78$, $p = ns.$ Group differences between teachers who endorsed high levels of openness to EBPs and those who endorsed low levels were found, such that those in the high group experienced significantly lower levels of burnout in the middle of the year compared to those in the low group, $F(1, 47) = 4.22$, $p <.05$, $\eta 2 = .082$.

Conclusions:

Results from the current study suggest a quadratic relationship between commitment to philosophy and burnout assessed in the middle of the year. Teachers who reported higher levels of commitment tended to report lower levels of burnout, while teachers with moderate commitment levels generally reported higher levels of burnout. Interestingly, teachers with lower levels of commitment also tended to report lower levels of burnout. Lastly, those with high openness to EBPs were found to experience lower levels of burnout, relative to those with low openness.

131.081 81 Addressing Engagement and Challenging Behaviors within a Naturalistic Language Intervention: A Cross-Disciplinary Collaboration. G. L. Lyons*[1], E. Haebig[1], A. McDuffie[2], W. Machalicek[3], A. Oakes[4], L. Abbeduto[2] and S. Ellis Weismer[1], (1)*University of Wisconsin-Madison*, (2)*MIND Institute University of California Davis*, (3)*University of Oregon*, (4)*University of California, Davis*

Background: Delays in communication are a core feature of autism spectrum disorders. Additionally, children with autism frequently display challenging behaviors (CB) that are likely to limit participation in the types of responsive parent-child interactions that facilitate language learning. Speech-language pathologists (SLPs) often have not received the specialized training needed to adequately address CB, potentially limiting the effectiveness of the language interventions they provide. Despite providing complimentary and overlapping services, few research studies have reported on collaborative efforts between Board Certified Behavior Analysts (BCBAs) and SLPs. The current study reports pilot data on cross-disciplinary collaboration from one parent-child dyad enrolled in a parent-mediated language intervention designed to teach mothers naturalistic language-facilitation strategies.

Objectives: Does collaborative delivery of individualized, direct positive behavior supports (PBS) within the context of SLP coaching sessions result in: (1) increased child engagement in play; (2) decreased CB; (3) increased SLP delivery of language coaching; (4) increased parent use of targeted strategies; and, (5) increased child communication?

Methods: A 3.6-year-old male child, diagnosed with autism by a university clinic, participated with his biological mother. The child had delays in nonverbal cognition and receptive/expressive language. His CB included head banging, aggression, and tantrums. An SLP implemented the language intervention consisting of 4 clinic-based parent education sessions and 17 one-hour coaching sessions delivered in the home via video-teleconferencing. The manualized intervention incorporated contextually-fitted PBS strategies, as well as indirect consultation by a BCBA. A single-case AB design was implemented comparing distance coaching sessions without and with direct coaching of PBS by a BCBA. Direct PBS was provided for this dyad after nine sessions due to interfering CB and lack of engagement. The

PBS was based on a functional analysis, preference assessment, direct observation, and collaboration with the SLP and parent. PBS strategies were embedded within the distance sessions; both the SLP and parent were coached in the use of targeted strategies by the BCBA during ongoing parent-child interaction. Video-clips of all 17 distance sessions were coded using an interval-based metric.

Results: Upon introduction of direct behavior support, CB immediately decreased to 2% of intervals (from an average of 20% at baseline) and remained stable for the remainder of the direct behavior support condition. Simultaneously, child engagement in play increased to 91.7% (from a 30% average at baseline) and SLP language coaching increased to consistently over 30% of intervals (from a 15% average at baseline). During engaged intervals, there was a 71% and 90% increase in frequency of parent prompting of communication acts and responding to child communication acts, respectively, as well as a 125% increase in child spontaneous communication acts. A non-overlap of data index suggested strong effects.

Conclusions: Collaboration among autism service professionals can result in more effective service delivery. This study provides preliminary evidence for an effective model of collaboration between SLPs and BCBAs. Specifically, decreasing CB allowed the SLP to more effectively implement parent coaching and allowed the mother to engage the child in play, provide language stimulation, and respond to child communication acts by using strategies targeted by the SLP.

131.082 82 Functional Behavior Assessments: A Comparison of Across Three Assessment Methodologies. S. B. Clark*[1], N. A. Call[2], N. A. Parks[1] and A. R. Reavis[1], (1)*Marcus Autism Center & Children's Healthcare of Atlanta*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background:

Children with autism may develop problem behaviors such aggression or self-injury that can result in injury to themselves or others (Kanne & Mazurek, 2007; Weiss, 2003). Identifying the consequences responsible for maintaining problem behavior through functional behavioral assessment (FBA) is a critical aspect of successful treatment of problem behavior (Hanley, Iwata, & McCord, 2003). The functional analysis (FA) developed by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) represents one of the most thorough assessments for identifying the function of problem behavior. In an analog FA, antecedent and consequence variables hypothesized to evoke and maintain problem behavior are directly manipulated. Although the FA methodology represents a rigorous demonstration of function, it is a lengthy and resource intensive approach. Abbreviated functional analyses, such as the Brief Functional Analysis (BFA; Northup et al., 1991), and indirect functional assessments, such as the Questions About Behavioral Function (QABF; Matson & Vollmer, 1995) rating scale, have been developed as less intensive FBA formats. Generally, indirect functional assessments and BFAs are considered to be less valid than analog FAs (Wacker et al., 2004). However, little direct research has been conducted on how well the results of these three FBA formats correspond with one another.

Objectives:

The purpose of the current investigation was to examine the correspondence between three formats of functional behavior assessments: FA, BFA, and the QABF.

Methods:

Ten participants who were admitted to an intensive day-treatment program for the assessment and treatment of problem behavior participated in this study. Prior to the admission, caregivers for each participant completed a QABF. This assessment consisted of a series of questions regarding the potential function of their child's problem behavior. Each question was assigned a score and grouped into a behavioral function (i.e., attention, escape, automatic, or tangible). During the admission to the day-treatment program, a BFA was conducted with each participant. Upon completion of the BFA, a FA was conducted. Conditions in the FA were similar to the BFA with the exception that a staff member served as the therapist.

Participant responses to the QABF were scored using the methods outlined in that measure's instruction manual.

Results of the BFA and FA were determined by graphing the rates of problem behavior observed during test and control conditions from each assessment into separate line graphs. Graphs were distributed to 7 naïve clinicians who had expertise in interpreting such graphs for clinical purposes. These clinicians indicated the function of problem behavior identified in each graph using a standardized rating scale.

Results:

The correspondence between the QABF and BFA, QABF and FA, and BFA and FA was 39%, 41%, and 65% respectively.

Conclusions:

The results of the current study indicate that the FBAs that utilize direct measures (i.e., BFA and the analogue FA) had greater correspondence as compared to the indirect measure. Additionally, results suggest that the QABF is more likely to identify multiple functions than the direct measures, increasing the opportunity for false positive results.

131.083 83 Increasing Positive Affect and Social Responsiveness in Children and Adolescents with Autism Spectrum Disorders: The Adaptation of a Music-Based Intervention in a School Setting. D. Tung*[1], R. W. Ellingsen[1], L. Tucci[2] and E. Laugeson[3], (1)*UCLA*, (2)*The Help Group-UCLA Autism Research Alliance*, (3)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

Children and adolescents with Autism Spectrum Disorders (ASD) face deficits in social and emotional behaviors that lead them to be isolated from their peers, family and community. Music tends to be an avenue of communication that comes easily to youth with ASD and therefore is a useful tool in their social and emotional development. While very little research has been conducted examining the positive impact of music with this population, there is clinical evidence that suggests music can promote the development of interactive communication. Through alternative communication, music can help cultivate the behaviors children and adolescents with ASD need to create cooperative and socially meaningful relationships. One such approach to using music to facilitate communication and social engagement is the Orff Schulwerk method of music instruction, which is a holistic approach to music-making that involves speech, singing, movement, and instrument-playing in a creative environment, while concurrently teaching academic curricula.

Objectives:

This study seeks to investigate the role and influence of the Orff Schulwerk-based music education in a specialized day school program for children and adolescents with ASD. The study aims to examine how school-based music instruction positively influences behaviors in children and adolescents with ASD.

Methods:

27 students with ASD ranging from 7 to 14 years of age participated in this study through the Bridgeport School at The Help Group. Students participated in daily music education classes over a 4-week summer session using the Orff Schulwerk method of music instruction. Live and recorded behavioral observations of students were conducted in music and academic classes. Behaviors were coded in the following areas: positive affect, joint attention, negative behavior, language, social avoidance and social responsiveness.

Results:

Results indicate higher levels of positive affect ($p<.001$), higher levels of social responsiveness ($p<.001$), and lower levels of joint attention ($p<.01$) in the music setting as compared to the academic setting. There were no significant differences in language, negative behavior, or social avoidance between the two settings.

Conclusions:

The results suggest that music classes may increase positive affect and social responsiveness in children and adolescents with ASD. The evidence gathered in this study may provide insights needed to understand how to develop better evidence-based interventions and music-based educational programs for youth with ASD, which may lead to the development of the skills needed to create lasting social relationships.

131.084 84 A Behavioral Summer Treatment Program Improves Social Functioning for Children with High-Functioning Autism Spectrum Disorder. E. S. Mitchell*, M. K. McCalla, S. Mrug, C. S. Patterson and J. B. Hodgens, *University of Alabama at Birmingham*

Background: Targeting reciprocal social interaction deficits is extremely important for children with high-functioning ASD (HFASD), as they initiate fewer interactions and are typically less engaged with peers. A case report by Mrug and Hodgens (2008) described how the Summer Treatment Program (STP), a comprehensive behavioral intervention developed for children with Attention-Deficit/Hyperactivity Disorder, produced substantial changes in social functioning in four boys with Asperger's Disorder. The STP offers a unique opportunity to target peer relationships and social skills of children with HFASD within the context of a naturalistic, summer camp setting. Moreover, the STP holds promise as an efficacious intervention for children with HFASD in that the program aims to foster social competence in an individualized manner.

Objectives: The present study examined individualized daily goals targeting the initiation of a conversation with a peer for children with HFASD during the STP.

Methods: The participants were seven boys with HFASD who attended the STP between 2004 and 2010. All participants were between 7 and 11 years (M = 8.9 years, SD = 1.4) and were diagnosed with a HFASD by a licensed psychologist. Throughout the intensive, 6-week-long daily behavioral treatment program, extensive data were recorded for all target behaviors, including initiating a conversation with a peer. Conversation was operationally defined as a child asking a peer a question, the peer responding, and the child making a contingent utterance (i.e., saying something related to the peer's response). Participants received immediate verbal praise, daily rewards from their parents and weekly rewards at the STP contingent upon attaining their goals. The frequency of initiating a conversation was monitored and calculated each day. This behavior was analyzed across each week of the program both visually as a series of single cases and quantitatively using polynomial contrasts in repeated measures ANOVA.

Results: The number of initiations of a conversation significantly changed over time, $F(1.8, 10.8) = 7.3$, $p < .01$. Additionally, a significant linear trend, $F(1, 6) = 13.83$, $p < .01$, $\eta_p^2 = .70$, indicated that conversation initiations increased linearly over time. Post hoc mean comparisons revealed that the number of conversations initiated during Week 6 (M = 3.5 conversations/day) was significantly higher than the number initiated during Week 1 (M = 0.2 conversations/day) of the program.

Conclusions: These results suggest that children with HFASD are responsive to the structure of the STP and add to the mounting evidence of the effectiveness of the STP in improving the social functioning of these children. Consistent with the STP focus on targeting individual areas of greatest functional impairment for each child and social deficits common in children with HFASD, individualized goals targeting social interaction deficits and aiming to improve interactions with peers were very common for children with HFASD in the STP. Overall, these children made significant improvements in their ability to initiate and maintain reciprocal social conversations with peers during the course of the STP.

131.085 85 SPARK: Improving Self-Regulation, Executive Functions, and Social Competence in Children with Autism. J. Montgomery[1] and H. MacKenzie*[2], (1)*University of Manitoba*, (2)*WIred Fox Publications*

Background: Difficulties with executive function (EF) are frequently observed in people with autism spectrum disorders (ASD). Improvement in self-regulation of EF is associated with increases in planning, impulse control, cognitive flexibility, self-monitoring and social competence. The *Self-Regulation Program for Awareness and Resilience in Kids* (spark*) is an innovative approach to improving behavioral, cognitive and emotional self-regulation skills in children with ASD. It is informed by positive psychology, neuro-biology, mediational learning, and mindfulness.

Objectives: To evaluate the feasibility, acceptability and effectiveness of spark* in improving executive functions (planning and organization, working memory, inhibitory control, self-monitoring, cognitive flexibility) and social competence in children with ASD by examining preliminary data collected during pilot testing.

Methods: Six 6-8 year old and seven 9-10 year old children with high functioning ASD and Aspergers participated in spark* groups over ten one-hour sessions. The intervention was administered by graduate students in school psychology who were supervised by experienced therapists. Pre- and post-treatment data were collected from parents on executive functioning (BRIEF) and social competence (SSRS, CCC-2). Intervention involved teaching skills across four main phases: awareness of the ability to use the skill, awareness of the need to use the skill, resilience in its use and self-advocacy to increase its use.

Results: spark* was found to be feasible in group settings and acceptable (no children dropped out or refused to attend). Results will be discussed in terms of impact on awareness of behavioral and cognitive self-regulation abilities and needs.

Conclusions: The results suggest that spark* is feasible in group settings and it can be conducted by graduate students in school psychology. It is also acceptable to elementary school-aged children with HFA and Aspergers. Parents see promise in the program for improving self-regulation in their children. The next step in the development process for spark* is to evaluate its effectiveness relative to a matched no-treatment (wait list) group of children.

131.086 86 Increasing Self-Confidence and Decreasing Stress in Parents and Professionals: The Effects of One-Day Pivotal Response Treatment Training.

J. Choi*[1], N. M. Reyes[1], A. Scarpa[2] and D. Openden[3], (1)*Virginia Tech* , (2)*Virginia Tech*, (3)*Southwest Autism Research and Resource Center*

Background: Parents of children with autism experience elevated levels of stress (Bebko, Konstantareas, & Springer, 1987), and parental stress is negatively associated with benefits obtained from services (Robbins, Dunlap, & Plienin, 2008). Training parents using Pivotal Response Treatment (PRT) has been shown to increase child-parent positive interactions, and parental interest in those interactions, as well as to decrease parental stress (koegel, Bimbela, & Schreibman, 1996). Also, increased parental positive affect was associated with PRT implementation (Schreibman, Kaneko, & Koegel, 1990). Although previous research has focused on parent training, little attention has been paid to training of professionals working with individuals with ASD.

Objectives: The current study investigated the effectiveness of training parents and professionals in dealing with challenging behaviors, increasing verbal communication, and decreasing stress levels using PRT.

Methods: Seventy-five adults (25% parents and 75% professionals) participated in the PRT training and 52 completed the study (42 females, 7 males, and 3 did not report gender) with a mean age of 39.28 (SD=11.14). This sample consisted of 82.6% Caucasian, 3.8% African American, 3.8% Hispanic, 1.9% Asian American, and 7.7% did not report ethnicity. Parents and professionals completed a 4-question form designed to obtain information about their confidence in managing difficult behaviors, and increasing verbal communication, as well as their stress levels due to their interactions with the child.

Results: A series of paired t-tests was conducted to assess self-perceived confidence and stress levels when dealing with difficult behaviors and working on the child's verbal skills. Data from parents and professionals were analyzed independently and then combined because the same results were found for each; thus, only the whole sample statistics are reported here. After the one-day PRT training, participants' confidence in dealing with difficult behaviors was significantly higher after (M=2.27, SD=.49) than before (M=1.83, SD=.55) the training $t(4.77)=p<.00$. Similarly, the level of confidence in increasing verbal abilities was significantly higher after (M=2.48, SD=.82) than before (M=2.08, SD=.613) the training $t(-2.62)=p<.01$. Moreover, participants' level of stress in dealing with difficult behaviors was significantly less after (M=2.10, SD=.66) than before (M=2.56, SD=.79) the training $t(-4.45)=p<.00$. Finally, participants' stress when working on verbal abilities was significantly less after (M=1.90, SD=.62) than before (M=2.29, SD=.82) training $t(-3.35)=p<.00$.

Conclusions: Very little is known about parents' and professionals' confidence and stress level when working with individuals with ASD. This study provides some initial evidence of the effectiveness of training parents and professionals to address difficult behaviors and improve language abilities in

individuals with ASD after only one day of training in PRT techniques. Thus, community outreach programs could make it a priority to reach parents and professionals and provide trainings that can ultimately increase their confidence and decrease their level of stress. A limitation of this study, however, is that it is not known whether the effects of these type of trainings are maintained over time. Moreover, it is not known whether the participants were then able to implement the newly learned techniques. Future research in those areas is needed.

131.087 87 Effects of Video-Based Group Instruction on the Acquisition of Complex Social Skills by Adolescents with Autism. J. B. Plavnick*[1], A. M. Sam[2], K. Hume[2] and S. L. Odom[3], (1)*Michigan State University*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of North Carolina*

Background: Qualitative impairment in social interaction is one of the defining characteristics of individuals diagnosed with autism. These deficits can be especially difficult for adolescents with autism as social demands in high school require frequent complex social interactions with a variety of social partners across numerous contexts (Locke, Ishijima, Kasari, & London, 2010). Though social deficits can be lessened with effective treatment during adolescence and into adulthood, very few social skills treatments have been identified for this group (Reichow & Volkmar, 2010; Shattuck et al., 2007). Further, diminishing resources create barriers to implementation and require instructors to teach multi-student groups, as opposed to the one-to-one instructional arrangements often described in research literature. Recent technological advances may promote viable social skills treatment options for adolescents with autism, though research demonstrating positive outcomes is needed to make this conclusion.

Objectives: The purpose of the present investigation was to evaluate the effects of video-based group instruction (VGI) on the acquisition of complex social behavior by adolescents with autism. A secondary purpose was to examine implementation variables, such as the acceptability of the intervention for consumers and the procedural integrity of implementation by a non-expert instructor.

Methods: A single-case experimental research methodology was used to identify a functional relation between VGI and the acquisition of complex social behavior by four adolescents diagnosed with autistic disorder. Specifically, a multiple probe across social domains design was used to examine the effects of VGI on the acquisition of multicomponent initiations, social awareness, and social reciprocity. Videos of young adults demonstrating the target behaviors were recorded and simultaneously displayed for all participants using an Apple iPad. Participants were then given the opportunity to match the modeled behavior with their peers in the social skills group.

Results: All participants rapidly acquired all complex social targets following the implementation of VGI. Additionally, all participants continued to demonstrate the behaviors at a high level after the video was faded. Parents of participants rated the social skills group as highly acceptable and the non-expert facilitator demonstrated a high level of procedural integrity.

Conclusions: The results of the study show that video modeling can be an effective practice for teaching complex social behavior to multiple adolescents with autism at one time. This is important as resources for this age group do not generally allow for one-to-one instruction, as often occurs for younger individuals with autism. Additional contributions of the research study include (1) the pace at which participants acquired complex social behavior, (2) the ability to teach new skills without using response prompts or contrived reinforcers, and (3) the sequencing of instructional targets when using video modeling to promote rapid skill acquisition. The results suggest VGI can be an effective and efficient approach for teaching complex social behavior to adolescents with autism.

131.088 88 Language and Academic Deficits Among Children with Autism Spectrum Disorders Attending Regular School Classes After Intensive Long Term Treatment. S. Kotsopoulos*[1], A. Kotsopoulos[2], I. Florou[1], M. Gyftogianni[3], A. Gasteratos[4] and A. Georgiou[1], (1)*Day Centre for Children with Developmental Disorders*, (2)*TEI Patras*, (3)*Day Centre for Children with Developmental Disorders,*

Messolonghi, Greece, (4)*Day Centre for Children with Develomental Disorders, Messolonghi, Greece*

Background: reatment programs providing intensive long term (usually 2 years) treatment for children with ASD in experimental settings report significant results, even loss of the diagnosis of autism in some cases. Reports though are still sparse on possible language and academic deficits which may prevent continuing progress of children with ASD in regular classes.

Objectives: Objective of the present study was the evaluation of the language and academic profiles of five children (all boys) with ASD who attended and completed an intensive treatment program (from 2 to 4 year) and continued to receive follow up focused treatment while attending regular school classes, in order to identify possible persisting deficits which might still impede progress.

Methods: The five children, with an IQ within the average range (Raven) were evaluated: three of them (age, all 8 yrs old) attended regular grade 3 and two (age 6 and 7 yrs old) attended grade 1 classes in different schools and locations in a Greek province, The children at the initial referral 5 to 3 years previously at the Day Centre, received the diagnosis ASD (DSM-IV criteria), corroborated by CARS and VINELAND. At that time none of the children had communicative linguistic skills. For the present evaluation the following test were administered: ADOS, PPVT-III, EOWPVT-R, Sentence Structure of CELF-4, Phonetic and Phonological Development, ERRNI, DELV – Pragmatics Domain, and the Reading and Writing Scales by Floratou (Greek language).

Results: ADOS: one child (**Th**) scored (4) below the cut-off point and did not maintain the initial diagnosis of ASD whilst the other 4 maintained it (scoring 7 or 8). **Speech and Language:** Four of the children had adequate speech and one was at the last stage of treatment for developmental dyspraxia. On the PPVT-III the three older children scored average and on the comprehension of 'complex sentences' of CELF-4 all scored below average. On the test ERRNI which provides a measure of narrative skills their performance was unequal. On the Pragmatic Domain – DELV the three older children were within the average range. **Academic performance:** On the Reading and Writing Scales by Floratou the results were unequal. Only the child **Th** (out of ASD) was performing within the average range for reading and writing with mild delay in math. The others performed within the average range in reading decoding but were experiencing difficulties in reading comprehension and writing (spelling, letter omissions, word accents) and had substantial delays in math. All children cooperated eagerly for the academic assessment but all showed signs of fatigue and expressed it verbally.

Conclusions: Children with ASD and average intelligence, who have progressed satisfactorily through an intensive treatment program upon entering regular school classes may still continue to present with language and academic difficulties requiring ongoing support.

131.089 89 Improved Social Motivation in Adolescents with ASD Following a Social Skills Intervention. M. Murray*[1], A. Pearl[1], J. A. Hillwig-Garcia[2] and L. A. Smith[3], (1)*Penn State Hershey*, (2)*Department of Psychiatry, Penn State Hershey*, (3)*Virginia Polytechnic Institute and State University*

Background:

Despite increases in research examining the efficacy of social skills interventions for individuals with autism spectrum disorders (ASDs), few studies have targeted adolescents. This is particularly problematic as adolescence is a time of significant social change with growing emphasis placed on peer relationships.

Objectives:

To gain increased understanding of the clinical features of individuals who might benefit most from a given intervention will have obvious benefit to families and providers. It was hypothesized that individuals who were more mildly impaired in regards to ASD symptoms would show more significant treatment effects compared to moderately and/or severely impaired individuals. Finally, additional differential treatment effects by internalizing and externalizing symptoms were explored in *post hoc* analyses.

Methods:

The Multi-Media Social Skills Project was developed to help teens with ASDs acquire better social conversational abilities. The model utilized components of social skills interventions which have strong empirical support as established through previous work, namely group instruction and video modeling. Twenty-one adolescents with an ASD were recruited for this study. Participants were grouped into four cohorts and each received a manual-based, 12-week social skills intervention. Each session lasted three hours. The first 90 minutes were devoted to group instruction of new skills using video modeling. The remaining time was spent participating in a digital photography class with typically developing peers where the participants and peers worked collaboratively. Videotaped samples of five minute unstructured conversations between each participant and a novel peer were obtained pre- and post-intervention, as well as at a three month follow-up. These samples were coded for social behaviors and fluencies (e.g., amount of silence, eye contact). Additional measures were obtained at each evaluation point including the Social Responsiveness Scale (SRS) and the Strengths and Difficulties Questionnaire (SDQ).

Results:

One-factor repeated measures ANCOVAs were conducted to compare the effect of the intervention on behavioral observations over three time points. Cohort was entered as a covariate in all analyses. *Post hoc* Bonferroni t-tests for significant effects were conducted to identify differences between pre- and post-test means, as well as post-test and follow-up means. There was a significant between-subjects effect for level of social impairment ($F = 7/34$, $p < .01$). The first hypothesis was supported; between-subject effects for severity of ASD symptoms were found in relation to significant treatment effects for amount of silence. Additionally, although externalizing symptoms did not have a moderating effect on outcome, anxiety was found to significantly moderate behavioral outcomes.

Conclusions:

Degree of social impairment, as well as level of anxiety, needs to be considered when designing and implementing social skills interventions. Individuals with moderate social skills impairments and anxiety demonstrated the most significant change with this intervention. Individuals possessing more awareness of their social skill deficits and experiencing higher anxiety and discomfort in social situations might be better able to learn from video modeling and more likely to try new skills with peers during generalization experiences. Anxiety in social situations may be an important determining factor in overall efficacy of social skills interventions.

131.090 90 ABA Therapy in the ASD Population: Predictors of Long Term Social Functioning and Gender Differences. A. N. Tagliarina*, A. T. Dovi, N. Raff, C. M. Brewton and G. T. Schanding, *University of Houston*

Background: Research indicates that Applied Behavioral Analysis (ABA) is one of the leading empirically-based interventions currently available to improve social skills in young children with Autism Spectrum Disorders (ASD; Peters-Scheffer et al., 2001; Zachor et al., 2007; Eikeseth et al., 2007). Furthermore, the age at which a child with ASD starts ABA therapy, as well as the amount of therapy received, may be related to the degree of improvement in social functioning demonstrated later in life (Fenske et al., 1985; Eikeseth et al., 2007). A majority of past studies focus on the effects of ABA therapy in early intervention, as well as short term outcomes of social functioning. There has been little research conducted to determine how the degree of ABA therapy received and the age at which the individual started ABA therapy relates to current levels of social functioning in children over the age of 10. The current study is unique because it examines an older age group than previous studies have to determine if there are lasting effects of ABA therapy. Another finding in the literature suggests that males with ASD tend to have better social functioning than females with ASD (Carter et al., 2007). However, research investigating gender differences in social functioning after participating in ABA therapy is lacking.

Objectives: The current study aims to investigate the relationship of current levels of social functioning in a population of children with ASD over 10 years old in relation to: (a) degree of ABA therapy and (b) age at which the individual started ABA therapy. Additionally, the current study will explore possible gender differences in participants' social functioning outcomes.

Methods: Participants will include individuals from the Simons Simplex Collection (SSC; https://sfari.org/simons-simplex-collection) ages 10 to 18 years old. All have received clinical diagnoses of ASD through administrations of the *Autism Diagnostic Interview—Revised* (ADI-R; Rutter et al, 2009) and the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al, 2000). Current social functioning will be assessed by the *Vineland Adaptive Behavior Scale, Second Edition* (VABS-II; Sparrow, Cicchetti, & Balla, 2005) socialization domain. An SSC-specific form called the Treatment History Form will provide information regarding the amount of ABA therapy received starting at age two through age eighteen years.

Results: Analyses will utilize multiple linear regressions to determine whether the amount of ABA therapy and/or the age at which individuals started ABA therapy are predictors of positive social functioning outcomes for individuals with ASD.

Conclusions: The findings of this study will contribute to the literature regarding the relationship between ABA therapy and social functioning outcomes later in life as well as how these outcomes may differ by gender. With these long term outcomes in mind, parents and service providers may be able make decisions about the age at which children with ASD would benefit from ABA therapy, and also how long they decide to continue utilizing this therapy.

131.091 91 Teaching a Child with Autism to Mand for Information Using "How". M. A. Shillingsburg*[1], C. N. Bowen[2] and A. L. Valentino[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background: To date, only one published study has provided procedures on teaching children with autism to request information using "How" questions (Shillingsburg & Valentino, 2011). Asking questions using "how" is particularly important given its functional use in everyday settings. The ability to seek information regarding how to do things and how things work is a crucial skill for children with autism. Often children with autism may be placed in settings where they are asked to complete unknown tasks. If an instructor is unaware that the child does not know how to complete a task, the child may not complete his or her work and this lack of work completion may result in negative consequences (e.g., problem behavior). However, if a child can effectively request "how" he can then obtain information in order to effectively complete the task. This crucial skill allows for a child to effectively learn from the environment in a way that many typically developing children already do.

Objectives: Objectives of the current study include a procedure to teach requests for information using "how" to obtain information to complete spelling tasks and other activities. Procedures also assess for generalization and functional use of the information.

Methods: Josh, a 7-year-old male diagnosed with autism, participated. A multiple baseline experimental design was used to assess treatment effects. Preferred activities were identified to use as scenarios in the study (e.g., spelling, using walkie-talkies, and calling people on the phone). Scenarios included activities Josh could complete without assistance and some activities in which he needed information or assistance to complete. Sessions were only conducted when there was a motivation to complete the activity. The spelling activity was chosen for treatment. The therapist presented, in an alternating fashion, words Josh could spell independently and some in which he needed assistance. If Josh could not complete the word independently the therapist used a vocal prompt via a time delay procedure to prompt the question "How do you do it?". Interspersing known and unknown spelling words served to promote discrimination between spelling opportunities in which asking "How?" was needed versus times when he could spell independently. Data were also collected on use of the information provided after the request "How" was emitted. Generalization probes were then conducted to assess if Josh would emit the request "How?" during novel activities.

Results: Prior to intervention Josh did not engage in the request for "How'' when needing information to complete an activity (i.e., spelling). Following intervention, Josh acquired the request "How" during spelling activities and was also able to discriminate between times he did and did not need the information. Data also indicate that Josh successfully used the information provided in response to the request.

Conclusions: The results show the participant was able to acquire and appropriately use the request "How?" within several scenarios. Though teaching "How?" across multiple scenarios was needed, the participant was able to generalize to one additional activity. Overall, the current study compliments and extends the limited previous research surrounding teaching the request "How?" to children diagnosed with autism.

131.092 92 Comparing Echoic Prompts and Echoic Prompts Plus Modeled Prompts on Teaching Beginning Conversational Language. A. L. Valentino*[1], M. A. Shillingsburg[1] and N. A. Call[2], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background: Some children with autism may struggle to develop conversational skills. In order to teach conversational language to children with autism, some clinicians begin by teaching simple back and forth exchanges (e.g., after someone says "ready, set" the child responds "go" or when asked "how are you?" the child responds "fine"). Some literature has supported the use of various prompting strategies to teach these conversational exchanges (Finkel & Williams, 2001; Goldsmith, LeBlanc, & Sautter, 2007; Vedora & Meunier, 2009). These prompting strategies investigated in previous literature often involve the use of picture prompts, vocal prompts, or a combination of the two. For some children, these prompts may be ineffective and it may be necessary to investigate the use of alternative prompting strategies to teach simple conversational exchanges. For children with have a history of communicating with sign language, it is possible that modeled prompts may be effective because the child has a history of communicating with motor movements.

Objectives: The purpose of the current study is to compare vocal prompts only with vocal prompts plus a modeled prompt to teach beginning vocal conversational language to a female adolescent with autism and Down syndrome with a history of sign language training.

Methods: One 13-year 9-month old female diagnosed with autism and Down syndrome attending a behavioral program participated in the study. A modified alternating treatments design with a repeated A-B design across stimuli was used to compare two prompting procedures to a control condition. The two prompting procedures compared included vocal prompts only and vocal prompts paired with modeled prompts. Six questions were chosen and were placed into two sets. Set one included three questions each assigned to a different teaching method: "What do you throw?" (ball), "What do you swim in?" (pool), "What can you drive?" (car). Set two also included three questions, each assigned to a different teaching method: "What goes with socks?" (shoes), "What goes with spoon?" (bowl), and "What goes with brush?" (hair).

Results: The results indicated that the participant acquired responses assigned to the vocal prompts paired with modeled prompts condition more quickly than those responses assigned to the control condition and the vocal prompt only condition.

Conclusions: The results of the current findings had particular clinical significance for the participant. Teachers were instructed to use modeled prompts to augment echoic prompts when teaching simple conversational exchanges. The addition of a modeled prompt (a simple, low-cost, and easy to implement procedure) allowed the participant to acquire skills at a higher rate, resulting in more skill acquisition in less time. Future research may examine whether adding modeled prompts when teaching other forms of language (e.g., receptive skills) may result in faster acquisition of vocalizations in the same way that modeled prompts effected conversational language for this participant.

131.093 93 Teaching Children with Autism to Seek Information by Asking Questions. C. N. Bowen*[1], M. A. Shillingsburg[2] and A. L. Valentino[2], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background:

Requesting information is useful because it allows an individual to obtain important, unknown information from the environment, which may result in increased social interaction and expansion of overall language. A common problem for children with autism is the lack of asking questions to others. Requesting information is typically emitted as a "wh" question such as who?, what?, when?, or which? Children with autism often require specific intervention to learn to request information. Studies have demonstrated effective procedures to teach requests for information (Sundberg, Loeb, Hale, & Eigenheer, 2002; Shillingsburg, Valentino, Bowen, & Bradley, 2011). However, requesting information is still a skill area in which the research with children with autism is limited, especially in relation to the types of questions taught. Additionally, little is known about subsequent use of the information once given.

Objectives: Objectives of the current study include an examination of treatment procedures to teach the request for information "which?" and "who?". Additionally, this study evaluates if participants use the information requested appropriately and whether these language skills generalize to novel scenarios.

Methods: Ian, an 11-year-old male, and Josh, a 7-year-old male, both diagnosed with autism participated. A nonconcurrent multiple baseline was employed to assess treatment effects. To teach the requests "which?" and "who?", scenarios were arranged to contrive a motivation for the needed information. During "which" scenarios, 10 containers were labeled with numbers or pictures. When the participant asked for a snack, the instructor indicated that the snack was in one of the containers. During "who" scenarios, several therapists were present. When the participant asked for a snack, the instructor indicated that one of the therapists had the snack. In both scenarios the information regarding which container or which therapist was withheld in order to increase a need for the information. In order to promote discrimination of when information is needed, these sessions were interspersed with sessions in which the information regarding the location of the snack was already given. Both "who" and "which" were taught simultaneously using a time delay procedure and a vocal prompt of the correct request. The two requests were alternated to assess correct discrimination of the two request forms and data were also collected on the use of the requested information. Generalization probes were conducted to assess requests for information in novel situations.

Results: During Baseline, neither participant requested information using "who?" or "which?". Both participants acquired the ability to request for information during teaching. Additionally, results showed that both were able to discriminate when information was needed versus when it was already provided, were able to use each request form under the appropriate conditions, and also successfully used the information that was provided in response to the request. Lastly, generalization probes demonstrated that both participants generalized the request for information "Which?" across four additional novel situations.

Conclusions: Procedures in the current study were successful in teaching two children with autism to emit requests for information when the information was desired. Participants were successful in using the two requests appropriately and generalizing to novel situations.

131.094 94 A Pilot Evaluation of Unstuck and On Target: An Executive Functioning Intervention for Children with ASD. L. G. Anthony*[1], L. Cannon[2], K. Alexander[2], M. A. Werner[2], M. C. Wills[1], J. L. Sokoloff[1], K. K. Powell[1], A. C. Sharber[1], J. Strang[1], M. A. Rosenthal[3], E. Bal[1], C. Luong-Tran[1], E. Fallucca[1], A. Youmatz[4] and L. Kenworthy[1], (1)*Children's National Medical Center*, (2)*Ivymount School*, (3)*Center for Autism Spectrum Disorders, Children's National Medical Center*, (4)*Childrens National Medical Center*

Background:

Difficulties with executive functioning are a commonly observed associated feature of ASD. We have developed a school-based intervention to improve flexibility, goal-setting and planning in students with ASD, the *Unstuck and On Target* intervention. Our team developed this new intervention using a participatory process informed by a theoretical framework that emphasizes real world interventions to remediate executive function deficits in ASD through cognitive training, self-

regulatory scripts, and faded practice and cueing in home and classroom settings.

Objectives:

Compare children's change in executive functioning skills before and after participation in either Jed Baker's *Social Skills Training* or *Unstuck and On Target*.

Methods:

Twelve children received the *Unstuck and On Target* intervention, and five children received the *Social Skills Training* intervention. Both interventions were delivered by school staff with small groups of students in at least 27 sessions of 30-40 minutes each. The Unstuck and On Target intervention teaches what flexibility is and why it is important, how to be flexible through the use of self-regulatory scripts and vocabulary, goal-setting/prioritizing and coping skills. The social skills intervention uses Jed Baker's *Social Skills Training* curriculum. We conducted a small pilot test of the intervention, comparing change from pre- to post-intervention via the Shift and Plan/Org subtests of parent and teacher BRIEF questionnaires.

Results:

The children who completed the *Unstuck and On Target* intervention demonstrated significant improvement in flexibility as rated by their parent on the BRIEF Shift Paired Samples t Score ($t= 4.28$, $p<0.01$, $df=10$; 10 of 11 showed some improvement), but not their teacher on the BRIEF Shift ($t= 0.12$, $df=11$, 7 of 12 showed some improvement). Neither parents nor teachers identified significant change in the BRIEF Plan/Org (Parents: $t= 1.56$, $df=10$, 7 of 11 showed some improvement; Teacher $t= -2.47$, $df=11$, 8 of 11 showed some improvement). Parent and teacher BRIEF scores did not show significant improvement for the *Social Skills Training* group participants Parent Shift: $t=0.03$, $df=4$, 3 or 5 showed improvement; Parent Plan/Org: $t=1.34$, $df=4$, 3 of 5 showing improvement; Teacher Shift: $t=0.58$, $df=4$, 3 of 5 showed improvement, Teacher Plan/Org: $t=0.76$, $df=4$, 3 of 5 showed improvement). Single subject change graphs will be presented.

Conclusions:

These results suggest that most children show increased flexibility after participation in either *Unstuck and On Target* or *Social Skills Training* group in their school, but parents reported statistically significant improvements in flexibility only in the children receiving *Unstuck and On Target* at school. These results should be interpreted cautiously, as the current comparison represents only a small number of children. A larger randomized controlled trial (N=69) of children with ASD in mainstream schools is currently underway to evaluate the effectiveness of this curriculum. This RCT also includes a companion parent manual and training program to be used in conjunction with the school-based intervention.

131.095 95 Music Therapy As An Effective Complementary and Alternative Medicine Therapy in Children and Adolescents with Autism or Related Diagnosis. L. Henry*[1], R. Tachdjian[2] and T. Babikian[2], (1)*Pepperdine University*, (2)*UCLA*

Background: Therapeutic modalities in the field of Complementary and Alternative Medicine (CAM) continue to gain popularity as effective adjuncts to traditional interventions for a variety of medical conditions and developmental/psychological disorders, including autism spectrum disorders (ASD). Music therapy, a form of mind-body therapy, is a CAM technique used increasingly to promote musical and non-musical communicative behaviors, positive peer interactions, compliant behavior, emotional synchronicity, and initiation of engagement in children and young adults who have been diagnosed with autism or related disorder, with promising results. The Children's Music Fund's (CMF) mission is to provide music therapy for children and young adults with chronic pain, life altering illnesses, and developmental disorders, with the goal of promoting general well-being for its clients. In addition, CMF seeks to actively improve and increase the available research on music therapy within the field of complementary and alternative medical therapies. In 2011, CMF will have provided over 300 individual music therapy sessions and donated a total of over 100 musical instruments to individuals, hospitals, and organizations.

Objectives: The literature continues to lack evidence-based systematic reviews and well-designed controlled studies to assess the efficacy of music therapy in facilitating prosocial and communicative behaviors with the ASD population. The goal of this study is to assess converging reports of these benefits in a sample of children and adolescents with an autism or related diagnosis at discrete time points.
Methods: Parent, child, and therapist pre- and post-intervention assessents are collected and will be summarized to delineate the therapeutic effects of music therapy on various key outcomes in children with ASD, including repetitive stereoptypical behaviors, social functioning, and communication by CMF clients.

Results: Findings are anticipated to reveal that children with ASD who are provided with music therapy will exhibit an increase in verbal and non-verbal communication as compared to the control group, show improvements in reciprocal social behaviors, and show reductions in repetitive/stereotypical behaviors.

Conclusions: Although music interventions have been used to facilitate social, behavioral and communication skills, further research is required to establish the contribution of these interventions to the development and maintenance of these skills.

131.097 97 Peer-Mediated Social Skills Instruction for Students with ASD in the General Education Classroom. N. Brigham*[1], R. Bernstein[2], L. Kaplan[2], J. C. Cosgriff[2], C. Reilly[2], M. Boykin[2] and C. Hughes[2], (1)*Vanderbilt University Medical Center*, (2)*Vanderbilt University*

Background: Social skills are critical to school performance, particularly in high school where conversation is the primary medium of interaction and class participation. Additionally, social skills are one of only three predictive factors associated with all three indicators of post-school success. Many students with ASD lack the requisite social skills to interact effectively with teachers and peers or respond appropriately to social stimuli. However, incorporating general education peers in to social skills instructional programs has been effective at increasing social interactions of high school students with autism spectrum disorders and their typically developing classmates.

Objectives: To increase social interacations between high school students with autism spectrum disorders or related developmental disabilities and their typically developing peers in the general education classroom setting.

Methods: A multiple-baseline design across settings and participants with a multiple-probe component was used to evaluate the effects of communication book use on participants' social interactions. Participants were six students identified with an autism spectrum disorder (including Asperger Disorder) or related developmental disability, three male and three female, ranging in age from 16-18. Each participant attended 4-7 general education classes. Thirty general education students served as conversational partners during intervention, of which 17 were female and 13 were male. The study consisted of three experimental conditions: (a) baseline, (b) communication book training, and (c) communication book use, across which generalization data were collected daily. Follow-up data were also collected.

Results: Communication book use was associated with increases in conversational initiations and responses between the students with ASD and their peers. Participants and peers reported that they enjoyed their interactions with each other. Communication book use appeared acceptable across social situations.

Conclusions: Communication books are effective in promoting interactions across students with varied social skills and, in fact, may serve as a "social prosthetic" to promote interaction among peers who might not typically interact.

Treatments: A: Social Skills; School, Teachers Program
132 Treatment II: Early Intervention

132.098 98 First Impressions: Facial Expressions and Prosody Signal ASD Status to Naïve Observers. A. Schmid*[1], N. Pitre[2], K. Hasty[1] and R. B. Grossman[2], (1)*UMMS Shriver Center*, (2)*Emerson College*

Background: Data suggest that differences in the voice quality and prosody of individuals with ASD quickly signal the disorder

to typically developing (TD) peers (Diehl et al. 2009, Lord & Paul, 1997) and that their facial expressions are rated as awkward by TD coders (Grossman et al. 2008).

Objectives: The purpose of this study was to determine whether facial expressions and/or prosody of adolescents with ASD convey their diagnosis or general social awkwardness to naïve participants even in very short stimuli. We hypothesized that dynamic information, particularly the combination of audio and video, would identify individuals with ASD, but still photographs would not.

Methods: We used videos of adolescents, aged 8-16 (TD=15, ASD=25) recorded during a story-retelling task (Grossman et al. 2008) and extracted still images, one-second clips and three-second clips. All video clips were saved in three different versions: Silent Video (SV), Audio Only (wave), and Audio with Video (AV). Naïve adult participants (17-29 per stimulus type) watched and/or listened to the stimuli and decided through button presses whether the person they had just seen or heard was "socially typical" or "awkward." Midway through the task the instructions changed, asking participants to determine whether the person in the preceding clip might have autism. We included both prompts to assess whether participants changed their perceptions of the adolescents in the stimuli when asked to determine a specific diagnosis, vs. more generic social awkwardness.

Results: We calculated accuracy for determining ASD or TD status of the adolescents in the clips for each stimulus type. Performance for still images was at chance throughout and accuracy for three-second clips was significantly higher than for one-second clips. A multivariate ANOVA with stimulus type (AV, SV, Wave) as the dependent variable showed no difference in accuracy rates for three-second clips produced by adolescents with ASD vs. those produced by TD adolescents if the prompt was to detect social awkwardness. When the prompt was to determine ASD status, AV stimuli produced by adolescents with ASD were categorized significantly more accurately than SV or wave files, which had accuracies at chance level.

Conclusions: Our data show that naïve adult observers were able to accurately differentiate between adolescents with ASD and their TD peers based on only three seconds of visual and/or auditory information. Still photographs did not provide sufficient information for naïve observers to make that determination. Participants were more accurate in trials prompting them to diagnose ASD than those prompting to detect social awkwardness, suggesting that there are indicators beyond general social awkwardness that are used by naïve observers to form their perception of ASD status. These factors appear to be most definitive when auditory (prosody) and visual (facial expression) features are preserved together, rather than presented in isolation.

132.099 99 Improving Social Conversation in Children with Autism Spectrum Disorders Through Teaching Multiple Questions. A. M. Krasno*[1], R. A. Doggett[1], R. L. Koegel[2] and L. K. Koegel[1], (1)*University of California, Santa Barbara*, (2)*Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*

Background: Social conversation is a multifaceted construct that involves a natural and reciprocal exchange of information between two or more people who are engaged in an interpersonal interaction (McTear, 1985). Conversation is a ubiquitous part of our social world, and is necessary for everyday interactions as well as forming and maintaining relationships with others (Brinton & Fujiki, 1985). However, individuals diagnosed with autism spectrum disorder (ASD) have a "marked impairment in the ability to initiate or sustain a conversation," often leading to social isolation (APA, 2000, p. 75; Marans, Rubin & Laurent, 2005).

Objectives: This study looks at one type of initiation, question-asking, and investigated whether a self-management intervention is effective for teaching simultaneous acquisition and discrimination of three social questions used in conversation: *who, what* and *where.* Additionally, the objectives included seeing if the participants' gains generalized to conversational partners not involved in treatment, and if the gains maintained over time.

Methods: Two female children diagnosed with ASD, ages 7 and 9, participated in this study. A non-concurrent multiple baseline across participants design was employed (Barlow, Nock, & Hersen, 2009). The children were taught when it is

appropriate to use the words *what*, *where*, and *who*, when asking questions during social conversation. To increase the child's motivation for learning the new skill, self-management was used. The child and clinician held a natural conversation, in which the clinician provided leading statements that prompted a question in response. The participants checked off a box each time they asked an appropriate *wh*-question during these opportunities, and upon completion of checking all boxes, the participants were given a reinforcer.

Results: Both participants dramatically and suddenly increased the appropriate use of all three *wh*-questions. These gains generalized to conversational partners uninvolved in treatment and gains were maintained at long-term follow-up (6 months or 1 year). Furthermore, the data suggest that lack of question-asking appears to be motivation-based rather than ability-based.

Conclusions: Asking questions may help to reduce negative psychological and psychosocial outcomes by teaching children to use an effective tool that facilitates reciprocal interactions with others. Increased use of basic question-asking has been shown to result in long-term improvements and collateral gains for young children with autism (Koegel et al., 2010) and may decrease their learned helplessness by motivating them to ask questions of others. A major strength of this study is that it used a versatile, easy to implement intervention that can be used by clinicians, teachers, and parents to teach question asking skills. Furthermore, changes in behavior were very fast, resulting in a short duration of intervention. The positive results of this study inspire future research on using self-management procedures to target several simultaneous spontaneous questions (i.e., without a clear leading statement as a prompt), and expanding on the complexity of the question taught to build on the partner's utterances, in addition to investigating collateral gains from teaching appropriate question-asking.

132.100 100 A Developmental Framework for Promoting Joint Attention in Toddlers with ASD: Formative Analysis of An Intervention. H. H. Schertz*[1], S. L. Odom[2] and K. M. Baggett[3], (1)*Indiana University*, (2)*University of North Carolina*, (3)*University of Kansas*

Background:

Single Case Design (SCD) research is typically used to study intervention effects. We review an alternative use – formative analysis of an intervention's design features. Joint Attention Mediated Learning (JAML) is a parent-mediated intervention for toddlers with autism spectrum disorders (ASD) that is designed to support joint attention development through promotion of theoretical developmental precursors. An earlier pilot study showed JAML's effects for three toddlers. A needed next step was to implement JAML with multiple interventionists in different sites and to use what was learned to design intervention refinements.

Objectives:

The study's purpose was to explore individual responses to JAML enhancements and to identify patterns of individual response relative to precursor-focused intervention phases.

Methods:

Seventeen toddlers with high risk for ASD and their parents participated in JAML to promote preverbal social communication. A SCD was used to track child progress in four targeted outcomes: focusing on faces (FF), turn-taking (TT), responding to joint attention (RJA), and initiating joint attention (IJA) through intervention phases corresponding with these outcomes. Participants progressed through phases as outcomes for previous phases were achieved. Earlier participants received the original version of JAML. Procedural changes introduced for later participants included merging the final two intervention phases and adding: guided reflection on video-recorded parent-child interaction, enhanced intervention materials, and video clips to illustrate targeted outcomes and mediated learning principles. Coders, blind to intervention condition, assessed weekly 10-minute recorded video sessions of parent-child interaction for the occurrence of each targeted outcome in each of 60 ten-second intervals. Data were plotted for visual analysis of child movement through the phases (i.e., their achievement of targeted outcomes) and the strength of individual responses to the intervention.

Results:

All except one child demonstrated joint attention in parent-child interaction over the course of the intervention. For half of

the participants, joint attention appeared before it was introduced as a phase of intervention. Seven of the 10 participants who received the enhanced version of JAML showed more than 10 instances of joint attention over at least two sessions. Only one of the seven participants who received the original version of JAML achieved this level of joint attention engagement.

Conclusions:

Before an intervention design is tested and disseminated for field-based implementation as an evidence-based practice, it is useful to consider features of the intervention that may affect its outcomes. Enhancements to JAML's design appeared to result in stronger toddler responses to the intervention. Analyses of individual responses to JAML and half of the participants' attainment of joint attention before it was introduced in the intervention support JAML's inclusion of the theoretical precursors FF and TT as a foundation for JA. Joint attention, in turn, is an important foundation for verbal language, as demonstrated in well-replicated research. Because of its depiction of individual patterns of response to an intervention over time, SCD is a useful tool for micro-analysis of an intervention's conceptual design and procedural features.

132.101 101 Caregiver Instruction and Ipad's: Implementation of Video Modeling Imitation Training. T. Cardon*,

Background:

Researchers have used video modeling to teach play skills, social skills, routines, and gestures to children with autism for over ten years (e.g., Charlop-Christy, Le & Freeman, 2000; Bellini & Akullian, 2007; Cardon & Wilcox, 2011). The development of tablet computers, such as the iPad, have dramatically increased the use of portable computers within special needs populations (Dunham, 2011; Sennet & Bowker, 2009). The purpose of this research was to teach caregivers to use Video Modeling Imitation Training (VMIT) with iPad technology in the home environment to teach daily routines and play skills.

Objectives:

1) To analyze how effectively caregivers can be trained to create effective video models using an iPad. 2) To examine the imitation skills acquired by children (ages 24-50 months) with autism during caregiver-implemented VMIT.

Methods: Caregivers attended one, two-hour training session, and received a training manual and video guide with step-by-step instructions on the iPad. Caregivers identified five specific routines (e.g., teeth brushing) or play schemes (e.g., pushing a car) that they wanted to teach their child to imitate. Caregivers then recorded the five video models on the iPad. Video recordings of the caregivers creating the video models with the iPads were made and analyzed for fidelity of implementation. Fidelity of implementation was analyzed using procedural checklists based on the VMIT protocol established by Cardon & Wilcox (2011). A multiple baseline design across four participants was conducted to determine if caregivers could teach their children with autism to imitate using VMIT. The following measures were obtained pre- and post- treatment to assess changes across treatment: Motor Imitation Scale (Stone, Ousley, & Littleford, 1997), MacArthur Communicative Development Inventory (Fenson, Dale, Reznick, Thal, Bates, Hartung, & Pethick, 1993) Developmental Play Assessment Instrument (Lifter, Sulzer-Azaroff, Anderson, & Cowdery, 1993), and the Preschool Language Scale – 5 (Zimmerman, Steiner, & Pond, 2011).

Results: Caregivers were able to successfully create video models to support imitation acquisition in their young children with autism. Fidelity of implementation was greater than 90% for all of the video models that were created and caregivers reported being satisfied with the treatment and results. All four children made gains in their imitation skills and maintained higher than baseline levels during treatment. Immediacy effects were evident in three of four participants. Two of four participants met a priori mastery criteria and five new video models were introduced. Imitation skills generalized to live presentations with the caregivers at one and three week follow up sessions. Post-assessment gains of language and play skills varied across participants.

Conclusions: Video Modeling Imitation Training can be successfully implemented by caregivers to promote imitation acquisition in young children with autism. Caregivers do not

require extensive training to become proficient at this type of intervention. VMIT is one type of treatment that can be effectively utilized with tablet computers to support skill development in children with autism.

132.102 102 Teacher-Implemented Joint Attention Intervention: Pilot Randomized Controlled Study for Preschoolers with Autism. K. Lawton*[1] and C. Kasari[2], (1)*The Ohio State University*, (2)*University of California, Los Angeles*

Background: The vast majority of children with an autism spectrum disorder (ASD) attend public preschools at some point in their childhood. Community preschool practices often are not evidence-based and almost none target the core deficits of ASD.

Objectives: This study investigated the effectiveness of public preschool teachers implementing a validated intervention (the Joint Attention and Symbolic Play/Engagement and Regulation intervention-JASP/ER) on a core deficit of autism, initiating joint attention.

Methods: Sixteen dyads (preschoolers with ASD and the public school teacher or paraprofessional who worked in the child's classroom) were randomly assigned to the six-week JASP/ER intervention or a control group.

Results: At the end of the intervention, JASP/ER teachers/paraprofessionals used more JASP/ER strategies than the control teachers/paraprofessionals and JASP/ER preschoolers used more joint attention in their classroom than control children. Additionally, JASP/ER children spent more time in supported engagement and less time in object engagement than control preschoolers.

Conclusions: Findings suggest that teachers/paraprofessionals were able to improve a core deficit of children with ASD in a public preschool context.

132.103 103 Effects of Early Treatment in Autism After the First Diagnosis: An Observational Italian Study. A. Narzisi* and F. Muratori, *University of Pisa - Stella Maris Scientific Institute*

Background: In the last two years the results of two wide studies published on prestigious journals as Pediatrics (Dawson et al., 2009) and Lancet (Green et al., 2010) confirm, in different ways, the importance of early interventions for early treatment in autism. We investigated the effect of not manualized AS USUAL intervention in a multicentric study in Italy.

Objectives: The main aim was to conduct an observational research to evaluate the role of early interventions for improving outcomes of toddlers diagnosed with autism spectrum disorder (ASD). Secondary aims were (a) to compare behavioral-oriented intervention vs. developmental-oriented intervention; (b) to compare children attending to school vs. children who do not attend to school; (c) to compare children whose parents are involved in treatment vs. children whose parents are not involved.

Methods: Seventy children diagnosed with ASD between 18 and 59 months of age (mean age: 34,7 months) were recruited. They were evaluated by blind researchers at baseline and after six months of intervention using ADOS-G; Griffiths Mental Developmental scales; and Vineland Adaptive Behavior scales (VABS). Parents filled out MacArthur inventory; Social Communication Questionnaire; CBCL and Parent Stress Index. All children were referred to community providers for intervention commonly available in the community.

Results: At endpoint, most children were still classified as having an ADOS-G diagnosis of autism spectrum disorder. However, 20 (35%) of 57 children with AD had changed from core autism to autism spectrum disorder and 4 (5,7%) out of 13 PDDNOS had changed from autism spectrum disorder to non-spectrum. Treatment effects were obtained for cognitive functioning (General Quotient was higher by 15.7 points than baseline on Griffiths); language; adaptive behaviour; child behaviour and parental stress. There were no clinical differences between developmental-oriented and behavioral-oriented intervention except for the larger amount of treatment hours in behavioral interventions. Attending school and parents involvement in child's treatments were predictive of a best clinical outcome.

Conclusions: This is the first Italian multisite study that confirm autism as a treatable disorder. We'll discuss our results

considering their similarity and differences compared to findings in Dawson' (2009) and Green' (2010) results.

132.104 104 Engaging Toddlers with Autism: Effective Caregiver Strategies. A. Fuller*, C. Ross, A. Gulsrud, K. Lawton and C. Kasari, *UCLA*

Background: Young children with ASD demonstrate differences in their use of joint attention and social play when engaging with others. Such behaviors make it difficult for caregivers to engage their children.

Caregiver mediated interventions have shown success in teaching parents strategies to help their children increase their use of joint attention initiations and responses (Kasari et al., 2010; Rocha, Schreibman, & Stahmer, 2007) and their engagement with others (Kasari et al., 2010). Many of these interventions utilize an individualized approach within the framework of the treatment model. One question is the extent to which caregivers enter treatment with mastery of specific strategies. Thus the current study examined caregiver strategy use prior to intervention.

Objectives: The purpose of this study was to describe and compare caregiver strategies while interacting with their children with ASD within supported joint and object engagement states.

Methods: The sample included 85 toddlers with ASD (70 males, 15 females) and their caregivers. The mean CA of the children was 31.62 months. Mean receptive language age on the Mullen was 18.24 months, and the mean expressive language age was 17.33 months. Children were recruited from an early intervention program at UCLA. Coding: Caregiver-child interactions were coded using *symbol-infused engagement states* (Adamson et al., 2004). This system measures the percentage of time in various engagement states between caregivers and their toddlers. Two states (object and joint engagement) were calculated given their importance in previous studies of caregivers and toddlers with autism (Kasari et al., 2010). *Caregiver strategies during the MCX* were coded, capturing five different strategies used by caregivers during interactions with their children. These strategies included: 1) caregiver directiveness 2) play level 3) maintaining strategies 4) activity level 5) gestural behaviors. Each variable was coded within the longest period of supported joint engagement and object engagement for each dyad.

Results: Exact McNemar tests were used to identify differences in the proportion of caregivers using each strategy between the object engaged and supported joint engaged states. Caregiver play level ($p<.001$), maintenance of their child's attention ($p<.001$), and caregiver activity level ($p<.001$) were significantly different between the two engagement states. A greater proportion of caregivers were able to match their child's play level during supported engagement than in the object state. Second, few caregivers attempted to redirect their children's attention during the supported joint state, while many tried to do so in the object state. Parents also tended to be less active in interactions with their object focused children. Verbal directiveness and gestural behaviors were not different between engagement states. Overall, children spent more time in object engaged states, and parents had difficulty modeling joint attention skills and playing at their child's level.

Conclusions: These findings suggest that playing at the child's level, having a balanced activity level, and maintaining the child's attention may be important components of sustaining joint engagement. Additionally, tailoring the intervention to the existing skills of the caregiver will likely be more successful than using the same "one shoe fits all" approach to intervention.

132.106 106 A Pilot Study of the Effects of An Australian Centre-Based Early Intervention for Children with Autism. J. M. Paynter*[1], J. Scott[2], W. Beamish[3], M. Duhig[4] and H. Heussler[5], (1)*Mater Medical Research Institute*, (2)*Queensland Centre for Mental Health Research*, (3)*Griffith University*, (4)*Queensland Children's Hospital*, (5)*The University of Queensland*

Background: Despite the ubiquity of educationally-based early intervention programmes for children with autism there is limited empirical evidence to support their use. Where research has investigated the effectiveness of such programmes, it has predominantly been as control conditions in Early Intensive Behavioural Intervention trials (e.g. ABA). There is clearly a need to specifically investigate educationally-based autism-specific early interventions. The

Australian Government has established six Autism Specific Early Learning and Care Centres (ASELCCs), including one in Brisbane, Queensland. The Queensland ASELCC opened in February 2010, and its service is provided by the AEIOU Foundation in partnership with Griffith University. The AEIOU programme follows Australian Best Practice Guidelines (Prior & Roberts, 2006) for early intervention for autism and runs an educationally-focused programme. As part of the ASELCC initiative each centre is required to conduct standardised assessments and build an outcomes evaluation strategy to assess programme effectiveness. As such, data has been collected at the Queensland ASELCC on all participating children and families.

Objectives: The objective of this research is to evaluate the clinical effectiveness of the AEIOU programme as implemented at the Brisbane ASELCC through investigating child and family outcomes captured in the assessment conducted as part of this initiative.

Methods: Participants included parents and their children with an ASD aged 2½ to 6 years who attended the Queensland ASELCC in 2010 and exited by July 2011 (n = 10). Assessment of children's communication, motor, and cognitive development as well as their adaptive behaviour were completed upon entry to the programme and at exit. Measures included the Vineland Adaptive Behaviour Scales (VABS-II), Psychoeducational Profile (PEP-III), the Mullen Scales of Early Learning (MSEL), and the Social Communication Questionnaire (SCQ).

Results: Significant improvements at a group level were found in the level of autism symptoms with the average SCQ score improving from the clinical to non-clinical range. Consistent with this, significant improvements were also observed in PEP-3 social reciprocity standard scores. In addition, significant gains were observed in PEP-3 standard scores for cognitive/verbal communication, fine motor and visual-motor imitation skills. No significant changes in standard scores for adaptive behaviour (VABS) were observed, although there were gains in some age-equivalent subdomain scores. Changes in age-equivalent scores on receptive language on the MSEL were observed although other subscales did not significantly change over time.

Conclusions: Preliminary results suggest promising outcomes for children participating in the AEIOU programme, particularly in terms of symptom reduction and increases in educational skills. Future studies require the use of larger samples and randomised and controlled methodology. However, this small-scale Australian study contributes to the evidence-base for centre-based educational intervention for children with autism.

132.107 107 Joint Attention Intervention for Young Children with Autism and Their Parents: A Case-Control Study.

C. H. Chiang*[1], C. L. Chu[2] and T. C. Lee[1], (1)*National Chengchi University*, (2)*National Chung Cheng University*

Background: Joint attention (JA) deficit is one of core symptoms in children with autism. Recent literature demonstrated that the JA intervention could improve their JA, play and language abilities. No studies explore the efficacy of JA intervention systematically and never include parent training in the program in Taiwan.

Objectives: The purpose of the study was to develop JA intervention program for children with autism and their parents. The current report was to describe initial findings for case-control study.

Methods: Participants were 15 children with autism (CA = 28-56 months, MA = 14-50 months) in intervention group and 15 CA, MA, gender and SES matched children with autism in control group. All of the children were diagnosed with DSM-IV-TR and ADOS by a research team including psychiatrists and psychologists. The JA intervention program consisted of two parts, one for children, and the other for their parents. The child JA intervention program was referred from Kasari's suggestion (Kasari, et al., 2006, 2010). For the child training, each session was 30 minutes, 3 times per week, and the total was 24 sessions. The discrete trial training and milieu teaching approaches were used on the table time and floor time separately. The JA intervention program for the parents was based on both of Kasari's lab and authors' clinical experience and followed the Parent JA Intervention Manual (PJAIM). The first half of the parent training was from session 1 to 8, the interventionist used the PJAIM as a reference to teach the parent what is going on from one way mirror while they are

observing his/er child's training session in the play room. From session 9 to 24, the parent was invited to interact with his/er child guided by interventionist for 15 minutes after child's training session. The interventionist assisted the parent to practice the strategies to improve the child's JA skills and joint engagement. The pre- and post- tests were: ESCS (Mundy, et al., 2003), and free play of parent-child interaction.

Results: The initial results showed significant difference in joint engagement but not in joint attention skills between intervention group and control group, with intervention group yielding more supported joint engagement in parent child interaction.

Conclusions: The initial findings revealed that the JA intervention program for young children with autism and their parents seems positive. The parents changed their teaching strategies from adult-directed approach to child-directed approach in the sessions and maintained the child-directed teaching strategies. Further studies are needed to analyze the joint attention skills in other conditions and its collateral abilities and follow the long term effects.

132.108 108 A Randomized Controlled Trial of a Group Parent-Training Program in a Joint Attention Intervention. K. Houghton* and C. Lewis, *Lancaster University*

Background: Interventions designed to facilitate increased joint attention skills in young children with autism have been found to be effective in addressing core autism symptoms. Furthermore, parents have been successfully trained to deliver these interventions effectively at home. However, parent-mediated joint attention interventions for young children with autism have yet to be widely adopted in community settings despite their promise for delivering effective early intervention at a lower cost than therapist-implemented models. Lack of widespead disemination may be, in part, due to the fact that most the published efficacy studies of parent-mediated, joint attention interventions have used a one-on-one parent-coaching model to train parents. This is not easily adapted to community-based settings with limited resources. Additionally, most of these interventions have been tested with predominantly White, middle-class Americans without testing the efficacy with families from low-income or minority cultural backgrounds bringing into question the applicability of these interventions to diverse populations.

Objectives: This randomized controlled trial is a pilot study of a parent-training program designed to teach parents from low-income and minority backgrounds to implement a joint attention intervention with their young children with autism.

Methods: Participants were parents of children 5 years and under diagnosed with autism spectrum disorder with an expressive language level of less than 32 months. The participants were predominantly from low-income households and were all from minority racial/ethnic groups. Children were assessed at intake with the ADOS, Mullen Scales of Early Learning, Vineland SEEC, McArthur Bates CDI and parents completed the Parenting Stress Index. Additionally, a 15 minutes parent-child free play video sample was coded for periods of joint engagement and joint attention skills. Parents were randomly allocated into two groups, 1) the treatment group received 12 hours of instruction in six 2-hour sessions over six consecutive weeks and 2) the delayed treatment group who received the same training at a later time. The parent-training program was designed to be highly interactive and require no more than an 8th grade reading level in English. Transportation costs to the training program were covered and child care was provided during training sessions. The McArthur Bates, PSI and parent-child free play measures were repeated immediately after parent training and at 3-month follow-up. All children maintained their regular schedule of state provided early intervention and preschool services throughout the study period.

Results: Changes in measures of child social-communication development, parent stress and the interactive states of the dyad were analyzed for between-groups differences.

Conclusions: Parents from diverse backgrounds were trained in a low-cost group settings to implement joint attention interventions at home with their young children with autism.

132.109 109 Effects of Parent-Mediated Early Intervention on Child Behavioral Outcomes in An Underserved Population. A. K. Dent*[1], T. Carr[2], S. Leitman[3] and C. E. Lord[4], (1)*Univeristy of Michigan*, (2)*University of*

Michigan, (3)*Weill Cornell Medical College/ NY Presbyterian Hospital*, (4)*Weill Cornell Medical College*

Background:

There has been less research on the outcomes of children from underserved populations (i.e. low socioeconomic status) enrolled in early intervention. The Early Social Interaction - Community Outreach Project (ESI-CO) was developed from the Early Social Interaction (ESI) project (Woods & Wetherby, 2003) but modified to better meet the needs of families from an underserved population. Caregivers participating in ESI-CO demonstrated an increase in the use of strategies to increase their child's social and communication skills (Carr, Lopez, Barriger, Jeanpierre, & Lord, 2011). Changes in child behavior, however, have not yet been analyzed.

Objectives:

This study investigates the effects of a parent-mediated intervention on child behavioral outcomes in children from an underserved population. In addition to standard measures such as the ADOS, Mullen, and Vineland, this study applies the use of a new measure, the Autism Diagnostic Observation Schedule –Change (ADOS-C) to assess change in child behavior across a short-term intervention.

Methods:

Eligible families were caregivers with limited education and family income whose child received a diagnosis of ASD. Participants were eight child-caregiver dyads who received 24 in-home treatment sessions. Dyads were also video recorded weekly engaging in short, interactive play activities. The activities were introduced using a multiple baseline design and were either targeted or non-targeted to assess the effects of treatment. Child outcome was measured two ways: full assessment at pre-and post-treatment and weekly coding of child-caregiver interactions. Full assessments, including the ADOS, Mullen, and Vineland, were conducted to assess broad changes in child outcome whereas the weekly child-caregiver interactions were coded using the ADOS-C to assess subtle changes in social and communication skills over treatment.

Results:

Paired t-test analysis yielded no significant differences between pre and post treatment assessments in ADOS, Mullen, and Vineland scores. Currently, child-caregiver interactions are being scored using the ADOS-C. Paired t-tests and effect size calculations will be used to analyze change in child outcome from pre- to post-treatment. A total of 96 interactions (12 per child-caregiver dyad) will be included in the final analysis. We hypothesize children will demonstrate improvements in social and communication skills as measured by the ADOS-C over the course of the intervention.

Conclusions:

This is one of the first investigations of a parent-mediated intervention in an underserved population. Implications related to the design of the intervention program and use of instruments measuring social and communication skills in diverse populations will be discussed.

132.110 110 Use of Multi-Modal Feedback to Facilitate Word and Syllable Combinations. L. DeThorne*[1], K. Karahalios[2], J. Halle[1], K. Lyons[1] and M. Aparicio Betancourt[1], (1)*University of Illinois*, (2)*University of Illinois at Urbana-Champaign*

Background:

Although communication difficulties represent a core feature of autism, literature documenting the effectiveness of speech therapy in this population is relatively sparse. Given documented challenges in auditory processing, imitation, and motor planning, the use of multimodal feedback (visual, tactile, and auditory) in speech therapy holds particular promise.

Objectives:

The purpose of this interdisciplinary work, currently funded by Autism Speaks, is to examine the use of multimodal feedback to facilitate multisyllabic speech production in children with speech-language impairments, including autism. The specific research questions are as follows:

Does an integrated speech therapy approach involving multimodal feedback improve children's production of multisyllabic targets?

Does use of a computer-based voice visualization system,

VocSyl, facilitate multisyllabic productions to a greater extent than traditional methods?

Methods:

Eighteen children with a variety of developmental disabilities (including autism), age 3-8 years, have been recruited to this work in progress, with completed treatment data available for 10 children at the time of submission. An initial assessment battery indicated that all enrolled participants were at the single-word stage of development.

Participants were systematically assigned six at a time to the following conditions: (a) speech intervention with traditional multimodal feedback, (b) speech intervention with Vocsyl, a computer-based voice visualization system, and (c) playgroup intervention focused on facilitating social interaction, serving as a control condition. Thirty multisyllabic targets were selected for all participants based on initial assessment and divided into two lists of 15 targets (treated v. untreated). Target lists were counterbalanced for semantic category, phonological complexity, and number of syllables. Neither list is treated in the control playgroup condition.

The two speech interventions consist of both an explicit motor practice segment and a period of developmental play. Motor practice is completed with either the pacing board or Vocsyl depending on the condition. The children assigned to the control group receive a comparable number of playgroup sessions without focus on any of the 30 multisyllabic targets.

All participants are systematically assessed on their 30 selected multisyllabic targets at five time points throughout the course of intervention using both a card-labeling and an object-play task.

Results:

Analyses focus on group differences across conditions as well as within group differences on treated versus untreated targets. The four children who have completed the control playgroup condition to date increased their production of targets to 20% and 15% in the card-labeling and object-play tasks respectively, thereby providing a comparison for our explicit speech interventions. In contrast, the six children in the traditional speech treatment group increased their accuracy on treatment targets by 40% and 39% respectively. Additionally, the children in the traditional speech treatment condition averaged 40% accuracy on treated targets compared to 16% on the untreated targets.

Conclusions:

Preliminary results based on six children in the traditional treatment condition and four in the control group suggested a modest but positive impact for the traditional speech intervention. Data collection should be complete by May, allowing us to present complete group comparisons, including a direct comparison of the traditional and computerized treatment conditions.

132.111 111 The Effectiveness of Speech Generating Devices for Children with ASD. D. Trembath*[1], C. Dissanayake[1] and T. Iacono[2], (1)*Olga Tennison Autism Research Centre, La Trobe University*, (2)*La Trobe University*

Background: Children with ASD who have little or no functional speech have the potential to benefit from the use of Augmentative and Alternative Communication (AAC) intervention. The aim of AAC intervention is to support the development of symbolic communication and possibly natural speech. In recent years, and following the advent of cheaper technology, there has been widespread interest in the possibility that one type of AAC, speech generating devices (SGDs), may provide expressive and receptive communication support for children with ASD who have little or no functional speech. To this end, a small number of studies have provided preliminary support for the use of SGDs in promoting communication with parents, peers, and educators. However, further research is needed to better understand the individual outcomes of providing SGD-based treatments to children with ASD, and to compare the relative effectiveness of treatment with, and without, a SGD.

Objectives: The aim of this study was to examine the effectiveness of a SGD-based treatment in supporting the expressive communication of three preschool aged children with ASD.

Methods: An alternating treatments single case experimental design was used to assess the treatment outcomes for each of three children, aged 3-5 years. Each child attended a series of 16 clinic-based play sessions with a treating clinician, including 3 baseline, 12 intervention, and 1 follow-up session. Each session lasted 30 minutes, during which the treating clinician attempted to engage the child in a series of play activities. The two treatments were naturalistic teaching with, and without, a SGD. The SGD was a Talara 32© containing eight frequently and commonly used words (e.g., help, more, finished) chosen for their relevance across a range of play activities. All sessions were video-recorded to assist with coding and analysis.

Results: Blind coding of the videos for the children's use of the SGD and production of natural speech is currently underway. The treating clinician's delivery of the intervention, including the creation of communicative opportunities and modelling of the SGD, is also being coded for all videos as a measure of fidelity. Preliminary analysis indicates varied outcomes for each of the three children, with all children responding to both treatment conditions (with and without a SGD). Detailed analyses of changes in the children's communication across baseline, intervention, and follow-up sessions, including a comparison of performance under each treatment condition, will be completed using visual and statistical analyses (Tau-U) and reported in the presentation.

Conclusions: The results of this study will provide preliminary evidence regarding the effectiveness of SGD-based treatments for preschool aged children with ASD. Importantly, the use of an alternating treatments single case experimental design will allow for a detailed analysis of individual outcomes for each child, under each treatment condition. These individual outcomes, including the children's use of the SGD and changes in natural speech over time, will be discussed along with the implications for parents, educators, and researchers attempting to provide effective, evidence-based treatments for children with ASD who have little or no functional speech.

132.112 112 The Effect of Brief Intervention on Spontaneous Turn-Taking in Pivotal Response Teaching for Children with Autism Spectrum Disorder. A. Kondo* and J. Yamamoto, *Keio University*

Background: Applied behavior analysis (ABA) has contributed to a lot of successes in early intervention for individuals with autism (Smith, et al., 2000). While focusing on various behaviors, pivotal response training (PRT) maximized the opportunities of receiving reinforcers in naturalistic conditions by keeping higher motivation level (Koegel & Koegel, 2006). Turn-taking behavior is one of the components of PRT. There are many intervention studies using PRT (Pierce and Schreibman, 1995; Schreibman et al., 2009). However, there are few intervention studies of focusing on improving spontaneous turn-taking behavior. In order for individuals with autism to adjust to naturalistic conditions, not only between two persons, more studies are needed that examine turn-taking behavior among three persons.

Objectives: We examined the effects of a brief intensive intervention using visual-prompts and deferential reinforcement on spontaneous turn-taking behavior among three persons (a child and two adults) for a child with autism spectrum disorder (ASD).

Methods: Participants were three boys with ASD. In *pre-assessment*, *post assessment and follow up phase,* we conducted two play situations using a toy for five minutes each. ***1) Turn-taking between two persons:*** A boy and an adult took turns to play with a toy. *2) Turn-taking among three persons:* A boy and two adults took turns to play with a toy. In each situation, the boy was instructed to give the toy to the person who should do next. In *intervention phase*, we used the toy, which was different from the one used in pre-assessment phase, but had the same functional structure. Intervention was only conducted for turn-taking among three persons situation. During the intervention, the number written paper (1, 2, or 3) was assigned in front of the boy and the adults, and he was instructed to give the toy by looking at these papers and caring for who should do next. This intervention had three sessions. Each session consisted of 24 turns including the boy's and the adults'. Dependent variables were the rates of correct response, which were the numbers of turns that the boy gave the toy to the correct person spontaneously over the total

numbers of adult's turns in both turn-taking between two persons and among three persons situations.

Results: The rate of correct response between pre and post assessment phase in the situation of turn-taking among three persons showed the improvement for all three boys (33.3 to 75.0%, 55.6 to 84.2% and 50.0 to 90.7%, respectively). In follow up phase, the rates of correct response in both situations were maintained in higher rate. Without intervention, the rate of correct response between pre and post assessment phase in the situation of turn-taking between two persons also showed improvement (59.1 to 80.0%, 75.0 to 100% and 87.5 to 100%, respectively).

Conclusions: The current study indicated that even a relatively short intervention could improve the correct turn-taking behavior among three persons. It also indicated that the intervention for turn-taking among three persons could improve the boy's spontaneous correct turn-taking behavior even in the two persons situation.

132.114 114 Transitioning From Development to Efficacy Trial: Challenges Faced by An Autism Intervention Study. K. P. Wilson*, J. R. Dykstra, K. M. Belardi, L. R. Watson, B. Boyd, G. T. Baranek and E. Crais, *University of North Carolina at Chapel Hill*

Background: The research process is comprised of sequential phases designed to systematically determine the effectiveness of an intervention. However, differences in phase characteristics make transitioning between phases challenging. While there is a body of literature discussing the transition from efficacy to effectiveness trials, there is a paucity of information on the challenges specific to the preceding transition from intervention development to efficacy trial, which is thought to be equally important to translation (Whittenmore & Grey, 2002). The current study responds to this gap by examining the specific challenges accompanying this transition, using a case study of a school-based intervention for preschool students with autism.

Objectives: The aims of this qualitative study were to: (a) illustrate the challenges and issues raised during the transition from intervention development to multi-site intervention efficacy trial in the field of autism; (b) describe lessons learned using an autism intervention study as a case example; and (c) provide suggestions for researchers seeking to fund and complete these two phases of the research process.

Methods: The school-based Advancing Social-communication And Play (ASAP) intervention for preschoolers with autism was developed and refined through a four-year development grant (IES goal 2), and the efficacy of the fully-developed intervention is currently being tested through an efficacy trial grant (IES goal 3) conducted at four research sites across the U.S. Issues and challenges related to the transition between these two research phases have been documented by the research team, and solutions have been trialed and implemented. Based on systematic qualitative analysis of the documentation of these challenges and solutions in research team meeting notes, recurring themes were derived using a grounded theory approach (Glaser & Strauss, 1967). This approach allowed the researchers to reverse-engineer hypotheses through a process of substantive coding, categorization, and melding of deductive and inductive reasoning. Due to the nature of the data and the research team's lack of a-priori theories, this approach to data analysis was most appropriate and produced the richest results possible.

Results: Preliminary themes that emerged from the documentation of the transition were in the following categories: consistency-related issues/solutions (e.g., moving to larger-scale monitoring of assessment/coding fidelity/reliability); statistical and methodological issues/solutions (e.g., ensuring adequate statistical power for a larger-scale study); and single site to across-site issues/solutions (e.g., variations in classroom characteristics across sites). Presentation of results will expand on these categories to provide a richer understanding of the myriad issues and processes inherent in the transition between these two research phases.

Conclusions: Implications for this study include an improved understanding of potential issues in transitioning between initial research phases, and strategies for addressing these challenges. Highlighting such issues and solutions has the potential to produce more rigorous research and more efficient translation of research findings into practice

(Glasgow, Lichetenstein, Marcus, 2003). Specifically, this presentation will use the ASAP research team's trial and documentation of solutions to inform future researchers' decisions (i.e., regarding methodology, organization, grant-writing, and analysis) during the transition from development to efficacy trial.

132.115 115 The Efficacy of An Intervention for Sensory-Related Behaviors in Children with Autism. R. Schaaf*[1], T. W. Benevides[1], D. Kelly[2], J. Hunt[2], E. VanHooydonk[2], P. Faller[2], R. Freeman[2] and Z. Mailloux[3], (1)*Thomas Jefferson University*, (2)*Children's Specialized Hospital*, (3)*Pediatic Therapy Network*

Background: Upwards of 90% of individuals with Autism Spectrum Disorders (ASD) demonstrate unusual responses to sensory stimuli or sensory differences including hypo and hyper sensitivity in multiple and varied sensory domains (Tomchek and Dunn, 2007; Marco, Leighton, Hinkley, et al 2011). Our work, to date, shows that families report that these sensory differences create social isolation for them and their child, significantly restricting full participation in daily activities. Consequently, interventions to address sensory differences are among the most often requested services, and, although data on their effectiveness is promising, more rigorous trials are needed.

Objectives: To address this need, our program of research developed an intervention for sensory differences entitled **In**tervention using **S**ensory **In**tegration for **C**hildren with Autism or InSInc; and completed a pilot study to evaluate feasibility, safety, acceptability, satisfaction and fidelity. Next we conducted a small randomized control trial to evaluate the efficacy of InSInc on decreasing sensory processing difficulties and problem behaviors, and improving adaptive behaviors and progress toward individual, parent identified goals. All subjects were well characterized using the ADOS, ADI-r and a cognitive assessment.

Methods: The design of our studies is based on recommendations in the literature for design and conduction of psychosocial intervention studies in autism (Smith, Scahill, Dawson, et al, 2007). Following this model, we first present the findings from the feasibility study (n = 10) and then provide data from the RCT. In the RCT (n = 26) all children were evaluated by a blind, independent evaluator and then randomized to treatment (30 sessions of InSInc) or usual care. Outcomes include measures of adaptive behavior, problem behaviors, sensory behaviors, and participation in activities of daily living, as well as individual progress in parent-identified goals using Goal Attainment Scaling.

Results: Data shows that this intervention is feasible and safe, that parents are satisfied with the intervention, and that therapists are able to obtain high fidelity. Preliminary data from RCT shows that outcomes are in the hypothesized direction with statistical significant improvements in individual, parent-identified goals. The RCT will be completed in April 2012 and full data set will be reported.

Conclusions: InSInc is feasible to deliver, acceptable to parents, and safe. Final data on efficacy will be analyzed and presented.

132.116 116 The Ottawa Act Early Autism Project: Does One Hour of Parent Coaching Make Changes?. Y. Korneluk*[1], R. Gaines[2], L. A. Vismara[3], D. Quigley[4] and C. Desrochers[5], (1)*Emerging Minds Treatment Centre*, (2)*University of Ottawa*, (3)*University of California at Davis MIND Institute*, (4)*Carleton University*, (5)*Pinecrest Queensway Community Health Centre*

Background: This presentation describes the outcomes of fifteen children and parents involved in the Ottawa Act Early Autism Project, a project designed to both identify young children who displayed 'at-risk' signs for the diagnosis of autism, and to provide parent-delivered intervention for these children.

Objectives: Our project involved an international team of researchers in the area of early identification and treatment and was designed with the following objectives:

1) To increase community awareness about the early signs of autism

2) To implement an effective screening of children under 2 years with at-risk signs of Autism

3) To replicate initial efficacy findings of the Early Start Denver Model Parent Curriculum (Rogers, Dawson, & Vismara, in press) with 15 families

Details will be provided about the 12 weekly one-hour, in – home, parent coaching intervention, and the child and family outcomes will be presented.

Methods: A mixed methods design evaluated the outcomes of this project.

Results: This presentation describes the processes and objectives used to attain Objectives 1) and 2). We will also present preliminary results pertaining to Objective 3) examining the efficacy of the ESDM Parent Curriculum intervention in terms of parents' skill usage and child changes in communication and adaptive skills.

In Phase 1, we implemented a successful community awareness campaign with family doctors, pediatricians and front-line care providers, using various media. During Phase 2 twenty-nine families were identified and invited to participate in an in-vivo screen of their children to determine eligibility for the study. Phase 3 provided 12 weeks of the ESDM parent coaching intervention to 15 families (13 boys, 12 girls), ranging in age from 16 to 27 months of age (mean age = 20.07 months, SD = 3.65). A set of pre-post intervention measures were administered including the MacArthur-Bates Communicative Development Inventory – Words and Gestures (Fenson, Marchman, Thal, Dale, Reznick, & Bates, 2007), the Vineland Adaptive Behavior Scales – Parent/Caregiver report form (Sparrow, Balla, & Cicchetti, 1984), and the Mullen Scales of Early Learning (Mullen, 1995). The ADOS (Lord et al, 1989) was given in the last session to clarify children's diagnostic presentation. Thus far, statistically significant changes occurred in children's communication skills. Additional data on individual parent-child profiles of learning will be shared.

Results from a focus group, with a small sample of parents involved in the study, identifying strengths and challenges inherent in the parent coaching intervention will also be discussed. A theme reported by many parents was the feeling of empowerment, as obtained through the parent-coaching process.

Conclusions: Successful ways to identify children with early signs of autism were used in this study. The results support the use of a cost-effective, resource efficient screening method with excellent predictive validity. Furthermore, the parent-coaching component of the Early Start Denver Model facilitated significant changes in children's development in only 12 one-hour sessions, supporting earlier findings from Vismara et al. (2009). Parents who participated in the study reported increased confidence as a result of the parent coaching process.

132.117 117 The Influence of Maternal Speech on the Expressive Language Production of Young Children with ASD. K. M. Walton*[1], I. Sherwood[2] and B. Ingersoll[1], (1)*Michigan State University*, (2)*University of Alabama*

Background: Maternal responsiveness is associated with a number of positive outcomes for both children with typical development and children with ASD. For children with ASD, mothers' use of language that follows the child's focus of attention and is non-demanding has been linked to child language gains over time. However, many interventions that make use of demanding language (i.e., prompting) have also been found to promote expressive language use in children with ASD. Differences in findings across these contexts may be due to differences in interaction partner (parent v. therapist) or outcome measure (in-session language use vs. long-term language gains).

Objectives: This study examined the relationship between mothers' responsive language use and the expressive language production of children with ASD during a play interaction. To examine the nature of maternal speech in more detail, responsiveness was broken up into two dimensions (relationship to child's focus of attention and demandingess) and categorized based on other important language dimensions, such as use of orienting cues and prompt type.

Methods: Participants in this study were twenty-three children with ASD aged 2 to 7 years and their mothers. Each dyad

participated in a 10-minute videotaped play interaction. To examine what types of maternal language promote child language production, instances of maternal language that occurred immediately preceding instances of child language were compared to instances of maternal language that occurred immediately preceding pre-determined control points within the same interaction.

Results: Preliminary results indicate that maternal language related to the child's current focus of attention and maternal language that required a verbal or behavioral response from the child were significantly more likely to precede instances of child language than control points. In particular, maternal language that both followed the child's focus of attention and demanded a behavioral response was significantly more likely to precede instances of child language than were other types of maternal language.

Conclusions: Overall, these results suggest that maternal language that both follows the child's focus of attention and places a behavioral demand on the child is most likely to promote expressive language production in young children with ASD during mother-child interactions.

132.118 118 Parent-Child Interactions During a Teaching Task in Children with ASD. C. Rubery*[1], E. J. H. Jones[1], D. Kamara[1], S. Corrigan[1], K. Toth[2] and S. J. Webb[2], (1)*Seattle Children's Research Institute*, (2)*University of Washington*

Background: Research shows that parents of children with ASD demonstrate a different interaction style compared to parents of typically developing (TD) children (Kasari & Sigman, 1997). This includes an increase in physical proximity (Kasari et al., 1988; Lemanek et al., 1993) and a display of more directive strategies during interaction episodes (e.g. Meirsschaut et al., 2011). The majority of this research emphasizes parent-child interactions during unstructured free play. Little is known, however, about differences in parental behaviors during teaching tasks. Comparing parents of children with ASD to parents of children with TD on a teaching interaction allows us to observe how parental behaviors may affect a child's ability to learn. Identifying the parental behaviors during learning episodes that are associated with better regulation of attention and emotion in children with ASD can help shape early-childhood interventions.

Objectives: Using a teaching task with groups of children with ASD and typical development, we will examine the relation between parent and child behavior during both baseline and teaching segments, and identify teaching strategies that correlate with improved attention and emotion regulation in children with ASD.

Methods: Participants in both groups are evaluated with the Mullen Scales of Early Learning (Mullen, 1995) and Autism Diagnostic Observation Schedule (Lord, et al., 1999). The teaching task is a highly structured parent-child interaction activity that is divided into three segments. First, the child works on an easy (as determined by the caregiver) puzzle for 2 to 3 minutes with the parent providing a supportive environment but not teaching (Baseline). Second, the parent teaches the child how to complete a hard puzzle for 5 minutes (Teaching). Third, the child works on another hard puzzle on their own for 2 to 3 minutes, once again without the parent's guidance (Application). Each segment of the teaching task is coded from videotape using a scheme derived from a combination of the NCAST Teaching Scale (Barnard et al., 1994) and the Dyadic Parent-Child Interaction Coding System (Eyberg et al., 2009). The overall coding scheme is divided into six subsections: sensitivity to cues, response to child's distress, social-emotional growth fostering, cognitive growth fostering, clarity of cues and responsiveness to caregiver. Using a 0-3 Likert scale rating system allows us to examine the relation between parent and child behaviors in both groups.

Results: Preliminary data suggest that aspects of parental behavior, specifically positive physical affection and changing facial expressions, affects their child's ability to regulate their emotions and attention during the teaching task. Data collection is ongoing.

Conclusions: By identifying strategies that promote self-regulation during learning episodes, the results of this study can suggest models for parental teaching that can be incorporated into early childhood interventions.

132.119 119 Improving Play Skills in Nonverbal Elementary-Age Children with Autism. Y. C. Chang*[1], K. Goods[2], C. McCracken[3] and C. Kasari[2], (1)*UCLA Semel Institute for Neuroscience & Human Behavior*, (2)*University of California, Los Angeles*, (3)*UCLA*

Background: Research studies have found that children with autism often display deficits in play skills (Jarrold, Boucher, & Smith, 1993; Williams, Reddy, & Costall, 2001). Thus, play skills have been targeted by researchers, and some studies have found that play skills can improve and are associated with language development in children with autism (Kasari, Paparella, Freeman, & Jahromi, 2008; Toth, Munson, Meltzoff, & Dawson, 2006). However, nonverbal elementary-age children with autism are often excluded from these intervention trials, and there is limited information on effective interventions for this subgroup of children.

Objectives: This study will examine the change in frequency of play acts in nonverbal elementary-age children (5-8 years old) during a three-month period, during their participation in an innovative intervention targeting spoken language that incorporates Joint Attention and Symbolic Play Engagement Regulation (JASPER; Kasari et al., 2006) and Enhanced Milieu Teaching (Kaiser, 1993).

Methods: A subset of 16 nonverbal elementary-age children (ages 5-8) with autism from a multi-site study based in Los Angeles was included in the study. All participants completed assessments on their cognitive skills (Leiter-R) and language abilities. (Peabody Picture Vocabulary Test, Test of Early Language Development). In addition, participants received two 60-minute JASPER/ EMT intervention sessions each week for three months. Once a month, the therapist and child are videotaped during their intervention sessions.

Four 10-minute videotaped interactions of the child and therapist were collected for each child during the three month period: Entry, Month 1, Month 2, and Month 3. Each 10-minute interaction was a standardized segment (minute 2-12) from a monthly taped 60-minute intervention session. For each interaction, blind coders recorded the frequency of spontaneous functional and symbolic play acts.

Results: Children in this study did not show symbolic play acts at the beginning of intervention; most were at the combinations level of play. Changes were noted in an increase in play acts considered pre-symbolic. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that the mean scores for the frequency of pre-symbolic play acts, specifically "child as agent" play acts, differed statistically significantly between time points, $F(1.590, 15) = 42.548$, $p < .05$. Post hoc tests using the LSD correction revealed that children increased their frequency of "Child as Agent" play acts at Month 3 (after 24 treatment sessions) ($M = 2.69$, $SD = 4.16$, $p < .05$), which was statistically significantly different from Entry ($M = 0.125$, $SD = 0.50$, $p < .05$) and Month 1 ($M = .250$, $SD = .58$, $p < .05$).

Conclusions: Results of this study indicate that while participating in a language-targeted intervention, children showed significant increase in the frequency of functional play acts during a three month period (24 sessions). Specifically, participants are beginning to show an increase in pre-symbolic play skills (i.e., Child as Agent) over time. This preliminary finding shows that nonverbal elementary age children can benefit from a play-based intervention. Future studies should continue to develop interventions for this population of children to improve play and language skills.

132.120 120 Autistic Spectrum Disorder (ASD) Among Omani Children Below 6 Years: A Five – Year Retrospective Descriptive Study. M. Al-Sharbati*[1], Y. M. Al-Farsi[1], Z. M. Al-Sharbati[2], A. Ouhtit[1], M. I. Waly[1], M. M. Al-Khaduri[1], M. Al-Shafee[3], F. Al-Sulaimani[4] and S. Al-Adawi[3], (1)*Sultan Qaboos University*, (2)*Sultan Qaboos University Hospital*, (3)*Sultan Qaboos University* , (4)*MOH*

Background:

Autistic spectrum disorders are lifelong developmental neurobiological disorders affecting children <3 years of age. They show impairments in social skills, communication, and stereotyped/repetitive behaviors and interests. They affect boys 3-4 times more than girls. The etiology is attributed to the interaction between both genetic and environmental factors. Comorbidity is high, mainly mental retardation, Attention Deficit Hyperactivity Disorder, epilepsy, and emotional disorders. The

prevalence of ASD increased dramatically during the last decade, approaching 1%. No specific treatment exists, but early diagnosis and intervention will improve the outcome considerably.

Objectives:

To identify the profile of ASD among Omani preschoolers, the comorbidity and the trend of incidence during five years.

Methods:

All children <6 years who have been diagnosed as cases of ASD in the child psychiatry clinic at Sultan Qaboos University Hospital (SQUH), from 2006 to 2010 were included in this study. Every case was reported once only. The diagnosis was based on the clinical assessment, and according to the DSM IV.

Results:

96 preschoolers have been diagnosed as ASD cases in SQUH during five years, boys constituted (80%; n=77). Those who were below 3 years constituted 20 cases (21%), between 3 and <4 were 28 (29%), between 4 and <5 were 29 cases (30%), and between 5 and 6 were 19 (20%). The annual number of cases were: 13 (in 2006), 9 (in 2007), 24 (in 2008), 21 (in 2009), and 29 (in 2010). Family history for ASD was positive in 20 cases (20.9%). The IQ test was done for 27 children, 16 of them scored ≤70, while 8 scored 70 to <90 and 3 only scored early 90s. ADHD was found in 52 cases (54.2%), whereas epilepsy was found in 2 cases. The previous treatment was as follows: 72 (75%) no treatment; 13 (14%) on Risperidone; 6 (6%) on Atomoxetine, 2 (2%) on Methylphenidate. Regarding the Current treatment: there was no treatment in 42 cases (43.8%), Risperidone in 24 (25%), Atomoxetine in 10 (10%), Omega 3 in 10 (10%), Methylphenidate in 3 (3%), speech therapy in 8 (8%), and 2 cases (2%) were given antiepileptics.

Conclusions:

The increased number of reported cases may indicate better awareness, and probably increased incidence. However, one fifth of patients were <3 years, which necessitates more awareness in order to diagnose ASD earlier. This study is in accord with others concerning the male: female ratio, and high comorbidity (ADHD and low intelligence). Although family history for ASD was positive in (20.9%), mild cases might be missed by inexperienced people. No treatment was given (apart from parental advice) in (43.8%). Most commonly used drugs were: Risperidone (25%), Atomoxetine (10%), and Omega (10%). A limited number have been given speech therapy (8 %) due to many factors such as: lack of specialists, inability to attend, hyperactivity, etc. We strongly recommend an increase in the resources, and improvement of the services presented to children with special needs, particularly ASD cases.

132.121 121 Teaching Storytelling and Story Recall to Children with Autism Using Textual Prompts. D. E. Conine*[1], A. L. Valentino[2], J. Holcombe[3] and A. Rogers[4], (1)*Marcus Autism Center & Children's Healthcare of Atlanta*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (3)*Marcus Autism Center and Children's Healthcare of Atlanta*, (4)*Marucs Autism Center and Children's Healthcare of Atlanta*

Background:

Recalling a story is an advanced skill that many typically developing children may be called upon to do (e.g., “tell me the story about the three little pigs” or “paraphrase the book you read last week”). Children with autism may struggle with the acquisition of verbal behavior of this complexity and thus may require specific teaching techniques. Studies have shown textual prompts (Finkel & Williams, 2001) and picture prompts (Goldsmith, LeBlanc, & Sautter, 2007) to be effective in teaching vocal verbal behavior to individuals with autism. Furthermore, although descriptive studies (Loveland, McEvoy, & Tunali, 1990; Norbury & Bishop, 2002; Diehl, Bennetto, & Young, 2006) on storytelling behavior and reading comprehension in children with autism exist, the impact of a verbal behavior approach on these skills has yet to be examined.

Objectives:

The current study aimed to determine the effectiveness of text prompts and backward chaining on storytelling behavior, and to assess generalization of behavior change to the recall of novel stories that were read but not targeted for treatment. The current study also aimed to determine the impact of such procedures on reading comprehension.

Methods:

Participants included two children: Josh, a 7-year-old male and Joel, a 4-year-old male, both diagnosed with autism. Five short stories were targeted for acquisition with each participant in a multiple baseline design across stories. Stories for Josh were ten pages in length, with six words per page; stories for Joel were five pages long, with five words per page. Differences in story length and complexity between participants were based on differences in age as well as in reading and language skills at pre-assessment, and the stories were created for this study to control for prior history. Story pages were targeted in succession through backwards chaining (Miltenberger, 2000). Treatment sessions consisted of an initial probe, followed by a prompted trial in the presence of the text, followed by an independent opportunity to respond with the targeted story page(s) when they were covered by a blank page. Baseline probes were conducted in an ongoing fashion to monitor generalized improvements in recall of nontargeted stories. Pre- and post-assessments consisting of basic reading comprehension questions were also conducted with Joel.

Results:

Results demonstrated an increase in storytelling behavior under treatment conditions and a generalized increase in recall of stories read but not specifically targeted in treatment with both participants. Results also indicated an increase in correct responses to reading comprehension questions following implementation of treatment with the one participant for whom comprehension was assessed.

Conclusions:

These findings indicate that recall of stories can be taught to children with autism using textual prompts and reinforcement contingencies based on backwards chaining procedures. Results of this study also suggest future directions for teaching reading skills and other complex verbal vocal behavior to children with autism.

132.122 122 Effectiveness of a Wide-Scale Community Based Intervention for Preschoolers with Autism. E. Boudreau*[1], B. D'Entremont[1] and M. Fulton[2], (1)*University of New Brunswick*, (2)*The University of New Brunswick*

Background: Evidence supports the efficacy of early intensive behavioural intervention (EIBI) based on principles of applied behaviour analysis (ABA) for improving the outcomes of children with autism spectrum disorders (ASD; e.g., Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). However, studies on the effectiveness of community-based programs are limited. Perry and colleagues (2008) conducted the largest effectiveness study to date on adaptive behaviour, autism severity, and cognitive level in a sample of children enrolled in a community-based, publicly funded EIBI program in Ontario, Canada. They found statistical and clinical improvement in all areas. Smith and colleagues (2010) recently evaluated the effectiveness of an EIBI program in Nova Scotia, Canada and found accelerated growth across multiple domains, including adaptive behaviour, autism severity, behavioural problems, cognitive level, and language ability.

Objectives: This prospective study was a pilot investigation of the outcomes of nine preschoolers with ASD enrolled in a community-based, publicly funded EIBI program provided in New Brunswick, Canada. The New Brunswick model differs from the Ontario and Nova Scotia models in that intervention is provided in for-profit agencies. Further, measures of treatment fidelity are lacking in both Perry et al. (2008) and Smith et al. (2010); therefore, measures of treatment fidelity are provided.

Methods: Nine boys (mean baseline age = 33.7 months) with ASD participated. All children underwent a comprehensive assessment at intervention onset and at 6- and 12-months follow-up. The assessment battery included measures of overall development, language ability, and adaptive behaviour. To account for limitations in past research, fidelity measures were obtained from video-recorded samples of children's therapy sessions.

Results: Repeated measures analysis of variance (ANOVA) revealed significant increases in children's overall development standard scores: $F(2, 16) = 4.795$, $p < .05$, overall development age equivalents: $F(2, 16) = 14.699$, $p < .01$, expressive language age equivalents: $F(2, 16) = 18.237$, $p < .01$, receptive language age equivalents: $F(2, 16) = 24.544$, $p < .01$, and adaptive behaviour age equivalents: $F(2, 16) = 31.944$, $p < .01$. Analyses of learning rates at 12-months follow-up on the measure of overall development indicated that 22% of children had learning rates exceeding the normal rate of 1 year of development per year of age. On the measure of adaptive behaviour, 44% of children had above-average learning rates, and on the measure of language ability, 56% of children had above-average learning rates. The majority of children showed some improvement (67%), 22% of children achieved average functioning, while 11% of children showed no change. No children regressed. Therapists demonstrated correct use of ABA techniques 95% of the time.

Conclusions: The New Brunswick EIBI model showed promising results in improving the outcomes of nine preschoolers with ASD. A range of outcomes was found given the heterogeneity of our sample; however, the majority of children showed some measurable improvement or progress. This suggests that EIBI can be associated with significant child improvement, and can be administered with very high levels of treatment fidelity, in a community-based, publicly funded setting.

132.123 123 Effectiveness of the Early Support Program for 2-Year-Old Children with Autism Spectrum Disorders. N. Inada*[1], M. Kuroda[2] and Y. Kamio[1], (1)*National Institute of Mental Health, National Center of Neurology and Psychiatry*, (2)*Shukutoku University*

Background: In Japan, although the importance of the early detection of autism spectrum disorders (ASD) has been recognized, the formal community support systems for children with ASD and their families in still lacking. One of the most common services in Japan is the community-based early support program, which is characterized by its low-intensity, eclectic nature, and parents' participation.

Objectives: This study aimed to examine the effectiveness of the early support program in Japan for 2-year-old children with ASD.

Methods: The participants were thirty-four children, who were identified throughout routine health checkups and were diagnosed with ASD when they were between 20 and 31 months of age (mean = 24.6 months). They were provided the community-based early support program for 1 year, which was conducted for 2 hours per 1–2 weeks and characterized by its eclectic nature and which required parents' participation. Children underwent evaluations pre-intervention and after 1 year of intervention.These evaluations included the assessment of developmental functioning (the Kyoto Scale of Psychological Development (Kyoto Scale) and the Enjoji Analytic Developmental Scale (Enjoji)) and ASD symptoms (ADI-R and ADOS).

Results: The outcomes exhibited a significant improvement in both developmental functioning and autistic symptoms.Significant progress was noted in the developmental quotient of language and the social domain of the Kyoto Scale after 1 year of intervention. Further, the social interaction domain scores of both ADI-R and ADOS showed significantly improvement. In addition, communication domain scores and severity scores of ADOS demonstrated significant progress. Moreover, children with repetitive behavior at 2 years of age showed significant reduction in some items of the repetitive domain in ADOS and ADI-R.

Conclusions: These findings emphasize the importance of early detection and early intervention for children with ASD.

132.124 124 Parents' Voices: 3-Month Follow-up After 12-Week Unity Parent ABA Training Program. M. N. Gragg*[1], C. Pasiak[1], B. E. Drouillard[1], J. L. Scammell[1], H. E. Jones[2], H. E. Hebert[2] and D. D. Barrie[1], (1)*University of Windsor*, (2)*The Summit Centre for Preschool Children with Autism*

Background: Applied Behaviour Analysis (ABA) is considered one of the primary evidence-based interventions for teaching young children with Autism Spectrum Disorders (ASD). Increasingly, parents are seeking early intervention for their children, only to find long wait lists for treatment. Training

parents to implement ABA at home is one way to access earlier treatment for their children. Parent input on follow-up is invaluable to gain their perspectives over time, and what ABA strategies they continue to use independently.

Objectives: To explore parents' views on; their concerns about the end of training, implementing ABA independently, how worthwhile the training was, and the effectiveness of a 12-week *Unity* ABA training program, 3 months after completing the training.

Methods: Fifteen parents of preschool children with ASD were selected to participate in *Unity* parent training (80% mothers, M_{age} = 32.3 years). Children (80% boys) ranged in age from 18 to 72 months (M_{age} = 39.7 months) at the beginning of the *Unity* program. Fourteen children had a diagnosis of Autistic Disorder and 1 had a diagnosis of PDD-NOS. Parents learned to apply ABA with their children during 180 hours of centre-based ABA training across 12 weeks. As part of a larger study, parents gave their views during a semi-structured interview three months post-training. Parents were asked questions about continuing ABA programming at home, changes in their concerns, how worthwhile they found the training, other training the parents wanted, and any additional comments.

Results: Preliminary thematic analysis of parent interviews indicated that the *Unity* parent training program was helpful in teaching parents how to implement ABA programs at home with their children. Many parents reported continuing to use ABA techniques. However, they used mainly incidental teaching at home, and few parents continued to collect data or use discrete trial training. Many parents also noted significant gains in their children's skills. Parents' main concerns at the end of training were how to continue the programming on their own without staff support and how to adjust to the lack of a structured environment and routine. Most parents wanted the ABA training to be longer. However, parents also reported that they felt comfortable knowing that they could continue to seek help and follow-up consultation from staff involved in the *Unity* training.

Conclusions: Parents voiced their accomplishments and concerns 3 months after completing a 180 hour ABA training program. The more parents learned how to implement ABA, the more it became a way of life rather than a temporary treatment. Implications for modifying the training program in future and increasing follow-up consultation are discussed. The opportunity to take into account parent perspectives is appreciated. Data collection is ongoing.

132.125 125 Congruence Among Parent and Teacher Ratings and Observational Assessments of Social-Communication and Play In Preschoolers with ASD. L. R. Watson*, B. Boyd, G. T. Baranek, E. Crais, J. R. Dykstra and K. P. Wilson, *University of North Carolina at Chapel Hill*

Background: An important question in intervention research pertains to the impact on individuals' daily functioning. Subjective methods of measurement generally ask post-hoc whether an intervention made a difference in a person's life. A more objective approach entails collecting pre- and post-intervention data on everyday functioning. This study reports on pilot testing of a parent-teacher rating scale to assess whether preschoolers with autism spectrum disorders (ASD) make noticeable gains on social-communication and play over a school year.

Objectives: (a) Examine correlations between parent and teacher ratings of social-communication and play at the beginning (pretest) and end (posttest) of the school year, and between teacher and parent rating change scores from pretest to posttest; (b) examine the correlations of teacher and parent ratings of social-communication and play skills with direct observational assessments of social-communication and play; and (c) determine whether teachers and/or parents rated children as significantly higher in social-communication and play at posttest than pretest.

Methods: Parents and teachers of 32 preschoolers with ASD were given a 5-minute video of a typically-developing preschooler engaging in toy play with an adult, along with a 5-item Likert scale. Each item was rated on a 10-point scale ("strongly disagree" to "strongly agree") at pretest and posttest. Items asked the adult to rate their student/child in comparison to the child in the video, e.g., "My student/child engages with people in similar ways as the child in the video." Social-communication and play skills were directly assessed at

pretest and posttest using a researcher-developed scoring system (Dykstra et al., 2011) of social-communication behaviors observed during the ADOS, and the Structured Play Assessment (Ungerer & Sigman, 1981).

Results: At pretest and posttest, teacher and parent ratings were significantly correlated for 3 of 5 rating items, and for the average rating across all items, *rho*s from .42 to .57, *p*-values < .05; however, the correlation between parent and teacher rating change scores (i.e., difference between pretest and posttest ratings) approached 0. At pretest, average teacher and parent ratings correlated significantly with observational measures of social-communication and play, *rho*s from .37 to .63, *p*-values < .05. At posttest, average teacher ratings also correlated significantly with observational measures of social-communication and play, *rho*(31) = .53 and .47, *p* = .002 and .008, respectively. Average posttest ratings by parents were not significantly correlated with the observational measure of play, *rho*(23) = .32, *p* = .10, but were significantly correlated with the observational measure of social-communication, *rho*(23) = .42, *p* = .04. Both teachers and parents gave children significantly higher mean ratings at posttest than pretest, *t*(30) = 6.2, *p* < .001, and *t*(21) = 2.9, *p* = .008, respectively.

Conclusions: The moderate congruence between parent and teacher ratings, and between social validity ratings and observational measures, suggests that the rating scale is a valid measure of children's social-communication and play as manifested in everyday activities at school and home. Such social validity measures can add an important and unique dimension to the assessment of change in intervention studies.

132.126 126 Efficacy of Therapist-Implemented Social Communication Intervention for Young Children with ASD. B. Ingersoll*, N. Bonter, A. L. Wainer and K. M. Walton, *Michigan State University*

Background: Project ImPACT (Ingersoll & Dvortcsak, 2010) is a naturalistic parent training curriculum that teaches parents of young children with ASD to promote their child's social communication using a systematic blend of developmental and naturalistic behavioral intervention techniques. Each individual intervention technique has been found to be efficacious for increasing social communication in children with ASD or related disorders in previous research, either in isolation or as part of a larger intervention package. However, the efficacy of entire ImPACT intervention package has not yet been evaluated.

Objectives: The goal of this study was to evaluate the efficacy of the ImPACT intervention as implemented by trained therapists for increasing language and social engagement in young children with ASD.

Methods: A single-subject, multiple-baseline design was used to evaluate the effect of the intervention on language and social engagement in nine young children with ASD. Children received 2 to 8 weeks of baseline followed by one hour of intervention twice a week for eight weeks implemented by trained therapists. Language and play skills were targeted separately for the first five children in 30-minute blocks and concurrently for the second four children. Rate of use of expressive language targets and percent of intervals of joint engagement with the therapist were scored for all sessions.

Results: Preliminary data indicate that the children increased their rates of expressive language and the amount of time they spent in joint engagement with the therapist with the onset of treatment. Improvements generalized to novel situations and maintained at a 1 month follow-up. Language and joint engagement gains were evident when language the sole target and when language and play were targeted concurrently.

Conclusions: This study demonstrates the preliminary efficacy of the Project ImPACT intervention for targeting social communication in young children with ASD. Research examining the efficacy of this intervention when implemented within a parent-training model is underway.

132.127 127 Predictors of Differential Responsivity to Pivotal Response Training and Discrete Trial Training. A. B. Jobin*, L. Schreibman and A. C. Stahmer, *University of California, San Diego*

Background: Treatment studies indicate that substantial gains may be achieved by some children with autism when treatment is provided at an early age. However, heterogeneity of treatment response is common to all evidence-based

approaches. After early intervention, many children remain considerably impaired. Investigators have hypothesized that customizing treatments based on individual child and family needs should increase the overall number of children that benefit from intervention. Improved understanding of how to match specific treatments (e.g., Discrete Trial Training/DTT, Pivotal Response Training/PRT) to children exhibiting different behavioral characteristics may enhance our ability to tailor interventions to individual children, thereby improving treatment effectiveness.

Objectives: (1) To evaluate the relative effectiveness of DTT and PRT for teaching children with autism under the age of 3 receptive and expressive language, play, and imitation skills, and (2) to identify variables influencing whether specific children are more likely to benefit from DTT or PRT in the tested domains.

Methods: Preliminary data are presented for four children, under the age of three, who participated in a single-subject alternating treatments design. Language, play, and imitation targets were matched on developmental appropriateness and difficulty and then randomly assigned to treatment conditions. Children received three 45-minute sessions of in-home treatment per week in each intervention for 12 weeks. Potential predictor variables were collected at pre-treatment. Fidelity measures were collected on 33% of all procedures. Data are reported on rate of learning, spontaneous skill use, and disruptive behaviors during sessions, as well as skill acquisition and generalization during weekly probes, and maintenance of gains at 3-month follow-up.

Results: Preliminary results indicate that participants made gains in the acquisition and generalization of the target behaviors in both treatments. However, response to treatment varied by child and curriculum area in that different children responded uniquely to DTT and PRT. Developmental level and age at intake did not influence these patterns. Similarly, a priori clinician judgment did not consistently predict responsivity patterns. Pre-treatment characteristics that did appear important included toy contact, adult avoidance, and early rates of learning. In particular, children who engaged in low levels of toy contact and were avoidant of adults were less likely to benefit from PRT. These same variables did not predict responsivity to DTT. Alternatively, children who were more interested in objects and less avoidant of adults did equally well in both interventions or had superior performance in PRT. Across most participants, PRT was superior for learning expressive language and spontaneous use of skills. Finally, patterns indicating which intervention was more effective seemed to emerge at approximately 4 weeks into treatment.

Conclusions: These data confirm the importance of treatment individualization and begin to suggest specific methods for tailoring treatment programs to individual child needs. The strengths and weakness of DTT and PRT may vary depending on child variables, as well as curriculum area focus. Specific child behaviors, including toy contact and adult avoidance, may aid in prospective treatment planning efforts. Additionally, early rates of learning may be predictive of longer-term treatment response.

132.129 129 Social and Non-Social Abilities Are Differentially Associated to Treatment Gains in Different Domains. G. Vivanti*[1], D. Trembath[2], C. D. Zierhut[3] and C. Dissanayake[4], (1)*La Trobe University*, (2)*Olga Tennison Autism Research Centre, La Trobe University*, (3)*Autism Specific Early Learning and Care Centre at La Trobe University*, (4)*Olga Tennison Autism Research Centre*

Background: Early intensive behavioural interventions such as the Early Start Denver Model have been shown to improve social and communicative outcomes in autism. However, children with autism display individual differences in response to treatment. Understanding the predictors of differential outcomes is crucial for enabling practitioners to prospectively recommend treatment strategies for specific children in order to increase the overall rate of positives outcomes.

Objectives: Our aim was to identify the individual differences in early emerging social and cognitive abilities which are associated with differential responses to treatment. To allow for a fine-grained measurement of such abilities we used two novel experimental paradigms.

Methods: Two experimental tasks assessing early emerging social and non-social cognitive abilities were administered to

the 21 children with an ASD enrolled in the MP Wing ASELCC program aged 2- to 5-years. A non-social cognitive measure assessed participants' ability to engage in purposeful (versus purposeless) actions on objects and a social cognitive measure assessed participants' ability to focus on social (versus non-social) stimuli in an eye-tracking task.

Based on previous work on early social-cognitive abilities and learning, we tested the hypothesis that individual differences in the ability to engage in purposeful actions would be associated to differential treatment outcomes related to cognitive abilities, while individual differences in visual attention to social stimuli would be related to differential treatment outcomes in communicative and social abilities. The MSEL and ESDM checklist scores at Time 2 (1 year after the start of treatment) were used as the outcome measures.

Results: Preliminary results (n=21) show that, as predicted, individual differences in the ability to engage in purposeful actions on objects were correlated to differential outcomes in non-verbal Developmental Quotient ($r=.8$; $p<.001$), while individual differences in social attention were associated to differential outcomes in verbal Developmental Quotient ($r=.7$; $p<.01$). Surprisingly, we found that the ability to engage in purposeful actions was highly correlated to gains in social skills ($r=.9$; $p<.0001$) at Time 2, while social attention was not.

Conclusions: Individual differences in early emerging social and non-social cognitive abilities were differentially associated to gains in different developmental areas. The ability to engage in functional actions with objects appears to be a powerful predictor of both non-social and social gains in our sample. The introduction of theory-driven experimental tasks in treatment studies might allow for a more fine-grained analysis of social-cognitive and learning profiles associated to differential treatment outcomes.

132.130 130 A Telehealth Approach to Working with Families with ASD. L. A. Vismara*, *University of California at Davis MIND Institute*

Background: There are various challenges to delivering parent coaching to families with ASD including long waiting lists, costly services, and few specialist providers. Telehealth, or using technology to deliver treatment, can support parents in their pursuit to help their children learn at home; however there is little information as to how this resource may translate into actual practice for families with ASD.

Objectives: The current randomized controlled trial examined parent-child behavior and program satisfaction from a telehealth-delivered parent coaching approach. Parents in the telehealth treatment versus control group were predicted to provide higher-quality learning with their children inside daily play and caretaking activities at home, resulting in larger gains in children's social, affective, communicative, and play development.

Methods: The intervention offered website-delivered information and live video conferencing to families either in the Early Start Denver Model (ESDM) or other evidence-based practices across a six-month period. Parent-child interactions were recorded in real time and coded by two independent, naïve raters on the frequency, quality, and generalization of parents' ESDM usage and changes in children's social-communicative behaviors. Parent-child activity was also tracked on the website to gauge goal performance during daily interactions at home as well as usage and satisfaction with the interactive learning features.

Results: Telehealth delivery facilitated frequent, competent, and generalized ESDM usage across more daily activities at home and with larger child gains than comparison families. Surprisingly, both groups failed to use all of the website features outside of sessions in spite of their ratings of perceived helpfulness.

Conclusions: Findings suggest the feasibility of a telehealth approach to working with families with ASD. However, not all technology options may be embraced by parents and or lead to effective change in parent-child behaviors. Additional research must confirm the promise and utility of telehealth for increasing the availability and quality of parent-delivered interventions.

132.131 131 The EFFECTIVENESS of Intensive Behavioural INTERVENTION In CHILDREN with AUTISM OVER the AGE of 6 YEARS: A MATCHED-Sample CONTROLLED STUDY. K. O. Blacklock* and A. Perry, *York University*

Background: Intensive Behavioural Intervention (IBI) is the most empirically supported form of therapy for children with Autism Spectrum Disorders (ASDs). It is often assumed that IBI is most effective in children who begin treatment very early, e.g., 2 to 3 ½ years. However, the research has been inconsistent, with some studies showing that younger children do better and others finding no relationship between age and outcome. In 2008, Perry et al. conducted a large-scale effectiveness study in the Ontario IBI program, which included retrospective data from 332 children aged 2 to 6 years. Results showed that there were positive but heterogeneous outcomes, and that age was a significant predictor (along with IQ, adaptive level, and autism severity (Perry et al., 2011)). Recently, Blacklock, Perry, and Dunn Geier (2011) did a similar study of 68 children beginning IBI at ages 6 to 13 years. The older children in the Blacklock sample did not fare as well overall. In the younger samples, children made statistically significant improvements on most variables. However, in the older sample, pre-post changes were not significant overall. In the younger sample, children made modest gains on IQ, whereas in the older sample children's IQs remained relatively stable. In the younger sample, the highest functioning group, adaptively, showed some changes comparable to those in model programs. By contrast, in the older sample, in some cases the lower functioning children improved more.

Objectives: Although the results from Blacklock et al.'s study can be crudely compared to those for the younger children, the two samples may differ in ways which confound this comparison. It is important to examine the differences in IBI outcomes more systematically, using carefully matched pairs. The purpose of the current study is to report a secondary analysis comparing the effectiveness of Ontario's community-based IBI program for children under the age of 6 years and children age 6 and over.

Methods: Each child from the 'over 6' sample will be individually yoke-matched to a child from the Perry et al. (2008) 'under 6' sample. The children will be matched primarily based on IQ at entry into treatment (which has been shown to be a strong predictor of outcome). If several children match based on IQ, they may then be further matched on adaptive level. This will result in about 60 well-matched pairs.

Results: Using Repeated Measures ANCOVAs, we will examine whether the younger and older children's progress in IBI differs on Time 2 measures of cognitive level, adaptive level, and autism severity, controlling for duration between Time 1 and Time 2.

Conclusions: Specific conclusions will be based on the specific results. These conclusions will have important clinical implications for appropriate service selection for older children with autism.

132.132 132 A Review of Early Parent Training and Coaching Models in Autism: Parent and Family Functioning in the First Year After Autism Diagnosis. T. Sendowski*[1], B. Siegel[1], S. Radhakrishna[2], O. Park[2] and S. Phuchareon[2], (1)*University of California, San Francisco*, (2)*Child and Adolescent Psychatiry, University of California, San Francisco*

Background: There is substantial empirical support for the efficacy of parent training in autism (*Educating Young Children with Autism*, NRC, 2001). This literature demonstrates that when parents develop a sense of self-efficacy by learning effective strategies to work with their child with autism, they experience a reduction in parental stress. We will present a review of this literature to delineate models for service delivery shown to best accomplish this. We have specifically hypothesized that parental stress reduction will translate into better family functioning, especially if parents are taught to crate and find 'teachable moments' in everyday activities. Specifically, we will examine a parent training method where these skills are 'front-loaded' (taught early after the diagnosis) before parents fall prey to the pull of non-evidence-based treatments, instead learning to be discriminating consumers of autism services. To test whether we could accomplish this, we developed JumpStart Learning-to-Learn (JSLTL), a one-week-long 'front-end' training program of full-time services (9am-3pm, Monday-Friday) for parents and their newly-diagnosed child delivered in the first month after diagnosis and before initiation of any intensive treatment.

Objectives: The goal of this research is to validate an evidenced-based model for autism training by demonstrating that, in comparison with families not having received JSLTL, JSLTL families will show more positive change on 1) the Beck Depression Inventory (BDI), 2) the Dyadic Adjustment Scale (DAS), and 3) the Family Empowerment Scale (FES).

Methods: We delivered JSLTL and then evaluated parent and family outcomes 6-12 months later in families who did and did not receive it. JSLTL trained parents in a four-pronged approach: 1) teaching behavioral management and daily living skills with an emphasis on pivotal responding, 2) communication training emphasizing a developmental-behavioral model emphasizing non-verbal communication as integral to semantics (VIA, Siegel & Ficcaglia, 2005), and a play component emphasizing child-centric interactional approaches to enhance the quality of family social interactions integrating methods of RDI and Floor-time (Siegel & Bernard, 2008).

Over the past 5 years, intervention procedures have been refined and manualized. Families were either self-referred or recruited through the Autism Clinic at UCSF. All participating children were assessed for autism prior to starting the program. Before beginning JSLTL, and 6 to 12 months after completing the program, parents were asked to complete the pre- and post-test measures. Comparison follow-up data were collected at 6-12 months after diagnosis in families not receiving JumpStart.

Results: We have visually examined pre-post data for JumpStart families and found trends supporting our hypotheses. We are now collecting comparison data, and both sets of these analyses (JSLTL pre- to post and JSLTL vs comparisons at 6-12 months post diagnosis) will be presented for the three measures (BDI and DAS, parent; and FES, family).

Conclusions: Earlier reported data suggested parents are benefiting from and satisfied with the program (Siegel, 2009). We expect empirical data analysis to support preliminary inspection of the data and parent subjective reports of better personal functioning.

132.133 133 Effects of Video Feedback on Parent Implementation of Pivotal Response Treatment. W. A. Ence*[1] and R. L. Koegel[2], (1)*University of North Carolina, Chapel Hill*, (2)*Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*

Background:

A myriad of parent education treatment approaches for parents of children with autism spectrum disorders (ASD) have been developed. Despite the critical nature of parent education programs, however, not all parents benefit equally. Unfortunately, there are relatively few studies that directly address *how* to conduct parent education sessions, especially for the parents who continue to struggle with the intervention techniques. Because of this, research identifying specific teaching methods that facilitate learning the intervention skills are necessary. Literature in related fields has found video feedback to facilitate learning through the process of self-observation, and that such feedback results in improved performance. In light of these positive findings, this study extended the use of video feedback to parent education for parents of children with autism. This study addresses the research gap and evaluates the effectiveness of video feedback as a training technique for parents who struggle with accurately implementing Pivotal Response Treatment (PRT) techniques.

Objectives:

The purpose was to evaluate the effectiveness of using video feedback for parents who did not meet treatment fidelity for an empirically supported autism intervention (PRT).

Methods:

To examine the effects of video feedback in parent education, a multiple baseline design across three parent-child dyads (children: ages 3 – 7; parents: two mothers, one father) was used with parents with a history of not meeting treatment fidelity. During the baseline condition, parent education consisted of modeling and in-vivo feedback. In the intervention condition, parent education sessions consisted of clinician modeling and video feedback. This approach was evaluated

to examine the impact on parents, children, and parent education variables.

Results:

The incorporation of video feedback into parent education yields positive results. Specifically, all three parents met treatment fidelity and displayed positive levels of affect, decreased parenting stress (Parenting Stress Index-Short Form), increased parental self-efficacy (Parenting Sense of Competence scale), and reported satisfaction with the intervention. Children displayed higher levels of affect and improved their individualized social communication target behavior. The type (e.g., constructive versus positive and general versus specific) and amount of feedback delivered by the clinician did not significantly differ between the conditions. Finally, findings suggest that the parents increased their amount of self-reflective feedback statements.

Conclusions:

The successful use of video feedback contributes to the literature identifying video feedback an effective teaching tool that can be implemented in the natural environment. Parents not only met and maintained treatment fidelity, but also, showed positive collateral effects on affect, confidence, stress, and self-efficacy measures. Similarly, the children exhibited improvement in affect and made improvements in their individualized target behavior. Finally, the investigation found that parent's self-reflective statements might be an important component to successful skill acquisition. In other words, the video feedback technique, which uses self-observation, results in increases in one's awareness. As the parents' awareness increases, positive behavior change is observed. Given this mechanism of change, video feedback has positive implications for use in parent education. Future research should examine these variables and identify characteristics of parents who may benefit from this intervention model.

132.134 134 Teaching Social Skills to Preschool Children with Autism Spectrum Disorders: Development of the UCLA PEERS for Preschoolers Program. C. A. Roman*[1], M. N. Park[2], J. S. Sanderson[3] and E. Laugeson[3], (1)*UCLA*, (2)*UCLA Semel Institute*, (3)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

With a growing body of literature indicating the importance of early intervention and parent training, children with Autism Spectrum Disorders (ASD) and their parents are receiving interventions focused on behavior and language from a much earlier age. However, comparatively few interventions specifically address the development of social skills, and even fewer interventions incorporate a parent-training component or evaluate treatment efficacy using multiple raters and valid, reliable standardized assessment measures.

Objectives:

The purpose of this study is to test the efficacy of a parent-assisted social skills intervention for high-functioning preschool children 3-6 years of age with ASD using core curricula developed through the UCLA Preschool Applied Learning of Social-Skills (PALS) Program (Sanderson & Laugeson, 2009), and evidence-based treatment delivery methods established through the UCLA Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010).

Methods:

Using core curricula developed through the UCLA PALS Program and structural elements of the UCLA PEERS Program, *PEERS for Preschoolers* will adapt two evidence-based social skills programs for preschool children with ASD to include an active parent-training component. Children ages 3 to 6 with ASD and their parents will participate in the *PEERS for Preschoolers* intervention. Treatment consists of 90-minute sessions, delivered once per week over the course of 16 weeks. Parents and preschoolers will attend separate concurrent sessions that will instruct them on key social skills. Children and parents will learn concrete rules and steps of social etiquette for social communication, turn-taking, sharing, peer entry, good sportsmanship, teamwork, helping behavior, and body boundaries. Child sessions will consist of puppet-facilitated scripted didactic lessons with role-playing exercises by group leaders and peer models, and structured and

unstructured behavioral rehearsal of skills with peers. Parent sessions will consist of review of socialization homework assignments, didactic lessons, and reunification with children to practice in-vivo social coaching and behavior management with performance feedback. Treatment outcome measures to be completed by parents and teachers at pre- and post-intervention include the Social Skills Improvement System (SSIS; Gresham & Elliot, 2008), the Social Responsiveness Scale (SRS; Constantino, 2005), the Vineland Adaptive Behavior Scale-Second Edition (Vineland-II; Sparrow et al., 2005), and behavioral observation data of targeted social skills during play.

Results:

Preliminary results from PALS reveal significant improvements in parent-reported overall Social Responsiveness ($p < .05$) and Social Cognition ($p < .01$) on the SRS, and improvements in teacher-reported overall Social Skills ($p < .01$), Cooperation ($p < .05$), and Assertiveness ($p < .01$) on the SSRS, as well as parent-reported Social Communication ($p < .01$) on the SRS. Forthcoming findings for the current study are expected to reveal greater improvement in social competence and social responsiveness on the SRS, SSIS, and Vineland Socialization Subscale, with behavioral observation ratings suggesting improvement in targeted social skills.

Conclusions:

It is anticipated that *PEERS for Preschoolers* will be efficacious in improving the social functioning of preschool-aged children with ASD. Findings from the current study will address a gap in the literature by incorporating parent education and training in social skills interventions for preschool-aged children with ASD.

132.135 135 The ELM As a Predictor for 12- Month Adaptive Behavior Outcomes for Children with Autism and Intellectual Disabilities. J. A. Reitzel*, *McMaster Children's Hospital/McMaster University*

Background:

There is a gap in the literature regarding outcome prediction for children with autism and severe intellectual disabilities. These children have a serious need for assistance in developing adaptive behaviours. This emphasis on the development of adaptive behaviours is imperative for severely affected children because adaptive behaviours encompass daily living skills, socialization, and functional communication that are necessary in maximizing independence. Finding variables that predict outcomes in adaptive behaviour can be useful in examining a child's prognosis.

Objectives:

The current study investigates whether the Early Learning Measure (ELM), a repeated assessment tool of early cognitive skills, is useful in predicting adaptive functioning in children with autism spectrum disorder (ASD) after 12 months over and above baseline measures such as nonverbal cognitive score (NCS), age, and adaptive functioning.

Methods:

Thirty-eight children (mean age= 55.23 mos, SD=13.83) were enrolled in the study and had independent clinical diagnoses of Autism or PDD-NOS according to DSM-IV criteria. At baseline, children were given a cognitive assessment (Mullen Scales for Early Learning or Stanford Binet- 5th edition), an adaptive functioning assessment (Vineland Adaptive Behaviour Scales (VABS) or Vineland II Adaptive Behaviour Scales), the Childhood Autism Rating Scale, and the ELM. The ELM was again administered at the end of every month for a 4- month period. The ELM assessed children's mastery of receptive instructions, expressive labels, non-verbal imitation and verbal imitation. ELM mastery was defined as scoring 80% in each domain at baseline or any time point within the 4-month assessment period.

Linear regressions were performed to find significant predictors of the 12- month VABS Adaptive Behaviour Composite (ABC) score. Tested independent variables were: age at baseline, CARS score, NCS (derived from the Mullen or Stanford Binet- 5th edition), ELM Mastery and entry VABS subscale standard score. Variables that were found to be significant (at the $p<.05$ level) were then subjected to a hierarchical linear regression analysis.

Results:

Results indicated that a model incorporating baseline measures excluding the ELM (VABS ABC, VABS daily living, VABS socialization and NCS) accounted for 57% of the variance of the 12-month VABS ABC. ELM mastery accounted for an additional 17% of the variance over and above all other tested baseline predictor variables ($p < 0.01$).

Conclusions:

Our findings have important implications in understanding adaptive functioning prognoses and determining next steps in treatment planning for children with intellectual disabilities functioning at the severe end of the autism spectrum. Using the ELM, clinicians will be better able to assess how successful a child will be in acquiring adaptive behaviours after 12 months. This will allow for the development of novel treatment plans that focus on adaptive functioning and independence.

132.136 136 The Effect of Robot-Child Interactions on Solo and Social Multilimb Synchrony in Typically Developing Children and Children with Autism Spectrum Disorders Between 4-8 Years of Age. M. Kaur, S. Srinivasan, T. Gifford, K. Marsh and A. Bhat*, *University of Connecticut*

Background:

Complex multilimb coordination emerges gradually over development (Getchell and Whitall, 2003). Specifically, children progress from performing consistent dual-limb actions such as clapping to consistent, multilimb actions such as march and clap motions. Children with Autism Spectrum Disorders (ASDs) have significant motor impairments in overall coordination as well as imitation and praxis (Green et al., 2008). These impairments will not only affect an autistic child's solo multilimb synchrony (movements on their own) but also their social multilimb synchrony (movements with a partner).

Objectives:

In the present study we aimed to develop a novel intervention tool using robot-child interactions to facilitate solo and social synchrony of typically developing (TD) children and children with ASDs between 4 to 8 years of age.

Methods:

12 TD children and 4 children with ASDs received 12 training sessions over a period of 6 weeks @ of 2 sessions per week. The training involved interactions of two children with a 24-inch tall humanoid robot called Nao (Aldebran Robotics, Inc.). The 30-45-minute training session comprised of various training conditions: greetings, warm up, rhythmic action, drumming, walking, and farewells. Solo and social coordination were measured using standardized motor measures using the bilateral coordination subtest of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP). In addition, solo and social synchrony was assessed in a task-specific and generalized synchrony test using kinematic analysis of slow and fast march-clap motions. In the task specific context, children were videotaped while imitating robot actions in session 1, 6 and 12. These were later coded for solo synchrony using measures of arm and leg movement variability. We also assessed social synchrony. In the generalized context, time spent in solo and social synchrony was evaluated using Continuous Relative Phase (CRP) analysis for march and clap actions in solo and social contexts. CRP values ranged from 0°-180° (Scholz & Kelso, 1989) and were grouped into three bins: 0°-60° (for in-phase coordination), 60°-120° (asynchronous state), and 120°-180° (for anti-phase coordination). In-phase coordination is expected in bilaterally symmetrical or synchronous limbs while anti-phase coordination is expected in bilaterally asymmetrical and alternating limbs.

Results:

Based on our preliminary analyses, we expect TD children to show improved bilateral coordination scores of the BOTMP during the posttest as compared to the pretest. Following training, we also expect an increase in the total time spent in task-appropriate solo synchrony as well as greater social synchrony during task-specific and generalized synchrony tests. We expect the children with ASDs to have greater solo and social synchrony impairments as compared to TD children which will improve following training.

Conclusions:

TD children improved their solo and social synchrony following training. Children with ASDs had particular difficulties in social synchrony which is a function of their performance in solo synchrony. However, children with ASDs also showed positive training effects in the form of enhanced social synchrony. Taken together, robot-child interactions may serve as a promising tool to address impairments of solo and social mulitlimb synchrony in children with ASDs.

132.137 137 Defining and Determining Factors Influencing Professional Decision Making in Eclectic Early Intervention Models. L. A. Sperry*[1], K. Hume[2], B. Boyd[3] and M. McBee[3], (1)*Griffith University*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of North Carolina at Chapel Hill*

Background: There is a call in the field for more rigorous research aimed at defining eclectic intervention models for young children with ASD to provide a better understanding of the practices that contribute to eclectic models.

Objectives: The purpose of this study was to (1) examine the evidence based practices endorsed by teachers in an eclectic model (2) determine what, if any, relationship existed between teacher attitudes towards evidenced based practices (EBPs) and practice endorsement (3) explore demographic variables such as education level, total years teaching children with ASD, that predict a teacher's use of EBPs within an eclectic model.

Methods: 28 teachers across 3 states completed the Classroom Practices Indicator (CPI) and the Evidence Based Practices Attitude Scale (EBPAS) as part of a larger study. These 28 classrooms were identified by their districts as using eclectic practices, rather than subscribing to one particular model. All classrooms met inclusion criteria for high quality and were screened into the study by research staff trained on a quality indicators measure. Demographic data was collected on total years of teaching children with ASD, level of educational attainment, gender, race and ethnicity.

The CPI is a psychometrically robust instrument which measures a teacher's endorsement of educational practices and the extent of their use within the classroom. The EBPAS measures teacher attitudes towards the adoption of EBPs in their classrooms. There are 4 attitudinal subscales, *Appeal, Requirements, Openness,* and *Divergence.*

Regression analyses were conducted to determine which demographic variables predicted teachers' use of EBPs and to determine which attitudinal variables on the EBPAS predicted endorsement of EBPs in eclectic models.

Results: Descriptive Statistics: The majority of teachers endorsed the following EBPs: Pivotal Response, Structured Teaching, Incidental Teaching, Visual Supports, Social Stories, Social Skills Training, PECS, and Positive Behavior Supports. Regression models indicated that level of education and years teaching were not significant predictors of teachers' selection of classroom practices. An endorsement of LEAP was positively correlated with years teaching (LEAP, .172, p <.05). Video Modeling was negatively correlated with years teaching (Video Modeling, -.05810, p <.05).

There was a negative correlation between teachers who reported more pressure from school administration to utilize EBPs and the endorsement of Social Skills Training (Requirement -.9746, p<.05). There was a positive correlation between teachers' openness to EBPs and endorsement of Positive Behavior Supports (Openness, 1.0048, p< .05). Scores on the divergence subscale were positively correlated to teacher endorsement of Voice Output Communication Aids (Divergence, 1.2286, p < .05).

Conclusions: This study identified EBPs endorsed by teachers in eclectic models. Level of education and years teaching were not significant predictors of teachers' selection of classroom practices. Rather, attitudinal variables such as Openness towards use of EBPs and Divergence from current practices predicted the use of specific EBPs (Positive Behavior Supports and Voice Output Communication Aids). The analysis of factors influencing adoption of EBPs is an essential step towards more clearly articulating what constitutes an eclectic model and reliably measuring the factors which predict the endorsement of evidence based practices.

132.138 138 Improving Prosocial Behavior in Children and Adolescents with Autism Spectrum Disorders: The Positive Impact of Music Education in the School Setting. Y. Bolourian*[1], L. Henry[2], M. Goodarzi[2], R. W. Ellingsen[1], L. Tucci[3] and E. Laugeson[4], (1)*UCLA*, (2)*UCLA* , (3)*The Help Group-UCLA Autism Research Alliance*, (4)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

Many children and adolescents with Autism Spectrum Disorders (ASD) indicate a preference for auditory stimuli, particularly when the auditory stimuli are presented in the form of music. Music has been shown to be an effective method of establishing alternate means of communicative interaction and creative development. Furthermore, clinical reports have shown that music created through structured and flexible improvisation, as demonstrated in the Orff Schulwerk approach, facilitates engagement and prosocial behaviors in children and adolescents with ASD. Although the positive impact of music has been reported in the research literature, little is known about the effectiveness of music education in promoting prosocial behavior for children with ASD.

Objectives:

The purpose of this study is to investigate the role and influence of the Orff Schulwerk-based music education in a specialized day school program for children and adolescents with ASD. The study aims to examine how school-based music instruction positively influences prosocial behaviors, which foster social interactions, in children and adolescents with ASD.

Methods:

Under the auspices of The Help Group-UCLA Research Alliance, 30 elementary and middle school students with a pre-existing diagnosis of ASD enrolled at the Bridgeport School at The Help Group were recruited for this study. Students participated in daily music education classes over a 4-week summer session using the Orff Schulwerk method of music instruction, which is a holistic approach to music making that involves speech, singing, movement, and instrument playing in a creative environment, while concurrently teaching academic curricula. In order to establish a baseline level of functioning, parent and teacher measures of social functioning were collected prior to the start of the Orff Schulwerk-based music education program and at the end of the 4 week summer session to assess the effect of an intensive daily music education program. Treatment outcome measures included the Social Responsiveness Scale (SRS: Constantino, 2005), the Social Skills Improvement System (SSIS: Gresham & Elliot, 2008), the Child Behavior Checklist (CBCL; Achenback & Edelbrock, 1981), and the Teacher Report Form (TRF; Achenbach, 1991) .

Results:

Forthcoming findings are anticipated to reveal that children and adolescents with ASD will exhibit increased social responsiveness and decreased problem behaviors as a result of engagement in an intensive 4-week music education program utilizing the evidence-based teaching methods of the Orff Schulwerk approach.

Conclusions:

Findings are anticipated to suggest that the use of music education in specialized school programs is effective in improving prosocial behaviors among children and adolescents with ASD.

132.139 139 Adapted Shared Reading for Minimally Verbal Students with Autism. C. Mucchetti*, *University of California, Los Angeles*

Background:

Approximately 30% of children with autism remain minimally verbal despite intervention. Literacy offers an important avenue of communication for these individuals, but almost nothing is known about their capacity to develop literacy skills or effective educational strategies. Shared reading is a regular practice in early education settings and is widely thought to encourage language and literacy development in typically developing children, as well as those with mild disabilities. A few studies have demonstrated that adapted shared reading may help increase early literacy skills in children with severe developmental disabilities.

Objectives:

The current study examined the impact of teacher-led adapted shared reading activities on the engagement and story comprehension of minimally verbal 5-6 year old children with autism. Additionally, this study addressed teacher fidelity of intervention implementation and teacher satisfaction with the intervention.

Methods:

A multiple baseline/alternating treatment design was used to measure student progress on story comprehension and task engagement during shared reading activities. Four minimally verbal students with autism and three special education teachers participated. Baseline sessions were conducted three times per week with books in their standard form and teachers were instructed to read as they normally would. After baseline, adapted shared reading activities were conducted twice per week with books that had been modified with visual supports, three-dimensional objects and simplified text to make them more accessible to minimally verbal students. Teachers were shown specific strategies for increasing student engagement during shared reading and asked to use them during the intervention sessions (e.g. giving student opportunities to manipulate story props or point to pictures). Standard shared reading sessions continued to be implemented once per week (the alternating treatment component of the design) to provide a comparison of the effects of repeated exposure to shared reading without adaptations.

Results:

All four students showed increased story comprehension and engagement during adapted shared reading, compared with baseline and repeated un-adapted shared reading. Average percent of session engaged was 87-100% during the adapted shared reading sessions, compared with 41-52% during the baseline sessions. Overall PND for all students was 95%. Average number of correct responses to story comprehension questions was 4.2-4.8 out of six during the adapted sessions compared with 1.2-2 out of six during baseline. Overall PND for all students was 100%. Teachers were able to easily learn strategies for increasing student engagement during these activities and had 100% fidelity of strategy implementation. Teachers reported that they believed the adapted shared reading activities were meaningful to their students and would continue to use activities after the conclusion of the study.

Conclusions:

Visual supports, tactile objects and specific teaching strategies offer ways for minimally verbal students to meaningfully participate in literacy activities. Student engagement in the adapted activities was high, which is associated with better learning outcomes. Teachers were able to quickly learn to conduct adapted shared reading and had high satisfaction with the activities. Future research should investigate adapted shared reading activities implemented classroom-wide, as well as joint engagement, language and literacy outcomes after using such activities over time.

132.140 140 AUTISM INTERVENTION In the FIRST YEAR of LIFE. S. J. Rogers*[1], L. A. Vismara[2] and A. Wagner[3], (1)*UC Davis M.I.N.D. Institute*, (2)*University of California at Davis MIND Institute*, (3)*MIND Institute, UC Davis Medical Centre*

Background: The primary purpose of early detection of autism spectrum disorders (ASD) is to prevent or mitigate the full onset of autism and its associated severe disabilities by allowing for earliest possible treatment. Early detection science requires that early treatment science develop in parallel, so that tested treatments are available for infants and toddlers showing early signs of ASD. To our knowledge, there are no published or tested treatment models that target autism-specific symptoms in infants.

Objectives: We developed and conducted a pilot study of Infant Start, a manualized, parent-delivered intervention for infants at or before 12-months of age who display risk features of ASD. The intervention targets six specific behaviors known to occur in infants who show abnormal behaviors in the first year of life and later develop autism: (1) visual fixations of objects; (2) abnormal repetitive behaviors; (3) lack of intentional communicative acts; (4) lack of age-appropriate, phonemic development; (5) lack of coordination of gaze,

affect, and voice in reciprocal, turn-taking interactions; and (6) decreased gaze, social orientation, pleasure, and engagement (Bryson et al., 2007). Parent-coaching focuses for two weeks on fostering more typical develop in each of the six symptom areas.

Methods: To date, five infant-parent dyads have enrolled, in the Infant Start pilot study. Each received twelve weeks of one-hour parent-coaching sessions and at least three follow-up visits for assessment and continued support. Overall infant development is measured before, during, and after treatment, up until 36 months of age using the Mullen Scales of Early Learning, the Vineland Adaptive Behavior Scales II, and the MacArthur-Bates Communicative Development Inventories. Autism-specific behaviors and symptomology are examined with the Autism Observation Scale for Infants (AOSI) and, after 24 months, the Autism Diagnostic Observation Schedule (ADOS). Parent-child play interactions are coded both for parent fidelity to the treatment model, as well as child behavior.

Results: To date, four of the five infant-parent dyads have completed the entire Infant Start treatment; four of the five have older siblings with ASD. All four infants demonstrated significant improvements in their overall developmental levels; three of the four are in the normal range by 24 months. All were speaking by 18 months of age; none of them displaying developmental regression. In addition, two of the four met diagnostic criteria for ASD by 12 or 18 months but no longer met any ASD criteria by 24 months. Three of the four children do not meet any ASD criteria on AOSI or ADOS scores by 24 months.

Conclusions: Initial findings from this pilot intervention study show improvement in social, communication, and developmental scores in children who met criteria for ASD during infancy. Future randomized controlled treatment studies are needed to test efficacy of this intervention model for improving developmental trajectories for infants under 12 months showing early risk signs of ASD.

132.141 141 Caregiver Mediated Joint Engagement Intervention for Young Children with Autism: A Case Study. C. L. Chu*[1], T. C. Lee[2] and C. H. Chiang[2], (1)*National Chung Cheng University*, (2)*National Chengchi University*

Background: Children with autism spectrum disorders display marked deficits in joint attention skills (JA) and poor joint engagement (JE) (Adamson, et al., 2009). Kasari and her colleague developed the caregiver mediated JE (CMJE) intervention program (Kasari, et al., 2010) and suggested that JA intervention could facilitate or maximize JE.

Objectives: The purpose of the study was to develop a CMJE intervention program for children with autism in Taiwan. This report described the initial results of working with 2 low-to-middle functioning children with autism.

Methods: Case A was a 38-month-old boy, whose mental age (MA), verbal mental age (VMA), and nonverbal mental age (NVMA) were 30 months, 29 months, and 31 months, respectively. Case B was a 44-month-old boy, whose MA, VMA, and NVMA were 27 months, 25 months, and 26 months, respectively. Mullen Scales of Early Learning (MSEL; Mullen, 1995) was used as the measure for developmental ability. Both boys were referred by hospitals in Taipei, were diagnosed with DSM-IV-TR and ADOS by two psychologists. Caregivers who attended the CMJE were both mothers. The program was developed according to Kasari's suggestion (Kasari, et al., 2010), consisted of 20 caregiver-mediated sessions with follow-up 3 months later. Each dyad completed ten modules in the 20 sessions, 60 minutes per session, and two sessions per week for 10 weeks. The CMJE intervention program was based on both of Kasari's lab and authors' clinical experience and followed the Caregiver Mediated Model (CMM) Treatment Manual. Each intervention session included interventionist coaching of caregiver and child engaging in play routines. Caregivers also had to practice in home after each session, bring their videotapes in next session and discuss with their interventionists. The primary measures were free play of parent-child interaction (Kasari, et al., 2010) for JE states and the Early Social Communication Scales (Mundy, et al., 2003) for JA skills. The other measures were the Screening Tool for Autism in Toddlers (Stone, et al., 2004) and ADOS for autistic symptoms, MSEL for developmental

ability, and Reynell Developmental Language Scales for language development.

Results: The results showed that there was greater improvement for case A on joint engagement outcomes, but slight improvement for case B. In JA skills, case A improved his ability from distal pointing for requesting to showing for JA in mild assistance. Case B developed his ability from reaching for requesting to showing for JA in hard assistance. The primary measures manifested some JA progress in case A but not in case B. There was improvement for case A on autistic symptoms, but worse for case B. There was no significant improvement on MA in both cases, but greater improvement on language in case A.

Conclusions: Our JE intervention for middle-to-low functioning children with autism seems promising. Further studies are needed to explore the variables might influence the efficacy of JE intervention. Experiment group design to explore the efficacy of the JE intervention in children with autism is also needed.

132.142 142 Promoting Quality and Use of Evidence-Based Practices for Children with Autism Spectrum Disorders in Inclusive Early Childhood Classrooms. C. Wong*[1] and S. L. Odom[2], (1)*UNC Chapel Hill*, (2)*University of North Carolina*

Background:

Although a base of evidence about effective educational practices for children with autism spectrum disorders (ASD) has emerged, many of these evidence-based practices (EBPs) have not yet reached school classrooms. In response to this issue, the National Professional Development Center (NPDC) on ASD developed a technical assistance model for promoting the quality of program environments and teachers' use of EBPs. While preliminary reports describe positive effects, specific study needs to document the effects of implementing the NPDC model, particularly with young children with ASD in inclusive environments.

Objectives:

With an overarching goal of promoting the development and learning of children with ASD through professional development, the specific questions of this study include:

1. Does the implementation of the NPDC model result in changes in classroom quality?
2. Do teachers increase their use of EBPs selected to promote specific goals of children with ASD when participating in the NPDC model?
3. Does teachers' participation in the NPDC model result in changes in child performance on identified goals?

Methods:

The study utilized a multiple baseline design across three inclusive early childhood classrooms that included an initial baseline period followed by the NPDC model of technical assistance with a delayed onset of the intervention in the subsequent classrooms. Nested within that framework was a multiple baseline across three teacher behaviors (implementation of EBPs) for each classroom. Participants included three children with ASD between the ages of two and four, their families, and their classroom teacher. The weekly coaching sessions consisted of classroom observations, reviewing the child's educational goals, assessing the classroom environment, individualizing EBPs, and providing monitoring and feedback to the teachers regarding those practices. From daily direct classroom observations, data were collected on critical classroom environmental items as determined by the Autism Program Environmental Rating Scale (APERS), teacher implementation of selected EBPs, and child attainment on individual goals in the classroom.

Results:

When the NPDC model was implemented, increases occurred in classroom quality, teacher use of EBPs, and child goal attainment, although there was more variability on the latter variable. Experimental control was established when similar effects occurred after the staggered onset of the intervention in the three classes in the study.

Conclusions:

The NPDC model is currently being implemented across 12 states in the U.S. to promote quality and the use of evidence-based practices for children with ASD in the schools. Results from this study provide support for the continued use of this model as well as guidance for further refinement of the model, especially when targeting the development and learning of young children with ASD in inclusive early childhood settings.

132.143 143 The Effects of Robot-Child Interactions on the Solo and Social Drumming Synchrony of Typically Developing Children and Children with Autism Spectrum Disorders Between 4 to 8 Years of Age. S. Srinivasan*, M. Kaur, T. Gifford, K. Marsh, B. Kay and A. Bhat, *University of Connecticut*

Background:

Children with Autism Spectrum Disorders (ASDs) present with generalized praxis deficits (i.e.; difficulty performing complex movement sequences) including praxis on imitation (Mostofsky et al., 2006). In addition, children with ASDs also present with significant motor coordination deficits including bilateral coordination, visuomotor coordination, and multilimb coordination (Ghaziuddin & Butler, 1998). Together, these impairments may contribute to poor solo synchrony (movements done on your own) and may also lead to poor social synchrony (movements done with a partner) due to the increased social monitoring demands of such activities. Currently, we are developing novel contexts involving robot-child interactions to facilitate solo and social synchrony in typically developing children and children with autism spectrum disorders (ASDs) between 4 to 8 years of age.

Objectives:

To examine the effects of robot-child interactions on the solo and social synchrony of typically developing children (TD) and children with ASDs between 4 to 8 years of age during drumming actions.

Methods:

12 TD children and 4 children with ASDs received 12 training sessions over a period of 6 weeks @ of 2 sessions per week. The training involved interactions of two children with a 24-inch tall humanoid robot called Nao (Aldebran Robotics, Inc.). The 30-45-minute training session comprised of various training conditions: greetings, warm up, rhythmic action, drumming, walking, and farewells. Solo and social synchrony were measured using a standardized rhythmic coordination measure, the bilateral motor coordination subtest of the Sensory Integration and Praxis Tests. In addition, solo and social synchrony during drumming was assessed in a task-specific and generalized synchrony test using kinematic analysis of slow and fast, simple and complex drumming motions. In the task specific context, children were videotaped while imitating robot's drumming actions in training sessions 1, 6 and 12. These were later coded for solo synchrony using measures of hand movement variability. We also assessed social synchrony through the percent of time the two children spent in full synchrony. In the generalized context, percent of time spent in solo and social synchrony was evaluated using Continuous Relative Phase (CRP) analysis for drumming actions. CRP values ranged from 0°-180° (Scholz & Kelso, 1989) and were grouped into three bins: 0°-60° (for in-phase coordination), 60°-120° (asynchronous state), and 120°-180° (for anti-phase coordination). In-phase coordination is expected in bilaterally symmetrical or synchronous hand motions while anti-phase coordination is expected in bilaterally asymmetrical and alternating hand motions.

Results:

Based on our preliminary data, we expect both groups of children to show greater solo and social synchrony during the posttest as compared to the pretest within task-specific and generalized contexts. Moreover, social synchrony will be more difficult to sustain as compared to solo synchrony in both groups of children. Particularly, children with ASDs will perform poorly during social synchrony contexts as compared to solo synchrony contexts.

Conclusions:

Our findings suggest that movement-based interventions performed within social contexts could facilitate interpersonal synchrony in children with ASDs. Moreover, robot-child

interactions could be a potential tool to address motor and social impairments of children with ASDs.

132.144 144 Using LENA Automated Analysis to Monitor the Language Experience of Children During Therapy, Preschool and with Primary Caregivers. J. Gilkerson*, J. A. Richards and D. Xu, *LENA Foundation*

Background: Correlations have been reported between early language environments and children's cognitive, social and emotional development (e.g., Hart and Risley, 1995), and interest in the causative influence of maternal responsiveness and turn-taking on the early development of typically-developing (TD) children is growing (e.g., Laundry, Smith & Swank, 2006). Hart & Risley investigated the home language environment of TD infants and toddlers longitudinally for three years, completing in-home hour-long audio recordings and transcribing the interactions. They reported positive correlations between the number of words children were exposed to before age 4 and their IQ and academic success through elementary school. More recently, Landry and colleagues reported results of experimental studies with premature and TD infants using a short, intensive intervention focusing on maternal responsiveness and turn-taking. Treatment group children experienced more adult-child interactions and showed significant elevations in communicative and social development compared to controls.

There is surprisingly little early language environment research focusing on preschool and non-primary caregivers. The paucity of such studies is likely due to logistical difficulties in collecting and transcribing naturalistic interactions through audio/video technology. This issue is addressed by the LENA (Language Environment Analysis) framework, which comprises a lightweight audio recorder that children wear plus automated computer-processing tools. This approach utilizes speech-recognition algorithms to segment the audio stream and generate estimates of 1) adult words spoken near the child, and 2) turn-taking interactions between caregiver and child (alternations between adult and child segments bounded by 5 seconds of silence/non-speech).

Objectives: The LENA framework was used to examine the language environments of children with ASD and TD children during and outside of preschool and therapy times.

Methods: Participants were 74 children with ASD between 24-48 months of age and 44 age-matched TD peers drawn from the LENA Research Foundation's natural language corpus. Participants recorded continuously throughout the day, and parents completed session diaries indicating specific times children attended therapy or preschool. Rates for adult word counts and turn-taking were computed for therapy hours, preschool hours, and typical hours (i.e., when the child was not attending preschool nor in therapy with a professional). Analyses include 831 recording sessions; 9,972 audio hours.

Results: For the ASD sample, adult word count was significantly higher during therapy ($t(45)=5.78, p<.01$) than during typical hours. Likewise, ASD children engaged in significantly more turns during therapy than during typical hours ($t(45)=4.83, p<.01$). Comparing groups during preschool hours, ASD adult word count was significantly higher than TD adult word count ($t(68)=2.84, p<.01$), and ASD turns were significantly higher than TD turns ($t(68)=6.32, p<.01$). During typical hours, ASD children engaged in fewer turns than TD children ($t(106)=2.95, p<.01$).

Conclusions: Children with ASD experienced more adult talk and greater vocal engagement while in therapy with a professional compared to more typical hours. ASD children experienced a more enhanced language environment during preschool compared to TD children, while turn-taking during typical hours was significantly lower for children with ASD. These results demonstrate the feasibility of automated analysis for monitoring language environments provided by parents, preschool teachers and therapists working with children with ASD.

132.145 145 Efficacy of Early Intervention Program: Evidence From Behavioral, Cognitive and Socio-Emotional Evaluations. F. Bonnet-Brilhault*[1], R. Blanc[1], S. Roux[2], P. Dansart[2], J. Malvy[1] and C. Barthelemy[1], (1)*INSERM U930*, (2)*Inserm U930*

Background: Based on the experience and practice of a multidisciplinary team we have developed an early intervention

program including Exchange and Developmental Therapy. This program aimed to develop psychophysiological functions required to improve communication abilities. This study reports the psychological and behavioural outcomes of a group of children with autism enrolled in this program.

Objectives: The aim of this study was to investigate the development of children with basic disorders of infantile autism such as impairment in social interactions and communication and resistance to change, using a new and complete assessment battery.

Methods: 29 children, aged from 2 to 8 years, with severe autism (DSM-IV T-R, APA, 2000, ADI-R, Le Couteur et al., 1989 and CARS, Childhood Autism Rating Scale, Schopler et al., 1986) and moderate to severe mental retardation (Brunet-Lézine scale-Revised, 1997 - French adaptation of Gesell scales, 1947) were recruited. We examined cognitive and socio-emotional skills using a recently validated scale, the (SCEB) (Adrien,2007 ; Thiébaut et al., 2010). Changes in autistic symptomatology were evaluated with the BSE scale (Behavioural Summarized Evaluation scale revised) (Barthélémy et al., 1997). The two types of assessment were performed at the beginning of treatment and then another developmental assessment was performed 10 months later, followed by behavioural evaluations every month. We compared clinical data at different times in the assessment process for each child.

Results: The results showed that this combined developmental and behavioral assessment could reveal not only general progress in cognitive and socio-emotional skills but also decreases in autistic symptomatology. Progress was different from one child to another and seemed dependent on the initial severity of the mental retardation. Finally, although overall retardation did not change, significant reduction in autistic behaviours occurred with therapy.

Conclusions: These results confirmed previous studies (Rogers, 1996; Schreibman, 1996; Adrien et al., 2002-b; Blanc et al., 2003; Howlin, 2005, Magiati, 2007 ; Wallace and Rogers, 2010) and indicated the value of this assessment battery which explores both the cognitive and socio-emotional development of the child and also follows the evolution of the autistic symptomatology. Moreover, this study identified functions sensitive and resistant to the intensive program including Exchange and Developmental Therapy, EDT, indicating directions for prevention and early intervention.

132.146 146 Comparison of Different Treatment Methods on Social Communicative Abilities in Young Children with Autism Spectrum Disorders. S. Van der Paelt*, P. Warreyn and H. Roeyers, *Ghent University*

Background: Impairments in social communicative abilities are among the first signals of an autism spectrum disorder (ASD). Because of their importance for the social and language development these abilities are crucial intervention targets for young children with ASD. Although there is much research on autism intervention, research that directly compares several treatment methods is rare.

Objectives: The aim of the present study was to compare the effect that different methods of intervention have on social communicative abilities in young children with autism. More specifically intervention based on Applied Behavior Analysis (ABA) was compared to treatment with a more specific intervention program targeting imitation and joint attention and to treatment as usual (TAU).

Methods: 50 children with ASD or a working diagnosis participated in this study. They were between 25 and 72 months at initial assessment and had an IQ between 50 and 118. At initial assessment the ABA group (n=11) had an average age of 50 months (SD=17) and a mean IQ of 66 (SD=15). They all received multidisciplinary therapy. The imitation/JA group (n=19) were on average 57 months old (SD=9) at initial assessment and had a mean IQ of 69 (SD=18). The TAU group (n=20) had an average age at the pretest of 47 months (SD=13) and an average IQ of 73 (SD=19). The children were tested in the therapy centers with the same instruments twice with a therapy period of 6 months in between. The Preschool Imitation and Praxis Scale, Early Social Communicative Scales, Test of Pretend Play. Reynell Developmental Language Scales and Autism Diagnostic Observation Scale were used to assess imitation, joint attention, symbolic play, language and symptoms of autism. Questionnaires were used to evaluate the progress children made at home and in school.

Results: At the moment only the data for imitation, symbolic play and language are processed. Results for the other variables will be presented at the meeting. In all three groups children improved during the 6-month-period on most measures (as is shown by several univariate repeated measures ANOVAs).When we directly compare the groups (with several univariate repeated measures ANOVAs and age and IQ as covariates) we find little difference between them. The only significant difference between the groups is that the ABA group improved more on procedural imitation than the other groups did ($F(2)=3.2$; $p=0.048$).

Conclusions: Children with ASD who receive multidisciplinary therapy show a substantial improvement in social communicative abilities after a 6 month-period. Comparing the different treatment methods only shows a larger improvement on procedural imitation in the ABA group. There is no difference in improvement between the groups on measures of gestural imitation, symbolic play, language comprehension and expressive language. However, these results are preliminary and should be interpreted with caution.

132.147 147 Moment-by-Moment Sequential Analysis of a Social Engagement Intervention for Young Children with Autism and Their Parents. T. W. Vernon*[1] and R. L. Koegel[2], (1)*Koegel Autism Center, Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*, (2)*Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*

Background:

Early social development is a transactional process in which parents and children mutually influence one another's social behavior through an ongoing series of initiated interactions and responses. In the case of parents with children with autism, however, these transactions understandably occur on a much more limited basis, as their children are less attuned to social bids and are less inclined to reciprocate these types of interaction. There is abundant evidence that these social vulnerabilities contribute to unfavorable long-term outcomes and negatively impact the emotional wellbeing of parents. However, emerging research suggests that incorporating social interactions derived from a child's pre-existing interests can significantly increase social behavior when implemented within the context of a naturalistic autism intervention model. Parents utilizing such methods for eliciting social behavior may be successful at establishing a positive social interaction feedback-loop with their children, which would have important implications for long-term social development.

Objectives:

This objective of this study was to evaluate the transactional social effects of teaching parents to embed a social interaction component into a Pivotal Response Treatment (PRT) intervention model. Specifically, this research examined the reciprocal relationship that governs the moment-by-moment emergence of social behavior in both young children with autism and their parents.

Methods:

This study used a multiple-baseline design across three young children with autism (ages 2:4, 2:11, and 4:3), with one parent per child participating in the research. In the baseline condition, parents were initially taught to use standard PRT procedures for increasing communication skills, with emphasis on using preferred toys and other objects to reinforce their children's language attempts. Across the 16 sessions of the experimental intervention phase, parents were taught to use this same intervention model while replacing the preferred non-social materials with socially analogous stimuli. Videos were coded on a moment-by-moment basis using behavioral coding software for child and parent social behavior. Lag sequential analyses were then performed to examine how the onset of specific parent social behaviors immediately evoked a corresponding child social response and vice versa.

Results:

During the social intervention phase, the onset of parent social behaviors (reinforcement delivery, positive affect) significantly predicted the subsequent occurrence of child social behaviors (eye contact, positive affect). The converse was also observed, with the onset of child behaviors (verbal initiations, eye contact, positive affect) predicting the occurrence of parent social behavior (positive affect). These behavioral

sequences were not observed in the baseline phase, even when the same parent or child social behaviors occurred.

Conclusions:

Evidence of reciprocal social exchanges was noted in the intervention phase, suggesting that social stimuli with adequate salience and motivational qualities can induce parent-child interactions that resemble those occurring in families with typically developing children. Using this methodology, it was possible to gain a better understanding of specific transactions that elicit desired social responding in children with autism. These findings may suggest a potential method for altering the social developmental trajectory of children with autism.

132.148 148 Stress in Parents of Children with Risk for ASD in An Early Intervention Program. S. Dufek*, E. C. Worcester, L. Schreibman, A. C. Stahmer, K. Pierce and E. Courchesne, *University of California, San Diego*

Background: Parents of children with ASD experience elevated stress in comparison to parents of typically developing children (Baker-Ericzen, Brookman-Frazee, & Stahmer, 2005). Previous research indicates that higher parent stress has been associated with lower child outcomes, increased child aberrant behaviors, and decreased child adaptive behavior (Osborne, Mchugh, Saunders, & Reed, 2008; Tomanik, Harris, & Hawkins 2007). However, minimal research has been conducted examining stress of parents of children who are newly identified with risk for ASD under the age of three (Baker-Ericzen et al., 2005).

Objectives: Our goal was to examine the association between parent stress and child outcome of children with risk for ASD in an early intervention program.

Methods: Forty-nine children between 13 and 27 months of age (M=22.4) identified with risk for ASD participated in an early intervention program. Children received an average of 9.29 treatment hours per week until age 3. Parents received an average of 21.04 hours of parent education and coaching in early intervention techniques during the course of their children's treatment. Children received a battery of standardized assessments at intake and exit to measure progress, including the Mullen Scales of Early Learning (MSEL), the Vineland Adaptive Behavior Scales (VABS), and the Autism Diagnostic Observation Schedule (ADOS). Parents completed the Parenting Stress Index (PSI) prior to and after completing the intervention program. The PSI is a questionnaire that evaluates stress in the parent-child relationship along two scales, one scale focuses on *parent-related* stress (stress due to issues unrelated to the child, such as financial stress or divorce) and the other scale focuses on *child-related* stress (stress due to child issues, such as a disability). The relationship between children's scores on standardized assessments and parental stress at intake and exit were examined using Pearson correlations.

Results: To date, data for 14 children have been analyzed. Both *parent-related* and *child-related* stress were elevated at both time periods. Preliminary findings indicate that *child-related* stress was negatively correlated with children's scores on the VABS at exit. Specifically, the better their children's outcome scores on the VABS the lower the parents' *child-related* stress at exit. However, *child-related* stress was not related to the children's scores on the MSEL or ADOS. In addition, there was no significant relationship between *parent-related* stress and child outcome on any of the standardized measures.

Conclusions: *Child-related* parent stress is associated with some measures of child outcome after participation in early intervention. Interestingly, *child-related* stress levels were not correlated with child scores on the MSEL or ADOS but were correlated with the VABS, which is a parent-report measure. Therefore, *child-related* stress may be linked to parents' perception of their children's level of functioning or to unique behaviors measured by the VABS.

132.149 149 Evaluation of Early Intervention Outcome in Young Children with Risk for ASD. E. C. Worcester*, S. Dufek, L. Schreibman, A. C. Stahmer, K. Pierce and E. Courchesne, *University of California, San Diego*

Background: Children with ASD often perform differently in varied contexts making assessment of overall functioning and prognosis challenging. Therefore, when determining overall child functioning, these children be require a comprehensive evaluation consisting of measures from multiple sources

(Ozonoff, Goodlin-Jones, & Solomon, 2005). First, standardized assessments across developmental domains (cognition, communication, social skills, adaptive behavior, behavior challenges) and diagnostic assessments (e.g., ADOS) are necessary. In addition, a detailed assessment of a child's response to treatment over time is necessary for an accurate picture of prognosis. This dual approach to evaluation provides data to examine possible correlates of differential responsivity to intervention, providing valuable information about child variables leading to best outcome.

Objectives: Our goals were to (1) create a comprehensive evaluation of child functioning based on standardized developmental and diagnostic assessments; (2) develop a measure of child responsivity to treatment; and (3) identify predictors of best outcome and treatment response for children with risk for ASD in an early intervention program.

Methods: Forty-nine children between 13 and 27 months of age (M=22.4) identified with risk for ASD participated in an early intervention program. Children received an average of 9.29 treatment hours per week until age 3. An empirically-based behavioral intervention utilizing Pivotal Response Training, Discrete Trial Training, developmental strategies and Functional Routines were used to teach a range of skills. .

Child outcome was quantified by ranking and combining scores from the Mullen Scales of Early Learning, the Vineland Adaptive Behavior Scales, and the Autism Diagnostic Observation Schedule at age 3.

Treatment responsiveness was measured every 3 months using an adapted Student Learning Profile (aSLP), a curriculum-based assessment measuring mastery of skills taught in intervention. Treatment responsiveness was quantified using changes in curriculum assessment scores from intake to age 3.

Results: To date, outcome data have been analyzed for 17 children and treatment responsiveness has been analyzed for 28 children. Children were divided into four groups based upon child outcome scores on standardized assessments. A Pearson's correlation revealed a positive relationship between child outcome groups and assessment scores at intake on the Mullen Early Learning Composite, and Mullen expressive and receptive language domains.

The aSLP revealed substantial heterogeneity in treatment responsivity as indicated by variability in the number of skills learned. Rate of learning after 3 months of treatment accounted for 52% of the variance on the final aSLP. Pearson correlations revealed intake scores on the Mullen Scales of Early Learning, Early Learning Composite were positively related to final aSLP scores. Final aSLP scores were not related to intake scores on the Vineland.

Conclusions: Quantitative indices of level of treatment responsiveness and overall outcome for each child with risk for ASD in an early intervention program were developed that identify subgroups of children, including those who demonstrated good, moderate or limited progress. A combination of standardized language measures and early rates of learning may be predictive of overall prognosis.

132.150 150 The Social ABCs for Toddlers with Suspected Autism: Pilot Evaluation of a Parent-Mediated Intervention. J. A. Brian*[1], I. M. Smith[2], T. McCormick[3], E. Dowds[4], J. C. P. Longard[5], S. W. Roberts[6], L. Zwaigenbaum[7] and S. E. Bryson[2], (1)*Bloorview Research Institute*, (2)*Dalhousie University/IWK Health Centre*, (3)*IWK Health Centre*, (4)*Bloorview Kids Rehab and Hospital for Sick Children/ University of Toronto*, (5)*Dalhousie University*, (6)*The Hospital for Sick Children*, (7)*University of Alberta*

Background: The *Social ABC's* is a parent-mediated intervention based on empirically supported Pivotal Response Treatment (PRT; Koegel & Koegel, 2006). The main goals of our intervention are to increase early communication skills and positive emotion sharing (parent and child smiling together) among toddlers at high risk for ASD. We have developed and refined our manualized intervention model and present data from our completed pilot phase.

Objectives: To examine post-training and follow-up gains in: (1) child early communication skills, (2) positive affect sharing, and (3) child engagement (looking at parent's face); and (4) to evaluate the feasibility and acceptability of our intervention.

Methods: Intervention included 12 weeks of in-home, live parent coaching, followed by 12 weeks of implementation by parents, and a follow-up assessment (at week 24). Parent satisfaction was measured through a *Parent Satisfaction Questionnaire*. Positive Emotion Sharing and Engagement were coded in 10-second intervals at Baseline (BL), Post-treatment (PT), and Follow-up (FUp). Communication was measured at all 3 time points using videotape analysis, as well as standardized assessment (at BL and FUp). Paired samples t-tests were used to evaluate change across time points.

Results: Twenty-three toddlers (mean age @BL = 21.8 mos; FUp = 29.7 mos) with suspected or confirmed ASD were included. Treatment duration varied due to variances related to families' schedules, illnesses, and competing demands. ***Communication****:* Standardized measure of language (Mullen) revealed non-significant T-score gains from BL to FUp for Receptive (M=44.1 vs. 45.4) and Expressive Language (M=44.79 vs. 47.57). However, significant Age Equivalent gains (BL vs. FUp) were obtained for both Receptive (M=18.7mo vs. 25.9mo); p=.001, and Expressive (M=19.1 vs. 27.9mo); p=.006, representing 7-8 months of gain in a mean duration of 8 months. Video analysis of *Functional Language* revealed statistically significant gains from BL to PT, that remained at FUp, in: Responsivity (.62, .82, .82), Initiations (14, 28, 28), and Total Functional Utterances (46, 77, 75), but no changes in child gesture use or rate of inappropriate responses. ***Positive Emotion Sharing***: Gains in *child smiling* approached significance from BL (M=27.9%, SD=19.0) to PT (M=36.6, SD=19.8), p = .06. *Shared smiling* increased from BL (M=16.9, SD=10.8) to PT (M=24.8, SD=14.6), t = -2.6, p = .02, but was attenuated at FUp (M=20.7, SD=11.4; n.s.). Child ***Engagement*** increased from BL to PT (26% vs. 36%; p<.05), and this was maintained at FUp (34%). ***Satisfaction****:* Parent ratings were extremely positive (mean = 30 out of 35). Correlations between raters for video-coding are very strong (p's < .001); Kappas will be calculated and reported.

Conclusions: Significant gains were observed in children's communication on video-coded measures, and standardized measures (age equivalent gains commensurate with typical developmental rates). Gains in shared smiling and engagement were observed post-treatment, but gains in smiling were not consistently maintained at follow-up. The model of training parents as mediators presents an opportunity for the integration of intervention into daily activities, thus allowing for intensive intervention at a very young age. Next steps include a randomized controlled trial (underway), and eventually community translation.

132.151 151 Examining the Fidelity of Implementation of Comprehensive Treatment Models for Preschoolers with ASD. K. Hume*, *Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*

Background: Measuring the implementation of comprehensive treatment model (CTM) components with a well-designed and valid tool is critical in efficacy research (Hume et al. 2011), yet few intervention studies collect and report on the psychometric properties of their implementation measures. Utilizing validated implementation measures in the context of intervention research may produce more robust associations between fidelity of implementation and participant outcomes.

Objectives: (1) To describe fidelity of implementation of critical components of the CTMs, and (2) To examine the reliability and validity of the instruments with study participants.

Methods: Research staff across four states were trained to reliably score three fidelity measures used within the context of the study [i,e., LEAP, TEACCH, and business-as-usual (BAU) measures]. Four observations were then conducted across the school year in each of the 75 participating classrooms (N=25 TEACCH, 22=LEAP, 28=BAU), along with two reliability observations. During each classroom observation, all 3 fidelity measures were completed. The reliability of the measures was confirmed by examining test-retest reliability, internal consistency, and interrater agreement. Discriminant analysis was conducted to examine the subscales of each measure that most contributed to the ability of the fidelity measure to discriminate model types.

Results:

Descriptives: Average implementation of model components across the four observations was M= 83% for TEACCH (83-

85% across 4 observations), M=92% for LEAP (91.7-92.4%), and M=83% for BAU (82-83%). Further analysis related to the overlap of implementation scores across measures is ongoing and will be reported.

Test-retest reliability for the measures across four observations was M= .81 for TEACCH (.56-.85 across 9 subscales), M=.81 for LEAP (.45-.88 across 8 subscales), and M=.69 for BAU (.59-.82 across 8 subscales).

Inter-rater reliability was measured as the proportion of agreement between observers. Inter-rater reliability was 98% (TEACCH, 88-98%), 95% (LEAP, 88-100%), and 88% (BAU, 87-99%).

Internal consistency was examined using Cronbach's alpha. For the TEACCH measure, the alpha was .95 (.59-.97), .96 for LEAP (.71-.95), and .93 for BAU (.68-.93).

Discriminant analyses were performed to identify the subscales of the fidelity measures that best discriminated between classroom types. On the TEACCH measure, three subscales-- *social, visual schedules, work systems* primarily contributed to the ability of the measure to discriminate between the 3 classroom types. On the LEAP measure *social interaction* best contributed to the discrimination between model types, and on the BAU measure, two subscales-- *social/peer relations* and *classroom environment* discriminated between the models.

Conclusions: Results indicate that CTM and BAU classroom staff were able to maintain high levels of implementation across the study period. In addition, when used with study classrooms, the measures remain psychometrically robust and continue to clearly discriminate between models. This study is one of the first in the field to systematically monitor intervention fidelity with reliable and valid tools, and implications for further analysis of this valuable data will be discussed.

132.152 152 The Effects of Robot-Child-Child Interactions on Joint Attention and Verbalizations Patterns of Typically Developing Children and Children with ASDs Between 4 to 8 Years of Age. C. Susca*, S. Srinivasan, M. Kaur and A. Bhat, *University of Connecticut*

Background:

Verbal and nonverbal communication delays are primary impairments of Autism Spectrum Disorders (ASDs) and are often addressed by traditional autism interventions. Currently, we are evaluating how an embodied social intervention involving interactions between a humanoid robot and two children affects the social communication skills of typically developing (TD) children and children with ASDs. Specifically, we would like to see whether such a motivating context enhances nonverbal and verbal communication between the two children interacting with a sophisticated 24-inch tall, humanoid robot called, Nao (Aldebaran Robotics, Inc.).

Objectives:

To examine the effects of robot-child-child interactions on the rates of Joint Attention (JA) bids and the percent duration of verbalizations in typically developing children and children with ASDs between 4 to 8 years of age.

Methods:

12 typically developing children and four children with ASDs were examined. Each child received 12, 45-minute training sessions involving robot-child-child interactions across six weeks. The 30-45-minute training session comprised of various training conditions: greetings, warm up, rhythmic action, drumming, walking, and farewells. Each movement context was also divided into "copy robot" and "move together" trials. We examined the rates of JA bids to the other child, percent duration of attention to the robot and the other child, as well as the percent duration of verbalization directed to the other child during the first, mid, and last sessions. We divided each code into spontaneous and responsive forms of communication.

Results:

Based on preliminary analysis, we expect the percent of spontaneous verbalizations to the other child to increase during the last session as compared to the mid and first training sessions. In terms of non-verbal communication, we expect the children to have greater rates of JA bids during the "move together" trial as compared to the "copy robot" trial.

Overall, we expect the rates of JA bids to increase within the "move together" context across the several weeks of training.

Conclusions:

Our preliminary data suggest that TD children increase their social communication skills following training as seen by increased spontaneous verbalizations to the other child. Relatively smaller improvements are expected in children with ASDs who may need a more extended and intense training protocol. Our next study will conduct a larger randomized controlled trial using such an intense protocol to examine the effects of robot-child interactions on the verbal and non-verbal communication skills of children with ASDs.

132.153 153 Measurement, Stability, and Modification of Prelinguistic Symptoms of Autism in Low-Risk Infants.

J. Bradshaw*[1], L. K. Koegel[1] and R. L. Koegel[2],
(1)*University of California, Santa Barbara*,
(2)*Department of Counseling, Clinical, & School Psychology, University of California Santa Barbara*

Background:

The development of early screeners for symptoms of autism in infancy has experienced a surge in recent years (Bryson, et al., 2007; Pierce et al., 2011; Zwaigenbaum, 2010). These screeners, however, do not directly address the stability of these symptomatic patterns in early infancy. Due to the rapidity of development in the first year of life and the implications of early brain plasticity, rigorous measurement of the stability of early signs of autism is paramount. Consequentially, the identification of infants exhibiting stable early signs of ASD urgently necessitates the investigation of early behavior modification programs for infants less than 18 months of age. Preliminary studies in our lab show that the use of motivational components of Pivotal Response Treatment (PRT) with infants as young as four months of age exhibiting weaknesses in social engagement can be effective in increasing affect, interaction, orienting to name, and eye contact (Koegel et al., under review).

Objectives:

The current study seeks to replicate previous studies measuring early markers of autism, assess whether these early behavior patterns show stability, and examine whether these behaviors can be efficiently and effectively modified.

Methods:

Fifteen infants were assessed for pre-linguistic signs of autism using parent-report and clinician-observation (Wetherby et al., 2008; Bryson et al., 2008). Two of these infants exhibited delays in communication and two presented with a lack of interest in social engagement. A treatment program designed to increase social communication was offered to infants exhibiting delays in both communication and social domains. The naturalistic treatment involved contingent and natural reinforcement of any communicative behavior. Treatment occurred three hours a week for six weeks, followed by one hour a week of parent-education for the last six weeks to promote maintenance of gains. Data from one representative infant is presented here to illustrate the pattern of findings.

Results:

Baseline observations for one 12-month old infant, showed several early signs of ASD, suggesting that autism symptomology can be measured in infancy. Additionally, these early signs, including atypical eye contact, no vocalizations, and lack of social engagement, were found to be stable across a one month baseline period. Despite stability, steady and considerable increases were made in the frequency of vocalizations upon the implementation of treatment. Further, collateral gains were observed in the area of social engagement with increased positive affect and non-toy play with both the therapist and caregiver. These gains generalized to the caregiver prior to the implementation of parent-education.

Conclusions:

The findings from this study lend support for the measurement and stability of early social weaknesses in infancy. Additionally, the use of a Pivotal Response Treatment for improving early behaviors consistent with ASD, such as low social engagement and vocalizations, is effective. Taken together, these results suggest optimism in the area of early identification and intervention. As more infants exhibiting early signs of ASD are identified, empirically-supported methods of

measurement and treatment for infants are critical. Further research with a large sample of infants exhibiting early signs of ASD is warranted.

132.154 154 Moderators of Cognitive Outcomes for Children with Autism Receiving Community-Based Early Intervention in Three Settings. A. S. Nahmias*[1], C. Kase[1] and D. S. Mandell[2], (1)*University of Pennsylvania*, (2)*Children's Hospital of Philadelphia, Center for Autism Research*

Background:

There is much debate in the literature about the most appropriate early intervention placement for children with autism. On one hand, autism-specific placements can provide intensive evidence-based care. On the other hand, inclusion settings provide interaction with typically developing peers, the importance of which is increasingly understood. To date, there is little empirical study of which settings produce the best outcomes and are most appropriate for which children.

Objectives:

The current study examined the association between early intervention (EI) setting for preschool-aged children with autism and outcomes upon entry into elementary school.

Methods:

Early intervention records were obtained for 100 children with autism (81 male) who received EI between ages 3 and 5 years and then attended elementary school in kindergarten-through-second-grade autism support classrooms in a large urban school district. Records contained Evaluation Reports, Developmental Assessment for Young Children (DAYC) scores, and Individualized Education Plans. Children were classified as receiving EI in one of three settings: ASD-only, mixed disabilities, and inclusive. Cognitive outcomes were assessed using the Differential Abilities Scale (DAS) at the beginning and end of participants' first year of elementary school. Potential moderators of interest included Time 1 DAYC Communication and Social-Emotional subtest scores.

Results:

Participants were an average of 38.1 (*SD* = 7.0) months when assessed for eligibility for entry into EI (Time 1) and 67.2 (*SD* = 5.6) months when assessed at the beginning of elementary school (Time 2). ASD-only (n=40), mixed-disabilities (n=35), and inclusive (n=25) setting groups did not significantly differ in Time 1 DAYC scores, demographics, or other baseline characteristics, except for Time 1 age and DAYC Communication subtest scores (*p*s < .05). Among children who did not floor on the DAYC Communication subtest at Time 1, Time 2 DAS scores of those who received EI in an inclusive setting were significantly higher than for children who attended a mixed disabilities setting ($p = .04$) and marginally higher than those who attended an ASD-only setting ($p = .07$). DAS Time 2 scores of these children who attended a mixed disabilities or ASD-only EI settings did not significantly differ from each other ($p = .66$). For children who did not reach the lowest standard score on the DAYC Communication subtest at Time 1, Time 2 DAS scores did not significantly differ from each other by setting (*p*s > .58). Among children with lower scores on the DAYC Social-Emotional subtest at Time 1, those in inclusive settings had significantly higher DAS scores than children in ASD-only settings ($p = .03$) and marginally higher scores than children in mixed disabilities settings ($p = .07$). DAS Time 2 scores of these children in ASD-only and mixed disabilities EI settings did not significantly differ from each other ($p = .77$). For children with higher initial social-emotional scores, DAS scores did not significantly differ from each other by setting (*p*s > .13).

Conclusions:

Preliminary results suggest that inclusive early intervention settings may be particularly beneficial for preschool aged children with autism with fewer social-emotional abilites and/or higher communication skills.

132.155 155 Implementing Evidence-Based Intervention for Young Children with Autism. V. Nanclares-Nogués*[1], C. P. Rolland[2], M. Cupoli[1], M. DiQuattro[3], S. Gove[4] and M. E. Msall[5], (1)*Advocate Illinois Masonic Medical Center*, (2)*Avocate Illinois Masonic Medical Center*, (3)*Advocate IL Masonic Medical Center*, (4)*University of Chicago*, (5)*University of Chicago Comer Children's Hospital*

Background:

The Early Start Denver Model (ESDM, Dawson et. al, 2010) demonstrated the effectiveness of early intervention in young children with autism, improving cognitive and adaptive outcomes, as well as lessening the severity of autism symptoms. However, there are gaps within Early Intervention and preschool services for implementing family-centered, comprehensive, evidence-based intervention. Currently in Illinois, there are significant barriers to accessing comprehensive evidence-based treatments for youngsters with ASD.

Objectives:

Our goal was to develop parent-professional intervention called *Busy Bees* and to evaluate its impact on child development and family well being in children between the ages of 24 and 36 months of age.

Methods:

We developed a comprehensive treatment program that integrates two early childhood evidence-based approaches, the ESDM and the SCERTS Models (Prizant, B., Wetherby, A., et. al., 2006). The ESDM approach includes a multidisciplinary team that implements developmental goals across domains, focuses on interpersonal engagement, develops strong imitation skills, and emphasizes both verbal and non-verbal communication development. The SCERTS model provides more defined social and language goals, including the use of Picture Exchange Communication System (PECS) and training goals for the communicative partner.

We recruited 15 children with ASD who were enrolled in Busy Bees and compared them with 15 children with ASD who received traditional Early Intervention services. In Illinois, these are home-based individual services that include separate sessions of speech, occupational and developmental therapies.

At baseline and at follow up (4-6 months after start of intervention) our developmental measures included the Mullen Scales of Early Learning, the Vineland Adaptive Behavior Scales-II, and the Brief Infant Toddler Social-Emotional Assessmen (BITSEA). We also measured parental competency, family life impairment, and adult well being using the Parenting Sense of Competence Scale (Gibaud-Wallston and Wandersman L. P., 1978), the Family Life Impairment Scale (Briggs-Gowen, M. and Carter, A., 2010) and SF-12 (short form). We compared pre and post intervention scores of those in Busy Bees with those in the traditional early intervention plan comparison group.

Baseline data was compared between groups using nonparametric tests as appropriate. Assessment scores for all children were converted to yield a developmental quotient and change in developmental quotients over time was compared between groups using unpaired t-tests. Wilcox Rank sum tests were used for ordinal data of parental competency, family life impairment, and adult well being. Statistical significance was defined as $p < .05$.

Results:

Preliminary results have demonstrated improvements in children's overall level of adaptive and cognitive competencies. Importantly, there were significant gains in parent sense of competency and decreased family life impairments due to the ASD diagnosis. We also identified barriers to enrollment, as well as, community supports the families experienced as helpful.

Conclusions:

We have demonstrated the feasibility in an urban setting with scarce resources an effective early intervention, evidence-based program that is comprehensive, family-centered, and multidisciplinary. We will discuss both facilitators and barriers to sustaining this model in the current fiscal environment.

132.156 156 Examining Factors Related to Response to Treatment in Autism Spectrum Disorders. K. Fossum*[1], I. M. Smith[2] and S. E. Bryson[2], (1)*Dalhousie University*, (2)*Dalhousie University/IWK Health Centre*

Background: Research consistently demonstrates that up to 50% of children with autism spectrum disorders (ASD) enrolled in various forms of early intensive behavioural intervention (EIBI) demonstrate significant improvements

(Howlin et al., 2009; Smith et al., 2010). The remaining children respond less optimally; the reasons for this variability in response to treatment remain unclear. Research examining the specific factors responsible is needed (Lord et al., 2005; Rogers & Vismara, 2008). One approach is to examine predictors of treatment response. Single-subject research has suggested that children who display higher levels of toy contact (TC), approach and stereotyped and repetitive verbalizations (SRV), along with lower levels of avoidance and stereotyped and repetitive non-verbal behaviours (SRNVB), respond better to an empirically supported intervention, Pivotal Response Treatment (PRT; Schreibman et al., 2009). Other PRT research also suggests that affect may play a role in predicting treatment response (Koegel et al., 1988).

Objectives: To examine, using group data, whether previously established treatment response variables and affect predicted communication gains over 12 months of treatment in the PRT-based Nova Scotia EIBI program (Bryson et al., 2007).

Methods: Participating families were enrolled in a larger EIBI effectiveness study (Smith et al., 2010). Eligibility for the clinical program was based only on age under 6 years and a clinical diagnosis of ASD. Data were collected at baseline, and after 6 and 12 months of intervention, including assessments of cognitive ability (M-P-R), both receptive and expressive communication (PLS-IV, VABS) and autism symptoms (SRS). Age Equivalents (AE) were used as the unit of measurement for outcome variables. Behavioural predictors were coded from video-recorded interactions between the child and a therapist collected as probe data in the context of the intervention program. Using Landis and Koch's (1977) criteria, only those video-coded predictor variables that achieved "substantial" reliability were included in the main analyses. Only approach (ICC = .51) and SRNVB (ICC = .31) were excluded using these criteria. Reliability of the remaining variables ranged from .63 to .75. Data from all three time points were available for N = 27 (*M* age = 51.26 mos, *SD* = 9.63; *M* cog AE = 26.89, *SD* = 9.66), and multi-level modeling was used to examine the hypotheses.

Results: Baseline cognitive AE, F (2, 22.77) = 4.00, p = .03, chronological age, F (2, 23.16) = 7.38, p = .00, and affect, F (2, 22.73) = 9.09, p = .00, were all associated with changes in expressive communication over time. None of the previously established treatment response predictors (i.e., TC, approach, avoidance, SRV and NVSRB) were associated with changes in either receptive or expressive communication.

Conclusions: Surprisingly, group data collected for children enrolled in a PRT-based intervention did not find that previously established treatment response variables predicted changes in communication scores over time. As found in other EIBI studies, both younger age and higher cognitive abilities at baseline did predict change in communication outcomes. Moreover, baseline levels of positive affect predicted increases in expressive communication over 12 months of intervention, a novel finding.

Treatments: A: Social Skills; School, Teachers Program 133 Treatment III: Pharmacologic, Treatment Factors, Outcome Measures

133.157 157 A Systematic Review of Psychosocial Interventions for Adults with Autism Spectrum Disorders. L. Bishop-Fitzpatrick*, S. M. Eack and N. J. Minshew, *University of Pittsburgh*

Background: While numerous studies evaluate psychosocial interventions for children with Autism Spectrum Disorders (ASD), relatively few investigate the efficacy of psychosocial interventions for adults with ASD. This is concerning given that a large cohort of people who were diagnosed with autism as children and will soon transition to adulthood and need efficacious intervention and services. However, no systematic reviews or meta-analyses of the literature examining psychosocial interventions for adults with autism exist. Consequently, remarkably little is known about the evidence-base for psychosocial interventions in this population.

Objectives: Describe and quantify the current and existing evidence base for psychosocial interventions for adults with ASD in order to guide future research and treatment.

Methods: A systematic review of the literature on psychosocial interventions for adults with ASD was conducted. A comprehensive search of the literature between January

1950 and September 2011 was completed. Studies were examined and included in this review if they were conducted using a longitudinal design (i.e., single case study, non-controlled trial, comparison study, randomized-controlled trial) and (1) reported quantitative findings, (2) included participants ages 18 and older, and (3) included participants with ASD. In order to ascertain the relative effectiveness of the psychosocial interventions described in the studies, effect size (*d*) was calculated using mean change divided by pooled standard deviation. Of the 1217 studies found in an extensive literature search, only 13 evaluated the efficacy of psychosocial interventions for adults with ASD.

Results: The 13 studies found in this review represented highly diverse research methodologies and modalities of intervention. A total of five studies were single case studies, three studies were comparison studies, two studies were randomized-controlled trials, and one study was an uncontrolled trial. Five studies evaluated applied behavior analysis, four studies evaluated social cognition training, and two evaluated other types of community-based interventions. As a whole, the studies identified had modest sample sizes of no more than 71 participants, with over three-quarters of studies having less than 20 participants. Effect sizes (*d*) for included studies ranged from 0.14 to 3.59. Due to the small number of studies on psychosocial interventions for adults with ASD, we were unable to conduct a meta-analysis of the adult ASD literature. As a consequence, clear estimates of effect size for different types of psychosocial interventions are unavailable. Effect sizes should also be interpreted with caution, especially for studies with small sample sizes, which comprised the majority of studies.

Conclusions: This body of research represents a positive and promising direction for psychosocial interventions for adults with ASD. However, both the amount and quality of research is limited by underpowered studies with limited internal validity for documenting intervention efficacy. This indicates that future research on interventions for adults with ASD is greatly needed, specifically on studies that employ more comprehensive and methodologically rigorous interventions designed to target core information processing deficits.

133.158 158 Adult Outcomes in Autism: A Prospective Longitudinal Examination of the Effects of Early Intensive Intervention-a 20 Year Follow up. B. Siegel*[1], T. Sendowski[1], O. Park[2], S. Radhakrishna[2] and W. Phuchareon[2], (1)*University of California, San Francisco*, (2)*Child and Adolescent Psychatiry, University of California, San Francisco*

Title: Adult Outcomes in Autism: A Prospective Longitudinal Examination of the Effects of Early Intensive Intervention: A 20 Year Follow-Up

Background: In the past 15 years, estimates of autism prevalence have increased to as high as 1:110 presently (2008, CDC). Utilization of special education, speech and language therapies, social skills training and occupational therapy by individuals with autism has increased dramatically, yet little is known about long-term effectiveness of this costly resource allocation (GAO, 2005). It is known that 95% of California adults with autism are unemployed and not living independently (SMART, 2010). Young adults with autism who are now 21-26 years old are the first cohort to have received early intensive behavioral interventions (EIBI), now the legal standard for a 'free and appropriate public education' (IDEA, 2004). It is now critical to ascertain whether this cohort, the first to receive EIBI, is better prepared for adulthood as it makes this transition.

Objectives: This preliminary study will examine whether 1) pre-treatment diagnosis and cognitive characteristics, or 2) receipt of EIBI or not, accounts for the most variance in adult outcomes.

Methods: We used a prospective longitudinal methodology relying on archival data from the UCSF Autism Archive. The archive includes initial diagnostic and cognitive assessments gathered by primary clinicians when these, now adult, subjects were 0-5 years old, as well as data indicating whether EIBI or less intensive interventions were then being used. Ss were re-contacted as adults, along with their caregivers, and new diagnostic (DSM-IV, ADOS), adaptive behavior (VABS), and status variables (living situation, employment) were collected. Data on interim treatment intervention were collected based on caregiver report. Intensity of services were indexed by

numbers of a) one-to-one treatment hours per week b) total treatment hours, and c) ratio of one-to-one hours/ total treatment hours. This is an important study as pre-treatment data and treatment status data were collected prospectively.

Results: To date, we have identified 49 Ss initially seen at 0-5 years of age, before initiation of any EIBI who remain in our catchment area. We so far, have re-contacted 8 families scheduled for the post-test assessment. Telephone interviewing suggests some of these Ss were 1) low functioning initially, received EIBI and remain low functioning, 2) that some were high functioning, did not receive EIBI and remain high functioning, and 3) that some were high functioning, received EIBI and remain high functioning.

Conclusions: We will present preliminary findings on a small sample of at least 20 Ss that represent these three groups and provide preliminary discussion of pre-test and treatment data that may explain outcomes.

133.159 159 Double-Blind Placebo-Controlled Trial of Methyl B12 Injections for Children with Autism. F. Widjaja*[1], J. E. Choi[1], S. J. James[2], R. E. Frye[3] and R. L. Hendren[1], (1)*University of California, San Francisco*, (2)*University of Arkansas for Medical Sciences*, (3)*Arkansas Children's Hospital Research Institute*

Background: Despite the fact that remarkable clinical improvements with few side effects have been reported with subcutaneous methyl B12 injections in children with autism, this remains an understudied biomedical treatment. Children with autism have been shown to exhibit markers of oxidative stress, which may be improved by methyl B12. We recently published a double-blind, placebo cross-over pilot study evaluating the effectiveness of methyl B12 for treating symptoms in 30 individuals with autism. One-third demonstrated clinical improvement but there were no statistically significant differences between active and placebo arms in behavioral measures or glutathione redox status (a potential biomarker for oxidative stress and treatment response) (Bertloglio *et al*, 2011). However, the responders exhibited significantly increases in concentrations of glutathione (GSH) and redox ratio of reduced-to-oxidized glutathione (GSH/GSSG) over the treatment period.

Objectives: We hypothesized that there is a subset of children with autism who behaviorally benefit from methyl-B12 injections because of an improvement in redox metabolism. To investigate this, we conducted a new randomized controlled trial of efficacy of injectable methyl B12 and examined measures of oxidative stress as potential biomarkers for treatment response. He we report a preliminary analysis of the first 32 of 50 children.

Methods: We conducted an eight-week, double-blind, placebo-controlled clinical trial of every 3-day injectable methyl B12 (75 mcg/kg) in children ages three to seven years with autism. Behavioral assessments and blood samples are obtained at baseline and weeks 8, 16 and 4 weeks post treatment. Independent-samples t-tests were were used for group comparisons. A subgroup of responders were indentified (independent of treatment) as subjects that showed improvement of at least a 2 points on the CGI to 'much improved' or 'very much improved' and 2 other behavioral measures (5 point improvement on the EVT, PPVT, ABC, MCDI, or SRS).

Results: We have enrolled 37 children; 32 have finished the double-blind phase and 22 have finished the open-label phase. MB12 treatment resulted in a .59-point greater average improvement on the CGI and a 9.4-point greater average improvement in ABC total scores. However, these differences were not statistically significant between groups. A subgroup of 9 responders (27%) were identified. There were no statistically significant differences in behavior measurements or glutathione endpoints between responders in the treatment and placebo groups. Pre-treatment levels of total GSH were found to be significantly higher in responders compared to non-responders (p=.01). Among subjects in the treatment group, pre-treatment levels of total GSH (p=.0006) and free GSH (p=.03) were found to be significantly higher in responders versus non-responders. There was no significant difference in any glutathione measurement between the responders and non-responders in the placebo group.

Conclusions: Initial levels of pre-treatment glutathione measurements, particularly total GSH and/or free GSH, may be a predictive biomarker of which children will demonstrate positive clinical response to subcutaneous methyl B12 treatment. Trends for significant improvement in behavioral measurements in the methyl B12 treatment group as compared to the placebo group may be significant with additional subjects

133.160 160 Effects of Video Modeling Interventions on Social and Communication Skills of Children with Autism Spectrum Disorders: A Meta-Analysis. C. Qi* and Y. L. Lin, *University of New Mexico*

Background:

Research has provided evidence of the effectiveness of video modeling (VM) interventions on social skills for individuals with autism spectrum disorders (ASD; Shukla-Mehta, Miller, & Callahan, 2010). Researchers have reached agreement on using meta-analysis in synthesizing single-case designs as it can result in more objective evaluation of multiple studies (Van den Noortgate & Onghena, 2003). Statistical procedures have been developed to provide more rigorous evaluations of the effectiveness of the intervention for single-case studies than traditional methods such as visual analysis.

Objectives:

The purpose of the study was to examine (1) the effectiveness of VM on social and communication skills of young children with ASD, (2) the relative effectiveness of VM in comparison to VM plus additional strategies, (3) the effectiveness of different models used in VM (self vs. others), and (4) the effects of potential moderators (child age, gender, or setting) on the effectiveness of VM on the outcomes. Four single-case research metrics were computed: the percentage of non-overlapping data (PND), the percentage of data points exceeding the median (PEM), the pairwise data overlap squared (PDO^2), and the robust improvement rate difference (IRD).

Methods:

Inclusion criteria were that studies must (a) be published in English language, peer-reviewed journals between 1985 and September 2011, (b) include at least one participant with ASD aged from 2-8 years, (c) utilize a single-case design that demonstrated experimental control, (d) have a baseline, (e) include a graphic display of child outcomes, (f) use VM only or VM with additional components, and (g) utilize outcome measures that targeted on social and communication skills as the primary dependent variables.

Results:

Twenty-six studies with 59 effect sizes were included for the meta-analysis. We adopted the criteria set by Scruggs and Mastropieri (1998) to categorize effects using the PND: a PND more than 0.90 is considered as very effective intervention, 0.70 to 0.89 as effective, and less than 0.70 as questionable or ineffective. We used these criteria to evaluate all the PND, PEM and PDO^2 methods. We used the Park et al. (2009) criteria to categorize effects using robust the IRD: a robust IRD more than .50 is considered an effective intervention; less than .50 ineffective. The mean values of PND (.73), PEM (.82) and PDO^2 (.85) obtained for 59 participants across studies all indicated that VM was considered an effective intervention for improving social communication skills of young children with ASD. The mean robust IRD values of .72 suggested a 72% improvement rate from baseline to intervention phrases. Child gender, age, and intervention settings, VM types (VM only vs. VM plus additional strategies), and model types (other vs. self) were not related to the outcomes of the study.

Conclusions:

All four metrics calculations indicate that VM intervention is effective to increase social communication of children with ASD. However, findings should be interpreted with caution because of the limitations of using percentage of nonoverlapping data.

133.161 161 Barriers to Successful Training in Positive Behavior Support: Predictors of Attrition and Success. M. L. Rinaldi*[1], K. V. Christodulu[2] and V. M. Durand[3], (1)*University at Albany - SUNY*, (2)*University at Albany, SUNY*, (3)*University of South Florida St. Petersburg*

Background: Parents of children with developmental disabilities have been taught to use positive behavior support

(PBS) approaches in their homes to successfully reduce and eliminate the challenging behaviors of their children and to help their children live more productive lives (Lucyshyn, Dunlap, & Albin, 2002). Despite the success of these training programs, many parents end treatment prematurely. Limited information is available regarding why these parents may be dropping out.

Objectives: The purpose of the present study was to examine the relationship between barriers to treatment participation, parental pessimism and depression, and attrition from treatment and treatment outcomes.

Methods: The study used a sample from a larger project, The Positive Family Intervention Project (Durand, 2007; see also Durand, Hieneman, Clarke, & Zona, 2009), in which parents with high pessimism scores were randomly assigned to either traditional training in PBS or PBS with the addition of an optimism component. Parents of a child with a developmental disability and significant challenging behaviors, ages 3- to 5-years-old, completed pre- and post-intervention questionnaires assessing child behavior levels and support needed and parental pessimism and depression. Pre- and post- video samples of the child's behaviors and treatment attendance were also collected. Finally, both the parent and the therapists completed the Barriers to Treatment Participation Scale (BTPS) following treatment. The present study examined the relationship between these variables across treatment conditions.

Results: Preliminary results indicated significant relationships between parental depressive symptoms and child behavior outcomes. In addition, therapist reports of stressors and obstacles to treatment were related to treatment attendance. Results also support the use of parent training programs targeting both child behaviors and parental perceptions to improve child behavior and family outcomes.

Conclusions: Discussion highlights the relationship between parental affect and treatment outcomes. Limitations of the study and future directions for research are also discussed.

133.162 162 Changes in Autistic Social Impairment with Treatment: Exploration of SRS Treatment Scales. S. W. White*[1], L. Scahill[2] and T. Ollendick[1], (1)*Virginia Polytechnic Institute and State University*, (2)*Yale University*

Background: Social deficits are a defining feature of Autism Spectrum Disorders (ASD), but research on the efficacy of interventions targeting improved social competence has yielded inconsistent findings. Improvement is variable across individuals, and long-term gain is often not realized (e.g., Bellini et al., 2007; Rao et al., 2008). Anxiety, common in ASD (e.g., White et al., 2009), is one individual variable that may limit treatment response if unaddressed. For instance, anxiety may lessen ability to focus and inhibit learning, diminish opportunities to practice newly learned skills, or decrease the fluency of mastered skills in social situations. Reducing anxiety while treating social skill problems might improve treatment response.

Objectives: This study evaluated change in social competence across specific ASD-related domains in an intervention targeting both anxiety reduction and social skill improvement.

Methods: Adolescents (n = 30) with a confirmed ASD and concomitant anxiety disorders participated in a randomized controlled trial (RCT) comparing a structured individual and group therapy program compared to waitlist. The purpose of the trial was to evaluate feasibility and preliminary efficacy of the combined psychosocial treatment program. This report presents results on the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) over the course of treatment and at three-month follow-up.

Results: The sample was predominantly Caucasian (87%) and male (77%), with estimated Verbal IQ ranging from 73 to 126 (M = 97.07). The SRS demonstrated excellent internal consistency (alpha = .93) in this sample. Baseline Total SRS scores were correlated, non-significantly, in the expected direction with theoretically similar constructs: r = .29 (p = .12) with ADOS algorithm scores, r = -.31 (p = .09) with Vineland Socialization domain score. Participants assigned to the combined psychosocial intervention (n = 15) had significant improvement in all SRS subscales compared to no change in the wait-list comparison group (n = 15). Within the active treatment group effect sizes ranged from 0.73 (Social

Motivation domain) to 1.18 (Autistic Mannerisms). Follow-up data are available on nine of the 15 participants assigned to active treatment. No significant deterioration is apparent across the SRS subscales or total score between endpoint and three-month follow-up, indicating that treatment gains largely persisted after the intervention ended.

Conclusions: The SRS appears to be a useful measure of social impairment in adolescents with ASD and these results indicate that it is sensitive to change with treatment. Addressing individual factors, such as anxiety, may be a useful consideration in treatments targeting improved social competence in adolescents with ASD, though such remains to be clearly demonstrated. Estimated effect sizes, on the SRS, in this trial are larger than the effects reported in recent clinical trials of interventions that did not also target anxiety reduction (e.g., Lopata et al., 2010; White et al., 2010). The next step will be to directly compare a 'pure' social skill development intervention to a combined approach.

133.163 163 Induction of Cellular Stress As a Potential Therapeutic Mechanism for Treatment of Autism. K. Singh*[1], K. D. Smith[2] and A. W. Zimmerman[1], (1)*Lurie Center for Autism, MassGeneral Hospital for Children*, (2)*Kennedy Krieger Institute*

Background: Previous research has shown that symptoms of autism are reduced by fever. These functional improvements likely involve heat shock proteins and induction of cellular stress responses that lead to changes in synaptic function and increased long-range connectivity.

Objectives: Our aim has been to identify substances that activate cellular stress responses as possible therapeutic agents for the treatment of autism.

Methods: We investigated the effects of hydroxyurea (HU), 4-phenylbutyrate (4PBA) and trichostatin-A (TSA) on heat shock responses (HSR) and mitochondrial biogenesis in human fibroblasts with HU, 4PBA and TSA. mRNA expression of HSR genes (HSPA1A (HSP70), DNAJC3 (HSP40), and HSP90AA1 (HSP90)) were measured and analyzed by RT-PCR and plotted relative to untreated healthy transformed human fibroblasts after 6-24 hours of treatment. For mitochondrial mass, cells stained with Mitotracker Green FM, and Mitotracker Deep Red 633 or PBS as a negative control were subjected to flow cytometric analysis.

Results: HSP gene expression (relative maximum gene and protein expression) and mitochondrial mass are increased with respect to gene and protein expression, as well as mitochondrial mass in untreated fibroblasts for all 4 compounds ($p<0.05$).

Conclusions: This study demonstrates that it is possible to mimic the effects of fever in-vitro by activating HSR and increasing mitochondrial biogenesis. Of these, HU shows great potential since it is best characterized clinically and has alrready been clinically approved for other conditions. A clinical trial of HU in autism is in the planning stage and holds potential for treating core features of the disorder.

133.164 164 Functional Health Outcomes of An Outdoor Sports Camp for Children with An Autism Spectrum Disorder. H. B. Carroll*, J. A. Agnew, Z. Pan and R. L. Gabriels, *Children's Hospital Colorado / The University of Colorado at Denver and Health Sciences Center*

Background: Published studies support the observation that individuals with an Autism Spectrum Disorder (ASD) are limited in their involvement in extracurricular activities compared to typically developing peers due to factors including social communication difficulties. Studies also suggest that children with an ASD engage in less physical activity than their typical counterparts. This is despite the fact that physical activity has positive effects for individuals with an ASD, including improving physical health, increasing social responsiveness and increasing self-regulation.

Objectives: The aim of this pilot study was to evaluate the effects of a one-week sports camp specifically targeted for children and adolescents diagnosed with an ASD on measures of 1) Self-regulation, 2) Leisure activities and 3) Social responsiveness.

Methods: During an initial phone interview, potential subjects were screened. Participants who met study inclusion criteria (6-17 years of age; diagnosed with an ASD (Autism, Asperger's or PDD) prior to study admission from a psychologist or psychiatrist in the community; meeting diagnostic cut-off

scores for ASD on the Social Communication Questionnaire (≥ 15); returning home and to normal routine directly within two weeks after completion of camp; enrolled in a one week (only) camp session; and not having a medical or psychiatric disorder or behavioral issue that would prevent participation) were then engaged in the informed consent/assent process. Prior to start of camp, a designated caregiver for each participant completed the Vineland Adaptive Behavior Scales – II, the Child and Caregiver Information Form- Research Version (CCIF-RV) and the Social Communication Questionnaire (SCQ) as demographic measures. Pre-post camp measures of participants' self-regulation and social behaviors included the Aberrant Behavior Checklist Community (ABC-C), Irritability, Hyperactivity, Lethargy and Stereotypy subscales, and the Social Responsiveness Scale (SRS). The pre-post measure of participants' leisure activities was the Children's Assessment of Participation and Enjoyment (CAPE). All measures were completed by a designated caregiver for each participant within one month before they participated in the seven-day camp and again four weeks following completion of the camp.

Results: Ten individuals participated in this research study (8 male / 2 female; ages 6-17 years). It is anticipated that at the time of this presentation, results will be reported on the pre- and post-intervention evaluations in the areas of self-regulation, social responsiveness and level of participation in leisure activities.

Conclusions: Determining if outdoor sports camps are helpful to children and adolescents with an ASD has multiple implications for the quality of life in this population including whether sports camps settings are effective in producing beneficial social and health outcomes for ASD individuals and whether or not parents/guardians should enroll their children in such activities. Additionally, future directions may include examination of whether longer term interventions (multi-week camps) are needed to produce significant social and health benefits for children and adolescents with an ASD.

133.165 165 Therapeutic Horseback Riding In Children with Autism Spectrum Disorders. Z. Pan*[1], J. A. Agnew[1], A. Sholffner[2], J. Vendl[1], J. S. Runde[3] and R. L. Gabriels[1], (1)*Children's Hospital Colorado / The University of Colorado at Denver and Health Sciences Center*, (2)*Colorado Therapeutic Riding Center*, (3)*Children's Hospital Colorado / The University of Colorado at Denver and Health Sciences Center*

Background:

Equine Assisted Activities and Therapies (EAAT) include therapeutic horseback riding (THR), which is frequently sought to address the behavioral disturbances that impair the quality of life for individuals with an autism spectrum disorder (ASD). However, few published evidence-based THR studies guide clinicians and consumers. In our pilot study (Gabriels et al., In Press), the effects of 10 weekly lessons of THR with 41 subjects diagnosed with an ASD (ages 6-16 years) were compared to a waitlist control group (n = 16). Subjects in the THR group demonstrated significant improvements on measures of Irritability, Lethargy, Stereotypic Behavior and Hyperactivity as compared with the control group. The THR-specific change suggested the improvements were related to the THR treatment.

Objectives:

To test whether the changes in self-regulation behaviors observed in the pilot project can be replicated by a larger randomized control trial (NIH/NINR 1R01NR012736) involving a THR and active control group. Also, to examine if there are long–term (i.e., six month) effects of THR on self-regulation behaviors (i.e., Irritability, Lethargy, Stereotypic Behavior, and Hyperactivity) as measured by the Aberrant Behavior Checklist-Community (ABC-C).

Methods:

Subjects are children and adolescents aged 6 to 16 years with a diagnosis of Autistic Disorder or Asperger's Disorder. Other inclusion criteria include a score of 11 points or higher on the Irritability and Stereotypic Behavior subscales of the ABC-C and nonverbal IQ ≥ 40. Exclusion criteria are those who have physical ailment or behavioral issue that would prevent participation, have a history of animal abuse or phobia to horses, are judged by the standard therapeutic riding screening to be beyond the level of a beginning rider, or if they have had more than two hours of EAAT experience within the

past six months. The intervention site is certified as a "Premiere" therapeutic horseback riding center by the PATH International, a national accrediting agency for EAAT. Subjects' pre- and post-intervention evaluations are conducted by occupational therapists, speech therapists, and professional research assistants blinded to intervention condition. A designated caregiver for each participant completes the ABC-C each week during the 10-week intervention period as well as six months after the participants have completed the THR intervention.

Results: **:** Preliminary analyses suggest that the ABC-C subscale response pattern in data collected thus far is similar to that in the pilot trial. It is anticipated that at the time of this presentation, preliminary results will be reported on ABC-C data from 17 subjects in the THR group from the randomized control trial and all six-month post intervention data (i.e., self-regulation, communication, socialization, and motor coordination and imitation functioning) from six subjects who participated in the THR group.

Conclusions:

Determining if and how the human-animal interaction via THR is helpful to individuals with an ASD has far-reaching implications for the quality of life in this ASD population and their caregivers. THR is less invasive than the use of medications to treat symptoms such as irritability and hyperactivity, critical areas that impact the child's ability to function successfully in home and school environments.

133.166 166 Movement Skill Trajectories Among Children with ASD. K. Staples* and C. Zimmer, *University of Regina*

Background: Movement skills play a critical role in development. The performance of movement skills by school-aged children with autism spectrum disorders (ASD) is impaired compared to same aged typically developing peers and to younger typically developing children matched on developmental level. These movement skill differences become more obvious with increasing age and children with ASD appear to fall further behind -- these increasing differences may reflect the limited opportunities of children with ASD to practice and improve their movement skills. One theory is that children with ASD do not have requisite skills to build on, which supports the contention of unique developmental trajectories among children with ASD in the movement domain. However, much of the research to date has examined performance at a single point in time and made inferences about development by looking at studies spanning across age groups. The use of trajectories puts a focus on change over time within the same individuals.

Objectives: This study explored the performance of 12 fundamental movement skills using the *Test of Gross Motor Development* (*TGMD-2*), a standardized assessment that includes specific performance criteria to examine both locomotor and object control skills.

Methods: 22 children with ASD (aged 9 to 12 years) were individually-matched on movement skill proficiency to 22 typically developing children based on the raw scores from the locomotor and object control subtests of the *TGMD-2* ($p = .715$ and $p = .805$, respectively). In order to match the groups on movement skill performance, the comparison group was significantly younger (aged 4 to 6 years). To explore trajectories of movement skill development, 17 children with ASD and 15 typically developing children were followed for 3 consecutive years. Using hierarchical linear regression, two developmental trajectories were established for each participant, one for locomotor skills and the other for object control skills. Each trajectory had its own parameters - intercept (i.e., starting point) and gradient (i.e., rate of change).

Results: The groups were closely matched on movement skill, as such there was no difference in intercepts between the groups on locomotor ($p = .983$) and object control ($p = .538$) skills. However, group differences in the gradients were found on both movement skill subtests ($p < .01$). This latter finding supports different developmental trajectories for children with ASD in the movement skill domain.

Conclusions: The significant age difference between these groups clearly demonstrates a delay in the development of movement skills among children with ASD and longitudinal comparisons revealed different developmental trajectories between the groups. Despite being significantly older, children with ASD seemingly reached a plateau in

performance, while the younger, typically developing children continued to refine their movement skills with increasing age. Intervention approaches need to target these different rates of development.

133.167 167 A Qualitative Methods Study of How Parents of Children with Autism Find and Use Information about Interventions. S. J. Gentles*[1], K. A. McKibbon[1], S. Jack[1], D. B. Nicholas[2] and P. Szatmari[3], (1)*McMaster University*, (2)*University of Calgary*, (3)*Offord Centre for Child Studies, McMaster University*

Background: Parents of children with autism are influential decision-makers regarding treatment, participating in decisions both within traditional clinical settings (eg, through shared decision-making) and independently in non-clinical settings (eg, choosing complementary and alternative therapies). They are also much more likely to have intense information needs compared to most health consumers. Greater understanding of how parents encounter health information and use it for treatment decision-making could lead to better informational support and inform knowledge translation strategies that improve parents' use of best research evidence.

Objectives: The aim of this study is to develop a substantive theory explaining how Ontario parents of children with autism experience and use information that informs their decision-making and attitudes regarding interventions for their child.

Methods: A grounded theory methodology was adopted to develop the theory inductively from data consisting primarily of audio-recorded and transcribed semi-structured interviews, as well as web sites and other documents. Interview participants include English-speaking mothers of recently diagnosed children identified through both clinical and community channels, living in both urban and rural areas of Ontario; and a small number of parent support professionals. Per grounded theory methods, data collection proceeds concurrently with analysis throughout the study, with successive data sources (participants, documents, interview questions) selected to meet the evolving analytic needs. Analysis relies on the constant comparative method to develop categories, and uses extensive memos and diagrams to reach higher levels of abstraction. Data management and analysis are being facilitated by QSR's NVivo software.

Results: At the time of writing, three parents had been interviewed about their experiences, opinions, and attitudes regarding treatment-related information; preliminary observations are noted. Parents described numerous interventions and services for which they had used information to support a positive/negative decision or to gain access to the intervention. Sources of information varied, and included clinician-provided information, books, web sites, PubMed abstracts and linked journal articles, online parent list-serves, workshops, etc. Some participants observed an apparent variability in the amount of time and energy that they and other parents choose to spend actively searching for information, particularly on complementary or alternative forms of treatment. Even when spending less amounts of time than other parents could be rationalized, guilt for not doing enough for their child was a reality.

Conclusions: The grounded theory study, currently in its early stages, has broad implications for improving use of research evidence by parents of children with autism. One plan to extend the study's utility after completion involves using conjoint analysis to model the information preferences of discrete segments of parents in order to be able better customize support services and information formats to cater to such populations. Hypotheses about barriers to finding and making optimal use of the best research evidence may be useful to suggest areas for further research or intervention development. Findings may also be used to provide clinicians more insight and sensitivity towards the informational challenges faced by parents. Better delivery of evidence-based information has potential to improve child outcomes, empower parents, and reduce misapplication of family resources.

133.168 168 Diagnosis and Management of Autism Spectrum Conditions in Adults : The Dutch 2012 Guideline. W. J. Verbeeck*[1] and B. B. Sizoo[2], (1)*Vincent van Gogh Institute*, (2)*Dimence*

Background: There is wide variation in rates of identification and referral for diagnostic assessment, models of multi-professional working, assessment criteria, diagnostic practice, biomedical investigation and therapeutic interventions for

adults with features of autism spectrum conditions (ASC). These factors contribute to delays in reaching a diagnosis , diagnostic overshadowing and subsequent access to appropriate services and support. There is an increasing emphasis on “best practice” by clinicians, consumers and health managers. As a consequence, guidelines serve as systematically developed statements designed to help practitioners and patients make decisions about appropriate health care for specific circumstances. The recent increase of available data on ASC has allowed for the development of symptom-based algorithms for the psychopharmacological management of specific target symptoms associated with ASC. Current treatment and management for autism spectrum conditions is often focused on children and adolescence, for which Dutch guidelines have already been developed and inplemented.

Objectives: To produce a clinical guideline on the management of autistic spectrum disorders in adults, as instructed by the Dutch society of Psychiatry (NVvP) and the Dutch National Institute of Psychology (NIP), in collaboration with the the Trimbos Institute, and the British National Collaborative Centre for Mental Health (NCCMH).

Methods: Both the scope and review questions were set out by the NCCMH. The Dutch taskgroup and topic groups pursued a 3 tier approach, deciding whether to evaluate, adapt or adopt the resulting scientific evidence. The scope of the guideline included case identification, diagnosis and assessment,biomedical interventions,and psychosocial interventions.

Results: We present the biomedical considerations and recommendations with regard to antipsychotics, antidepressants, anxiolytics, cognitive enhancers and stimulants, anticonvulsants, hormones, and complementary-alternative medicine, for the treatment of core symptoms and associated features for individuals with ASC. The quality of evidence and strenght of recommendations are expressed in GRADE (Grading of Recommendations Assessment,Development and Evaluation) terminology.

Conclusions: The authors show how the guideline assists decision making in clinical practice with a comprehensive summary of evidence based and practice based pharmacological interventions for ASC and related comorbid conditions in adults.

133.169 169 Strategies for Accessing and Implementing Inclusive Personal Training Programs for Young Adults with Autism. D. Campbell*[1] and K. G. Steiner[2], (1)*allAbilitiesFitness*, (2)*New Leaf Link (NeLL)*

Background:

In Canada, studies have shown that only approximately 3% of individuals with a disability are actively engaged in regular physical activity and sport, and 60% of youth with disabilities seldom or never play active games with friends in their free time. However, educators are becoming increasingly aware of the benefits of personal fitness for their special education students. Some are convinced that physical education has a central role to play in building self-esteem and social skills that in turn lead to a more active and inclusive lifestyle for children with autism (e.g., Ochtabienski & Byl, in press). Further, young adults with autism are showing interest in accessing personal fitness opportunities, yet few programs outside school settings seem accessible. And fitness professionals are not systematically trained to include people with disabilities in their fitness programs.

Objectives:

This study identifies barriers to accessing and implementing personal fitness programs for young adults with autism. We aim to develop strategies to overcome barriers to inclusive personal training programs.

Methods:

We used purposeful sampling to select three young adult case study participants to represent different diagnostic categories of autism. These participants were seeking support in integrating regular physical activity in their daily lives. The first author, who is a certified personal trainer and a qualified teacher, developed and documented an individualized personal training program for each participant. Further, she interviewed caregivers, teachers, and personal fitness professionals who became associated with participants in the course of implementing each training plan. Inductive analyses

of program documents (i.e., instructional materials, assessments, and transcripts of semi-structured interviews) across these cases yielded identification of barriers to fitness and strategies for overcoming barriers.

Results:

These three cases presented a diversity of social, economic, and motivational barriers to personal fitness. Collectively, participant experiences suggested ways of overcoming barriers by tailoring programs to particular needs, and by transferring skills learned in one setting (e.g., home or school) to others (e.g., a fitness club or an organized recreational program setting). In each case, the social network of the individual expanded and there was evidence of reciprocal learning on the part of individuals with autism, caregivers, teachers, and fitness professionals.

Conclusions:

People with autism benefit from personal fitness whether they are non-verbal and have multiple disabilities or have a diagnosis of Asperger syndrome and little initial interest in personal fitness. However, systematic research is needed to track the impact of personal fitness on the development of people with autism of varying ages, interests and abilities. Further, an emphasis on physical education during the high school years needs to be represented in transition planning for young adults who are about to finish school. We argue here that it is important to take full advantage of school-based resources in the fitness domain to plan for the personal fitness needs of adults with autism who are leaving school. Finally, fitness professionals require training to be able to include individuals with autism in public and private personal training settings.

133.170 170 Cerebral Folate Receptor Autoantibodies in Autism Spectrum Disorder. R. E. Frye*[1], J. M. Sequeira[2], E. V. Quadros[2], S. J. James[1] and D. Rossignol[3], (1)*University of Arkansas for Medical Sciences*, (2)*SUNY-Downstate Medical Center*, (3)*International Child Development Resource Center*

Background: Cerebral folate deficiency (CFD) syndrome is a neurodevelopmental disorder typically caused by folate receptor autoantibodies (FRAs) that interfere with folate transport across the blood-brain barrier. Autism spectrum disorders (ASD) and improvements in ASD symptoms with leucovorin (folinic acid) treatment have been reported in some children with CFD. In children with ASD, the prevalence of FRAs and the response to leucovorin in FRA positive children has not been systematically investigated.

Objectives: First, to determine the prevalence of FRAs in a group of children with ASD. Second, to determine the correlation between FRAs and cerebrospinal (CSF) concentrations of 5-methyltetrahydrofolate (5MTHF). Finally, to examine the effects of folinic acid treatment on ASD behaviors.

Methods: In this study, serum FRA concentrations were measured in 93 children with ASD. A subset of FRA positive children underwent a lumbar puncture to determine CSF concentrations of 5MTHF. Children with FRAs were treated with oral leucovorin calcium (2 mg/kg/day; maximum 50 mg/day). Treatment response was measured and compared to a wait-list control group.

Results: A high prevalence (75.3%) of FRAs was found. In 16 children, the concentration of blocking FRA significantly correlated with the CSF fluid 5MTHF concentrations which were below the normative mean in every case. Compared to controls, significantly higher improvement ratings were observed in treated children over a mean period of 4 months in verbal communication, receptive and expressive language, attention and stereotypical behavior. Approximately one-third of treated children demonstrated moderate to much improvement. The incidence of adverse effects was low.

Conclusions: This study suggests that FRAs may be important in ASD and that FRA positive children with ASD may benefit from leucovorin calcium treatment. Given these results, empirical treatment with leucovorin calcium may be a reasonable and non-invasive approach in FRA positive children with ASD. Additional studies of folate receptor autoimmunity and leucovorin calcium treatment in children with ASD are warranted.

133.171 171 Get FRESH: Evaluation of A Healthy Lifestyles Group for Teens with ASDs and Their Parents. S.

Nichols*[1], L. Adamek[2], E. M. Mansdorf[3], S. P. Tetenbaum[1], L. B. Perlis[4] and G. Reilly[5], (1)*ASPIRE Center for Learning and Development*, (2)*Children's Hospital Boston*, (3)*Hofstra University*, (4)*Independent Practice*, (5)*Stony Brook University*

Background: Health and fitness are important to quality of life as they are linked to cognitive performance, social functioning, and self-esteem (Kwak et al, 2009; McAuley, Mihalko, & Bane, 1997). Youth with autism spectrum disorders (ASDs) engage in less health and fitness activities due to limited interest in physical play, lack of motivation to engage in social fitness activities, limited self-awareness, and restricted food interests. Thus, education and intervention are needed in this area. A recent review of physical exercise with individuals with ASDs demonstrated decreases in child problem behaviors such as stereotypy, aggression, and off-task behavior (Lang et al, 2010). The studies reviewed typically focus on one fitness behavior, do not include a health curriculum, and lack a parent component. To better address health and fitness outcomes for youth with ASDs, more comprehensive health and fitness curriculum must be developed and evaluated.

Objectives: The aim of the current study was to evaluate the effectiveness of a group-based parent and teen curriculum designed to improve adolescent's fitness, increase healthy lifestyle changes, and attain specific fitness goals. Further, the study aimed to assess possible secondary gains including global changes in social skills, problem behavior, and quality of life.

Methods: Twenty-two adolescents (14 male, 8 female) ages 12-16 (m = 14.27; SD =1.12) and their parents were recruited for the current study. A wait-list control was used to compare groups. Participants attended 90 minute, weekly sessions for 12 weeks. Teen and parent groups included fitness exercises and a healthy lifestyle curriculum covering a variety of topics (e.g., healthy eating, positive sleep habits). Analyses of pre and post group measures included an observational exercise assessment by a certified fitness trainer; and parent reports of child activity level, eating habits, individualized goal attainment, social skills, problem behavior, community integration, sleep, and quality of life.

Results: Results indicate significant improvement in exercise skills as measured by a certified fitness trainer (t (18) = -.3.47, p < .002). Gains were made in parent-reported child activity level (t (18) = 2.24, p < .039), fitness goal attainment (t (18) = -7.52, p < .001), some social functioning such as self-control (t (18) = 2.20, p < .042), overall problem behavior (t (18) = 2.27, p < .036), and task compliance (t (18) = -2.55, p < .020). There were no significant changes in parent fitness, child and parent eating style, other aspects of social skills, community integration, quality of life, and sleep.

Conclusions: Findings demonstrate the benefits of group-based health and fitness curriculum for youth with ASDs and their parents. Improvements were noted in health and fitness outcomes, as well as on social and behavioral functioning. Limitations and recommendations for future research directions in health and fitness will be discussed.

133.172 172 The Effectiveness of a Yoga Based Program on Decreasing Maladaptive Behaviors in School Aged Children with ASD. K. P. Koenig*[1], A. Buckley-Reen[2] and S. Garg[1], (1)*New York University*, (2)*For Kids OT, PC*

Background:

The need for scientifically based educational interventions, whenever practical, is outlined in the re-authorization of the Individuals with Disabilities Educational Improvement Act (2004). Often, multiple interventions are used with children with ASD, making it exceedingly difficult to assess the efficacy of a new intervention utilized in a classroom. Promising interventions are often not available to students from disadvantaged backgrounds, unless they are delivered in public school settings. Occupational therapists utilize school-based yoga programs, but these interventions typically lack manualization and evidence from well designed studies.

Objectives:

The purpose of this research is to examine the effect of the "Get Ready to Learn" (*GRTL) program* for children with ASD on decreasing maladaptive behaviors that may interfere with classroom performance and increasing adaptive classroom behaviors. Specifically it is hypothesized that children who

participate in the *GRTL program* will show a decrease in interfering behaviors, as measured by the Aberrant Behavior Checklist (ABC), compared to the control group.

Methods:

An experimental pre-test post-test control group design examined the effectiveness of the GRTL classroom yoga program in a culturally diverse sample of children with ASD at a large urban public school that serves low income students. The intervention group (n = 24) received the manualized yoga program daily for 16 weeks, while controls (n = 22) engaged in their standard morning routine. Challenging behaviors were assessed with standardized measures pre and post intervention. An analysis of variance was completed between groups to assess differences in gain scores on the dependent variables.

Results:

At baseline, groups were comparable as there were no significant differences in age, sex, ethnicity and Vineland Adaptive Behavior scores. Pretest measures of maladaptive behavior on the ABC showed no significant differences between groups. Students who participated in the *GRTL program* showed significant (F = 5.079, p = .029) differences on their total ABC score as compared to students in the control condition. We found a moderate effect (F = 5.079, p = .029, Cohen's d = 1.19) for the total behavior scores on the teacher ratings of the ABC and small effect for Subscale I: Irritability, Agitation, and Crying (F= 3.89, p = .05, Cohen's d = .59). Subscale II-Lethargy, Social Withdrawal (F = 3.064, p = .087,Cohen's d = .53) and Subscale IV-Hyperactivity, Noncompliance (F = .3.34, p = .074, Cohen's d = .55) approached significance. The students' in the control group did not display any significant reductions of maladaptive behavior as measured by the ABC and actually had scores that had a tendency to either stay the same or increase, which is indicative of more negative behavior, with the exception of Subscale II-Lethargy, Social Withdrawal.

Conclusions:

Students that received a daily 16 week manualized yoga intervention showed a reduction in behaviors that were identified as maladaptive by teachers, including irritability, lethargy, social withdrawal, hyperactivity and non-compliance, compared to students who engaged in their standard morning routine. Evidenced-based yoga programs may be a viable option for improving behavior in public school classrooms.

133.173 173 A Placebo-Controlled, Double-Blinded Study of Minocycline in Children with Fragile X Syndrome. M. J. Leigh*[1], D. Nguyen[2], T. Winarni[3], A. Schneider[1], T. Chechi[1], S. M. Rivera[4], D. Hessl[1] and R. J. Hagerman[1], (1)*U.C. Davis MIND Institute*, (2)*U.C. Davis*, (3)*CEBIOR Diponegoro University*, (4)*U.C. Davis Center for Mind & Brain, MIND Institute*

Background: Fragile X syndrome (FXS) is the most common inherited cause of intellectual disability and the most common known single gene cause of autism. Minocycline has been found to decrease levels of matrix metalloproteinase 9 and normalize synaptic connections in the knock out mouse model of FXS. Minocycline also normalized the behavioral phenotype of the fragile X mouse model. Prior open label studies of minocycline in individuals with FXS suggest benefits for behavior.

Objectives: To assess the efficacy and safety of minocycline as a targeted treatment for children with FXS with and without a pervasive developmental disorder.

Methods: Children with FXS 3.5-16 years of age were randomized to receive minocycline or placebo. After three months, participants were crossed over to minocycline or placebo for the following three months. Investigators and participants were blinded to the randomization. Outcome measures including the Clinical Global Impressions-Improvement scale (CGI-I), Visual Analogue Scale (VAS) for target behaviors, and the Aberrant Behavior Checklist (ABC) were administered at baseline, 3 months and 6 months. Appropriate Autism Diagnostic Observation Schedule (ADOS) modules and cognitive measures were administered to participants at baseline.

Results: This preliminary analysis focuses on 40 individuals, mean age 8.64 +/- 3.46 years. There was a significantly

greater improvement in CGI-I scores after minocycline treatment compared to placebo (p=0.0274). The VAS showed a trend for greater improvement after minocycline treatment for one of the target behaviors identified by caregivers. No serious adverse events occurred and there was no significant difference in side effects during the minocycline period vs. the placebo period.

Conclusions: Preliminary analysis supports the potential efficacy of minocycline treatment for FXS, but evidence of a placebo effect is also seen. Treatment with minocycline for 3 months has been well tolerated. The trial is ongoing. Although preliminary data has been presented before, further results will include updated data for 50 patients as well as an analysis of ABC composite scores and subscale scores including a revised subscale for FXS individuals. Correlations of baseline ADOS scores and IQ scores with response to treatment and available data regarding anti-nuclear antibodies (ANA) post-treatment will be presented as well. Larger, multi-center trials are indicated to further study this treatment. Recommendations for patients on minocycline include close monitoring for side effects and obtaining pre- and post-treatment ANA levels when possible.

133.174 174 Societal Economic Burden of Autism on Families in Oman: A Cross-Sectional Study. Y. M. Al-Farsi*, M. I. Waly, M. Al-Sharbati, S. Al-Fahdi, A. Al-Farsi, S. Al-Suleimani, O. A. Al-Farsi and M. Al-Shafaee, *Sultan Qaboos University*

Background:

Autism spectrum disorder (ASD) has become an urgent public health challenge worldwide. Nonetheless, there is serious paucity of information about societal economic burden on families caring for ASD children in the Arab world.

Objectives:

To investigate the societal economic burden on families caring for autistic children (ASD families) in Oman.

Methods:

A cross-sectional study was nested on on-going research project among families of ASD children who are registered at the Autism Database at SQU. Questionnaires, both in English and Arabic, were developed based on the standardized and validated Client Service Receipt Inventory (CSRI). Elements covered were**:** (1) Time spent in informal care; (2) Out-of-pocket expenses; and (3) Range of services used by ASD children. Families were interviewed by trained medical students.

Results:

Out of 150 ASD families surveyed, majority were considered low-income (69; 46%) or middle income (50; 33%). The average monthly income for the whole group was 2051 ± 218 US Dollars (USD). Total monthly out-of-pocket expenses spent per ASD child 215 ± 57 OMR (27.2% of total average income). The average time spent in informal care per month was 224 ± 23 hours. The estimated average income loss due to lost employment opportunity or quitting jobs by mothers was 1830 ± 109 USD. Ranges of services used by ASD children varied among families. Of total, 33 (22%) families reported sending their ASD children to private special schools, and 22 (15%) families needed to move to closer service. Hiring a housemaid to help in caring was reported by 71 (47%) families. Seeking treatment abroad was reported only among high-income families, and the average cost of which was 8780 ± 718 USD per year.

Conclusions:

The societal economic burden on ASD families is considerably high. Effective social services are urgently needed to improve quality of life of ASD families.

133.175 175 The Feasibility and Efficacy of Problem Solving Therapy in College Students with Autism Spectrum Disorders. C. E. Pugliese* and S. W. White, *Virginia Polytechnic Institute and State University*

Background:

The need of students with Autism Spectrum Disorder (ASD) transitioning to college is an area that is gaining attention. Such students have difficulty adapting to college due to increased academic demands, difficulty with organization, and social problems. These obstacles contribute to drop out, even in students with exceptional academic skills. Currently, there is

no empirically-supported treatment designed to help students successfully adapt to the college environment. This study presents pilot data on a group-based cognitive behavioral intervention program, Problem-Solving Skills:101 (PSS:101) to address impaired problem-solving ability in ASD. PSS:101 was designed to promote problem-solving ability in college students with ASD who are likely to be struggling with academic, social, and emotional problems in a college setting. Though a manualized therapy specifically targeting problem-solving has never been used with college students with ASD, several empirical studies have successfully targeted this skill as a component of a larger intervention (Stichter et al., 2010). PSS: 101 is based on Problem-Solving Therapy (D'Zurilla & Nezu, 2007), an evidence-based, cognitive-behavioral intervention designed to promote an adaptive problem-solving attitude and teach skills to reduce psychopathology and enhance psychological functioning.

Objectives:

Primary aims were to collect data on the feasibility of implementing PSS:101 and on the short-term efficacy of the intervention. Treatment feasibility is defined as a combination of treatment integrity (i.e., delivery of the intervention's key elements), treatment adherence (i.e., participant attendance and engagement with treatment), and consumer satisfaction (i.e., participant ratings of satisfaction).

Methods:

We are currently midway through the nine-week program. Five students with a previous diagnosis of ASD, confirmed by the ADOS (Lord et al., 2000) and AQ (Baron-Cohen et al., 2001), were recruited to participate in this ongoing study. During baseline evaluation, students completed measures of efficacy (e.g., problem-solving ability, general psychological distress). Students will attend 9 weekly group sessions lasting 1.5 hours each, co-led by two graduate students under supervision of a licensed clinical psychologist. Each week, group leaders complete measures of treatment integrity and students will complete measures of treatment adherence, consumer satisfaction, and efficacy. After PSS:101, students will complete measures of efficacy. Statistical modeling techniques will be used to assess each individual's progress during therapy with respect to efficacy measures. Treatment integrity and adherence components will be calculated as percentages for each participant. Mean scores for consumer satisfaction will be calculated through questionnaires assessing helpfulness of sessions, therapy components, and homework.

Results:

Five students with ASD enrolled in PSS:101. Preliminary data from the first 6 sessions resulted in an attendance rate of 90%, 97% of treatment goals met, and 70% homework completion. Further analyses will be conducted after all data is collected.

Conclusions:

If PSS:101 is feasible and potentially efficacious, it can be conducted with larger samples to test treatment efficacy in randomized controlled trials. With empirical support, it could be a cost-effective way for universities to support students with ASD. If hypotheses are not supported, changes based on therapist and group members' feedback can be used to modify PSS:101 to be more aligned to students' needs.

133.176 176 Treatment of Fragile X Syndrome with STX209 (arbaclofen): Open-Label Extension Experience. R. J. Hagerman[1], B. Rathmell[2], P. Wang*[2], M. Cherubini[2], R. L. Carpenter[2], M. F. Bear[3] and E. Berry-Kravis[4], (1)*U.C. Davis MIND Institute*, (2)*Seaside Therapeutics*, (3)*HHMI and MIT*, (4)*Rush University Medical Center*

Background: Fragile X syndrome (FXS) is the most common known cause of autism, and the most common genetic cause of intellectual disability. Animal models of FXS show that it is characterized by an elevated ratio of excitatory:inhibitory neurotransmission, and by abnormal synaptic plasticity, which results from excessive signaling in the mGluR pathway. STX209 (arbaclofen) is a GABA-B agonist that augments inhibitory neurotransmission, and that rescues many abnormal phenotypes in FXS animal models. In a randomized, controlled study of 63 children and young adults with FXS, post-hoc analysis showed that STX209 was associated with significant improvement on the Aberrant Behavior Checklist (ABC) – Social Avoidance scale, which has been specifically validated in the FXS population (Sansone et al., 2011). Other

post-hoc analyses showed improvements on the Socialization domain of the Vineland Adaptive Behavior Scales (VABS) among subjects with more severe social impairment at baseline. Anecdotally, many subjects were reported to be more communicative as well.

Objectives: To examine the long-term safety and tolerability of orally-administered STX209 in patients with FXS. A secondary objective was to examine the open-label effects of STX209 on adaptive function in patients with FXS.

Methods: Subjects who completed the randomized, controlled study, and who met other inclusion/exclusion criteria, were invited to enroll in a 12-month, open-label extension study of STX209. The dose of STX209 was titrated upwards flexibly over the first 4 weeks. Clinicians could continue to adjust drug dosage throughout the remainder of the study, according to their best judgment. Up to 3 concomitant psychoactive medications were permitted. Follow-up visits were conducted at Weeks 4, 10, 20, 30, 40 and 52, with safety assessments and the ABC scale. The VABS and the Stanford-Binet IQ test were administered during the placebo-controlled trial, and then at Week 52 of the extension study.

Results: 45 subjects (6 female, 39 male; age range 6 – 31 years) enrolled in this open-label study, out of 46 who met eligibility criteria. 34 subjects (76%) remained in the study at Week 52. There were no serious adverse events. Data from the study are currently being compiled and analyzed. Available data from 15 subjects showed a change in the standard score on the VABS-Communication domain from 56.9 ± 13.2 (mean ± standard deviation) to 62.3 ± 12.4 at Week 52. The VABS-Composite score showed a smaller change, from 59.4 ± 9.2 to 61.7 ± 10.0. By contrast, Fisch et al. (1996) reported that VABS composite scores decreased in 22 out of 24 children and adolescents with FXS who were followed over a 2 year period.

Conclusions: Full data on subject disposition, safety, tolerability, and efficacy will be presented.

133.177 177 A Systematic Review of Non-Pharmacological Interventions on Sleep Problems in Youth with An Autism Spectrum Disorder. C. A. Brown[1], M. H. Kuo*[1], L. Phillips[2], R. Berry[1] and M. Tan[1], (1)*University of Alberta*, (2)*Concordia University College of Alberta*

Background: Four-fifths of children with an autism spectrum disorder (ASD) have at least one sleep problem (Liu et al., 2006). Sleep problems are more prevalent in ASD than the other disorders (Cotton & Richdale, 2006), and they predict more severe autism symptoms (Schreck et al., 2004). Parents of children with an ASD find non-pharmacological sleep interventions (NPSIs) more preferable and acceptable than sleep-enhanced medication (Williams et al., 2006).

Objectives: The objectives of this systematic review are: (1) to identify the current NPSIs options for youth with an ASD, (2) to investigate the effectiveness of NPSIs for sleep problems in this population; (3) to examine the methodological quality of the evidence.

Methods: Literature presented here is a subset from a project examining the effectiveness of NPSI on disordered sleep of youth with chronic health conditions. Literature from January 2000 to May 2012 in the Medline, CINAHL, and PsycINFO databases was searched to locate NPSI studies published in English that included children (2-11 years old) and adolescents (12-19 years old) with chronic health conditions; measured outcomes related to sleep; and used non-drug interventions. Additional studies were located by cross-checking reference lists. Studies were excluded if they used substance-based interventions, focused on sleep apnea, continuous passive airway pressure devices, hypnosis, and other interventions requiring specialized training beyond the scope of most entry-level health care providers. The *Guidelines for Critical Review* (GCR) protocols (Law et al., 2008) developed by researchers at McMaster University were used to analyze the quality of each reviewed study. The *Effective Public Health Practice Project Quality Assessment Tool* (EPHPP; Thompson et al., 2004) was used to synthesize and categorize the strength of the evidence.

Results: Forty-one papers met the inclusion criteria. We extracted 19 that included participants with an ASD. Six of the studies were RCT design, 6 were single-case design, 5 were case study, and 2 were before-after design. Half of the 19 studies had less than 10 participants. A majority of studies

included youth with an ASD in combination with those having other disabilities. The interventions were grouped into two categories: behavioral interventions (17 studies; extinction, graduated extinction, faded bedtime with response cost, non-specific behavioural intervention), and non-behavioral interventions (2 studies; chronotherapy, massage therapy). All of the research demonstrated positive findings and none reported adverse effects. Based on the EPHPP scores, the evidence for all interventions reviewed, except massage therapy, was weak. The methodological quality of the evidence for massage therapy was moderate, but only one study used this intervention. Common weaknesses of the studies were small samples, over-reliance on self-report outcome measures, and the lack of a clear description of the intervention under examination.

Conclusions: Although strong evidence is lacking, the findings suggest that the NPSIs are promising and warrant further, more targeted and rigorous study. There is a clear need to improve the amount and quality of research on NPSIs for youth with an ASD.

133.178 178 Extended Release Methylphenidate Is Associated with Cognitive Improvement in Children with ASD and Significant ADHD Symptomatology. D. A. Pearson*[1], C. W. Santos[1], M. G. Aman[2], L. E. Arnold[2], C. D. Casat[3], K. A. Loveland[1], R. J. Schachar[4], S. W. Jerger[5], R. Mansour[1], D. M. Lane[6], S. Vanwoerden[1], E. Ye[1], P. Narain[1] and L. A. Cleveland[1], (1)*University of Texas Medical School*, (2)*Ohio State University*, (3)*Carolina NeuroSolutions, LLC*, (4)*The Hospital for Sick Children*, (5)*University of Texas at Dallas*, (6)*Rice University*

Background:

Although many children with ASD are treated with psychostimulant medication (Aman et al., 2005), few controlled studies have explored the cognitive effects of stimulants in these children. While early small studies yielded inconsistent indications for MPH treatment in this group, the larger scale RUPP study of MPH treatment in children with PDDs found evidence of significant improvements in hyperactive and inattentive behaviors with methylphenidate (MPH) treatment (Posey et al., 2007; RUPP Autism Network, 2005). This study builds upon the RUPP findings [which used TID dosing of immediate release (IR) MPH] by using a treatment regimen that more closely mirrors current clinical practice: extended release (ER) MPH in the morning, and IR MPH in the afternoon.

Objectives:

The primary objectives of this study were to examine the effectiveness of extended release methylphenidate (MPH) on cognitive functioning in children with ASD and significant symptoms of ADHD, and to determine if higher doses of MPH were associated with progressive behavioral improvement—or if initial improvement was followed by lesser improvements (or even declines) at higher doses.

Methods:

The cognitive effects of four doses of MPH were investigated using a within-subject, crossover, placebo-controlled design in 24 children (mean: CA=8.8 yrs, FSIQ=85) who met DSM-IV-TR criteria for ASD on the *ADI-R* and on the *ADOS*. Dosing strategy was based on the experience from the MTA Study, as well as the RUPP MPH trial. Cognitive measures (tapping sustained attention, selective attention, and inhibition/impulsivity) were obtained at each MPH dose.

Results:

Performance on cognitive tasks tapping sustained attention, selective attention, and inhibition/impulsivity improved significantly with MPH treatment. These improvements were generally linear in nature—i.e., higher doses of MPH were usually associated with improvements in task performance. There was only one dependent variable (SST Stop Signal Accuracy), for which the dose-response function had both significant linear and significant non-linear components of trend.

Conclusions:

Psychostimulant treatment using ER MPH in children with ASD and significant symptoms of ADHD is associated with significant improvement in cognitive task performance—and higher MPH doses were associated with successive

improvements in the dose range studied. These cognitive task data are consistent with the parent and teacher behavioral ratings obtained in the same trial (Pearson et al., 2010). However this does not necessarily mean that the same doses were optimal for both behavior and cognition, as we (Pearson et al., 2004) have previously shown that changes in behavior and cognition often occur rather independently in the same children. Combined with our previously reported findings, it appears that ER MPH treatment is associated, on average, with both cognitive and behavioral improvements in children with ASD and significant symptoms of ADHD.

133.179 179 Sex Differences in Co-Occurring Conditions of ASD. M. Stacy*[1], B. Zablotsky[2], H. Close[3], B. Makia[1], A. W. Zimmerman[4] and L. C. Lee[3], (1)*Johns Hopkins School of Public Health*, (2)*Johns Hopkins Bloomberg School of Public Health* , (3)*Johns Hopkins Bloomberg School of Public Health*, (4)*Lurie Center for Autism, MassGeneral Hospital for Children*

Background: Researchers have noted that as the overall number of autism spectrum disorders (ASDs) diagnoses has increased over the last few decades, a large difference in the number of female versus male diagnoses has also persisted, with males being 3-4 times more likely than females to be diagnosed with ASD. Reasons for the large sex difference remain unclear; some have speculated that co-occurring conditions of ASDs may play an important role in determining the diagnosis of ASDs. Examining the differences in co-occurring conditions between males and females with ASD may help to understand how these conditions affect the determination of ASD.

Objectives: To compare numbers and types of co-occurring conditions in females versus males aged 3 – 17, with a current ASD diagnosis.

Methods: Using the US 2007 National Survey of Children's Health dataset, two study groups were defined based on parent-reported data: 1) Males with a reported current ASD diagnosis (n = 753), and 2) Females with a reported current ASD diagnosis (n = 168). Co-occurring conditions of interest included Attention Deficit Hyperactivity Disorder (ADHD), learning disability, developmental delay, speech problems, hearing problems, anxiety, depression, behavioral or conduct problems, and seizures or epilepsy. Statistical analysis was carried out to examine the associations between child sex and the ASD co-occurring conditions. Odds ratios (ORs) were computed by taking the odds of each co-occurring condition for the female group and comparing them against the odds of the condition for the male ASD group. Analysis was performed using weighted data and accounted for the complex sampling procedures of the NSCH.

Results: As compared to males with a current ASD, females with a current ASD were 3.5 times (95% CI: 1.1-11.0) more likely to be African American (AA) and 2.4 times more likely to have a mother with education less than HS or HS (OR=2.4, 95% CI: 1.2-5.1). Furthermore, boys with a current ASD were nearly 13 times more likely to have learning disability in the past and 5 times more likely to have a current, mild learning disability than girls. Girls were found to be 8 times more likely to have a reported speech problem in the past than boys after taking into account race, ethnicity, and maternal education.

Conclusions: Selective vulnerability of AA females to ASD, along with lower educational attainment of their mothers, if confirmed, may suggest differences in underlying risk including biological, nutritional, and/or environmental factors. Greater risks for learning disabilities in males and speech problems in females with ASDs may relate to different patterns of sex-specific brain development. Studies that provide larger sample sizes are needed to further investigate sex differences in each co-occurring condition.

133.180 180 The DD-CGAS As a Tool for the Assessment of Global Functioning in Treatment Outcome Research. L. A. Smith*, A. R. Schry and S. W. White, *Virginia Polytechnic Institute and State University*

Background: Successful treatment should improve the client's global functioning as well as alleviate targeted symptoms. The Developmental Disabilities Modification of the Children's Global Assessment Scale (DD-CGAS; Wagner et al., 2007), developed as a measure of global functioning for children with ASD, is administered by a rater trained to assign ratings reliably using all available information . This is the first report on the DD-CGAS as a measure of change in a randomized-controlled treatment (RCT) study.

Objectives: The purpose of this study was to further examine the utility of the DD-CGAS as a treatment outcome measure. Specifically, we report on the measure's convergent and discriminant validity, its sensitivity to change with intervention, and procedures for establishing reliability among raters.

Methods: Data for the present study were drawn from an RCT evaluating a psychosocial therapy program with higher functioning adolescents (n = 30) with ASD and co-occurring anxiety disorders. The DD-CGAS was administered by independent raters trained to a pre-established reliability threshold (Wagner et al., 2007) who were blind to treatment assignment (treatment or wait-list). Higher DD-CGAS scores indicate better functioning and are based on the domains of self care, communication, social behavior, and academic functioning.

Results: Over a one-year period, eight raters were trained to reliability on the DD-CGAS. Baseline DD-CGAS scores were, as expected, negatively correlated with ASD-related social disability (r = -.388, p < .05). They were not, however, significantly correlated with adaptive behavior (r = -.23, *ns*) or parent-reported symptoms of anxiety (r = .02, *ns*) at baseline. Bivariate correlations were calculated to analyze the relationship between the change in DD-CGAS scores from baseline to post-treatment with the change on parent-reported social disability and anxiety. Improvement on the DD-CGAS was significantly correlated with improved social competence (r = .40, p < .05), but not with improvement in anxiety (r = .30, *ns*). An independent samples t-test revealed that the mean change in DD-CGAS scores was greater for those participants in the active treatment condition than those in the wait-list control condition, $t(30)=2.54$, $p< .05$. Finally, an independent samples t-test was used to test whether the change in DD-CGAS scores were higher for those participants who were considered treatment responders, based on the CGI-I (Guy, 1976), than for non-responders, $t(30)= -2.00$, p = .06. Although not a statistically significant result, this finding demonstrates a trend toward treatment responders having higher DD-CGAS scores (mean difference = 4.81) than non-responders.

Conclusions: Raters can be trained to reliability on the DD-CGAS in a fairly brief period of time. The DD-CGAS demonstrated convergent validity with ASD-related social disability. Discriminant validity of the DD-CGAS was evidenced by the non-significant correlation with adaptive behavior. Although it showed sensitivity to treatment gains, it may be primarily tethered to core ASD problem areas and, as such, less relevant for treatment studies addressing comorbid problems in ASD. Further examination is needed to evaluate its utility in treatment studies targeting a non-ASD problem domain.

133.182 182 Positive Behavior Supports for Individuals Diagnosed with ASD: Basic Behaviors & Life Skills. A. R. Amraotkar* and M. Boman, *Western Kentucky University*

Background: Individuals with Autism exhibit impaired cognitive processing, which may lead to delayed or underdeveloped responses. Special Education extensively relies on using verbal and visual cues to help process information. Differential Reinforcement strategy of Applied Behavior Analysis focuses on positive feedback in educating individuals with ASD and could be a pioneer in skill acquisition for individuals with Autism Spectrum Disorders (Karsten & Carr, 2009).

Objectives: To induce positive behavior changes and life-skills acquisition in ASD individuals with problem behaviors using Un-Prompted Differential Reinforcement strategy.

Methods: The participants for this study are three non-verbal individuals of different age groups and genders diagnosed with ASD attending an after school program at the Kelly Autism Program, Western Kentucky University. Problem behaviors identified in all participants were targeted for gradual extinction. Six tasks, three involving life skills and three involving behaviors previously introduced had been included in the lesson plans for these individuals. One task from each group with highest frequency was selected for every participant and further administered. Trained professionals applied the guidelines of Un-Prompted Differential Reinforcement strategy using Positive Behavioral Supports with the help of High Autism Interest objects which stimulate individuals to accomplish tasks and achieve their goals (Sasson, Turner-Brown, Holtzclaw, Lam, Bodfish, 2008). Functional Analysis & Screening Tool (FAST), developed by the Florida Center on Self-Injury (2005) would be used to further observe behaviors.

Frequency of recognized behaviors along with attention span during current task was recorded in participants and their peers. Positive Behavioral Supports were developed and updated based on consecutive assessment reports and have been implemented successfully.

Results: Participants exhibited positive changes in tasks from each category. In contrast to assessment of all six tasks, high frequency tasks indicated that behavior changes (e.g., asking for more food) were slower to occur, while skills (e.g., puzzle solving) developed faster. Recognized problem behaviors decreased by 40 - 50% between all three participants during a period of 6 months. Among all participants, attention span and active participation increased by 10 seconds per task during a period of 6 months. Behaviors and skills were successfully combined resulting in a stronger intervention plan.

Conclusions: This strategy was effective in bringing the desired positive changes in skills & behaviors of non-verbal individuals diagnosed with Autism Spectrum Disorders. Attention span for desired task can be increased by designing an intervention for problem behavior and development of Positive Behavior Supports. Behaviors and skills may be addressed together to create a stronger intervention plan.

133.183 183 Effect of a Vitamin/Mineral Supplement on Children and Adults with Autism. J. Adams*,

Background:

Vitamin/mineral supplements are among the most commonly used treatments for autism, but the research on their use for treating autism has been limited.

Objectives:

Determine the effect of a customized vitamin/mineral supplement on indivdiuals with auitsm, including the effect on nutritional status, metabolic status, and autistic symptoms.

Methods:

This study is a randomized, double-blind, placebo-controlled three month vitamin/mineral treatment study. The study involved 141 children and adults with autism, and pre and post symptoms of autism were assessed. None of the participants had taken a vitamin/mineral supplement in the two months prior to the start of the study. For a subset of the participants (53 children ages 5-16) pre and post measurements of nutritional and metabolic status were also conducted.

Results:

The vitamin/mineral supplement was generally well-tolerated, and individually titrated to optimum benefit. Levels of many vitamins, minerals, and biomarkers improved/increased showing good compliance and absorption. Statistically significant improvements in metabolic status were many including: total sulfate (+17%, p=0.001), S-adenosylmethionine (SAM; +6%, p=0.003), reduced glutathione (+17%, p=0.0008), ratio of oxidized glutathione to reduced glutathione (GSSG:GSH; -27%, p=0.002), nitrotyrosine (-29%, p=0.004), ATP (+25%, p=0.000001), NADH (+28%, p=0.0002), and NADPH (+30%, p=0.001). Most of these metabolic biomarkers improved to normal or near-normal levels.

The supplement group had significantly greater improvements than the placebo group on the Parental Global Impressions-Revised (PGI-R, Average Change, p=0.008), and on the subscores for Hyperactivity (p=0.003), Tantrumming (p=0.009), Overall (p=0.02), and Receptive Language (p=0.03). For the other three assessment tools the difference between treatment group and placebo group was not statistically significant.

Regression analysis revealed that the degree of improvement on the Average Change of the PGI-R was strongly associated with several biomarkers (adj. $R^2 = 0.61$, $p<0.0005$) with the initial levels of biotin and vitamin K being the most significant ($p<0.05$); both biotin and vitamin K are made by beneficial intestinal flora.

Conclusions:

Oral vitamin/mineral supplementation is beneficial in improving the nutritional and metabolic status of children with autism, including improvements in methylation, glutathione, oxidative stress, sulfation, ATP, NADH, and NADPH. The

supplement group had significantly greater improvements than did the placebo group on the PGI-R Average Change. This suggests that a vitamin/mineral supplement is a reasonable adjunct therapy to consider for most children and adults with autism.

133.184 184 A Pilot Study of Oxytocin in Children and Adolescents with Autistic Disorder. L. Sikich*, T. C. Bethea and C. Alderman, *ASPIRE Research Program, UNC-CH*

Background: Oxytocin and high densities of oxytocin receptors in the nucleus accumbens have been implicated in bonding, prosocial behaviors, social memories and social rewards
in primate and nonprimate animals. Mice with reduced or absent levels of oxytocin receptor gene (OXTR) expression show reduced social responses to separation from the mother as infants with less remarkable social differences seen in older animals. Given the critical importance of aberrant social interactions and reciprocity in autism symptomatology, several investigators have examined the oxytocin gene (OXT) and oxytocin receptor gene (OXTR) among people with autism. Oxytocin plasma levels are reduced in some individuals with autism. Recent work suggests associations between the chromosomal region containing OXTR and autism in multiple populations. Individuals with autism who have deletions in OXTR have been identified. One study revealed epigenetic modification of OXTR (e.g. greater methylation of the promoter and intron 3) in 20 individuals with autism (~70%) as compared to 20 controls (~40%) and replicated this finding in postmortem temporal cortex samples from 4 individuals with autism.

Objectives: Our study is highly innovative in that it combines efforts to advance our understanding of the epigenetic phenomena of OXTR methylation in autism, to develop proof of concept
data for translating these findings into useful biomarkers of diagnostic homogeneity and/or oxytocin treatment response, and to obtain pilot data that is essential to design and implement
a pivotal trial of supplemental oxytocin therapy in autism.

Methods: Twenty-four youths between the ages of 3-17 year old with autistic disorder were randomized to 2 months of treatment with intranasal oxytocin or placebo. Subsequently all participants will receive open-label oxytocin for 2 additional months. Oxytocin will be titrated weekly to target doses of 24IU or 32IU depending on age and tolerability. Safety assessments include systemic adverse event surveillance, electrocardiograph, vital signs and electrolytes. Efficacy outcomes include behavioral and developmental assessments including the clincal global impression scale, social reciprocity scale, Vineland adaptive behaviors, pervasive developmental disorder behavioral inventory, caregiver strain questionnaire, aberrant behavior checklist and Stanford-Binet. Post-treatment assessments will be done 3-15 months after treatment is discontinued. We will also determine OXTR methylation status at baseline to explore potential relationships with baseline severity of social problems and treatment response.

Results: Enrollment goal met in October 2011. All youth will complete treatment by March 2012 when initial study outcomes and OXTR data will be available. Mean age of currently randomized participants (n=15) is 10.0 (SD 4.1) yrs range 3 -18 years, mean ABC-SW score is 11.3 (SD 7.8) range 2-33, 53% are nonverbal and 60% have intellectual disability.

Conclusions: We anticipate that oxytocin will be safe and well-tolerated for sustained treatment of youth with autism and may become the first agent with clinically important efficacy for core social impairment.

133.185 185 Effects of Ambient Prism Lenses on Autonomic Reactivity to Emotional Stimuli in Autism. G. Sokhadze[1], M. Kaplan[2], E. M. Sokhadze[1], S. M. Edelson*[3], J. M. Baruth[1], A. S. El-Baz[1], M. Hensley[1] and M. F. Casanova[1], (1)*University of Louisville*, (2)*Center for Visual Management*, (3)*Autism Research Institute*

Background: Autism is a pervasive developmental disorder characterized by deficits in communication, social interaction, and behavior. An additional common yet overlooked deficit in autism is the dysfunction of the ambient visual system, which can have negative effects on visually dependent cognitive abilities such as proper shifting of attention, hand-eye coordination, and gross motor skills.

Objectives: The current study evaluates the effects of corrective ambient prism lenses on these deficits in autism. In addition, this study aims to contribute to the understanding of abnormal autonomic reactivity mechanisms present in autism.

Methods: The participants in this study were 21 children with autism, mean age of 12.5 years. The study was a 2x2 within subject design, with *Prism / Placebo Prism* conditions, and *High / Low* emotional arousal video stimuli taken from the classic Disney film Lion King. The order of stimuli type and Prism conditions were counterbalanced across all subjects. Physiological responses, which included Heart Rate (HR), Heart Rate Variability (HRV), and Skin Conductance Level (SCL), were monitored and collected during the session and later analyzed block by block.

Results: Analysis of Heart Rate showed significant difference between Prism and No Prism in the Low emotional arousal condition ($p = 0.032$), and across all conditions combined ($p = 0.032$). Furthermore, subjects had significantly higher SCL in Prism conditions versus No Prism conditions ($F=11.5$, $p=0.003$), and had a significantly higher number of Skin Conductance Responses (NS.SCR) in Prism conditions ($p = .007$). Analysis of High (HF) and Low frequency (LF) components of HRV (LF and HF of HRV) revealed no significant differences, though the power of LF of HRV tended to be higher in Prism condition ($p = .062$).

Conclusions: The lowered HR and increased electrodermal responses during viewing of the stimuli suggest increased attention to audio-visual stimuli during wearing ambient prism lenses. Higher electrodermal reactivity (SCL, NS.SCR) in Prism condition during more emotionally loaded episodes is indicative of increased emotional arousal and attentiveness to affective content of the movie. Our preliminary study support utility of ambient prism lenses application to improve emotional reactivity in autism.

133.186 186 Pre-Treatment Gene Expression and Risperidone Associated Weight Gain in Children with Autism Spectrum Disorders (ASD).

J. E. Choi*[1], F. Widjaja[1], A. D. Sossong[2], L. Lit[3], F. R. Sharp[4] and R. L. Hendren[1], (1)*University of California, San Francisco*, (2)*Massachusetts General Hospital*, (3)*University of California, Davis*, (4)*University of California at Davis*

Background: Atypical antipsychotics have been shown to be beneficial in decreasing behavioral disturbances, such as aggression and anxiety, in children with ASD. However, previous studies have shown that these drugs are not effective for all children. In addition, they also have the potential for serious short-term and long-term side effects, including excessive appetite, weight gain, and diabetes. In our recently published study, we demonstrated that peripheral blood gene expression before treatment with the atypical antipsychotic risperidone may predict improvements in severe behavioral symptoms (Lit *et al*, 2011). We identified 5 genes that were differentially expressed between the subjects who imporved the most and the least to risperidone. In this study, our aim was to apply the same method to identify genes that predict severe weight gain.

Objectives: To determine if a peripheral blood gene expression profile prior to 8 weeks of treatment with risperidone will predict weight gain in children.

Methods: We used data from 41 subjects children who had an initial Aberrant Behavior Checklist Irritability (ABC-I) subscale rating of ≥18. The 8-week dosing schedule mirrored that used in two recent positive trials of risperidone. Affymetrix GeneChip Human Exon 1.0 ST Arrays were used to obtain gene expression values. Raw Affymetrix CEL files were imported into Partek Genomics Suite 6.6 Beta. Probe-level expression was summarized and normalized using the robust multichip average technique. Weight gain was represented through change in z-scores of anthropomorphically-adjusted BMI distributions. Subjects with a decrease in weight (n=4) were excluded from analyses. ANOVA was performed on pre-treatment exon expression levels across high, medium, and low weight gain groups based on change in BMI z-score pre-post treatment controlling for age and gender. Benjamini-Hochberg FDR method ($\alpha < 0.05$) was used to correct for multiple comparisons. Expression of exons within genes that had an expression fold change of $> |1.5|$ between groups were chosen.

Results: We found one differentially expressed gene, PLP2 (A4 protein), that had a 1.88 underfold expression in high weight gain subjects (change in z-score > 1) compared to low weight gain subjects (change in z-score < 0.25) (p=1.73x10^{-7}). We found no differentially expressed genes between the high and medium or the medium and low weight gain groups.

Conclusions: A recent study by Lee *et al* (2004) has associated the PLP2/A4 gene to the CCR1 signaling pathway, which is involved in immune and inflammatory processes. A separate study by Zhang *et al* (2007) associated this gene with X-linked mental retardation. The genes identified in our current study did not replicate those found in a study of risperidone treatment of autism done by Correia *et al* (2009). The difficulty of finding similar genes expressed across studies highlights the challenge of predicting personalized responses to medication without knowing the specific "causative genes" and the need to recruit large enough samples to control for multiple gene effects.

133.187 187 Metabolic Effects of Tetrahydrobiopterin Treatment. R. E. Frye*[1], R. DeLaTorre[2], H. Taylor[2], S. Melnyk[3] and S. J. James[3], (1)*Arkansas Children's Hospital Research Institute*, (2)*University of Texas - Heath*, (3)*University of Arkansas for Medical Sciences*

Background: Tetrahydrobiopterin (BH4), produced in the United States as Kuvan® for the treatment of BH4-responsive phenylketonuria, has been shown in several open-label and two double-blind placebo-controlled studies conducted in Japan and Scandinavia to have efficacy in the treatment of core autism spectrum disorder (ASD) symptoms. Given the dearth of available treatments for core ASD symptoms, interest has grown for the use of Kuvan® for the treatment of ASD. A double-blind placebo-controlled study examining the efficacy of Kuvan® for the treatment of core ASD symptoms has recently been completed by the Children's Health Council (Palo Alto, CA). BH4 is known to influence neurotransmitter, nitric oxide and oxidative stress metabolism. The current study was designed to complement the Children's Health Council study by examining the metabolic effect of Kuvan® treatment using a similar treatment protocol.

Objectives: The purpose of this study was to evaluate the behavioral and metabolic effects of Kuvan® treatment on young children with language and/or social delays and to determine if metabolic biomarkers can predict behavioral response to Kuvan® treatment.

Methods: 10 participants (ages 2-6 yrs.) were entered into a 16-week open-label trial of 20mg/kg/day once-daily treatment of Kuvan®. At baseline, 8 weeks and 16 weeks, measures of language (Preschool Language Scales [PLS]) and adaptive behavior (Vineland Adaptive Behavior Scales [VABS]) as well as metabolic measures of oxidative stress (oxidized glutathione [GSSG], reduced glutathione [GSH], S-adenosylmethionine [SAM], S-adenosylhomocysteine [SAH], 3-nitroTyrosine), plasma pterins (tetrahydrobiopterin [BH4], dihydrobiopterin [BH2], biopterin [B]), and nitric oxide (arginine, citrulline, 3-nitroTyrosine) metabolism were obtained. Adverse effects were monitored throughout the trial. Repeated-measures analysis of covariance with a 0.05 alpha was used. Only significant effects are reported below.

Results: Two participants were withdrawn from the study: one from mild adverse effects and one due to non-compliance. Total and receptive PLS scores increased over the 16 weeks of Kuvan® treatment as did expressive and receptive language and personal, community, interpersonal and coping skills on the VABS. Increases in GSH, SAM and the GSH/GSSG and SAM/SAH ratios were consistent with strong improvement in transmethylation and redox pathways. Decrease in 3-nitroTyrosine was consistent with decreased peroxynitrite production. BH4 increased while BH2 and B decreased resulting in an improved reduced-to-oxidized pterin ratio (BH4/BH2+B). Citrulline changed in a non-linear manner. Higher baseline arginine-to-citrulline ratio was associated with more improvement in expressive and total PLS scores. Greater improvement in the reduced-to-oxidized pterin ratio was association with more improvement on expressive and total PLS scores and coping skills on the VABS. Greater citrulline increases were associated with greater improvement in personal, coping and play VABS skills. Kuvan® was well-tolerated.

Conclusions: Kuvan® was associated with significant improvement in the transmethylation, redox and nitric oxide pathways as well as the reduced-to-oxidized pterin ratio. Greater improvements were seen in patients with more

favorable improvements in biomarkers of nitric oxide and reduced-to-oxidized pterins. These data suggest that behavioral improvement associated with Kuvan® treatment may be associated with improvements in nitric oxide metabolism.

133.188 188 Vocational and Personal Independence Training for Adolescents and Adults with ASD. S. L. Booker*, T. Gower Foster, K. Ward and S. V. Leew, *Society for Treatment of Autism*

Background: The number of children diagnosed with ASD increased dramatically during the early 1990s due to broader diagnostic criteria and increased public awareness (Gurney et al., 2003). The diagnosis of autism tends to be stable over time and so a large number of adolescents/adults with ASD has finished secondary school and requires supports and services. Research has typically focused on the assessment, diagnosis, and treatment of children with ASD, with only a few studies (Billstedt et al., 2007; Eaves & Ho, 2008; Howlin et al., 2004; McGovern & Sigman, 2005; Taylor & Seltzer, 2010) investigating adult outcomes. The studies demonstrate that adults with ASD are often under-employed (Howlin et al., 2004) and display long term impairments in social skills and adaptive functioning (McGovern & Sigman, 2005).

Objectives: To assess the efficacy of services designed to increase vocational and personal independence of adolescents and adults with ASD.

Methods: Sixty-four individuals with ASD participated in personal independence and vocational interventions for 11 weeks. Though three programs with separate curriculums were offered concurrently, participants were registered in one program only. Each participant was assigned to an intervention based on adaptive information provided by the Vineland Adaptive Behavior Scales II (VABS-II) and an intake meeting.

- Community*Works* ® (Southwest Autism Research & Resource Center, 2008): pairs individuals with ASD and typically developing peers to perform volunteer tasks in community organizations.
- Practical Assessment Exploration System © (PAES©; Swisher, 1987): employs performance-based methods to identify transition planning needs associated with employment and vocational training. It is comprised of five units that can be worked through sequentially to develop skills within an identified skill area.
- Skills for Life (Society for Treatment of Autism, 2010): involves teaching life skills through didactic interactions with a hands-on, experiential component. Three to seven skills are identified by participants and/or parents/caregivers and are targeted for multiple opportunities throughout the 11 week session.

Specific data acquired included: participants' levels of independence, specific skill/task prompting required, levels of supervision required, duration of tasks. Methodology was specific to each program. Qualitative data was collected through parent/caregiver and participant surveys.

Results: Preliminary results suggest:

- A high level of parent/caregiver and participant satisfaction with the services provided;
- 71% of participants reported making friends during the program;
- Clinically significant gains in independence for Community*Works*® participants; statistically significant gains in individual social goals;
- All PAES© participants demonstrated aptitude scores indicative of readiness for supported employment;
- Clinically significant gains in personal independence in targeted life skills;

Conclusions: Specific intervention services for adolescents and adults with ASD appear to be effective in increasing personal and vocational independence. Identifying the most appropriate program for each individual was essential for

participant success. Clinical implications and further studies will be discussed.

133.189 189 "Nutritional Supplementation in Children with Autism Spectrum Disorders (ASD) in Qatar: Effects on the Methionine-Transsulfuration Cycle and Behavior". F. T. Al-Rawi*[1], P. Chandra[2], N. H. Al Kadhee[3], A. M. Al-Balsha[1] and L. Hedin[4], (1)*Hamad Medical Corporation*, (2)*Hamad Medical Corporation*, (3)*Gama Dynacare Labs*, (4)*Scania County*

Background:

Several factors are suggested to contribute to ASD. Earlier studies have demonstrated defective synthesis of neurotransmitters and both pharmacological and non-pharmacological measures have been used to enhance neurotransmission. An example of the latter approach is nutritional supplementation. Very few studies have systematically analyzed the effects of vitamins and minerals on both biochemical parameters, (e.g. related to the synthesis of neurotransmitters involving the methionine cycle), and behavior.

Objectives:

To investigate the effects of a widely used nutritional supplement containing vitamin B_6 and Mg^{2+} on the methylation-transsulfuration pattern of the MC and on behavior in children with ASD (according to the criteria of DSM-IV R) in an out-patient setting in Qatar.

Methods:

31 patients (4 females, 27 males), 3- 9 years of age, were randomized into two parallel groups to receive either a placebo formulation (16 patients; control group) or a commercial, nutritional supplementation containing vitamin B_6 and Mg^{2+} (15 patients; treatment group) for 12 weeks. The patients' behavior was evaluated with the Child Autism Rating Scale (CARS) and the Autism Treatment Evaluation Checklist (ATEC). Blood samples were collected and analyzed (University of Heidelberg, Germany) for the contents of amino acids (AA) and intermediates of the methionine cycle (methionine, homocysteine, cystothionine, cysteine and glutathione) prior to and after treatment. The patients in both groups continued to participate in the regular educational program at the clinic during the trial.

Statistical Methods: Chi-square test was used to examine the association between various qualitative measurements and outcome mean of quantitative variables were compared using paired and unpaired t tests. All analyses were performed with the statistical packages SPSS 18.0.

Results:

Subjects in the treatment group demonstrated significantly decreased levels of homocysteine (means: 3.66 ± 2.74 post- vs. 5.71 ± 2.67 pre treatment; p= 0.006).

Between treatment comparision revealed that Homocysteine levels were significantly reduced in the treatment group than placebo (p= 0.034).

Although not statistically significant, the levels of methionine and cysteine were also reduced in patients receiving treatment compared to the control group. There were no differences in the levels of measured amino acids prior to or after treatment.

The patients in the treatment group showed improved scores in the CARS test (post- vs. pre-treatment, p<0.0001).

Although, not statistically significant, the results of the ATEC test demonstrated also a trend towards improvement in the treatment group.

No significant adverse reactions were observed or reported for the two groups.

Conclusions:

This randomized, placebo-controlled, double blind pilot trial demonstrates that a multivitamin preparation containing vitamin B_6 and Mg^{2+} can enhance both behavior and metabolic parameters associated with a defective methionine cycle in children with ASD. Furthermore, the use of this preparation was found to be safe and without significant side effects.

133.190 190 Effects of Oxytocin on Face Processing in Autism. G. Domes*, *University of Freiburg*

Background: Recent human research has focused on the behavioural significance of neuropeptides, such as arginin vasopressin and oxytocin. It has been shown, for example, that oxytocin suppresses behavioural and endocrine responses to social stress and increases trust. Regarding the role of oxytocin in autism spectrum disorders (ASD), a few studies have shown that genetic variations of the oxytocin receptor might play a role in the pathogenesis. In addition, beneficial effects of exogenously administered oxytocin on ASD symptoms have been reported.

Objectives: In recent years we have conducted a number of studies investigating the effects of oxytocin on the processing of social stimuli with the aim to elucidate the behavioural and neural underpinnings of the proposed prosocial effects in ASD.

Methods: We used intranasal administrations of single doses of 24 IU oxytocin in between- and within group designs to investigate the effects of exogenous oxytocin on performance in facial emotion recognition, face discrimination and facial attention tasks. In addition, functional magnetic resonance imaging was used to assess effects on regional brain activity as reflected by modulations of local blood-oxygen-level-dependent responses to the stimuli presented in these tasks.

Results: Using exogenous administration of oxytocin we could show that oxytocin increases emotion recognition, early stages of visual attention, and overt visual scanning for human faces in neurotypical controls. Data from functional magnetic resonance imaging studies show that on the neural level, oxytocin modulates the neural circuitry that specifically corresponds to the observed behavioural effects. In ASD, several brain regions known to be involved in social cognition (anterior insula, cuneus/precuneus, rostral anterior cingulate cortex, and temporal parietal junction) showed oxytocin-induced increased activity during the processing of facial stimuli, which was associated with improved emotion recognition. In another study, a single dose of oxytocin increased amygdala activity in response to neutral faces – an effect that was specific for participants with ASD.

Conclusions: Oxytocin-induced facilitation of social attention and emotion recognition suggests that the intranasal administration of oxytocin might be a promising approach in the treatment of cognitive deficits in the social domain in ASD. However, the experimental studies so far underline the need for controlled clinical trials.

133.191 191 Three Cases – 5 Methodologies: 5 Recommendations. S. Shore*,

Background:

Noting that there has been no true comparison between educational/behavioral/developmental approaches for working with children on the autism spectrum, qualitative research was initiated to investigate Applied Behavioral Analysis (ABA), Treatment and Education of Autistic and Communication-handicapped CHildren (TEACCH), Daily Life Therapy (DLT), Miller Method (MM), and Developmental Individual difference Relationships intervention (DIR).

The closest research in this area appears to be where ABA is pitted against what is termed "eclectic approaches" where ABA comes out the winner (Howard, Sparkman, Cohen, Green, & Stanislaw, 2005). Rather than attempting to seek the best way of working with children on the autism spectrum, this research opens the door to examining how best practice can be matched with the needs of children on the autism spectrum.

Leading developers of the five above mentioned approaches were asked their opinions on the causes of challenging behaviors and recommendations for interventions for a three fictional case studies specially prepared to represent the breadth of the autism spectrum.

Objectives:

To initiate research towards identifying contrasts and strengths of each approach with the goal of matching commonly employed and best practice to the needs of children on the autism spectrum.

Methods:

Qualitative research focused on querying key developers, namely Tristram Smith (ABA), Gary Mesibov (TEACCH), Anne Roberts (Daily Life Therapy), Arnold Miller (MM), and Serena Wieder (DIR) on topics including defining autism, explaining

behavior and treatment according to their own approaches, and intellectual histories. An initial email survey was conducted which was followed by one hour videotaped interviews to gather data for analysis.

Results:

Findings suggest...

• Similar techniques employed between approaches are often given different names, and sometimes even different, yet valid theories as to why they work.

• additional awareness of other approaches beyond what an individual practitioner employs is needed,

• realization amongst key developers that developing a trusting relationship with the learner is necessary for intervention to be effective,

Conclusions:

The ever widening conception of what is included in the autism spectrum calls for a diversity of approaches for empowering people with autism lead fulfilling and productive lives to their greatest potential. Continued research is suggested for matching commonly employed and best practice to the needs of children and youth with autism.

133.193 193 Behavioral Intervention: Severe Behavior Follow-up Program. A. R. Reavis*[1], N. A. Parks[1], B. R. Lopez[1] and N. A. Call[2], (1)*Marcus Autism Center & Children's Healthcare of Atlanta*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background:

Many individuals with autism engage in problematic behaviors. Severe problem behaviors may require treatment in intensive settings such as day-treatment programs. Following implementation of a successful treatment in the day-treatment setting, the treatment needs to be generalized to the individuals natural environment (e.g., home), which requires treatment implementation by the individual's caregivers (Allen & Warzak, 2000). Positive long-term outcomes for individuals who received interventions in intensive day- treatment settings for severe problem behavior are correlated with high treatment integrity of caregivers upon discharge (Witt et al., 1997). If caregivers are not able to implement treatment with high fidelity, long-term gains are unlikely. However, to date there are few longitudinal studies examining outcomes and the integrity of treatment implementation following discharge from intensive day-treatment programs.

Objectives:

The purpose of the current investigation was to examine caregiver treatment integrity following training that occurred as part of an admission to an intensive day-treatment program that specialized in the treatment of severe problem behavior. Specifically at issue was whether caregivers maintained high fidelity of treatment implementation and if treatment integrity was associated with rates of problem behavior in the natural environment following discharge.

Methods:

Six caregivers of children referred to an intensive day-treatment program that specialized in the assessment and treatment of severe problem behavior participated. It was standard practice of the program to train caregivers to implement function-based treatments in the final week of their child's admission. Training consisted of didactics, role plays, and in vivo sessions. Each participant was required to demonstrate all treatment components in role-play and at 90% procedural fidelity for 3 10 min sessions in a row prior to discharge.

Follow-up services were provided in the families' homes and communities for 12 visits that occurred during the six months following discharge. During these visits, a trained therapist observed and recorded data on child problem behavior and caregiver implementation of the treatment package. If needed, additional training was provided in the form of didactic instruction, modeling, rehearsal, and performance feedback.

Results:

Overall, rates of problem behavior that were recorded at the moment of discharge persisted following discharge. Furthermore, treatment results generalized across community settings (e.g., home, the grocery store, school, etc.) for some participants. Results indicate that caregivers who maintained high treatment integrity also observed an 80% or greater reduction in problem behavior upon discharge from the day-treatment program. The number of treatment components or complexity of treatment did not seem to affect treatment integrity.

Conclusions:

Results of the current investigation emphasize the importance of providing follow-up services to families upon discharge from intensive day-treatment facilities.

133.194 194 An Innovative Behavioral Treatment for Restrictive, Rigid Behaviors Displayed in Persons with ASD. L. A. Oakes*[1], D. A. Napolitano[2], T. Smith[1] and V. M. Knapp[3], (1)*University of Rochester*, (2)*University of Rochester Medical Center*, (3)*Summit Academy*

Background: Efficacious psychopharmacological interventions for repetitive behaviors and rigid routines have not been identified for persons with ASD. Temporary reductions in repetitive motor actions may be achieved with applied behavior analytic (ABA) interventions, but generalization beyond the intervention setting and maintenance over time have not been demonstrated. Moreover, ABA interventions for more complex routines do not yet exist.

Objectives: To conduct an initial efficacy trial of a behavioral intervention to reduce restrictive, rigid behaviors.

Methods: This study recruited 2 male participants aged 9 and 10 who attended a private, non-profit educational agency. A reversal design across multiple behaviors was used for these participants. All behaviors were initially observed in a baseline condition, and an assessment to determine degree of rigidity was conducted. The intervention for each behavior was then introduced. Next, a reversal of the intervention back to baseline was conducted, and then the intervention was re-introduced. Finally, an assessment of maintenance was conducted to determine whether the treatment gains continue over time. The baseline assessment consisted of a modified functional analysis in which data were collected on a participant's rigid, routine behavior. After baseline, the experimenter conducted 3-4 30-minute sessions per week. Sessions included (1) a lag-reinforcement schedule to encourage any variation from the rigid routine, (2) interruption of the routine if it occurred, and (3) an individualized social script to address the problem behavior. The script described the behavior, listed how the child might feel if he could not engage in the behavior, presented coping strategies and what others would think if the child accomplished the changes, specified what he would earn for accomplishing the change, and reaffirmed that the child would be okay.

Results: Both participants displayed high rates of protests (3 or more protests per session) and low rates of compliance (0-10% of session time) when they were asked to change their rigid behaviors. After the intervention, the number of protests dropped to 0-1 per session and the rate of compliance rose dramatically (i.e. 85-100% of session time). Follow-up data collected for Participant 2 has continued to show this change 4 and 8 weeks after the intervention was concluded.

Conclusions: Although further testing through larger efficacy trials is necessary, this 3-part intervention shows promise for addressing restrictive, rigid behaviors by both reducing the problem behavior and promoting varied adaptive behaviors.

133.195 195 A Structured Indirect Assessment of Problem Behavior Severity. N. A. Parks*[1], D. E. Conine[1], B. R. Lopez[1] and N. A. Call[2], (1)*Marcus Autism Center & Children's Healthcare of Atlanta*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background:

The severity of problem behavior is a key factor in triage and placement decisions for programs that serve children with autism who exhibit severe problem behaviors. Without an appropriate method to identify which services would be most appropriate, individuals are at risk for being placed within a program that is either not equipped to treat the problematic behavior or resources are spent on treating behaviors that could have been decreased with less intensive services .

Currently, there are only a few standardized rating scales that provide information about the severity of problem behavior; however, they are not ideally suited to evaluate individuals with autism who exhibit severe problem behavior. Absent such a standardized assessment, clinicians must rely on the reports of caregivers, which are often unreliable, or expend precious resources on other in vivo observations or functional assessments. A standardized assessment would not only provide an objective measure of severity of problem behavior, but would and decrease the amount of resources required to make objective decisions regarding program placement.

Objectives:

The Problem Behavior Severity Scale (PBSS) was developed to provide an objective measure of the severity of problem behavior as it relates to injury to self or others, property destruction, and the level of intervention or staff required to safely intervene.

Methods:

A clinician who conducts assessments to determine placement within a continuum of behavioral services interviewed parents and conducted a structured observation within an individual's home for the purposes of determining appropriate placement into treatment services. The clinician then made a clinical referral to the most appropriate program using best clinical judgment, as well as completed a PBSS. A scale was developed based upon scores on the PBSS to determine the most appropriate level of intervention according to the score on the PBSS. Clinician referrals and PBSS ratings were completed with 285 individuals. Clinician referrals and PBSS ratings were compared.

Results:

The clinician ratings and PBSS produced the same recommendation for 87% of the individuals. Disagreements were analyzed to determine which recommendation (PBSS or clinician) was more appropriate, as determined by successful completion of one program or a referral to a different program. Recommendations from the clinicians were more appropriate for 6%, where as the severity score from the PBSS was more appropriate for 1%.

Conclusions:

The quantification of problem behavior exhibited by individuals with autism is important for ensuring individual receive the most appropriate treatments. This behavior is often difficult to measure without expending vast resources. The PBSS appears to be an adequate instrument for satisfying this need.

133.196 196 The Affect of Delays to Treatment Outcome on How Caregivers of Children with ASDs Value Treatments. N. A. Call*[1], A. R. Reavis[2] and A. J. Findley[2], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*, (2)*Marcus Autism Center & Children's Healthcare of Atlanta*

Background:

Many autism treatments appear in the literature (Green et al., 2005). Some have empirical support, but many caregivers utilize those that are not (Zane, Davis, & Rosswurm, 2008). Most empirically supported treatments require significant time before benefits are achieved (Allen & Warzak, 2000). These delays to treatment outcome may influence how caregivers of individuals with autism value empirically supported treatments.

Delay discounting refers to the degree to which individuals devalue outcomes as a result of the delay those outcomes (Madden & Johnson, 2010). Discounting is evaluated by presenting individuals with choices between hypothetical immediate and delayed rewards of varying magnitudes. A robust literature has shown that it is possible to quantify the degree to which individual's choice making is susceptible to the influence of delays (Madden et al., 2010). However, to date, no literature exists examining whether delay discounting influences how caregivers of individuals with autism value treatments outcomes. Additionally, there may be differences between caregivers discounting of delayed treatment outcomes based on type of treatment goal (i.e., reduction of problem behavior vs. skill acquisition).

Objectives:

The objective of this study was to extend the existing literature on delay discounting to caregivers of individuals with autism

and the choices they make regarding treatments for their child's autism spectrum disorder.

Methods:

Caregivers of children with autism who were receiving treatment for problem behavior or skill deficits participated in this study. Each participant provided a definition of their treatment goals for their child. Participants then completed a delay discounting procedure (Mazur, ??) in which they were asked to make choices between hypothetical treatment outcomes that would be available immediately or after a various delays. The treatment outcomes presented to participants varied with respect to the percentage of their treatments goals achieved and the latency to achieving that outcome. For example, one choice trial consisted of "Would you prefer a treatment that will achieve 60% of your treatment goals immediately, or a treatment that will achieve 100% of your treatment goals 6 months now?" A titrating procedure was used in which the percentage of treatment goals achieved by the immediate treatment increased from 0% until the participant switched from the delayed to the immediate treatment.

Results:

Switch points were plotted for each delay assessed creating a monotonic decelerating curve Mazur, 1987), with area under the curve serving as measure of sensitivity to delays (Myerson, Green & Warusawitharana, 2001). Caregivers of children receiving treatment for skill deficits or problem behavior showed 0.84 and 0.80 AUC respectively.

Conclusions:

Both groups of participants demonstrated significant discounting of the delayed treatment outcomes, suggesting that their choices of treatment were highly influenced by delays to treatment outcomes. Furthermore, caregivers who prioritized reductions in problem behavior showed greater sensitivity to delayed improvements in problem behavior than did caregivers who prioritized acquisition of skills by their child. This result highlights the need for those who deliver or develop treatments for those with autism to continually refine their interventions to make them increasingly efficient.

133.197 197 Cognitive-Kinesthetic Integration: Using a Novel Multifaceted Model and Exercise to Target Compliance, Challenging Behaviors and Stereotypy in Autism. K. Ibrahim*[1] and J. Zarcone[2], (1)*University of Hartford*, (2)*Johns Hopkins School of Medicine,*

Background: Previous studies have demonstrated the positive effect of exercise in reducing stereotypy, maladaptive behavior and increasing on-task responding in children with autism (e.g., Rosenthal-Malek & Mitchell, 1997).

Objectives: To evaluate a multifaceted model using exercise to target behavior and cognitive abilities for two young males with autism.

Methods: Two males with autism (age 7 and 13) attended an exercise program at a local YMCA. Sessions were structured so that increasingly more complex motor skills, coordination and voluntary behavior (e.g., compliance) were promoted. The model was individualized to each participant's needs (e.g., motor skills, aerobic capacity, strength) and behavioral concerns (e.g., compliance, stereotypy). Weekly sessions were conducted by a trainer in a community gymnasium. Five conditions were implemented across 12-months within exercise sessions: 1) adaption to setting and engagement with a simple task, 2) gross motor skill development using obstacle courses, 3) reinforcement of expressive and receptive language use during play, 4) reinforcing left-right discriminations, and 5) crossing the midline. Stereotypy was examined across three conditions for one boy who engaged in stereotypic behavior: exercise, exercise in the presence of a distractor (e.g., toys), and exercise with response blocking and relaxation. Participants were observed 1 year after completing the program to determine long-term effects of the intervention. A parent interview was also completed to assess behavioral outcomes in the home environment. Compliance to instructions, task interaction (capture and return during a ball-toss task), anticipatory (intentional) movements, and stereotypy (physical and verbal) were measured using behavioral observation. Stereotypy was observed across four intervals during a typical session: 1) pre-exercise; 2) during and 3) following aerobic-type exercise; session conclusion). A second independent observer collected stereotypy data to

determine the interobserver agreement (IOA) during random sessions.

Results: Compliance to instructions and task interaction improved overall by 75% from baseline; correct responding for capture and return of the ball at baseline (M = 20% and M = 0%, respectively) increased by the end of intervention (M = 100%). Compliance increased across 2 months to the end of training (M = 40% to M = 80% correct responding, respectively). Anticipatory movements improved from baseline to the end of intervention regarding body movements (M = 40% to M = 100%, respectively), while eye contact remained constant (M = 90%). Stereotypy decreased across sessions (start of intervention: M = 11.7 responses per minute (RPM); end of intervention: M = 8.5 RPM). When a distractor was incorporated using a Frisbee or Barney toy, stereotypy increased (M= 21.1 RPM and M = 35 RPM, respectively). Stereotypy decreased significantly when response blocking with relaxation was implemented from 53 RPM to 5.7 RPM by the end of intervention (M = 33 RPM overall). Parents reported significant improvements in behavior at the end of intervention that continued at one year follow up.

Conclusions: Interventions incorporating exercise and evidence-based strategies to target specific areas of concerns in individuals with autism are needed. This study proposes a novel methodology employing several components that are individualized to target new behaviors within the context of exercise.

133.198 198 Analysis of Demand Assessments in the Treatment of Severe Behavior. J. C. Mintz*[1], N. A. Call[2] and N. A. Parks[1], (1)*Marcus Autism Center & Children's Healthcare of Atlanta*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background:

Individuals diagnosed with autism spectrum disorders may engage in problem behavior to avoid or terminate aversive stimuli or demands to engage in non-preferred activities (Iwata, Dorsey, Slifer, Bauman & Richman, 1982/1994). Identifying stimuli that are likely to evoke problem behavior and developing a hierarchy of aversiveness can be helpful in developing treatments for problem behaviors maintained by escape/avoidance. However, methods for identifying and measuring aversiveness have generally relied upon information obtained from indirect sources, such as caregiver report (e.g., the Negative Reinforcement Rating Scale; Zarcone, Crosland, Fisher, Worsdell, & Herman, 1999). Recently, systematic assessments have been developed for this purpose (Call, Pabico, and Lomas, 2009; Roscoe et al., 2009). In the study by Call et al, the aversiveness of a demand was measured by the latency to the first instance of problem behavior following its presentation. However, the study by Call et al. only presented data from two participants who each displayed different patterns of responding: either all demands evoked problem behavior, or only a few did so. These results raise the question as to whether such patterns of responding are common during such assessments, and how these patterns may inform clinical practice.

Objectives:

The purpose of the current investigation was to examine patterns of responding during demand assessments across a large number of participants.

Methods:

Fifty-seven individuals referred to an intensive day-treatment program for the assessment and treatment of problem behavior participated. For each participant, ten potentially aversive demands were selected based on information provided by caregivers. A demand assessment session consisted of the presentation of one of the caregiver nominated demands using a three-step-progressive prompting procedure (i.e., verbal, model, physical prompts) until the first occurrence of problem behavior or 10 min had elapsed. The order of sessions was randomly determined; however, each session was conducted once before being conducted again. Each demand was evaluated a total of three times for each participant.

Results:

Results show that the demand assessment was able to create a hierarchy of aversiveness for 73% of participants, but results for individual participants varied with respect to the amount of

skew in that hierarchy. Demand aversiveness was defined as an average latency to the first occurrence of problem behavior less than 200 seconds. One to 3 demands were identified as aversive for 28% of participants; four to six demands were found to be aversive for 26% of participants; seven to nine demands were found to be aversive for 12% of participants; and all 10 demands were found to be aversive for 7% of participants.

Conclusions:

The distribution of participants was skewed heavily towards fewer demands being shown to be aversive. This result suggests individuals with autism spectrum disorders may be more likely to find specific demands to be aversive, as opposed to demands in general. Overall, the demand assessment described by Call et al. 2009 appears to be a useful procedure for clinicians to determine the relative aversiveness of demands.

133.199 199 Social Validity and the Children with Hyperactivity and Autism Research Treatment Study. J. A. Hollway*[1], P. A. Sayre[2], M. G. Aman[1], L. E. Arnold[2], T. Smith[3] and B. L. Handen[4], (1)*The Ohio State University*, (2)*Ohio State University*, (3)*University of Rochester Medical Center*, (4)*University of Pittsburgh School of Medicine*

Background: Inattention and hyperactivity are often observed in children with Autism Spectrum Disorders (ASD). Traditional medications for ADHD have been shown to be less effective for children with ASDs. Side effects also appear to be more problematic. Behavior intervention (BI) is an effective and established treatment for problem behavior. Few investigations have studied BI in group designs. In some cases BI alone is not enough and clinicians are recommending a combination of treatments. Recently, Strattera was indicated as an alternative treatment for ADHD symptoms. Therefore, we proposed a large multisite trial to include both parent training and Strattera, in order to determine Strattera's clinical value in combination with a BI. Parents of study participants were surveyed to determine whether they viewed the study intervention as worthwhile and "socially valid."

Objectives: To examine the social validity of a multimodal plan of treatment for decreasing symptoms of inattention, hyperactivity, and noncompliance, in children with ASD, who participated in a randomized clinical trial.

Methods: Parent Treatment Preference Surveys were completed by 72 parents of children ages 5-13 years, with ASD, and ADHD symptoms, prior to study enrollment. Participants were randomly assigned to one of four treatment groups: (1) Strattera alone, (2) Strattera with parent training, (3) Placebo alone, and (4) Placebo with parent training. Ten weekly visits included parent training sessions. An optional 24-week extension study with parent training sessions (monthly) was also conducted. Parent Satisfaction Questionnaires were completed at study endpoint to determine whether the study intervention was socially valid.

Results: Prior to enrollment 86.9% of parents gave BI an acceptability rating for treatment of ADHD symptoms and 79.6% of parents gave Strattera an acceptability rating for treatment of ADHD symptoms ($p<.02$). Additionally, 61% of parents were concerned about considering a "medical solution" for their child's problem behavior, while 97% of parents felt that their child's behavior would improve if assigned to behavior intervention. Post-study, 92% of parents reported that they would recommend the study to other parents with children having similar conditions, and 86% of parents said that they would participate again if they could do it all again. Some, 12% of parents said they might do it again, but with some reservation. Of those who received BI, 79% of parents reported that they felt more confident in managing future problem behaviors in their children. To date, we have enrolled approximately half of our study sample, and of these, 35% have shown improvement. Overall, in regards to study participation parent satisfaction was high. (A more detailed description of the results will be added at the item level in regard to parent satisfaction on the final poster).

Conclusions: The intervention introduced in this study appears to be socially valid, as a large majority of parents report that they would participate in this study again and an even larger proportion would recommend this study to parents with children having similar conditions. Parents of study participants were also highly satisfied with the results.

133.200 200 Auditory-Motor Mapping Training and Language-Related Pathways in Minimally Verbal Children with ASD. C. Y. Wan*, A. Landers, A. Norton and G. Schlaug, *Beth Israel Deaconess Medical Center and Harvard Medical School*

Background: Although up to 30% of individuals with ASD are minimally verbal, extremely few interventions can reliably produce improvements in speech output. Recently, we developed Auditory-Motor Mapping Training (AMMT), a novel intonation-based intervention, which aims to facilitate speech output in minimally verbal children with ASD (Wan et al., 2010, 2011). This intervention involves the mapping of sounds to articulatory actions through intonation and bimanual rhythmic motor activities. AMMT is built upon the musical strengths and preferences that have been observed in these children. Furthermore, associating sounds with actions engages an auditory-motor network of brain regions important for speech that has been reported to be dysfunctional in ASD.

Objectives: The overall aim of the study is to examine the efficacy of AMMT in facilitating speech output in minimally verbal children with ASD. We first conducted a proof-of-concept study to determine if AMMT can result in significant speech improvements (Wan et al., 2011). After establishing proof-of-concept, we are now in the process of comparing the efficacy of AMMT with a Control Therapy (CT). In addition, we also collected diffusion tensor imaging (DTI) data in some of these minimally verbal children, to determine if their language-related pathways (arcuate fasciculus, uncinate fasciculus) are abnormal.

Methods: Treatment study - 6 minimally verbal children with ASD who had no words participated in the proof-of-concept AMMT study. So far, 10 additional minimally verbal children have participated in the AMMT vs. CT study. These children undergo intensive one-on-one treatment sessions 5 times/week for a total of 25 sessions. In AMMT, a pair of tuned drums is used, and the speech therapist introduces the target words by intoning the words while simultaneously tapping the drums to facilitate sound-motor mapping. In CT, the key components of AMMT (intonation and hand-motor actions) are omitted, but CT is also designed to promote speech production. All children are assessed on their consonant-vowel productions multiple times before, during, and after therapy. Imaging study – Minimally verbal children with ASD and their matched controls (N=8) participated. Diffusion tensors were calculated for every voxel using FSL, and tractography was then applied to the DTI data to reconstruct white matter tracts. The two language-related tracts of interest were the arcuate fasiculus and the uncinate fasciculus.

Results: Results from the ongoing treatment study show that relative to CT, an intensive course of AMMT leads to significantly greater improvements in speech production, generalizing to items not trained during the therapy sessions. Results from the ongoing DTI study show that both language-related tracts are actually present in all minimally verbal children with ASD. Compared to those in typically developing children, however, the arcuate fasciculi of the minimally verbal children show reduced volumes and a right>left (rather than typical left >right) asymmetry. No such differences are observed in the uncinate fasciculus.

Conclusions: AMMT appears to have significant potential in facilitating speech output in minimally verbal children with ASD. Its effectiveness may lie in its ability to engage and potentially remodel the language-related pathway that is abnormal in these children.

133.201 201 Treatment of Ritualistic Behavior Using Principles of Behavioral Economics. L. A. Pepa*[1], C. Manente[1], J. Maraventano[2], A. Shcherbakov[1], S. Wichtel[1], I. Jorge[1], E. Thomas[1] and R. H. LaRue[1], (1)*Rutgers University- Douglass Developmental Disabilities Center*, (2)*Rutgers University- Douglass Developmental Disabilities Center*

Background: Autism is a developmental disorder characterized by difficulties in communication, social functioning, as well as the presence of stereotyped behaviors and restricted interests. These stereotyped and restricted behaviors can include highly preferred interests in certain objects or the repetition of certain activities. These patterns can influence academic and work environments. For example, students may choose tasks in a particular order, have a restricted task or reinforcement repertoire, or show resistance to non-preferred tasks. In order to address these rituals, physical prompting is often required. This is a

particular concern for older learners, as attempting to physically prompt older, stronger individuals may put staff, family members, and the learner themselves at risk for injury. One potential strategy to address ritualistic behavior without physical prompting is through the manipulation of "pay rates" of less-preferred tasks and the "cost " of preferred reinforcing items. By manipulating these economic variables, it may be possible to increase the range of task and preference selections, as well as to increase the completion of less-preferred tasks.

Objectives: The purpose of the current study was to address ritualistic behavior by manipulating the pay rate of tasks and the cost of preferred reinforcers.

Methods: Using an MSWO preference assessment procedure, highly preferred and non-preferred tasks and reinforcers were established for a 36 year-old male diagnosed with Autistic Disorder. Four tasks and four reinforcers were introduced into an economy, and two distinct cost structures were implemented. Under Cost structure 1, or the baseline assessment, all tasks payed $1 and all reinforcers cost $1. Under Cost structure 2, the most highly preferred reinforcer cost $10 and the least preferred task payed $10. In all four phases, percent of selections were recorded for tasks and for reinforcers.

Results: Under Baseline/ Cost structure 1, the learner established ritualistic choosing patterns for both tasks and reinforcers. Each task was selected between 24-27% of the time and reinforcer selection alternated between two highly preferred edibles; pretzels (49%) and Nutrigrain Bar (51%). When Cost structure 2 was introduced, task selection became varied, and the learner began to choose the low-cost edible (Nutrigrain Bar) more frequently (67%). Additionally, selection of the high pay-out task (33%) occurred as often as the high-cost reinforcer (33%). A reversal back to Cost structure 1 showed a reemergence of ritualistic behavior for both tasks and preferences. The second implementation of Cost Structure 2 induced the same treatment effect; tasks became varied, and reinforcer selection reflected a preference toward the lower cost reinforcer.

Conclusions: The results of this investigation show that ritualistic behavior can be addressed with economic manipulations. The participant was sensitive to the price of reinforcers and reinforcer selection changed significantly as price increased. These results suggest that the manipulation of price helped to broaden the task and reinforcer repertoire for the student. This has broader implications for the treatment of stereotyped behavior and restricted interests in academic and work environments.

133.202 202 Factors Predicting Continued Bicycle Riding Success in Youth with Autism Spectrum Disorders. J. L. Hauck*[1] and L. R. Ketcheson[2], (1)*University of Michigan*, (2)*University of Michigan*

Background: With the rise in sedentary behavior in youth with Autism Spectrum Disorder (ASD) as they age (MacDonald, Esposito, & Ulrich, In press; Pan & Frey, 2006; Sandt, 2005), it is becoming increasingly important to provide opportunities to increase physical activity. Until recently few physical activity intervention studies have been conducted for youth with ASD. The intention of these interventions is to provide positive psychosocial benefits and physiological health benefits (MacDonald, Esposito, & Hauck et al. 2011). What is currently unknown are the factors that predict continued physical activity participation following these interventions.

Objectives: Bicycle riding provides youth with ASD increased social opportunities, independent travel and age appropriate physical activity. Despite these advantages, few youth with ASD ever obtain the skill of independent bicycle riding (Ulrich et al., 2011; Hauck et al., in review). Furthermore of those who learn, few retain the skill overtime. Our objective is to understand the factors predicting continued bicycle riding three months following a bicycle training intervention.

Methods: A one-week bicycle training intervention was provided for youth with ASD aged 9-18 years. Following this intervention, we surveyed 49 families to determine whether their child maintained independent bicycle riding skills three months post intervention.

Results: Logistic regression was used to create a model to predict factors that influence continued riding success in children with ASD. We determined that parental interest in

physical activity, paternal age, ASD severity, time on task and sedentary physical activity were predictive of bicycle riding status at three months following the intervention. This statistical model predicted riding ability at three months post intervention with 85.7% accuracy.

Conclusions: Continued riding throughout adolescence provides youth with the opportunity to gain social and physiological benefits associated with increased physical activity. Physically active lifestyles are something that we strive for as we age and participating in lifetime physical activities are an important part of obtaining this goal (Hauck et al. in review). Understanding these predictors will enable researchers to increase their focus on these factors during interventions to increase success over time.

133.203 203 Self-Determination Measures with College Students Diagnosed with Asperger. M. Boman* and A. R. Amraotkar, *Western Kentucky University*

Background:

Currently, there are limited studies regarding students with Asperger (AS) who are attending college and self-determination (SD). According to Wehmeyer (1992), SD is "acting as the primary causal agent in one's quality of life and making choices and decisions regarding one's quality of life free from undue external influence or interference." This research explores the results of an ongoing study of college students with AS to evaluate if these skills improve through the experience of attending college. Success in college can be affected significantly by how students with AS feel about themselves and their acceptance of their personal strengths and weaknesses (Palmer, 2006).

Objectives:

To measure and assess if college students with AS can increase their self-determination through their college experience.

Methods:

The participants for this study include 8-10 students incoming freshman, who are involved with the "Kelly Autism Program Circle of Support" at Western Kentucky University. This number varies from year to year as well as from semester to semester due to the number enrolled in the program. All students met the same requirements that are needed to be accepted for college at WKU. As part of their support system/programming, each participant receives three hours of tutoring for four days a week, a mentor who supports them through various social aspects of the college experience, and a private dormitory room. Besides academic support during their study hours, the participants also receive metacognitive social training, executive functioning skill building, and study skills. The participants completed the Arc's Self-Determination Scale (Wehmeyer & Kelchner, 1995)at the end of each semester for the past three years to evaluate if they are learning skills which will lead them to a more productive life whereby they can make decisions for themsleves. This study also measured other aspects that might influence the outcomes regarding ACT scores, Grade Point Average, and family support.

Results:

Although all data has not been totally analyzed at the time of the writing of this abstract, preliminary results indicate that for over 60% of the participants their self-confidence and self-awareness increased as well as their self-determination. Most felt that they had more control over various components of their lives especially when it came to their personal life as their parents/caregivers had served in this role for many years. Other correlations were assessed which impacted the outcomes for these students as well; these will be included in the poster presentation.

Conclusions:

As college students participated in the Circle of Support Program at WKU, they rated themselves regarding self-determination. The results indicated strong positive changes as many felt that for the first time that they were in control of what occurred during their lives. They also felt that their desire to accomplish their personal and professional goals increased.

133.204 204 Development and Interrater Reliability of a New Measure of Functional Behaviour Skills for Children with Autism Spectrum Disorder. B. Lorv*[1], J. A. Reitzel[2], J. Summers[2], P. Szatmari[3], L. Zwaigenbaum[4], S. Georgiades[3], E. Duku[3] and M. Gandolfo[1], (1)*McMaster University*, (2)*McMaster Children's Hospital/McMaster University*, (3)*Offord Centre for Child Studies, McMaster University*, (4)*University of Alberta*

Background: Autism is a heterogeneous neurodevelopmental disorder that causes children to exhibit a wide range of functional and cognitive deficits. To date, only a portion of children with autism have responded to Intensive Behavioural Intervention (IBI) by making significant gains in their cognitive and language functioning. Many children at the severe end of the autism spectrum are nonverbal and require training for the development of functional skills. While cognitive, language and adaptive behaviour assessments are commonly used to measure the outcomes of IBI, there is a need for an objective observational measure that is sensitive to important changes in functional behavioural skills.

Objectives: The objective of this study was to develop a functional behaviour skills assessment (FBSA) and evaluate its reliability in measuring adaptive skills in children with autism. A standardized videotaped assessment and coding system were created to assess various functional skills. To ensure consistency across multiple trained assessors and raters, interrater reliability of this coding system was calculated.

Methods: The FBSA was developed to measure five distinct functional behaviour skills, namely requesting, hand-washing, sitting at the table while eating, responding to name and toileting. Standardized scenarios of the child's behaviour with their parent were administered in the children's homes by trained and reliable assessors who were blind to the child's treatment status. Each FBSA took 1 hour to administer and 1 hour to score. The first of these four skills were videotaped and coded. Toileting skill, however, was not videotaped and scored separately. The presence or absence of aspects of requesting behaviours in a 10-minute period of child-parent interaction was coded using the ABLLS-R requesting (Partington, 2006) criteria. Other videotaped skills were coded using task analyses; specifically the presence or absence of aspects of the functional skill (e.g. did the child turn on the tap during hand-washing). The parent's use of prompts was also coded behaviours (e.g. did the parent physically prompt the child's action). Raters were trained on three coding tapes to an 80% rater agreement criterion. These raters then coded 30 videotapes and interrater reliability using Inter-Observer Agreement (IOA) was evaluated on 47% of these.

Results: Interrater reliability was separately scored for each skill. Response to name was demonstrated to have the largest agreement between raters with an IOA of 89%. This was followed by requests at 84%, hand-washing at 78%, and sitting at table while eating at 76%. The average IOA across all skills and videos was 84%.

Conclusions: Our novel FBSA and coding system offers a valuable measure of functional skills for children functioning at the severe end of the autism spectrum. Results demonstrated that our coding system is reliable (greater than 75% interrater reliability), suggesting that consistent objective ratings of functional skills can be achieved. This reliable measurement of functional behavioural skills will allow professionals the opportunity to follow the progress of children with autism to determine appropriate adaptive functional skills treatment.

Partington, J. (2006). The assessment of basic language and learning skills-revised. Pleasant Hill CA: Behavour Analysts Inc.

133.205 205 The Early Learning Measure As a Predictor for 12- Month Adaptive Behavior Outcomes for Children with Autism and Intellectual Disabilities. J. Summers*[1], J. A. Reitzel[1], D. Lee[2], L. Zwaigenbaum[3], P. Szatmari[4], S. Georgiades[4], E. Duku[4] and K. A. Baird[2], (1)*McMaster Children's Hospital/McMaster University*, (2)*McMaster University*, (3)*University of Alberta*, (4)*Offord Centre for Child Studies, McMaster University*

Background: Children with autism (ASD) and intellectual disabilities (ID) have a serious need for assistance in developing adaptive behaviours and what predicts this development is not well understood. This emphasis on the development of adaptive behaviours is imperative for severely affected children because adaptive behaviours encompass daily living skills, socialization, and functional communication that are necessary in maximizing independence. Identifying

variables that predict outcomes in adaptive behaviour can be useful in examining a child's prognosis.

Objectives: The current study investigates whether the Early Learning Measure (ELM), an assessment tool of early cognitive skills, is useful in predicting adaptive functioning in children with ASD and ID. after 12 months.

Methods: Thirty-eight children (mean age= 55.23 mos, SD=13.83) were enrolled in the study and had independent clinical diagnoses of Autism or PDD-NOS according to DSM-IV criteria. At baseline, children were given a cognitive assessment (Mullen Scales for Early Learning or Stanford Binet- 5th edition), an adaptive functioning assessment (Vineland Adaptive Behaviour Scales; VABS), the Childhood Autism Rating Scale, and the ELM. The ELM was again administered at the end of every month for a 4- month period. The ELM assessed children's mastery of receptive instructions, expressive labels, non-verbal imitation and verbal imitation. ELM "mastery" was defined as scoring 80% in each domain at baseline or any time point within the 4-month assessment period.

Linear regressions were performed to identify significant predictors of the 12- month VABS Adaptive Behaviour Composite (ABC) score. Tested independent variables were: age at baseline, CARS score, NCS (derived from the Mullen or Stanford Binet- 5th edition nonverbal scales), ELM Mastery and entry VABS subscale standard scores. Variables that were found to be significant (at the $p<.05$ level) were then subjected to a hierarchical linear regression analysis.

Results: Results indicated that a model incorporating baseline measures excluding the ELM (VABS ABC, VABS daily living, VABS socialization and NCS) accounted for 57% of the variance of the 12-month VABS ABC. ELM mastery accounted for an additional 17% of the variance over and above all other tested baseline predictor variables ($p < 0.01$).

Conclusions: The ELM is a useful measure for the prediction of adaptive functioning in children with ASD and ID after 12 months. Our findings have important implications in understanding adaptive functioning prognoses and determining next steps in treatment planning for children with intellectual disabilities functioning at the severe end of the autism spectrum. Using the ELM, clinicians will be better able to assess how successful a child will be in acquiring adaptive behaviours after 12 months. This will allow for the development of novel treatment plans that focus on adaptive functioning and independence.

133.206 206 Validation of the Conversation Participation Rating Scale. G. R. Timler* and W. Boone, *Miami University*

Background: Speech-language pathologists frequently use norm-referenced pragmatic language tests to identify children's pragmatic deficits (Adams, 2002). Clinical and research reports reveal that a) Some children achieve standard scores within the normal range even though parents and teachers have significant concerns about children's pragmatic skills (Volden & Phillips, 2010); and b) Standard scores do not yield sufficient description of children's skills for determination of intervention goals, activities, and progress (Paul, 2009). We are developing the Conversation Participation Rating Scale (CPRS), a self-report measure of conversation participation for school-aged children, ages 8 to 16 years, to address some of these limitations.

The conceptual roots for the development of the CPRS originate from the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF; World Health Organization, 2001). The ICF provides a taxonomy that describes human functioning and restrictions. Participation is a major component of the taxonomy and reflects the nature and extent of an individual's involvement in life situations including how others facilitate the individual's participation (or nonparticipation). An important "life situation" for school-age children is conversation. Within the ICF framework, participation includes children's perception of their own words and actions in conversations as well as perceptions of peers' words and actions towards them. Children's parents have some knowledge about children's participation in conversations with peers (particularly during the preschool years); however, peer interactions among school-age students become more covert and complex over time. Older children's self-report of peer interactions may be more valid than parent reports (Crick, Casas, & Nelson, 2002).

Objectives: The purpose of this study is to present initial psychometric analyses of the CPRS. Children's performance on the CPRS will be compared to parent report measures of children's social language skills and children's performance on two norm-referenced language measures.

Methods: The pilot version of the CPRS has utilized item response theory and Rasch analysis (Linacre, 1991). A pool of 119 statements reflecting conversation skills and situations (e.g., "I greet other students"; "Other students greet me, "I know how to join a group of students") was developed from review of the extant literature, existing measures, and family interviews. CPRS items are read to child participants and the participant selects one of six frequency-based responses ranging from never to always. In addition to the CPRS, the study protocol includes administration of the Kaufman Brief Intelligence Test-Second Edition (Kaufmann & Kaufmann, 2004), the Test of Pragmatic Language-2 (Phelps-Terasaki & Phelps-Gunn, 2007) and the Social Language Development Test (Bowers, Huisingh & LoGiudice, 2008; 2010). Participants complete a second self-report measure, the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008). Parents complete the Children's Communication Checklist-2 (Bishop, 2003) and the parent version of the SSIS.

Results: Data collection is still in progress. To date, we have recruited 14 participants with autism spectrum disorders and 24 control participants.

Conclusions: Rasch analysis will be used to discuss child trait level, item difficulty and best fit items. The relationship among CPRS performance, parent report measures, and child test measures will be discussed.

133.207 207 Autism Symptoms and the Functions of Problem Behavior. K. Pelzel*[1], D. P. Wacker[1], S. D. Lindgren[1], Y. C. Padilla[2], J. F. Lee[2], T. Kopelman[3], J. Kuhle[1] and D. B. Waldron[1], (1)*University of Iowa Hospitals and Clinics*, (2)*University of Iowa*, (3)*University of Iowa Children's Hospital*

Background: Problem behavior (e.g., aggression toward others, self-injurious behavior) is a significant stressor for caregivers of children with autism (Estes et al., 2009). Identifying the function of problem behavior using functional analysis (FA) frequently leads to effective treatments (Pelios et al., 1999). Previous investigations of FA results for individuals with ASDs who engage in problem behaviors suggest tangible and escape functions are common (e.g., Love et al., 2009). To date, the symptom profile of children whose problem behavior is maintained by access to a tangible item versus the symptom profile of children whose problem behavior is maintained by escape from task demands has not been examined.

Objectives: We aim to better understand the relations between the symptoms of autism and the functions of problem behavior displayed by young children with ASDs. Ultimately, our objective is to develop symptom profiles that clinicians completing FAs with this population could employ to prioritize the order of their FA sessions and to more efficiently develop treatment plans.

Methods: Twenty-six children (ages 2-6) diagnosed with ASD are participating in this study. Autism symptoms were assessed with the ADOS and the ADI-R. Each child will complete extended FAs (Iwata et al., 1982/1994) of parent-identified problem behavior as part of a larger study of behavioral treatment via telehealth. The FA is conducted over 2-way teleconferencing connections linking behavioral specialists from a university with an outpatient clinic within 50 miles of the child's home. Five minute sessions are conducted within individual single case multi-element designs during one hour periods, once a week, until at least 3 stable sessions are completed for each condition (free play, attention, tangible, and escape). Behavioral functions are coded as: attention (behavior maintained by verbal or physical attention), tangible (behavior maintained by access to a tangible item), escape (behavior maintained by escape from task demand), and/or automatic (behavior maintained independent of social reinforcement). Multiple functions can be coded for the identified problem behavior.

Results: To date, 26 participants have completed the ADOS and ADI-R. Twenty-two have completed the FA. Four are currently completing the FA or are scheduled to complete it. The present investigation will focus on participants who display problem behaviors with tangible and/or escape functions (n = 21 at present). Earliest findings suggest that children whose behavior serves a tangible function (n=5) or a

combination of tangible and escape functions (n=13) tend to manifest more severe social deficits during the ADOS than children whose problem behavior serves an escape function (n=3). ADI-R and ADOS scores will be further compared between these groups after all FAs are completed and diagnostic scores are standardized.

Conclusions: Knowing the symptom profile of children whose problem behavior is maintained by different functions has clinical utility. Earliest findings suggest children with more severe social deficits may be more likely to have problem behavior serving a tangible function or a combination of functions than problem behavior serving an escape function.

133.208 208 Evidence of Frequent Psychotropic Medication Use Among Children with Autism Spectrum Disorders and Their Family Members. A. Jain*[1], D. Spencer[2], J. Marshall[1], C. J. Newschaffer[3], G. Yang[1], L. J. Lawer[4] and T. Dennen[1], (1)*The Lewin Group*, (2)*Optum Insight*, (3)*Drexel University School of Public Health*, (4)*University of Pennsylvania School of Medicine*

Background: Autism spectrum disorders (ASDs) affect a large and heterogeneous group of children and their families. Despite increasing interest in and attention to ASDs, most research studies to-date have included only small or narrow clinical samples of children, without an understanding of how findings generalize to children with ASDs more broadly. In particular, it is unknown how the use of psychotropic medications among children diagnosed with ASDs, and that of their families, compares to children and families without ASDs.

Objectives: Using a large, existing administrative dataset, we compare the use of psychotropic medications among children with ASDs and their family members to those of children without ASDs and their families.

Methods: This is a retrospective study using medical, behavioral health and pharmacy data and health plan enrollment information from a large US research claims database from January 2001 to December 2009. Descriptive analyses were conducted for six main samples: children with ASDs, a randomly selected comparison group of children without ASDs, parents of children with and without ASDs, and siblings of children with and without ASDs. Children 0 to 20 years old with Autism, Asperger's Syndrome, or Pervasive Developmental Disorder not otherwise specified (PDD-NOS) were included; children with Rett Syndrome and Childhood Disintegrative Disorder were not included in the sample of children with ASDs. All study subjects were required to have at least six months of health plan continuous enrollment.

Results: We identified a large sample of children with ASDs (46, 236 children) their siblings (57,056), and parents (80,164) as well as a comparison group of 138, 876 children and their family members (428,097). Children with ASDs averaged 41.8 months of continuous enrollment, and the comparison group averaged 30.5 months of enrollment. Preliminary, unadjusted analyses indicate that 59% of children with ASDs had at least one claim for a psychotropic medication: 41% received medication for attention deficit disorder, 30% received an antidepressant, 25% received an atypical antipsychotic (17% Risperidone specifically), 17% received an anticonvulsant, and 14% received an anxiolytic. In comparison, 11% of children without ASDs had at least one claim for a psychotropic medication, with the greatest number receiving an attention deficit disorder medication (5%) or an antidepressant (4%). Eleven percent of siblings of children with ASD received a medication for attention deficit disorder, and 8% received an antidepressant. Thirty-one percent of parents of children with ASDs received an antidepressant, and 21% received an anxiolytic. Additional analyses will assess the degree of concomitant polypharmacy among children with ASDs.

Conclusions: Many children with ASDs received a psychotropic medication. Evidence of select psychotropic medication use among their family members was also noteworthy. Further research is needed to assess patterns of psychotropic medication use, including polypharmacy, among children with ASD and their family members.

133.209 209 The EFFECT of A CO-Robot Therapist On Repetitive Behaviors DURING Applied BEHAVIOR ANALYSIS In Individuals with AUTISM Spectrum DISORDERS. E. A. Klinepeter*[1], N. M. Shea[1], B. Thomas[2], M. Van Ness[1], J. Kumar[1], S. L. Mazur[1], M. A. Millea[1], K. Wier[1], M. Villano[1], C. R. Crowell[1] and J. J. Diehl[1], (1)*University of Notre Dame*, (2)*Northwestern University*

Background: The use of an interactive humanoid "co-robot" in therapy to aid a human therapist in teaching communicative skills to children with autism spectrum disorders (ASD) is a relatively new approach with limited clinical data (Diehl et al. 2011). It is important to understand both the benefits of this approach and potential undesirable outcomes of this technique. One potential unwanted outcome is the possibility that the presence of the co-robot would increase repetitive behaviors displayed by participants because of increased arousal. Current theory on repetitive behaviors suggests their importance in regulating emotional arousal and sensory input from the environment (Leekam et al, 2011).

Objectives: The purpose of this study was to examine the effect that the introduction of a co-robot had on repetitive behaviors displayed by children with ASD during an Applied Behavior Analysis (ABA) therapy session.

Methods: Participants were four children with ASD (ages 8-11) taken from a larger study examining the incremental validity of using co-robots in empirically supported treatments. Diagnoses were confirmed using the Autism Diagnostic Observation Schedule, the Social Communication Questionnaire (Lifetime Form), and clinical judgment. All participant Full Scale IQs and language standard scores were at least two standard deviations below the mean for their age. Participants were pair-wised matched on chronological age, gender, Full Scale IQ, and language abilities, and both pairs had the same human therapist. Participants received 12 sessions of ABA therapy, six of which included communicative interactions with a co-robot (Nao, Aldebaran Robotics) controlled by an experimenter in an adjacent room. For each child, we examined the frequency of nonverbal repetitive behaviors (e.g., flapping hands) and repetitive verbalizations. The number of times each behavior was displayed by each participant was recorded within the first 10 minutes of practice during each of the 12 sessions. Patterns of response were examined across all four participants, and also individually for each participant.

Results: Preliminary data suggest that the presence of a co-robot in therapy had a differential effect on verbal and nonverbal repetitive behaviors, (X^2=5.76, p<.05). Nonverbal repetitive behaviors were more frequent in sessions involving the co-robot, whereas verbal routines were no different whether or not the robot was present in the session. It should be noted, however, that in addition to this broader pattern there were individual differences between the four participants in the way in which the robot affected specific repetitive behaviors, and individual differences appeared to be related to the purpose of the behavior (increasing or decreasing arousal).

Conclusions: These pilot data suggest that the introduction of a co-robot into therapy might increase the frequency of nonverbal repetitive behaviors in children with ASD. Therefore, interventions that test the clinical utility of co-robots must consider both potential benefits and potential obstacles to optimal therapeutic outcomes. It is also possible that the co-robot could be used as a method of eliciting the repetitive behaviors as a means of teaching replacement behaviors using differential reinforcement of an alternative behavior.

133.210 210 INFLUENCE of Symptom SEVERITY and Adaptive BEHAVIOR Functioning of CHILDREN with AUTISM Spectrum DISORDERS On Parental ADHERENCE to TREATMENT Recommendations. K. Tang*[1], A. Dammann[1], E. Nash[1], K. DiPiero[2], K. A. Uhland[1] and J. J. Diehl[1], (1)*University of Notre Dame*, (2)*St. Mary's College*

Background: Previous research has suggested a relationship between parental adherence to treatment recommendations for children with autism spectrum disorders (ASD) and diagnosis of the child. Moore and Symons (2009) found that parents of children with Asperger syndrome were less likely than parents of other ASD diagnoses to adhere to behavioral treatment recommendations. It is unclear, however, whether it is the actual diagnosis that influences treatment adherence, or

whether this difference is related to other factors such as child's level of symptom severity and/or current level of adaptive behavior functioning.

Objectives: This study investigated the roles of symptom severity and adaptive behavior functioning in parents' adherence to treatment recommendations. We predicted that parents of children who currently exhibit more severe ASD symptoms and/or lower levels of adaptive behavior functioning were more likely to adhere to treatment recommendations than parents with children with milder ASD symptom presentations and/or higher levels of adaptive behavior functioning.

Methods: Ninety-five primary caregivers of individuals with ASD anonymously completed four online questionnaires. All participants were parents of individuals 21-years-old or younger. Accuracy of diagnosis was screened using the Social Communication Questionnaire (SCQ) Lifetime version. The SCQ Current version was used to measure current symptom severity. To measure adaptive behavior functioning, parents completed the Adaptive Behavior Assessment System-Second Edition (ABAS-II). Parents then completed the Parental Adherence Questionnaire, which looked at parental adherence to behavioral and medical treatment recommendations for children with ASD (modified from Moore & Symons, 2009).

Results: When controlling for parent-reported diagnosis of the child, SCQ Current total score accounted for a significant proportion of variance in parental adherence to both behavioral and medical treatment recommendations (β=.283 and β=.324, $p<.05$) over and above the effects of diagnosis alone. When only parent-reported diagnosis was used, parental adherence was found to be statistically significant with only behavioral treatment recommendations. Overall level of adaptive behavior functioning was not correlated with parental adherence to either behavioral or medical treatment recommendations (r=.126 and r=.188, $p>.05$).

Conclusions: These data suggest ASD symptom severity is predictive of parental adherence to both behavioral and medical treatment recommendations over and above diagnosis alone. Therefore, parents of children with milder ASD symptoms, as seen in individuals with a diagnosis of Asperger Syndrome or "high-functioning" autism, are less likely to adhere to treatment recommendations possibly impeding on additional developmental gains of the child. In fact, Saulnier and colleagues (2011) reported that with age, gains in adaptive skills do not develop at the same rate as cognitive skills in children with high IQ, thus stressing the importance for parents to adhere to treatment recommendations for children with higher skills set. Future research should examine whether specific items (rather than summary scores) are more predictive of parental adherence to treatment recommendations.

133.211 211 Medication Use Among a Cohort of Adolescents with An Autism Spectrum Disorder. M. Maye*[1], F. Martinez-Pedraza[1], T. W. Soto[1], D. K. Anderson[2], C. E. Lord[2] and L. Wainwright[1], (1)*University of Massachusetts, Boston*, (2)*Weill Cornell Medical College*

Background: While there is a current dearth in the literature evaluating psychotropic medication use among individuals with autism spectrum disorders (ASDs), medication use within this group has continued to rise (Aman, 2005). Psychotropic medications are being prescribed to allay symptoms with little empirical support (Oswald, 2007). The few studies that have examined psychotropic medication use of individuals with an ASD found significant relationships between medication use and demographic variables such as, intellectual disability, parent education and classroom placement (Aman, 2005). However, there are two major gaps in this literature: 1) the relationships of medication use with demographic variables have only been examined cross-sectionally, thus there is limited knowledge of whether these relationships persist over time; and 2) little is known about other variables such as behavioral symptoms that may predict medication use within this population.

Objectives: 1. To explore the relationship between demographic variables and psychotropic medication use among adolescents with an ASD at 3 time points. 2. To analyze behavioral predictors of psychotropic medication use among adolescents with an ASD at 3 time points

Methods: The sample [T1N1 = 87 (*M* = 12.5 years, SD=1.15), T2N2 = 62 (*M* =14.65 years, *SD* = 1.10), T3N2 = 63(*M* = 17.43 years, *SD* = 1.09)] is comprised of adolescents who were recruited through consecutive referrals for possible autism at age 2 to clinics in North Carolina and Chicago, and have been followed longitudinally as part of a larger study. Chi-square tests of independence were performed to examine the relationships between psychotropic medication use and demographic variables. Logistic regressions were used to analyze behavioral predictors of psychotropic medication use.

Results: At Time 1 and Time 2 a significant relationship was found between psychotropic medication use and classroom placement [T1: $x^2(2, N=87) = 10.89$, $p < .005$, T2: $x^2(2, N = 62) = 6.14$, $p < .05$]. At Time 1 and Time 3 a significant relationship was found between psychotropic medication use and diagnosis (Autism versus PDD-NOS) [T1: $x^2(1, N = 87) = 4.185$, $p<.05$, T3: $x^2(1, N = 63) = 6.51$]. At Time 1 and Time 3 a significant relationship was found between education of caregiver and psychotropic medication use [T1: $x^2(3, N = 87) = 11.81$, $p<.05$, T3: $x^2(3, N = 63) = 7.92$, $p>.05$]. Logistic regression models indicated varied relationships between behavioral predictors and medication use at each time point. Time 1 indicated that lethargy and stereotypy symptoms were significant predictors of psychotropic medication use (W=6.79, p>.01, W=5.49, p>.05). Time 2 indicated that irritability was a significant predictor of medication use (W=4.69, p>.05) Time 3 indicated no significant behavioral predictors of psychotropic medication use.

Conclusions: The discussed analyses suggest that significant relationships exist between psychotropic medication use and demographic and behavioral variables. However, these relationships appear to shift over time rather than remaining constant. This research provides the foundation for future analysis of the patterns of medication use over time within a single cohort of individuals to assess whether stable relationships exist.

133.212 212 The Role of a Biomarker in the Double Blind Placebo - Controlled Study of CM-AT in Children with Autistic Disorder Ages 3-8. J. Fallon*[1] and M. Heil[2], (1), (2)*Curemark LLC*

Background:

Autistic Disorder (AD) and Autism Spectrum Disorder (ASD) is a behavioral disorder with no known etiology. Although multiple theories exist with respect to the underlying etiology, including the role of epigenetics, it is thought that multiple subtypes may exist across the autism spectrum. In some patients with ASD, primary GI immuno-pathology may leads to secondary immune activation in the CNS that may contribute to the neurological features of autism, as well as a local inability for the gastrointestinal system to function properly thereby reducing function. This reduced function may also lead to various missing components of complete digestion, which may also affect the brain and brain function by limiting the pool of available amino acids. One such subtype has been thought to be related to the lack of protease enzymes associated with protein breakdown, and the resulting available amino acid pools from which to make novel proteins

Objectives:

The primary objective of this study was to examine the role of the endogenous lack of protease enzyme on the treatment of children with specific enzyme replacement as determined by a measured biomarker in a multi-site double blind placebo controlled study of CM-AT.

Methods:

The determination of the levels of fecal chymotrypsin (FCT)was undertaken in a double blind placebo controlled study of over 150 children, who met the DSM-IV criteria for ASD on the ADI-R, and who were also screened on the SCQ to differentiate spectrum from non-spectrum disorders. Multiple stool levels of FCT were taken throughout the trial both in CM-AT treated and placebo treated children. Those who tested positive were also administered a battery of cognitive, behavioral and physiological tests.

Results:

Greater than 50% of children who met the screening criteria for Autistic Disorder, also screened for abnormal FCT at baseline. These results were correlated with the outcomes measures from baseline to termination across the cognitive, behavioral and physiological domains. Differences in the FCT

levels at termination were examined between the CM-AT administered children and those administered placebo.

Conclusions:

The presence of a specific biomarker in greater than 50% of the children who screened positive for Autistic disorder, holds significance with respect to the children who require specific enzyme replacement therapy. The potential for identifying a subtype within the autism spectrum holds promise for the understanding of the disease and potential treatments. The findings indicate that within the autism spectrum there exists a subtype of children that have an endogenous lack of chymotrypsin which cleaves only essential amino acids in the digestive process. The three major proteases include trypsin, elastase and chymotrypsin. This endogenous lack of chymotrypsin may leave the child with a dearth of essential amino acids, and an amino acid prioritization problem, and an inability to synthesize new proteins. This subtype has heretofore never been identified in multi-site double blind placebo controlled trials

133.213 213 Effectiveness of a Rapid Toilet Training Workshop for Parents of Children with Autism and Other Developmental Disabilities. K. Rinald[1] and P. Mirenda*[2], (1), (2)*University of British Columbia*

Background: Although the Rapid Toilet Training (RTT) Method has been shown to be effective at teaching continence to a wide range of populations, toilet training remains a challenge for families of children with disabilities. In the large body of research related to toilet training, parents of children with autism and other disabilities are virtually absent. A lack of continent toileting can be a strain on children and families. Thus, research on time- and cost-effective toilet training methods that parents can implement as independently as possible is a worthy pursuit.

Objectives: To determine whether parent participation in an RTT-derived workshop would result in increases in positive toileting behaviours emitted by their children with developmental disabilities.

Methods: After collecting baseline data on their child's toileting, six parents of children with disabilities (4 with autism, 2 with other developmental disabilities) attended an RTT-derived workshop where they were taught how to implement the toileting protocol at home with their children. In the 5 days following the workshop, the parents implemented the toilet training procedure with their children and reported data (number of accidents/successes) each day to the researchers. The researchers were available for telephone support at any time, but the parents were responsible for implementing the entire intervention.

Results: Five families completed the study. All five children showed significant gains in positive toileting behaviours and displayed both urinary and fecal continence within a short period of time (i.e., 5 days). Four of the five children were independently initiating toilet use by the time of a 2-week follow-up data point. In addition, social validity and self-efficacy ratings from participating parents were very high.

Conclusions: Parent participation in the RTT-derived workshop resulted in rapid increases in positive toileting behaviours in all participating children. Both urinary and fecal continence were acheived for all children completing the study. This study has multiple implications for both clinical practice and future research involving parents and toilet training.

Invited Educational Symposium Program
134 Progress, Pitfalls, and Potential of Postmortem Human Brain Research On Autism
Chair: C. M. Schumann *UC Davis M.I.N.D. Institute*

Postmortem human brain tissue studies uniquely span multiple disciplines, including neuroanatomy, neurochemistry, molecular biology and genetics; a single brain donation is often used for several programs in each of these fields around the world. Although autism research on postmortem human brain tissue is still in its infancy, a heightened emphasis on understanding the neurobiology of autism has led to a dramatic increase in progress over the last decade. As investigators from widely varying backgrounds enter this field in an attempt to uncover the neurobiological underpinnings of brain development in autism, they are often surprised by how little is known and frustrated by the modest amount of quality tissue available. Successfully uncovering consistent types of

neuropathology of autism spectrum disorders will require the availability of more abundant, high-quality postmortem tissue, the application of modern neuroanatomical and genetic methodologies, and multidisciplinary collaborations. This topic is ideal for an educational symposium because it brings together experts at the top of their field from very different backgrounds, from neuropathology to genetics, to share one rare resource. This topic will therefore be of interest to a broad audience. We propose to have each of these experts provide insight into how postmortem human brain tissue, using methods from their respective fields, can lead to understanding the causes of, developing treatments for, and finding cures for autism spectrum disorders.

134.001 Progress in Understanding the Neurobiology of Autism. D. G. Amaral*, *UC Davis MIND Institute*

134.002 The Neurochemical Profile of Autism. G. J. Blatt*, *Boston University School of Medicine*

134.003 Environmental Vulnerability and Oxidative Damage in Autism. J. James*, *Arkansas Children's Hospital Research Institute*

134.004 Gene Expression in the Central Nervous System in Autism. D. H. Geschwind*, *University of California at Los Angeles*

Cognition and Behavior Program
135 Early Developmental Processes & Trajectories In ASD: Infant & Toddler Studies
Chair: L. Zwaigenbaum *University of Alberta*

135.001 Developmental Differences At 6 and 12 Months Associated with ASD Outcomes in a High-Risk Infant Cohort. L. Zwaigenbaum*[1], A. M. Estes[2], H. Gu[3], J. T. Elison[4], S. Paterson[5], K. Botteron[6], H. C. Hazlett[7], J. Piven[8] and I. B. I. S. Network[9], (1)*University of Alberta*, (2)*University of Washington*, (3)*University of North Carolina*, (4)*California Institute of Technology*, (5)*Children's Hospital of Philadelphia*, (6)*Washington University School of Medicine*, (7)*University of North Carolina at Chapel Hill*, (8)*University of North Carolina, Chapel Hill (UNC-CH)*, (9)*Autism Center of Excellence*

Background: Prospective studies of high-risk infants have yielded important insights into early developmental trajectories associated with a later diagnosis of ASD. Most previous studies have reported that differences in early cognitive and social-communication skills associated with ASD emerge at 12 months or later.

Objectives: To examine early development of cognitive and adaptive skills and behavioral risk markers of ASD using longitudinal data from a high-risk cohort, and with a focus on differences at 6 versus 12 months.

Methods: Data were drawn from an ongoing, multisite, longitudinal study of brain and behavioral development in ASD (Infant Brain Imaging Study; IBIS). Participants included 113 high-risk infants (HR; younger siblings of children with ASD) and 35 low-risk comparison infants (LR) followed to 24 months of age. Early behavioral risk markers were assessed using the Autism Observation Scale for Infants (AOSI) at 6 and 12 months. Cognitive skills were assessed using the Mullen Scales of Early Learning (MSEL) and adaptive skills using the Vineland Adaptive Behavioral Scales – II (VABS-II) at 6, 12 and 24 months. We compared HR infants meeting 24-month Autism Diagnostic Observation Schedule (ADOS) criteria for ASD (HR+; n=32), HR infants scoring below the ASD range (HR-; n=81) and LR infants (n=35) using mixed model ANOVAs, co-varying for study site and maternal education level.

Results: Significant group differences were found on MSEL and VABS-II composite scores at 6, 12 and 24 months, with post-hoc analyses revealing less advanced cognitive and adaptive skills in HR+ compared to HR- and LR groups at all 3 time points. Subscales indicating delays in HR+ compared to HR- and LR infants at 6 months included Gross Motor and Expressive Language on the MSEL, and all VABS-II subscales. HR+ infants scored lower than HR- and LR infants on all MSEL and VABS subscales at 12 months. Mean AOSI total scores were higher in HR+ infants compared to both HR- and LR infants at 6 and 12 months (all $p<.05$). To further explore differences in behavioral profiles associated with ASD at 6 vs. 12 months, AOSI items were divided into two categories, the first indexing social communication and affective behaviors ('Social Affective'), and the second, composed of items

indexing other domains ('Other'). The HR+ group had elevated scores on the AOSI-Other item group at 6 months ($p < .004$, mainly 'motor control' and 'atypical motor behavior' items) and not AOSI-Social Affective ($p=.1$), whereas findings at 12 months were due to differences in AOSI-Social Affective ratings ($p<.001$) and not AOSI-Other ($p=.2$). To limit age variations within visits, sensitivity analysis allowing a tight optimal visit window revealed similar results.

Conclusions: Important differences during the first year were identified in this HR sample later assessed for ASD at 24 months. Delays in cognitive and adaptive skills and qualitative differences in motor behavior emerged at 6 months, whereas manifestations of more defining features (i.e., social affective atypicalities) were detectable at 12 months. These findings will be discussed in relation to volumetric and white matter findings from ongoing neuroimaging studies of the same sample.

135.002 The Attunement of Visual Salience From 2 until 24 Months in TD and ASD Infants. J. D. Jones*, A. Klin and W. Jones, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Throughout development, infants filter environmental information by specifically attending to stimuli they perceive to be salient, thereby restricting the information they process and learn from. While previous studies of social engagement have identified social vulnerabilities in infants with autism spectrum disorders (ASD) by assessing global looking patterns, these methods fail to capture dynamic, context-driven changes in infants' interest and attention. By dynamically assessing group agreement in visual scanning, we can define and quantify group tendencies in attention as well as individual deviation from group norms. Previous research suggests that dynamic measures of attention, as well as the timing of deviations in attention, may be useful in the early identification and characterization of ASD.

Objectives: This study aims to map developmental trajectories of visual attention in typically developing infants and infants with ASD to 1) identify physical and social stimuli that are salient to infants at various developmental milestones and 2) investigate the developmental process by which children with ASD construct alternative schemas of salience during infancy.

Methods: Data were collected prospectively and longitudinally from infants at high- or low-risk for ASD (infant sibling study design), and conventional diagnostic evaluations at twenty-four months defined 26 typically developing children (TD), and 13 children with confirmed ASD diagnosis. Eye-tracking data were collected during viewing of naturalistic movie scenes. Allocation of visual resources was quantified by kernel density analysis at each moment in time in TD children to create a continuously changing map of normative salience in relation to movie-content. This process was repeated to create differential landscapes of salience for infants with ASD.

Results: By 24 months of age, typical patterns of attention become stable and constitute a developmental baseline, providing a landmark for comparison in typically developing infants. In relation to this baseline, TD infants exhibit the following developmental milestones (in order of first emergence): dyadic attention to eyes (4 months), dyadic attention to mouths (5 months), triadic attention to faces (12 months), and triadic attention to body and gestures (18 months). During this period, TD infants gradually diminish their attention to physically salient stimuli in favor of more socially relevant content. In contrast, children with ASD begin to exhibit unique patterns of attention as early as 4 months of age, and individual measures of deviance from typical viewing patterns increase over time for children with ASD.

Conclusions: This research demonstrates that viewing patterns of TD infants serve evolving purposes related to their developmental goals. Additionally, the timing of attentional milestones suggests that triadic interactions become important later in development, and attention to faces is important earlier in their development than attention to body and gestures. This research also suggests that infants with ASD employ alternative attentional strategies during the first months of life that fail to capture certain experiences important for learning, resulting in deviant developmental trajectories. These measures of the dynamic allocation of visual resources may be useful in the early identification of risk for ASD as well as early treatment of the disorder.

135.003 "Sticky Attention" in Autism: Children Who Fail to Disengage Show Greater Symptoms and More Impaired Social Attention and Intersensory Processing. L. E. Bahrick*, J. T. Todd, J. Vasquez and B. Yusko, *Florida International University*

Background: Children with autism (ASD) show difficulty in disengaging attention away from competing stimulation to attend to a peripheral event (Landry & Bryson, 2004), similar to young infants (sticky attention; Hood, 1995; Johnson et al., 1991). In some studies, a subgroup of children with ASD completely fail to disengage attention and remain fixated on a competing stimulus on some trials. We assessed whether this subgroup of children with ASD also show greater symptom severity and greater impairments in social attention and intersensory processing (attention skills often impaired in ASD; see Bahrick & Todd, 2011). Such comparisons are possible with the Multisensory Attention Assessment Protocol (MAAP; Newell et al., 2007), a single test assessing four indices of attention (disengagement, orienting, maintenance, and intersensory processing) to dynamic, audiovisual social and nonsocial events.

Objectives: We identified a subgroup of children with ASD who, on the MAAP, showed a complete failure to disengage from a central stimulus (silently moving geometric shape) across at least one 10-s presentation of two dynamic audiovisual events. We assessed if this subgroup showed 1) greater symptom severity (SCQ and SRS), 2) increased latencies to disengage overall, 3) decreased attention maintenance, and 4) decreased intersensory processing, compared with TD children and children with ASD who disengaged.

Methods: Children with ASD (*N*=18; *M*=4.19 yrs, *SD*=.87), who passed the cutoff on the ADOS, and TD children (*N*=16; *M*=2.49 yrs, *SD*=1.15), roughly matched on Mullen adjusted age (ASD: *M*=2.30, *SD*=1.23; TD: *M*=3.44, *SD*=1.22), participated. In the MAAP, trials of the central visual event were followed 3s later by two side-by-side peripheral events (10s), with the natural soundtrack synchronized with one of the two events. Trials of social (woman speaking) and nonsocial events (objects striking a surface) were presented. Intersensory matching (looking to sound-synchronous events), attention maintenance, disengagement (RT to shift attention from the competing central event), and orienting (RT to shift attention without the competing central event) were assessed.

Results: ASDs overall showed greater symptom severity (SCQ & SRS T scores) than TD children ($p < .001$), however, ASDs who failed to disengage (*N*=10) showed greater symptom severity than ASDs who disengaged (*N*=8; $p<.05$). ASDs who failed to disengage showed no evidence of intersensory processing, greater latencies to disengage than orient attention, and decreased attention maintenance to social events compared to TD children and ASDs who disengaged ($ps<.05$). In contrast, TD children and ASDs who disengaged showed no attentional differences. Finally, none of the groups differed in overall orienting in the absence of competing stimulation, nor in attending to nonsocial events.

Conclusions: Findings demonstrate that children with ASD with the most extreme difficulties in disengaging attention also show the greatest symptom severity and greatest impairments in social attention and intersensory processing. These individuals can be identified using the MAAP, by a failure to disengage from a silently moving geometric shape across a 10s presentation of dynamic audiovisual events. These finding have potential for identifying individuals with ASD who are most impaired and could most benefit from interventions focused on attention and intersensory processing.

135.004 Developmental Trajectories of Attention to Social and Nonsocial Events As a Function of Chronological and Mental Age in Children with Autism and Typical Development. J. T. Todd*, L. E. Bahrick, J. Vasquez and B. Yusko, *Florida International University*

Background: Compared to typically developing (TD) children, children with autism (ASD) show impairments in intersensory processing and in maintaining and disengaging attention to social events (see Bahrick & Todd, 2011). Because symptoms of ASD increase across development, and children with ASD show wide variability in cognitive functioning, it is critical to assess which attention skills are maintained vs. become increasingly impaired across development, whether mental age (MA) is a better predictor of change, and how trajectories differ as a function of diagnostic group. These questions can

be addressed using the Multisensory Attention Assessment Protocol (MAAP; Bahrick & Todd, 2011; Newell et al., 2007), a comprehensive, nonverbal test of attention to dynamic audiovisual social and nonsocial events that assesses four fundamental indices of attention.

Objectives: We assessed developmental trajectories for attention disengagement, orienting, maintenance, and intersensory processing for social and nonsocial events across 2-5 years of age in children with ASD and TD. We evaluated whether skills increased, decreased, or were maintained across chronological age (CA) and whether MA was a better predictor and resulted in different trajectories compared to CA.

Methods: Children with ASD (*N*=18; *M*=4.19 yrs, *SD*=.87, range: 2.50 to 5.58 yrs), who passed cutoff on the ADOS, and TD children (*N*=26; *M*=3.15 yrs, *SD*=1.15, range: 1.75 to 5.75 yrs) participated. Mullen adjusted MA was calculated (ASD: *M*=2.30, *SD*=1.23; TD: *M*=3.44, *SD*=1.22). In the MAAP, trials of a central visual event followed 3 s later by two side-by-side peripheral events (10s) with the natural soundtrack synchronized with one of the events, were presented. Trials of social (woman speaking), and nonsocial events (objects striking a surface) were presented. Intersensory matching (looking to sound-synchronous events), attention maintenance, disengagement (RT to shift from the competing central event), and orienting (RT to shift without the competing central event) were assessed.

Results: Regression analyses revealed that with increasing CA, TD children showed increased attention maintenance and intersensory processing for social events (*p*s<.01). In contrast, children with ASD showed no significant changes across CA for any measure. MA was a better predictor of performance than CA in both groups (average R^2 increase=.11). As MA increased, TD children showed increased attention maintenance and intersensory processing for social events (*p*s<.05), whereas children with ASD showed increased attention maintenance and decreased latencies to disengage to social events (*p*s<.04), but no change in intersensory processing. No changes in orienting nor in attention to nonsocial events emerged for either group as a function of CA or MA.

Conclusions: Although TD children showed significant increases across CA in attention and intersensory processing of social events, children with ASD showed no significant change, indicating that they lose ground compared to TD children across 2-5 years of age. In contrast, ASDs showed increases as a function of MA in attention maintenance to social events (as did TDs) and faster attention shifting to social events. These findings indicated that MA is a significant predictor of social attention in ASD and with increasing MA, children with ASD show more typical attention patterns to social events.

135.005 ASD Toddlers Present Deficits in Their Ability to Track Social Cues of Others. E. B. Gisin*[1], A. Dowd[2], G. M. Chen[2], F. Shic[2] and K. Chawarska[2], (1) *Yale University School of Medicine*, (2) *Yale University School of Medicine*

Background: The ability to attend to the actions and social cues of others is critical to understanding what others are doing and why. A previous study has shown that the monitoring of the social activities of others is disrupted by the second year of life in ASD (Shic *et al*., 2010), with toddlers with ASD showing less attention towards activities and a greater focus on non-social background elements as compared to typically developing (TD) peers. It is unknown, however, under what conditions do these atypical attention processes manifest.

Objectives: To examine (1) how socially directed cues (looking, talking and/or pointing) by the adult toward the child effects the gaze patterns of observers (child-directed); (2) how patterns of attention vary depending on the presence and absence of social cues (e.g eye contact, talking, pointing, etc..) and (3) what associations exist between viewing patterns under these conditions and social and cognitive functioning in ASD.

Methods: Eye-tracking data was collected from toddlers with ASD (22 months; n=30) and TD controls (20 months, n=32). Subjects were shown a 30-second video of a female adult and a male toddler playing with a puzzle. To assess the influence of child-directed cues, three one-second intervals representing before, during and after the onset of the child-directed cues were analyzed. In addition, times without any

directed cues were isolated (i.e. the only activity is the child playing with the puzzle), to assess looking patterns in the absence of social cues. The proportion of looking time at different regions of interest within the scene for these specified times were analyzed between diagnostic groups (ASD or TD).

Results: In the absence of social cues, TD toddlers looked longer toward the interaction (p<.01), while ASD toddlers looked longer toward the background (p<.01). This pattern was also seen before the presence of a child-directed cue by the adult, with TD toddlers looked more toward the activity (p<.01) and ASD toddlers looked more toward the background (p<.01). Furthermore, during these times, no differences were seen in looking time toward people. However, during and after the social cue, TD toddlers looked significantly longer toward the actors' heads (p<.01, for both increments) while during the cue, ASD toddlers continued to look significantly longer at the background (p<.01). The significant between group differences in activity monitoring disappeared with the presentation of the child-directed cue.

Conclusions: Findings suggest that TD toddlers have an acute sensitivity in their ability to track characters and align with the characters' focus of attention. With the introduction of a child-directed social cue, TD toddlers were able to redirect their attention from the activity to the expected areas of interest, while ASD toddlers were not. Even in the absence of child-directed cues, the ASD toddlers have limited activity monitoring, confirming previous findings. These supplementary results suggest that ASD toddlers have a deficit in their ability to the track the social cues of others, suggesting that they may have difficulties with either acknowledging the cue, knowing how to react toward the cue, or possibly reacting slower.

135.006 Measuring Interactive Developmental Pathways in ASD: A Dual-Domain Latent Growth Curve Model. T. Bennett*[1], P. Szatmari[1], S. Hanna[2], M. Janus[1], E. Duku[1], S. Georgiades[1], S. E. Bryson[3], E. Fombonne[4], P. Mirenda[5], W. Roberts[6], I. M. Smith[3], T. Vaillancourt[7], J. Volden[8], C. Waddell[9], L. Zwaigenbaum[8] and A. Thompson[1], (1)*Offord Centre for Child Studies, McMaster University*, (2)*CANChild Centre for Childhood Disability Research, McMaster University*, (3)*Dalhousie University/IWK Health Centre*, (4)*McGill University*, (5)*University of British Columbia*, (6)*The Hospital for Sick Children*, (7)*University of Ottawa*, (8)*University of Alberta*, (9)*Simon Fraser University*

Background: Autism spectrum disorders (ASDs) are characterized by heterogeneity in both abilities and impairment across developmental domains. How quickly individuals with ASDs develop skills in one important domain [e.g., social competence (SC)] may affect the rate of acquisition of multiple abilities [e.g., language (LANG)] in a cascade-like fashion. Uncovering whether and how such dynamic processes occur is crucial to understanding the pathophysiology of ASDs and to developing more effective interventions. This is possible through modeling the interactions between simultaneously measured growth curves of different developmental domains using a latent growth curve (LGC) analysis approach.

Objectives: SC and LANG are key predictors of outcomes and foci of intervention for children with ASD. We therefore aimed to: a) determine whether SC and LANG varied significantly in a cohort of preschoolers with ASDs; and b) model dynamic interactions between initial levels and rates of change over 1 year in SC and LANG trajectories.

Methods: Data for 365 2- to 4-year-olds were obtained from a prospective longitudinal study of preschoolers recently diagnosed with an ASD in Canada. Children were assessed at time of diagnosis and then twice at 6-month intervals using the Vineland Adaptive Behavior Scale II Socialization domain as a measure of SC (relating to others, social play etc.) and the Preschool Language Scale 4 (Auditory Comprehension) as a measure of LANG. Latent variables represented the intercept (baseline level) and slope (rate of change) of SC and LANG. Models were developed to measure the associations between intercepts and slopes of the two developmental domains. These models were then compared in two groups: participants diagnosed before versus after the median age of diagnosis (39.5 months), and participants with cognitive abilities lower and higher than the sample median IQ of 55 as measured by the Merrill-Palmer-Revised Developmental Index.

Results: The LGC model demonstrated an excellent fit to the data (CFI=0.99; RMSEA=0.04). Initial levels (intercepts) and rates of change (slopes) in LANG and SC varied significantly between individuals. The intercept and slopes of SC were positively associated with the rate of change of LANG over the first year after diagnosis, with the rate of change in SC being more strongly predictive of LANG slope. Initial levels of LANG did not predict rate of change in SC in the overall sample. Children who were diagnosed before versus after 40 months of age differed only with respect to initial levels of LANG and SC. By contrast, children with higher IQ demonstrated significantly higher initial SC and LANG, and greater rates of change across both domains. Furthermore, initial LANG was a stronger predictor of subsequent growth in SC in the cognitively higher-functioning group compared to those with lower IQ.

Conclusions: Early social competence and its growth in the first year after diagnosis appear to be more important predictors of change in language ability than vice-versa. However, this growth appears to be moderated by IQ. These findings emphasize the importance of early ASD intervention focusing on social competence with additional interventions (e.g. language) tailored to children of differing cognitive abilities.

135.007 Unique Acoustic Characteristics of Children with Autism and Their Caregivers: A Comparison with Language Delayed and Typically Developing Counterparts. D. Xu*[1], J. Gilkerson[1], J. A. Richards[1] and S. Rosenberg[2], (1)*LENA Research Foundation*, (2)*University of Colorado Denver*

Background: Our previous research demonstrated the convenience of collecting naturalistic audio data for autism research using wearable recorders. The developed algorithm for automatic data analysis has demonstrated reliability and validity. Naturalistic daylong recordings capture the characteristic behaviors of children, their caregivers, and the interactions between them, providing an ecological means to study the entire natural environment of children with autism. The efficiency of this methodology facilitated data collection for samples of children with autism (ASD), children with language delay (LD) and typically developing children (TD). These data provide a unique opportunity to study both children and caregivers, and to examine acoustic characteristics that are unique to ASD children or their caregivers.

Objectives: Previous research reports higher f0 and f0 variation for ASD children, based on data from laboratory settings and comparison with TD children only. One objective of this study is to examine f0 using naturalistic data in large quantity and to compare to both TD and LD children. Unique acoustic characteristics for ASD children are studied. Similarly, we examine the acoustic patterns of caregivers to determine whether variations observed in the children hold for adults.

Methods: Daylong audio recordings were collected using wearable LENA recorders. The automated algorithm detected key-child, adults and other environment sounds. Human voice was further processed via phone recognition algorithms into four sound categories: consonant-like, vowel-like, non-speech-like and pause. We focus on key-child sounds and female adult sounds which are immediately adjacent to key-child and can thus be considered an approximation to caregiver's child-directed voice. Acoustic phonetic properties of f0 as well as duration, dB-level and spectrum-entropy for each sound category are studied and compared.

Results:

The dataset comprises 71 ASD children (228-recordings), 49 LD children (333-recordings) and 106 TD children (802-recordings). To some extent, higher f0 and f0 variation for ASD children are confirmed. However, LD children show similar patterns, reducing the uniqueness of this feature to ASD. As well, both ASD and LD children produce longer duration and higher duration variation than TD children. Interestingly, the dB-level of vowel-like sounds and the spectrum-entropy of unvoiced-consonant-like sounds are unique for ASD children compared with both LD and TD children. Caregiver's child-directed voice usually exhibits longer duration, higher dB and f0 for vowel-like sounds which are characteristics of motherese. These characteristics are further exaggerated for caregivers of ASD children. Non-speech-like sounds,

measured with spectrum-entropy, are also unique for the caregivers of ASD children.

ASD-versus-TD; ASD-versus-LD; LD-versus-TD; Feature

t(175)=5.9, p=1.6e-08; t(118)=4.8, p=3.9e-06; t(153)=0.03, p=0.98; Child-Vowel-dB

t(175)=5.2, p=5.2e-07; t(118)=3.6, p=5.5e-04; t(153)=0.74, p=0.46; Child-unvoiced-consonant-Spectrum-entropy

t(175)=4.6, p=7.7e-06; t(118)=3.1, p=2.3e-03; t(153)=0.48, p=0.63; Caregiver-Vowel-Duration

t(175)=7.1, p=2.9e-11; t(118)=5.1, p=1.1e-06; t(153)=0.93, p=0.35; Caregiver-Vowel-dB

t(175)=3.6, p=3.5e-04; t(118)=2.8, p=6.7e-03; t(153)=0.20, p=0.85; Caregiver-Vowel-f0

t(175)=6.2, p=3.2e-09; t(118)=4.7, p=6.0e-06; t(153)=0.71, p=0.48; Caregiver-Non-speech-like-sound-Spectrum-entropy

Conclusions: This study demonstrates an ecological way of studying both ASD children and their caregivers in natural home environments using audio recordings. Unique acoustic characteristics for both ASD children and their caregivers are found when compared with LD and TD counterparts. We discuss possible reciprocal effects child vocalization could have on caregiver's vocal output.

135.008 Motor Development and Its Relation to Cognitive and Language Development in Young Children At High Risk for ASD. R. J. Landa*, *Kennedy Krieger Institute*

Background: Motor abnormalities have been documented in children with autism spectrum disorders (ASD) from infancy into adulthood. In typical development, self-experience (self-generated action) is linked to social and language abilities. Early motor delay could interfere with the type of self-experience needed for healthy development in non-motor domains. Three prospective longitudinal studies of ASD have reported disruption in early motor development in 6-month-olds, with preliminary evidence that early delay in postural control is related to social and communication impairment, including ASD at 36 months. Also, motor impairments are reportedly associated with social and communication impairments in older children with ASD.

Objectives:

1. Determine rate of motor delay at 14, 24, and 36 months in siblings of children with ASD (sibs-A) with and without ASD outcome diagnosis (made at 36 months).
2. Determine whether children with ASD who exhibit motor delay have comparable language and non-verbal cognitive functioning as children with ASD whose motor development is within normal limits.

Methods: A prospective, longitudinal study of development was conducted involving younger siblings of children with ASD (sibs-A; n=204). Children were tested at 14, 24, and 36 months. At each age, the Mullen Scales of Early Learning was administered. Criterion for motor delay: Scoring >1.5 sd below the test mean on the Mullen Fine or Gross motor scale (Only the Fine Motor scale was administered at 36 months). Outcome diagnosis of ASD (n=52) was established at age 36 months based on expert clinical judgment and meeting ADOS criteria for ASD or autism.

Results: The proportion of sibs-A with motor delay increased with age in the ASD group, but not in the non-ASD sibs-A, as shown below.

Age	14 months		24 months		36 months	
Group	ASD	Non-ASD	ASD	Non-ASD	ASD	Non-ASD
Proportion with delay	19%	20%	45%	11%	63%	11%

Next, the ASD group was separated into two subgroups: No Motor Delay and Motor Delay. At 14 months, the ASD Motor Delay group scored significantly lower on the Mullen Visual Reception scale compared to the No Motor Delay group (p=.027). Mean Visual Reception T score for both groups was within a standard deviation of the mean, indicating average

nonverbal cognitive ability. At 24 and 36 months, the ASD Motor Delay group scored significantly lower than the No Motor Delay group on the Visual Reception and both language scales (p's<.001).

Conclusions: Motor delay increasingly becomes evident as children with ASD near the third birthday. Early in the second year of life, motor delay could not be attributed to nonverbal cognitive delay because nonverbal cognitive scores were within normal limits. Nonetheless, at subsequent ages, the Motor Delay ASD group was comprehensively impaired, and by 36 months, scored ~2 standard deviations below the No Motor Delay ASD group. Results indicate that early intervention for children with ASD should address motor functioning. Motor demands of speech targets (e.g., phonetic structure and motoric complexity) and of actions required for gesture or play activities should be carefully examined and modified according to children's motor abilities.

Core Symptoms Program
136 Core Symptoms
Chair: D. A. Fein *University of Connecticut*

136.001 Developmental Course of Symptom Severity in Preschool Children with ASD. P. Szatmari*[1], S. Georgiades[1], E. Duku[1], A. Thompson[1], S. E. Bryson[2], E. Fombonne[3], P. Mirenda[4], W. Roberts[5], I. M. Smith[2], T. Vaillancourt[6], J. Volden[7], C. Waddell[8] and L. Zwaigenbaum[7], (1)*Offord Centre for Child Studies, McMaster University*, (2)*Dalhousie University/IWK Health Centre*, (3)*Montreal Children's Hospital*, (4)*University of British Columbia*, (5)*The Hospital for Sick Children*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*

Background: Although it is generally well appreciated that the severity of ASD symptoms reduces over time, the timing and rate of that change is not well understood. Moreover, previous studies have generally considered ASD to be a homogenous disorder and thus have neglected the potential impact of clinical characteristics that could lead to the indentification of more homogeneous sub-groups.

Objectives: (a) To identify more homogeneous sub-groups of preschool children with ASD who show differential rates of change on a measure of autism severity; and (b) to identify predictors of sub-group membership as well as outcomes of those sub-groups.

Methods: 420 children with ASD 2-4 years of age were assessed soon after receiving an initial diagnosis of ASD, and then 6 and 12 months later and then at 6 years of age. ASD symptom trajectories based on the severity metric of the ADOS were used to identify more homogeneous sub-groups. Possible predictors of group membership included language skills (PLS-4), developmental level (MP-R), age at diagnosis, and sex. Outcome measures included adaptive behaviour functioning (VABS II), internalizing/externalizing problems (CBCL), and parent report ASD symptoms (ADI-R). Semi-parametric group based modeling (PROC TRAJ) of longitudinal data was used to identify distinct trajectories. Analysis of variance (ANOVA) and cross tabulations using chi-squared tests were used to examine trajectory group differences on predictor and outcome variables.

Results: Two distinct developmental trajectories of ADOS severity were identified in preschool children with ASD. Group 1 (11% of the sample) showed a significant reduction (declining trajectory; p<0.001) in symptom severity as indexed by the ADOS; the other group showed no significant change. Children in Group 1 had higher language skills (p=0.029) at baseline but there was no difference in IQ, age of diagnosis, or sex. Children in Group 1 had higher adaptive functioning skills (p=0.001) and fewer internalizing/externalizing problems (p=0.013) at age 6. On the ADI-R, children in Group 1 had lower social and communication domain scores (p=0.001 for both) at age 6. In terms of ADOS classification, in Group 1 there was a significant shift from Autism/ASD to non-ASD during T1 to T4 (p<0.001). There was little or no change in ADOS classification in Group 2.

Conclusions: These results suggest that there are at least two sub-groups of children with ASD that show different rates of change on the ADOS severity metric from the point of initial diagnosis at 2-4 years of age until 6 years. The existence of those two groups is also validated through differential patterns of predictor and outcome variables. At least 10% of preschool

ASD children show notable improvement in autism symptoms over the first few years. This finding emphasizes the heterogeneity of the prognostic course in ASD and might be used to generate new hypotheses with respect to the clinical variables that influence the developmental trajectories of children with ASD.

136.002 Assessment of Social Communication in Infants At High Risk for Autism Spectrum Disorders: A Comparison of Contexts. M. V. Parladé* and J. M. Iverson, *University of Pittsburgh*

Background: In addition to demonstrating impairment in gesture production and use of eye gaze to coordinate attention, children with autism spectrum disorders (ASD) have difficulty producing these behaviors in combination (e.g, Wetherby et al., 2004). However, communicative performance in these children appears to be strongly influenced by contextual variations (e.g., Lewy & Dawson, 1992; Sigman et al., 1986). Therefore, it may be important to measure social communication behaviors in multiple contexts when evaluating for ASD in infancy. This study examined whether infants at heightened ASD risk (later-born siblings of children with autism; HR) demonstrate variability in communication skills across unstructured (naturalistic and toy play) and structured (Early Social Communication Scales; ESCS) contexts.

Objectives: To assess the extent to which production and temporal coordination of social communicative behaviors in HR infants vary as a function of interactional context.

Methods: Fifty HR infants (44% male) were observed at home with a primary caregiver at 8, 10, 12, 14, and 18 months of age. At 24 and/or 36 months, all infants were given a diagnostic evaluation (i.e., ADOS and clinical judgment using DSM-IV-TR criteria by a trained clinician blind to all previous study data); eight infants received a diagnosis of ASD. All infant-initiated gestures, eye gaze, and gesture+eye gaze combinations were coded during a) naturalistic interaction consisting of everyday household activities and toy play with caregiver, and b) semi-structured assessment designed to elicit social communication behaviors (i.e., ESCS).

Results: Preliminary data were subjected to a two-way repeated-measures ANOVA with Age and Context as within-subjects factors. With regard to the mean number of gestures produced at each session, the Age x Context interaction was significant, $F(3,54) = 5.285$, $p = .003$. The frequency of gestures increased steadily with age in the ESCS context; however, the mean frequency of gestures produced in the naturalistic context was lower than in the ESCS context and remained so over time. Regarding the mean frequency of gestures coordinated with eye contact, again, there was a significant Age x Context interaction, $F(3, 54) = 6.717$, $p = .001$. Specifically, gestures coordinated with eye contact occurred at a greater frequency in the naturalistic context at 8 and 10 months but not after 12 months. Beyond 12 months of age, gesture + eye gaze coordinations were more frequently observed in the highly structured ESCS context. In both analyses, the difference between contexts was most dramatic at the 14 month observation. Results suggest that observed frequency of communication in HR infants is highly susceptible to differences in the degree of structure afforded by the measurement context, particularly after 12 months of age.

Conclusions: Contexts that offer more structure may provide a better indication of overall communicative competence, while familiar settings with familiar social partners may offer a more accurate picture of infants' day-to-day behavior. Results of this study suggest that each methodology provides unique and valuable information about the development of social communication skills, and that naturalistic communication samples should be utilized in concert with standardized assessments in evaluating children at risk for ASD.

136.003 Profiles of Sensory Processing in Children At High and Low Genetic Risk for ASD. M. Levine*[1], K. Caravella[2], Y. Stern[3] and C. A. Saulnier[4], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine* , (3)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (4)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine*

Background: Research has shown that as many as 95% of children with ASD exhibit some atypical sensory processing behaviors (Tomchek & Dunn, 2007). However, patterns of sensory processing are still not well understood, particularly in toddlers with varying developmental risk factors, with only one study to date finding low-registration and sensory-avoiding behaviors to be most prevalent in such a young cohort of children (Ben-Sasson et al., 2007).

Objectives: This study investigates sensory processing profiles in toddlers with and without risk for ASD using the Infant/Toddler Sensory Profile (Dunn & Daniels, 2002). Given the forthcoming criteria in the DSM-V for ASD that includes symptomatology of atypical sensory reactivity, profiles are also examined in comparison to autism symptomatology, developmental and adaptive behavior, and age.

Methods: The Infant/Toddler Sensory Profile (ITSP) was administered to 82 children at three different developmental points during a longitudinal study on infants at risk for ASD. Mean age at the first visit was 12.02 months (SD=0.62), at the second visit was 18.15 months (SD=0.71), and at the third visit was 21.46 months (SD=0.66). Fifty of these children (72.7% male) were at high-risk for developing ASD (i.e., Siblings) and 32 (41.7% male) were low-risk (i.e., non-Siblings). At 24-months, 8 children received confirmatory diagnoses of ASD. Developmental, adaptive, and diagnostic measures included the *Mullen Scales of Early Learning,* the *Vineland Adaptive Behavior Scales*, and the *ADOS, Toddler Module*, respectively.

Results: At 24 months, Siblings showed a significant difference in the ITSP domain of Sensation Avoiding [$F(1,80) = 6.01$; $p<.05$] as compared to non-Siblings. For these high risk children, positive correlations were observed between Vineland Socialization scores at 24 months and Sensation Avoiding behaviors at 12 months ($r = .48$, $p<.01$), 18-months ($r = .35$, $p<.05$), and 24-months ($r = .42$, $p<.01$) respectively, indicating that these symptoms were significantly impacting adaptive social functioning by age 2. These associations were not observed in low-risk children. When children were grouped according to diagnostic outcomes at 24-months, significant Sensation Seeking symptoms were evidenced in ASD at 24 months [$F(1,77)=4.93$; $p<.05$], whereas Sensation Avoiding [$F(1,77)=13.18$; $p<.01$] and Low Registration [$F(1,77)=4.03$; $p<.05$] behaviors were more prominent in ASD at 18 months.

Conclusions: This study confirms that toddlers with ASD exhibit atypical sensory-avoidant and low registration symptoms, but only at 18 months, whereas sensory-seeking behaviors appear more prominent at 24-months of age. Of importance, significant findings were observed just based on risk-status alone, with siblings of children with ASD experiencing sensory-avoidant behaviors, as well, particularly at 24 months of age. High-risk siblings also display greater social impairments at 24 months, as compared to children at low risk for ASD. These results suggest that the sensory profile may be important in assisting with the early detection of risk factors for ASD, especially in younger siblings who are at much greater risk than the general population.

136.004 Longitudinal Associations Between An Eye-Tracking Measure of Social Responsiveness and Social Symptoms. K. Gillespie-Lynch*[1], M. Sigman[2], S. P. Johnson[2] and T. Hutman[3], (1)*UCLA*, (2)*University of California, Los Angeles*, (3)*UCLA Center for Autism Research and Treatment*

Background:

Reduced responsiveness to joint attention (RJA) is an early predictor of autism (Rozga et al., 2011; Landa et al., 2007, Sullivan et al., 2007; Yoder et al., 2009) that is associated with long-term outcomes (Sigman & Ruskin, 1999; Gillespie-Lynch et al., 2011). While retrospective analyses suggest that children who are later diagnosed with autism exhibit reduced social responsiveness by 6 months of age (Maestro et al., 2002), few behavioral differences between autistic and non-autistic infants have been demonstrated prospectively prior to 12 months (Yirmiya & Charman, 2010). Infants later diagnosed with autism exhibited reduced RJA during an in-person assessment at 12, but not 6, months of age (Rozga et al., 2011). Perhaps an eye-tracking measure of RJA might detect symptoms earlier than in-person measures have?

Objectives:

1. Determine if an eye-tracking measure of RJA is associated with autism symptoms at 24 months.

2. Assess relations between eye-tracking RJA and language development.

Methods:

Infant siblings of children with autism participate in a longitudinal study at 6, 12, 18, 24, and 36 months of age. An eye-tracking measure of RJA is administered each visit. During eye-tracking, infants watch a video of a model fixating 1 of 2 objects while eye movements are recorded with a Tobii 1750 eye tracker. Each trial consists of a baseline phase, a social greeting, and the model turning toward an object for 5 seconds. Social attention is indexed by the overall duration of time the infant attends to the model during the social greeting. RJA is calculated by dividing the number of trials wherein the infant first looks toward the object that the model is attending to by the number of usable trials. Language is assessed at each time point with the Mullen Scales of Early Learning. Social symptoms and restricted, repetitive behaviors are calculated from the Autism Diagnostic Observation Schedule (ADOS: Gotham, Risi, Pickles, & Lord, 2007) administered at 24 months. Diagnostic outcomes will become available this year.

Results:

Six month (r (11) =-.638, p= .044) and twelve month (r (21) =-.517, p= .016) social attention was associated with 24 month social symptoms. Eye-tracking RJA at 6 and 12 months was not associated with 24 month symptoms (p>.05). Six month eye-tracking RJA was associated with expressive (r (19) =.511, p= .025) and receptive (r (19) =.582, p= .009) language at 12 months of age. No relations between eye-tracking RJA at 12 months and language were observed (p>.05).

Conclusions:

The observed link between social responsiveness and subsequent autism symptoms is consistent with retrospective analyses (Maestro et al., 2002). Social attention may be an earlier predictor of social symptoms than RJA. Indeed, reduced social interest in autism may contribute to atypical RJA (e.g. Dawson et al., 1998). Eye-tracking RJA at 6 but not 12 months predicted language development. While eye-tracking RJA measures a similar construct as in-person measures of RJA, eye-tracking may be less effective at eliciting RJA (Navab et al., 2011). Interactive RJA assessment may mirror the contingencies of language learning situations better than pre-recorded stimuli.

136.005 Emotion Recognition in Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD): An Analysis of Dimensional Constructs of the Phenotype and Their Co-Occurrence.

K. L. Ashwood*[1], B. Azadi[1], S. Cartwright[1], P. Asherson[1] and P. F. Bolton[2], (1)*Institute of Psychiatry, Kings College London*, (2)*Institute of Psychiatry*

Background: Deficits in the recognition of facial affect have been reported in both children and adolescents with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD). However, few studies have examined emotion recognition performance using both categorical and dimensional concepts of the phenotypes. Here we explored the correlations between facial affect recognition performance and traits of ASD and ADHD.

Objectives: The current study examined dimensional measures of behaviour in four categorically defined groups with ASD, ADHD, ADHD+ASD and controls, to assess whether emotion recognition abilities were related to ASD and ADHD traits within and across disorders.

Methods: 113 males between the ages of 7 and 16 took part in the study. Included were individuals who, according to the DSM-IV, fulfilled the diagnosis of an ADHD (n=33) or ASD with (n=39) and without comorbid ADHD symptoms (n=17) and healthy controls (n=24) with an IQ>70. Both SCQ and Conners questionnaire scores provided a measure of parent-reported ASD and ADHD traits for all participants. Facial affect recognition was assessed using labelling and same/different discrimination computer tasks, with negative emotions (sad, angry, fear, disgust) from the Facial Expression of Emotion: Stimuli and Tests (FEEST) at three different intensities (25%. 50%, 75%).

Results: Correlational analysis using bias corrected scores across the whole sample revealed that fewer ASD traits were associated with more accurate performance on the labelling

task (r=-.29, p=.001), but not the discrimination task (p≥.10). The same pattern of results was shown for both inattentive traits (r_s=-.21,p=.02) and hyperactive/impulsive traits (r_s=-.25, p=.01). However, after controlling for FSIQ only the association between ASD traits and emotion labelling ability remained significant.

Conclusions: The current results suggest that the correlations between emotion recognition performance and ADHD traits is dependent on IQ, whereas ASD traits are associated with performance on facial affect recognition tasks even after controlling for IQ. Overall, the findings support an association between ASD traits and emotion labelling abilities which may suggest a fundamental problem in identifying and processing emotion, independent of general cognitive ability.

136.006 Respiratory Sinus Arrhythmia in Children with ASD: A Biomarker for Positive Functioning. M. Patriquin[1], A. Scarpa*[1], B. H. Friedman[1] and S. W. Porges[2], (1)*Virginia Tech*, (2)*University of Illinois at Chicago*

Background: Emerging neurovisceral evidence suggests that children and adolescents with autism spectrum disorders (ASD) demonstrate lowered respiratory sinus arrhythmia (RSA) at baseline compared to their typically developing peers (Bal et al., 2010; Van Hecke et al., 2009). Further, RSA patterns in ASD have been correlated to challenges in social development that characterize autistic symptomatology (Van Hecke et al., 2009). Although these recent data suggest decreased RSA in children and adolescents with ASD, which is indicative of a chronically mobilized state, hypotheses regarding autonomic variables and ASD have been articulated since the 1960s. With the improvement of data analysis and collection techniques, past hypotheses of brainstem mechanisms of ASD symptoms (MacCulloch & Williams, 1971) are being understood through current theoretical models (Porges, 2004) and data (Bal et al., 2010; Denver, 2004; Ming, Julu, Brimacombe, Connor, & Daniels, 2005). More specifically, studies indicate that hyper-arousal (i.e., decreased RSA) is associated with more ASD symptomatology, and, conversely, that higher RSA and thus vagal regulation of the heart is associated with more positive functioning in ASD.

Objectives: The objectives of this study were to examine vagal regulation of the heart via RSA in children with ASD. We predicted that children with higher baseline RSA would demonstrate appropriate autonomic regulation to an attention-demanding task (i.e., decreased RSA to task, increased RSA at recovery), higher receptive language ability, and better social functioning.

Methods: Twenty-three young children (aged 4 years, 3 months to 7 years, 9 months; M = 5.72, SD = 1.17) with prior diagnoses of Autistic Disorder (n = 12), Asperger's Disorder (n = 10), or Pervasive Developmental Disorders – Not Otherwise Specified (n = 1) participated in the study. Participants were administered the PPVT-III. Baseline heart period (HP) data were collected during a neutral 3-minute video and attention-demanding task (audiobook or music listening, 12 min) with the LifeShirt® ambulatory heart monitor. Children were administered the Social Interaction Coding Scale (SICS; Bazhenova, 2006), a semi-structured play task. HP data were edited with CardioEdit and CardioBatch (Brain-Body Center, University of Illinois at Chicago; Porges, 1985)

Results: Higher baseline RSA amplitude was correlated with greater RSA reactivity during an attention-demanding task during task period #1 (min 1-3), r = -.60, p = .003 and to task #2 (min 10-12), r = -.69, p < .001. It was also related to greater recovery, r = -.58, p = .01. Higher baseline RSA was correlated with higher receptive language ability, r = .44, p = .04, better joint attention, r = .48, p = .03, and more conventional gestures, r = .60, p = .004.

Conclusions: Our results suggest that RSA may function as a biomarker for more positive autonomic, cognitive, and social functioning in ASD. Due to the neural structures involved in regulating vagal influences on the heart, which are manifested in RSA, future research directions will be discussed that explore simultaneous monitoring of central nervous system activity and RSA in ASD.

136.007 Respiratory Sinus Arrhythmia and Facial Electromyography in Children with ASD. E. Bal*[1], E.

Harden[2], A. V. Van Hecke[3], D. Lamb[4] and S. W. Porges[2], (1)*Children's National Medical Center*, (2)*University of Illinois at Chicago*, (3)*Marquette University*, (4)*Emory University*

Background: Previous research suggests that children with autism spectrum disorders (ASD) demonstrate lower respiratory sinus arrhythmia (RSA) at baseline compared to typically developing (TD) children (Bal et al., 2010; Ming et al., 2005; Van Hecke et al., 2009). These findings indicate a mobilized physiological state that would be consistent with the frequently observed features of anxiety. In addition, higher RSA has been related to better social skills ratings (Van Hecke et al., 2009) and faster emotion recognition (Bal et al., 2010) in children with ASD. Facial expressions are major components of social interaction and communication, and individuals with ASD are known to have a limited range of facial expressions (APA, 1994). However, the literature evaluating facial expressions using facial electromyography (EMG) in children with ASD has been limited, and the relationship between RSA patterns and EMG has not been explored.

Objectives: The current study explored the relation between facial EMG and RSA in children with ASD and TD children. It was hypothesized that children with ASD would show different patterns of EMG activity and would be less reactive to presented affective expressions in comparison to TD children. Further, it was expected that RSA would be positively related to emotional expressivity (i.e., children with higher RSA would show more EMG reactivity).

Methods: Seventeen children with ASD (*M* age =10.30 years, *SD* = 2.22) and 36 TD children (*M* age = 11.16 years, *SD* = 2.89) matched on age, sex, and IQ participated in the research. Two minutes of baseline heart period (HP) data were collected. Using the Dynamic Affect Recognition Evaluation (DARE; Porges, Cohn, Bal, & Lamb, 2007) software, participants were shown videos displaying a face starting with a neutral expression and slowly transitioning into one of the six emotions (i.e., anger, disgust, fear, happiness, sadness, surprise). HP and facial EMG data over the corrugator supercilii (i.e., CS, eyebrow region) and zygomaticus major (i.e., ZM, cheek region) regions were collected continuously during the presentation using Biopac Systems. HP data were edited with CardioEdit and RSA was calculated with CardioBatch (Brain-Body Center, University of Illinois at Chicago).

Results: Children with ASD had significantly lower baseline RSA than TD children (F (1,51) = 4.25, p = .045, previously published, see Bal et al., 2010). Paralleling this group difference in RSA, preliminary analyses of the EMG data suggest that children with ASD were selectively more reactive in the ZM muscle region (i.e., lower face) than the CS muscle region (i.e., upper face), F (1, 12) = 6.650, p = .024. Additional analyses are being conducted to expand the sample size and to evaluate possible emotion specific differences between the groups in EMG activity as well as correlations between EMG activity and RSA.

Conclusions: Previous studies indicate a strong relationship between RSA and social skills, including emotion recognition, in children with ASD. The current study extends previous research and explores the relationship between RSA and facial expressions measured by facial EMG. Data continue to be analyzed. Final results and future research directions will be discussed.

136.008 Language Profiles of Individuals with a History of ASD Who Have Optimal Outcomes. K. E. Tyson*[1], E. Troyb[1], A. Orinstein[1], L. Best[2], M. Helt[1], I. M. Eigsti[1], M. Barton[1], L. Naigles[1], E. A. Kelley[2], M. A. Rosenthal[3], M. C. Stevens[4], R. T. Schultz[5] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Queen's University*, (3)*Children's National Medical Center, Center for Autism Spectrum Disorders*, (4)*Institute of Living, Hartford Hospital / Yale University*, (5)*Children's Hospital of Philadelphia*

Background: A study is currently following children who have a history of autism spectrum disorder (ASD), but who no longer meet diagnostic criteria for such a disorder. These children have achieved social and language skills within the average range for their ages and receive little or no school support. Several recent studies suggest that this small subset of children, once diagnosed with ASDs, achieve "optimal outcomes" (OO; Sutera et al., 2007; Helt et al., 2008; Kelley, Naigles, & Fein, 2010). Kelley, Naigles, & Fein (2010) found

that their OO group showed some small, but notable differences in language scores compared to a typically developing group.

Objectives: The current study examines language skills as measured on the Clinical Evaluation of Language Fundamentals, 4th Edition (CELF-IV), California Verbal Learning Test (CVLT), Comprehensive Test of Phonological Processing Nonword Repetition subtest (CTOPP NR), and Test of Language Competence (TLC) in a cohort of OO individuals. The study compares these language abilities in the OO group to abilities in a group of individuals with high-functioning autism (HFA) and a group of typically developing (TD) individuals.

Methods: Participants included 32 OO individuals, 34 HFA individuals, and 30 TD individuals. Participants were matched on sex, age (M(OO) = 12.75, SD = 3.30; M(HFA) = 13.28, SD = 2.67; M(TD) = 13.80, SD =2.63), and performance IQ (M(OO) = 112.81, SD = 14.41; M(HFA) = 110.45, SD = 14.03; M(TD) = 113.43, SD = 11.45). Verbal IQ scores, although all within the average range, differed significantly across the groups (M(OO) = 112.66, SD = 13.83; M(HFA) = 102.85, SD = 12.29; M(TD) = 111.77, SD = 10.57, $p < .01$). We compared the three groups' performance on four tests of language ability.

Results: We performed ANOVAs to assess group differences in overall performance on language testing. On the CELF-IV Core Language composite, the OO, TD, and HFA groups scored significantly differently from each other (M(TD) = 118.00, SD = 6.73, M(OO) = 109.70, SD = 10.97, M(HFA) = 97.58, SD = 16.59, $p<.05$), though well within the average range. On both the CVLT and CTOPP NR, there were no significant differences across groups. Lastly, on the TLC, a measure of pragmatic language abilities, there were significant differences between the HFA and both the OO and TD groups on the Making Inferences subtest (HFA<OO, TD $p<.01$). On the TLC Figurative Language subtest, there were significant differences between all three groups (HFA<OO<TD, $p<.01$).

Conclusions: Data were collected from a group of OO individuals who *no longer meet criteria* for ASD on the ADOS. They also scored within the average range on all language measures. However, despite their generally strong language skills, these OO individuals scored significantly worse than TD peers on measures requiring them to interpret figurative language. Thus, given their high IQs, these OO individuals appear to be exhibiting relative weaknesses compared to TD peers in some language skills. However, they are doing well overall, as their scores consistently fell within the average range across language domains.

Stakeholder Experience Program
137 Stakeholder Experience
Chair: A. Singer *Autism Science Foundation*

137.001 Beyond ASD: Developmental Outcomes of High Risk Siblings. D. S. Messinger*[1], G. S. Young[2], S. Ozonoff[2], L. Zwaigenbaum[3], K. R. Dobkins[4], A. S. Carter[5], T. Charman[6], R. J. Landa[7], M. S. Strauss[8], J. N. Constantino[9], S. E. Bryson[10], L. J. Carver[4], T. Hutman[11], J. M. Iverson[8], S. J. Rogers[2], M. Sigman[11], W. L. Stone[12] and Z. Warren[13], (1)*University of Miami*, (2)*UC Davis M.I.N.D. Institute*, (3)*University of Alberta*, (4)*University of California, San Diego*, (5)*University of Massachusetts Boston*, (6)*Institute of Education*, (7)*Kennedy Krieger Institute*, (8)*University of Pittsburgh*, (9)*Washington University School of Medicine*, (10)*Dalhousie University/IWK Health Centre*, (11)*University of California, Los Angeles*, (12)*University of Washington*, (13)*Vanderbilt University*

Background: The Baby Siblings Research Consortium (BSRC) recently reported that 18.7% of high risk infant siblings of children with autism spectrum disorders (ASD) will themselves develop an ASD (Ozonoff et al., 2011). However, the three-year outcomes of high-risk siblings who do *not* have an ASD have not yet been well characterized.

Objectives: Describe three-year-old, non-diagnosed high-risk siblings with respect to ASD-related symptom severity and developmental functioning—and identify latent subgroups of high-risk siblings.

Methods: This multisite BSRC dataset included 508 high-risk (HR) siblings with no ASD diagnosis and 324 low-risk (LR) controls (i.e., no known relatives with ASD) with no ASD

diagnosis. Model building employed negative binomial regression analyses of Autism Diagnostic Observation Schedule (ADOS) severity scores that varied from 1-10 (Gotham, Pickles, & Lord, 2009). Latent class analyses were used to identify clusters of three-year-olds based on ADOS severity and Mullen Verbal (V) and Non-Verbal (NV) Developmental Quotients (DQs). The latent class analysis included the 447 HR siblings and 197 LR controls for whom requisite data were available.

Results:

The ASD symptom severity scores of HR siblings (M=2.19, SD=1.76) were significantly higher than those of LR controls (M=1.64, SD=1.22), X^2=13.99, df=1, p<.001. The verbal DQ of the HR group (M=104.28, SD=17.39) was significantly lower than that of the LR group (M=110.47, SD=15.97; t=3.81, p<.01). The non-verbal DQ of the HR group (M=107.50, SD=17.10) was significantly lower than that of the LR group (M=111.60, SD=15.36; t=2.76, p<.01.

Evaluation of the latent class analysis using Bayesian Information Criteria indicated a best-fitting five cluster solution (see Table 1). High risk children were under-represented in Cluster 1 (low ASD symptom severity and high DQ). They were over-represented in Clusters 4 (low symptom severity and low DQ) and 5 (moderate symptom severity and moderately low DQ).

Table 1							
	Measures			Status			
Clusters	ADOS Severity	Verbal DQ	Non-Verbal DQ	Low Risk	High Risk	HR/LR Odds Ratios (95% CI)	
1. Low Symptom Severity, High DQ	1.2	119	122	49%	35%	**0.56 (0.40-0.79)**	
2. Low Symptom Severity, Typical DQ	1.3	99	102	34%	30%	0.85 (0.59-1.21)	
3. Moderate Symptom Severity, High DQ	4.3	113	113				
4. Low Symptom Severity, Low DQ	1.3	77	82				
5. Moderate Symptom Severity, Moderately Low DQ	5.1	89	89				

Note. Bolded Odds Ratios, $p < .05$.

Conclusions: At three years, HR children without an ASD had higher levels of ADOS symptom severity, and lower levels of developmental functioning than LR children. They were more likely to occupy clusters characterized by lower levels of developmental functioning, and less likely to occupy a cluster characterized by higher levels of developmental functioning and low levels of symptom severity. Descriptively, two-thirds of HR children occupied Clusters 1 and 2, characterized by normative outcomes, whereas one third occupied Clusters 3, 4, and 5, characterized by elevated ADOS severity, lower developmental quotients, or both. These results suggest an early 'broader autism phenotype' in HR siblings characterized by ASD symptoms sub-threshold for diagnosis and/or developmental delays.

137.002 Shared Decision Making (SDM) and the Treatment of Autism Spectrum Disorders (ASDs). S. E. Levy*[1], S. Colantonio[2], H. Reed[2], G. Stein[3], V. McGoldrick[2], D. S. Mandell[4] and A. G. Fiks[1], (1)*Children's Hospital of Philadelphia/ University of Pennsylvania*, (2)*Children's Hospital of Philadelphia*, (3)*Center for Autism Research*, (4)*University of Pennsylvania Perelman School of Medicine*

Background: While many pediatricians are comfortable managing children with disorders such as ADHD that is not necessarily the case with ASDs. Discomfort may be increased when families pursue novel or complementary and alternative

medical (CAM) treatments. Shared decision making (SDM) is a process that includes participation by both physicians and family members, who share information, reach a consensus and then agree on a treatment to implement. SDM is especially useful when there are multiple treatment options with distinct risks and benefits that families value differently, as is found with many treatments offered for ASDs.

Objectives: The purpose of this qualitative study is to examine factors influencing shared treatment decisions by primary care pediatricians (PCP) and families of children with an ASD, and to compare treatment related preferences, goals, and needs. Identifying these factors will help clinicians and families collaborate more effectively to implement an evidence-based treatment plan.

Methods: We conducted semi-structured interviews with 20 primary care pediatricians at Children's Hospital of Philadelphia (64% female, 93% Caucasian, 7% Asian) and 20 parents of children 3-5 years of age (13% Asian, 20% African American, 67% Caucasian) with a reported ASD diagnosis. Interviews were audio taped, transcribed verbatim and analyzed with NVivo9© software. The research team employed a modified grounded theory approach and identified common and differing themes.

Results: We identified four primary themes. (1) Role of the PCP: many parents did not expect their pediatrician to make ASD-specific treatment recommendations, in fact they often did not think of speaking to them about treatment options. Pediatricians were comfortable making referrals to early intervention, but reported inadequate training to advise families about specific ASD treatments or referrals. (2) Treatment choice: this was an area of conflict for parents and clinicians, especially when parents discussed CAM treatments. When parents did discuss CAM treatment, they reported difficulty engaging their PCP in a discussion. Most PCPs did not feel trained or competent to discuss the merits or problems of CAM treatments. (3) Barriers to care: both parents and clinicians recognized similar barriers to ASD treatment receipt (delays in obtaining evaluations, costly treatments, and a lack of treatment providers). While parents did not view pediatricians as a primary source of treatment advice, they did view them as a potential resource to coordinate care and overcome these barriers. (4) Caregiver stress: families experienced great stress. They often found support in the community and many did not perceive that their pediatricians knew how to support them.

Conclusions: Our study identified multiple areas to be addressed for SDM to be possible for the treatment of ASD in primary care. Many pediatricians do not view ASD treatment as within their scope of practice, and, even clinicians interested in managing ASD, lack training. Families need to be guided regarding what to realistically expect from their PCP and how to work with them to decrease stress and access appropriate resources.

137.003 Prevalence and Consequences of Elopement in Autism Spectrum Disorders. P. A. Law*[1], J. K. Law[1], C. M. Anderson[1], A. M. Daniels[2] and D. S. Mandell[3], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins Bloomberg School of Public Health*, (3)*University of Pennsylvania Perelman School of Medicine*

Background: Death, injury, and major family burden due to elopement behavior in children with autism spectrum disorders (ASD) have been reported, yet there has been virtually no research on this topic. In response to the Interagency Autism Coordinating Committee's urgent call for data to address this gap, the Interactive Autism Network (the largest web-based autism registry), in partnership with diverse advocacy organizations, deployed an online *Elopement and Wandering Questionnaire* to families of children with ASD.

Objectives: The aim of this study was to provide a preliminary estimate of elopement prevalence among children with ASD. Predictors and consequences of elopement were also evaluated.

Methods: Elopement was assessed in children age four through seventeen. In addition to elopement frequency and age of occurrence, parents were asked if their child had ever gone missing long enough to cause concern, to describe consequences of the behavior, and to report what motivated their child's elopement. The final study sample included 1,367 children with ASD. The association between child sociodemographic and clinical characteristics and elopement risk was estimated using a Cox proportional hazards model.

Results: Forty-eight percent (n=661) of survey respondents reported that their child had attempted to elope at least once at age four or older; 26% (n=358) were missing long enough to cause concern. Of these, 65% reported a close call with traffic injury and 26% a close call with drowning. Police were contacted in 36% of cases. Elopement rate decreased with age but began to increase during adolescence. Compared with affected children, unaffected siblings had significantly lower rates of elopement across all ages. After adjusting for other characteristics in the model, children who screened positive on the Social Communication Questionnaire had more than a two times increased risk of elopement compared with children with negative screens (RR 2.05, 95% CI: 1.17, 3.61) and, on average, the risk of elopement increased by one percentage point for every one point increase in Social Responsiveness Scale t-score (RR 1.01, 95% CI: 1.00, 1.02). Motivation for affected children's elopement was typically goal-directed. Children whose parents believed they eloped because they enjoyed running/exploring were significantly more likely to have a diagnosis of autistic disorder or "other ASD" ($p<.001$), while parents of children with Asperger's disorder were more likely to report that elopement was driven by the need to escape an anxious situation ($p<.001$).

Conclusions: Nearly half of children with ASD engage in elopement behavior, a much higher rate than that of their typical siblings, and more than a quarter go missing long enough to cause concern. Likelihood of elopement is positively correlated with autism severity, and elopement behavior is often goal-directed. This critical information is already being used by families, advocates, and policy makers, and has played a role in the adoption of an ICD-9 code for ASD-related "wandering." The speed with which data were collected and employed demonstrates the potential of an online registry of engaged families working in partnership with committed advocacy groups.

137.004 Polypharmacy Profiles and Predictors Among Adults with Autism Spectrum Disorders. J. K. Lake*[1], Y. Lunsky[2] and K. Azimi[1], (1)*University of Toronto*, (2)*Centre for Addiction and Mental Health*

Background: Mental health and behavioural issues are extremely common in individuals with autism spectrum disorders (ASD) and the primary treatment for these issues is pharmacological. Recent studies estimate that over one half of young people with ASD are prescribed psychotropic medications with one fifth taking two or more (Aman, Lam, et al., 2003; Langworthy-Lam, et al., 2002; Mandell, at al., 2008). Greater age, more restrictive housing, and more severe autism are all associated with increased medication use (Aman, et al., 2003; 2005). Despite this, very few studies have examined drug prevalence rates or patterns of medication use among adults with ASD.

Objectives: To examine the medication profiles and risk factors for polypharmacy in a clinical sample of Canadian adults with ASD.

Methods: As part of a larger project examining behavioural crises and developmental disabilities, medication information was collected on 142 adults with ASD from three urban centers in Ontario, Canada. Each of these adults experienced a "psychiatric or behavioural crisis" and was served by participating social service or mental health agencies for people with developmental disabilities. Medication information was recorded by agency staff alongside other demographic and clinical information (e.g., risk behaviours, service use, comorbid medical and psychiatric conditions).

Results: Sixty-four percent of adults with ASD reported to be taking psychotropic medication and over three quarters of those taking psychotropic medications were prescribed antipsychotics. Of those prescribed medications, 30% percent were taking anxiolytics, 25% antidepressants, and 18% mood stabilizers. Over half were prescribed non-psychotropic medications and none reported taking stimulants.

Almost half of adults (46%) were prescribed 2 or more psychotropic medications and the majority of these individuals (83.3%) resided in group homes.

Psychiatric support, residence, and aggression predicted multiple medication use. Adults with ASD living in a group home were 11 times more likely to be prescribed 3 or more psychotropic medications and 3 times more likely to be prescribed 2 or more psychotropic drugs than those living with family and relatively independently. Adults with ASD who had a

history of aggression were 5 times as likely to be taking any psychotropic medication, and 2 times more likely to be taking 2 or more psychotropic medications than those without aggression history. Finally, adults with ASD who were receiving psychiatric services were 4 times more likely to be prescribed any psychotropic medication and 2 times more likely to be on 3 or more psychotropic drugs than those not seeing a psychiatrist.

Conclusions: Almost one half of the current sample was prescribed 2 or more psychotropic medications with antipsychotics being the most commonly prescribed psychotropic drug. Group home residence, psychiatric support and history of aggression were all risk factors for polypharmacy. As such, adults with ASD living in group homes or who have a history of aggressive behaviour may be at particular risk for polypharmacy. Knowledge of these patterns may help families, clinicians and individuals with ASD anticipate the use of medication, and explore strategies to best monitor medication use and consider alternative or adjunctive treatments.

137.005 The Impact of a Student's Diagnosis of Autism Spectrum Disorder on General Education Teachers' Attitudes. L. Hiruma*, K. V. Christodulu and M. L. Rinaldi, *University at Albany, SUNY*

Background: This study examines the extent to which disclosure of a diagnostic label specific to autism impacts teachers' attitudes, feelings of self-efficacy, and response to student behaviors in a general education setting. General education teachers were asked to read a vignette about a hypothetical student who displayed some challenging behaviors. In one condition, teachers were told that the student has an autism spectrum disorder. In the other condition, this information was not provided. Differences in teachers' ratings were examined between these two groups.

Objectives: The purpose of the present study was to examine the impact of diagnostic labeling a student as having an autism spectrum disorder on general education teachers': (1) attitudes toward the student; (2) use of positive practices versus punishment toward student challenging behaviors; and (3) feelings of teacher self-efficacy.

Methods: This study used a web-based survey, in which 56 fourth and fifth grade general education teachers were randomly assigned to read one of two vignette conditions about a hypothetical student who displays behaviors associated with autism. In one condition, teachers were told the student portrayed has an autism spectrum disorder. In the other, this information was not disclosed. Teachers were then asked to answer questions related to how they would respond to student behaviors, their attitudes toward the student, and their feelings of self-efficacy as a teacher using the Teachers' Sense of Efficacy Scale (Tschannen-Moran & Woolfolk, 2001) to see how knowledge of the student's autism diagnosis might impact teachers' ratings. A one-way analysis of variance was used to analyze differences in teachers' ratings for those who received diagnostic disclosure, versus those who did not.

Results: Results indicated that there was a significant difference in the extent to which teachers reported that they would use positive behavioral approaches in response to the hypothetical student's challenging behaviors in the ASD label versus no diagnostic label condition. Findings from this study also indicated that high ratings of teacher self-efficacy were positively correlated with use of reinforcement-based strategies to manage challenging behaviors, whereas high ratings of self-efficacy were negatively correlated with use of punishment-based strategies.

Conclusions: Discussion focuses on the relationship between general education teachers' knowledge of a student's diagnosis of ASD and their likelihood of using more positive teaching practices to manage student behaviors. The relationship between teachers' sense of self-efficacy and their use of positive versus punishment practices to address student behaviors are also addressed. Additionally, the implications of study findings for students identified with ASD in general education settings, along with study limitations and directions for future research are highlighted.

137.006 Spotting Autism in Early Childcare Settings (SPAECS): Workshops to Increase Knowledge and Confidence in Autism for Early Childcare Workers. M. Lopez[1], J. Bellando*[1], C. Lloyd[2] and Z. Fetterman[1], (1)*University of Arkansas for Medical Sciences*, (2)*University of Arkansas at Little Rock*

Background: Research has shown that there is a delay (ranging from 2-4 years) in obtaining an Autism Spectrum Disorder (ASD) diagnosis despite consistent recognition of developmental problems prior to 2 years of age among US children. Given the known benefits of early intervention, it is important to initiate the diagnostic process and remediation efforts at the earliest opportunity. Informed early childcare workers (ECW) who can recognize developmental differences that are red flags for autism can guide families in seeking evaluation and intervention for their child. However, previous surveys across different cultures indicate that ECWs need a better knowledge and understanding of autism.

Objectives: To develop a curriculum that would increase knowledge (in core ASD symptoms, in developmental differences that indicate ASD concerns and in simple interventions to address these differences) and increase confidence (in implementing simple interventions; in handling behavioral problems related to ASD in the daycare setting; in approaching families regarding concerns for their child and providing information on how to access developmental evaluation) among ECWs in Arkansas.

Methods: An autism curriculum tailored for ECWs was developed and presented in 6 full day workshops across the state of Arkansas. These workshops were set up through Resource and Referrals agencies of the Arkansas Department of Human Services. 193 out of 322 attendees consented to participate in the research component of these workshops. Participants were asked to complete knowledge and confidence questionnaires pre/post workshop and at six months follow up. Knowledge questionnaires measured: ability to recognize myths about autism (MYTHOS); ability to recognize core features of autism using case examples (CORE); and ability to recognize treatments for ASD (TREAT). Confidence questionnaires measured: ability to implement interventions (INTERVENE); ability to handle problem behaviors (PROBLEM); and ability to talk to parents about how to initiate an evaluation and early intervention services for suspected developmental differences (PLAN).

Results: Results were obtained using paired sample t-test analysis. Significant increases were seen in participant ability to recognize mythos ($p<.001$), core features ($p<.001$), and evidence-based interventions ($p<.001$), for autism. Significant increases were found in participants' confidence to implement intervention techniques ($p<.001$), manage problem behaviors, and talk with parents appropriately about how to access a developmental evaluation ($p<.01$). Six month follow-up data collection is on-going but current data suggests skills are being maintained.

Conclusions: Teaching ECWs specifically about autism spectrum disorders increased their knowledge and confidence in ability to recognize autism symptoms and implement interventions, ability to counsel families about their child's developmental concerns and inform families how to access developmental evaluations. More longitudinal research is needed to determine if this increased knowledge and confidence results in earlier diagnosis and treatment initiation for children with ASD.

137.007 Lack of Correspondence Between Self- and Parent-Report on Structured Psychiatric Interviews of Adolescents with High-Functioning Autism Spectrum Disorders. C. A. Mazefsky*[1], A. J. Hughes[1], D. P. Oswald[2] and J. E. Lainhart[3], (1)*University of Pittsburgh*, (2)*Commonwealth Autism Service*, (3)*University of Utah*

Background: The gold standard for diagnosing psychiatric disorders is to obtain information from multiple sources and achieve a consensus diagnosis. However, disagreement between sources is common and often a single source is used in research. Adolescent self-report results are frequently exclusively utilized over parent report in psychiatric research studies of typically-developing adolescents. This approach may not be best for even bright and verbal adolescents with ASD due to differences in emotional understanding, communication, and self-awareness that may impact their ability to self-report psychiatric symptoms. To date, studies of psychiatric comorbidity in ASD utilize a variety of methods for establishing diagnosis, and parent- and self-report on

psychiatric interviews have not been directly compared to determine the degree of correspondence.

Objectives: The study aimed to determine the degree of correspondence between self- and parent-report on a semi-structured psychiatric interview for adolescents with ASD.

Methods: Participants included 37 10 – 17 year old children with an ASD (confirmed with the ADOS and ADI-R) and without intellectual disability (mean FSIQ = 106). Current and lifetime comorbid psychiatric diagnoses were established via the *Autism Comorbidity Interview*, which is a modification of the *Kiddie-Schedule for Affective Disorders and Schizophrenia*. Lifetime and current diagnoses consistent with DSM-IV criteria were determined, as well as subsyndromal and subthreshold diagnoses which reflect milder variants.

Results: Parent-report interviews resulted in substantially more current DSM-IV psychiatric diagnoses than self-report, with 42 diagnoses based on parent report compared to 8 diagnoses based on self-report. Diagnostic concordance was extremely low, with parent-child agreement for only 6 current DSM-IV diagnoses (14% of parent-reported diagnoses). When allowing for any level of diagnosis (e.g. collapsing subthreshold, subsyndromal, and DSM-IV) and not specifying a time frame (e.g. using lifetime scores), agreement improved, with parent-child agreement on 34% (33) of the 97 parent-reported diagnoses. For parent-reported major depression, results indicated 41% agreement (7/17) for any level lifetime diagnosis, which was the highest rate of agreement.

Conclusions: The results indicated very poor diagnostic agreement between parent- and self-report on a psychiatric interview. The findings were in stark contrast to research on typically-developing adolescents, revealing an opposite pattern of disagreement; namely, adolescent report among typically-developing populations results in higher rates of disorders than parent report, whereas the present findings revealed low to zero rates of disorders based on the self-report of adolescents with ASD despite high rates of psychiatric disorders based on parent-report. Agreement for lifetime diagnoses at any level (e.g. subthreshold or higher) was better, suggesting that adolescents with ASD may be able to report on their psychiatric symptoms to a certain degree. Overall, the results imply caution should be exercised before dismissing concerns about a comorbid psychiatric disorder based on the adolescent's self-report alone. Further, the best approach to research on psychiatric comorbidity in ASD may differ from typically-developing populations, in that parent report may be preferable to adolescent report data if only one source is utilized. However, obtaining information from multiple sources when determining a diagnosis is still preferable, particularly given the complex nature of differential diagnosis in ASD.

137.008 'How Has This Child Affected Your Life?': Parents' Reports on the Impact of ASD. F. K. Miller*, C. B. Sorensen and L. R. Kowalski, *University of Michigan*

Background: Parents of children with ASD consistently report higher levels of parenting distress, aggravation, and depressed mood than parents of children with other developmental disorders (Estes, et al., 2009; Schieve et al., 2010). Less is known about fathers' experiences in ASD, although they report lower levels of distress than mothers (Herring et al., 2006). To improve models of clinical care, further information is needed on the nature and sources of parenting distress.

Objectives: To examine parenting experiences, including the nature and sources of parenting distress, in a sample of 532 parents of 297 children who had been referred for an ASD evaluation at a university based autism clinic. The group included 285 mothers, 247 fathers, and 235 mother-father-child trios.

Methods: 221 males and 76 females (Mean Age = 88 months; Range (20 to 398 months) participated in a comprehensive clinical evaluation. Child Best Estimate diagnosis was based on the ADI-R; the Vineland-II; the ADOS; and a standardized cognitive assessment.

Parents provided written responses to the question: *"What effects has this child had on other areas of your life, including marriage, family relations, social relations, work situation, and so forth?"* Responses to this question were analyzed using the "cut and sort" method (Ryan & Bernard, 2003). A qualitative coding scheme of 218 specific codes was created and then sorted into 31 themes. Coding was performed using the EZtext coding software (CDC). In addition, a 4-point global stress severity index was created to identify overall stress (1 = Low; 2

= Moderate; 3 = Severe; 4 = Pervasive). Inter-rater Reliability was established on 10% of the cases; percentage of exact agreement across 3 coders, blind to diagnosis and parent relationship status, was 93%. Every tenth case was triple coded to prevent rater drift.

Results: Endorsement of each of the 31 themes was examined separately for mothers and fathers. For Mothers, 10 categories exceeded 20% endorsement: Negative Marital Effects (55%); Feelings of Loss and Despair (51%); Difficulties Managing Child Behavior (41%); Coping with Challenge (40%); Exhaustion (34%); Negative Career Effects (31%); Negative Sibling Effects (31%); Strengthening Marital Bond (25%); Increased Isolation (24%); and Received Social Support (22%). For Fathers, 5 categories exceeded 20% endorsement: Difficulties Managing Child Behavior (36%); Negative Marital Effects (34%); Feelings of Loss and Despair (33%); Coping with Challenge (29%); and Strengthening the Marital Bond (25%). Global Ratings showed that 49% of mothers experienced Severe to Pervasive Stress while 35% of fathers did so. At $p < .05$ with this sample size, a difference of 8.25% is significant. Mothers had a higher endorsement than fathers on 8 of their top 10 themes, excluding only child management and the positive report of marriage strengthening.

Conclusions: Mothers report higher levels of stress than fathers on every category but difficulty managing child behavior. Additional analyses will examine the relationship between mothers' and fathers' reports and child functioning, including calibrated severity scores and ASD diagnostic category, IQ, and adaptive behavior.

Cognition and Behavior Program

138 Cognition and Behavior I

138.001 1 Neglected Dimension: Regulation of Affect and Attention in Toddlers with ASD. J. Koller*, K. Chawarska and S. Macari, *Yale University School of Medicine*

Background: Temperament, biologically-based behavior style reflecting regulation of affect, attention, and activity, has been studied relatively infrequently in children with autism, particularly in toddlers (Garon et al., 2009; Zwaigenbaum et al., 2005). The assessment of temperament may provide novel dimensions on which to characterize young children with ASD, enhancing our understanding of the heterogeneity of the autism spectrum.

Objectives: To examine temperament in toddlers with autism spectrum disorders (ASD) including autism (AUT) and pervasive developmental disorder-not otherwise specified (PDD-NOS), and in two control groups: toddlers with non-autistic developmental delays (DD) and typical development (TD).

In addition, we explored associations among temperament traits, verbal/nonverbal ability, as well as severity of autism symptoms.

Methods: 180 participants (AUT, n = 60; PDD-NOS, n = 33; DD, n = 26; TD, n = 61, mean age 26 months) were assessed by a multidisciplinary team. Diagnostic classification was based on outcome diagnosis at 36-48 months. Measures included the Toddler Behavior Assessment Questionnaire–Supplemental (TBAQ-S; Goldsmith, 1996; Becken Jones, 1999), the Mullen Scales of Early Learning (Mullen, 1992), and the ADOS-G (Lord et al., 2000).

Results: The temperament scales that differentiated toddlers with AUT and PDD-NOS from the other groups were Inhibitory Control, Positive Affectivity, Low Pleasure, and Perceptual Sensitivity, with lower scores for the children with ASD. Scales that differentiated AUT from PDD-NOS, DD, and TD were Attention Shifting and Soothability, whereby the children with AUT received the lowest ratings. Attention Focusing differentiated all three clinical groups from the TD toddlers, who were rated highest. Social Fearfulness differentiated only the AUT group from the TD group, who were rated with highest levels of social fearfulness (all $p < .05$, using ANOVA with post-hoc comparisons, with Bonferroni correction).

Associations between temperament features and measures of symptom severity and cognition in the ASD group were negligible. Only the Attention Shifting scale was correlated with severity of social-affective impairment on the ADOS (r=-.31, p<.01) as well as restricted-repetitive behaviors (r=-.26, p<.01). Scores on Soothability were correlated with restricted-repetitive behaviors (r=-.25, p<.05).

Conclusions: Parents rated toddlers with ASD (autism and PDD-NOS combined) as exhibiting less excitement and enthusiasm for positive events, and as less able to regulate their behavior in response to adult instruction compared to non-ASD controls. Toddlers with autism had greater difficulties regulating their arousal and shifting attention between tasks flexibly compared to toddlers with PDD-NOS and the non-ASD groups. Difficulties in sustaining focused attention and higher social fearfulness were not specific to ASD, as the toddlers with DD were rated similarly. Taken together, these results suggest that toddlers with ASD show a decreased ability to regulate their arousal, attention, and emotional responses. However, the vast majority of parent-reported temperament features were not associated with symptom severity or DQ. Thus, our findings suggest that temperament may constitute a dimension that is relatively independent from the other phenotypic features and is likely to contribute to the heterogeneity of early syndrome expression and affect the child's amenability to treatment and outcomes.

138.002 2 An Eye Tracking Study of Rapid Automatized Naming Ability in Adult Siblings of Individuals with ASD. A. H. Hogan-Brown*, K. M. Lynn, B. D. Kravis, B. B. Thomas and M. Losh, *Northwestern University*

Background: Rapid automatized naming (RAN) ability is strongly associated with reading ability, and it is theorized that phonological processing deficits contribute to impairments in RAN (Wolf et al., 2000). Given that impaired phonological processing, reading delays, and various language-related deficits have been reported in individuals with ASD and their first-degree relatives (Bolton et al., 1994; Hughes et al., 1999), it follows that examining RAN might help to clarify the role that phonological processing plays in the language-related phenotypes of ASD. Interestingly, RAN abilities do appear to be impaired in individuals with ASD and their parents (Losh et al., 2010; Piven & Palmer, 1997), though no studies to date have examined the ability in adult siblings. Furthermore, the underlying processes that contribute to RAN performance in first-degree relatives of individuals with ASD remain unknown. Eye tracking technology has been used extensively to investigate the link between eye movements and spoken language during picture naming and sentence production in typical adults (e.g., Griffin & Bock, 2000; Meyer et al., 1998), and during the RAN task in individuals with dyslexia (Jones et al., 2006). These studies have shown that the time spent looking at objects during naming reflects the amount of time required for phonological retrieval. As such, this preliminary study utilizes eye tracking to determine if longer looking time is related to impaired RAN performance in adult siblings of individuals with ASD (ASD-Sibs).

Objectives: To compare RAN ability in adult ASD-Sibs to adult controls, and to investigate the relationship between eye movement patterns and performance on RAN.

Methods: Seven ASD-Sibs (57.1% male; mean age = 20.79 years) and seven control subjects (42.9% male; mean age = 21.45 years) participated in this study. Speed and number of errors were measured during a RAN task consisting of color, letter, digit, and object naming. Total amount of time spent looking at items during naming was measured using a Tobii X60 eye tracking device.

Results: ASD-sibs demonstrated slower naming than controls on Letter and Digit trials (ts > 2.60, ps < .05). Likewise, ASD-Sibs spent more time looking at items than controls during Digit naming, $t(11) = 2.55$, $p < .05$), and group differences for looking time during Letter naming approached significance ($p = .06$). ASD-Sibs also committed more errors during Color naming, $t(12) = 2.40$, $p < .05$). For both groups, looking time was highly correlated with speed of naming (all rs > .90, ps < .001), but not number of errors.

Conclusions: Results suggest that RAN abilities are impaired in adult siblings of individuals with ASD, relative to healthy adult controls, providing additional evidence that RAN is a promising marker of genetic liability to ASD. Results from eye tracking analyses indicate that ASD-Sibs are looking longer at items for trials on which they are slower at naming, which may be suggestive of slower phonological processing (Meyer, 1998). Future studies will expand this preliminary study to include additional subjects and fine-grained analyses of the temporal relationship between looking and speaking during rapid naming.

138.003 3 Competence Sintatic-Semantic Ambiguity Test in Children with Autism and Specific Language Impairment. A. C. Tamanaha*[1], S. M. Isotani[2], M.

Ishihara[2], A. E. Chaves[2], M. Bevilacqua[2], R. C. Nascimbeni[2], A. Fiori[2], M. C. Rosario[2] and J. Perissinoto[3], (1), (2)*UNIFESP*, (3)*Universidade Federal de Sao Paulo*

Background: Autism characterizes for prejudice on social interaction; restricted and stereotyped repertory of interests and accentuated difficulty of verbal and nonverbal communication. As for the Specific Language Impairment, it is eminently determined based on exclusion criteria (lack of hearing impairment, cognitive disability and in the motor development of speech, neurological injuries and/or socio-emotional disorders), for low performance in formal tests and standardized receptive and expressive language. Although it is possible to observe changes in the jurisdiction of language in both conditions, we hypothesize that the degree of severity is higher in children with Autism, especially in the analysis of non-literal information and of ambiguous content.

Objectives: Therefore, the objective of this study was to analyze and compare the syntactic-semantic competence in evidence of ambiguity of children with Autism and with Specific Language Impairment.

Methods: This is a case-control study. The sample was composed of 20 children, in the age group of 6 to 12 years, of both sexes, diagnosed and treated in the Speech Therapy Research Laboratory from the Department of Speech Language and Hearing at UNIFESP and divided in two groups: Autism Group (AU Group) composed by 10 boys with multidisciplinary diagnosis of Autism and Specific Language Impairment Group (SLI Group) composed by 5 boys and 5 girls.

All children were regularly enrolled in public schools on elementary school and presented results of audiological and neurological evaluations within parameters of normality. The psychological evaluation indicated for SLI Group an average of intellectual quotient in the band and for the AU Group, average low.

We utilized the subtest Ambiguous Sentences of the Test of Language Competence – TLC (Wiig, Secord, 1989). For the analysis of the results were compared the scores of the children in both groups, according to the total number of correct answers. We used the Mann-Whitney nonparametric test with a significance level of 0.05.

Results: There was a significant difference, with the best performance of the SLI Group in comparison with the AU Group (p=0.010).

Conclusions: Although both groups have shown deficits in competence syntactic-semantic, the degree of severity found in the AU group was greater, proving that the language impairments in autistic children are more pronounced and of greater complexity.

138.004 4 EEG Mu Wave Attenuation in Broader Phenotype ASD. E. Massand*, B. Aaronson, R. T. Lowy, S. J. Webb, E. M. Wijsman and R. Bernier, *University of Washington*

Background:

The Broader Autism Phenotype (BAP) refers to autistic traits that may be qualitatively similar but expressed to a lesser degree than fully developed impairments associated with autism (Piven et al., 1997). Electrophysiological measures have been useful in the exploration of the BAP, highlighting differences in parents of children with ASD, such as impairments in face processing (Dawson, Webb et al., 2005). Previous EEG research has evidenced dysfunction of an execution-observation matching system in individuals with ASD. The attenuation of mu wave (spectral power falling within the 8-13 Hz frequency range), has consistently been observed during the execution-observation of human movement (e.g., grasping). Bernier et al. (2007) and Oberman et al. (2005) found reduced mu rhythm attenuation during observation, but not execution, of biological motion for individuals with ASD compared to a TD group, suggesting an execution-observation system dysfunction in ASD. However, findings have been inconsistent (Raymaekers et al, 2009). It is hypothesized that if reduced mu attenuation were a component of the BAP, parents of children with ASD would fail to show attenuation of the mu wave during the observation of a biological action, compared to parents of TD children.

Objectives:

This study aims to examine if differential EEG activity in execution-observation matching, as evidenced by reduced mu wave attenuation, is observed in parents of children with ASD.

Methods:

EEGs were collected during Resting, Observation and Execution of a simple hand-grasp motion from 84 parents of children with ASD and 31 parents of non-ASD children. Mu rhythm was defined as the power in the 8-13 Hz band among a cluster of eight electrodes over the central right and left hemisphere. Degree of mu attenuation was quantified as the log transform of the ratio of the power in the Observe and Execute conditions compared to the Resting condition.

Results:

Preliminary analysis confirmed that there was no difference between resting mu rhythm between groups ($F(1, 113) = .7$, p = n.s.).

When observing a biological movement, mu wave was significantly attenuated in both groups, replicating previous findings of an execution-observation matching system in individuals with TD, and extending these findings to parents of individuals with ASD (TD $t = -5.24$, $df = 30$, $p < .001$; ASD $t = -8.14$, $df = 83$, $p < .001$). There was no significant difference in mu power between groups in the observe condition ($t = -0.39$, $df = 113$, p = n.s.)

Conclusions:

The lack of differences between groups in the attenuation of spectral power in the mu rhythm when observing grasping actions suggests intact functioning of the execution-observation matching system in parents of children with ASD. Our findings suggest that differential mu wave activity during the observation of biological movement likely is not a component of the broader autism phenotype, but is rather specific to individuals with ASD. It is possible that given the small sample sizes, power may be an issue for these analyses. Additional analyses will examine the relationship between the BAP and mu attenuation in the parent group.

138.005 5 Eye-Tracking Established As a Reliable Test-Retest Measure in Adolescents with ASD: Visual Attention to Social and Non-Social Stimuli. M. H. McDermott*[1], H. W. Kang[1], J. Parish-Morris[2], C. Chevallier[1], J. C. Bush[1] and R. T. Schultz[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background: Prior research suggests that eye gaze patterns can be useful for quantifying social interest and motivation in individuals with autism spectrum disorder (ASD) and neurotypical controls (Jones et al., 2008), and to characterize phenotypic differences between these two groups (Klin et al., 2002; Nakano et al., 2010). Clinically, these findings are relevant because they highlight the core social deficits of ASD and suggest that eye tracking may be a valuable tool for identifying potential behavioral markers and measuring treatment response. Although test-retest reliability of eye tracking measures has recently been demonstrated in other disorders (e.g., Fragile X Syndrome, Farzin et al., 2011), it has yet to be established in ASD. Demonstrating the test-retest reliability of eye gaze measures in persons with ASD is essential if these are to be used as a stable measure of intervention efficacy, as well as in early detection studies.

Objectives: To assess the test-retest reliability of an eye tracking measure of attention to social and non-social stimuli in adolescents with ASD.

Methods: Nineteen males aged 12-17 (M=14.3, SD=1.7) with a diagnosis of ASD and full-scale IQ ranging from 47-133 (M=92.9, SD=22.4) participated in the present study at Time 1 and Time 2, separated by an interval of 9 weeks. Sitting approximately 60 cm from a 17-inch display, participants passively viewed six 10-second arrays of 12 static images (adapted from Sasson et al., 2008) while a Tobii X120 infrared eye tracker collected gaze information as part of a larger battery of studies. Pictures were classified as either social (e.g., a person smiling) or non-social (e.g., a train), and were selected to be relatively similar in complexity and size. Gaze variables of interest included Total Fixation Duration (i.e., proportion of time spent looking at social and non-social images relative to the total amount of time spent looking at both types of images), Fixation Count (i.e., proportion of times

a social or non-social image was fixated relative to the total number of fixations made), and Visit Count (i.e., proportion of visits made to social or non-social stimuli relative to the total number of visits made).

Results: Intraclass correlation coefficients (ICC) and Pearson correlation coefficients were computed for each gaze variable, comparing looking patterns at Time 1 to looking patterns at Time 2. Results revealed moderate correlations in Total Fixation Duration (*ICC*=.537, *p*=.007; *r*=.55, *p*<.05) and Fixation Count (*ICC*=.535, *p*=.008; *r*=.54, *p*<.05) to social and non-social stimuli, and a strong correlation in Visit Count (*ICC*=.769, *p*=.000; *r*=.77, *p*<.01) at Times 1 and 2.

Conclusions: Using a modified set of established stimuli, this study provides evidence for the test-retest reliability of gaze patterns to static social and non-social images in adolescents with ASD. Although preliminary, these findings suggest that future behavioral or medical intervention studies may be able to use eye tracking as a reliable outcome measure gauging treatment response.

138.006 6 The Use of Prosodic and Syntactic Cues to Understand Intent in Discourse by Children with Autism Spectrum Disorders. S. L. Mazur*[1], J. J. Diehl[1] and L. Bennetto[2], (1)*University of Notre Dame*, (2)*University of Rochester*

Background: Atypicalities in prosodic expression are a hallmark clinical feature of autism spectrum disorders (ASD), but we are only beginning to understand differences in prosody comprehension that might characterize production differences. One important function of prosody is to structure interchanges in discourse (e.g., indicating when a question is asked that necessitates a response). Previous studies on the use of prosodic cues for discourse structure have suggested intact functioning in ASD. Still, it is possible that individuals with ASD may be able to understand what is communicated by prosody, but may have a different processing strategy for utilizing prosody in conjunction with other cues to understand the intended meaning of an utterance.

Objectives: The current study examined the ability of individuals with ASD to use prosodic and syntactic cues to understand intent in discourse. We investigated their ability to make decisions in discourse when prosodic patterns and sentence structure provided either congruent or incongruent information about intent, as is common in natural speech.

Methods: Participants were 30 individuals with high-functioning ASD and 30 typically-developing peers between the ages of 11 and 19. Groups were matched on chronological age, gender, Full Scale IQ, and receptive language. All participants had Full Scale IQ and receptive language scores greater than 80. Participants were asked to make judgments on a series of sentences that indicated a speaker's intent in discourse. In this task, participants were asked to identify whether or not someone was asking them a question, by pressing "yes" or "no," but were given no further instruction. Stimuli included utterances that indicated intent via prosodic cues (e.g., final-rise in intonation), and syntactic cues (e.g., subject-verb inversion). When both prosodic and syntactic cues were present, they could be congruent (e.g., "Is she going to the store?" or "She is going to the store.") or incongruent (e.g., "You are going to the store?" or "Are you going to the store.").

Results: We found a group by stimulus type interaction, *p*<.05, partial eta squared=.08. Individuals with ASD were less likely than their typically developing peers to identify utterances as questions when the syntactic structure indicated a question but the prosody did not, *p*<.05, partial eta squared=.09, and were marginally more likely than peers to identify utterances as questions when the prosodic structure indicated a question but the sentence structure did not, p<.10, partial eta squared=.06. There were no group differences when prosodic and syntactic structures were congruent. A post hoc acoustic analysis of the stimuli revealed that typically developing peers were sensitive to subtle (but meaningful) acoustic differences in prosodic patterns in incongruent stimuli that did not seem to affect the interpretations of participants with ASD.

Conclusions: This study suggests that individuals with ASD utilize prosodic and syntactic cues to discourse differently than typically developing peers. Participants with ASD gave preference to prosodic cues over syntactic cues in cases of incongruence. Despite this preference, participants with ASD

were less sensitive than typically developing peers to subtle acoustic differences in intonation patterns.

138.007 7 Cue-Driven Face Scanning in Typical and Atypical Development. R. Bedford*[1], M. Elsabbagh[2], A. Senju[2], T. Charman[1], A. Pickles[3], M. H. Johnson[4] and .. BASIS team[2], (1)*Institute of Education*, (2)*Centre for Brain and Cognitive Development, Birkbeck*, (3)*Institute of Psychiatry, King's College London*, (4)*Centre for Brain and Cognitive Development, Birkbeck, University of London*

Background: From immediately after birth human infants preferentially attend to socially relevant stimuli such as faces. It could be that atypical scanning of social scenes, i.e., reduced fixation on the eyes (e.g., Klin et al., 2002), contributes to the subsequent development of the social communication problems which characterise individuals with an autism spectrum disorder (ASD). Further, Young et al. (2009) showed that individual differences in face scanning, with increased mouth relative to eye fixation, predicted subsequent expressive language.

Objectives: The primary aim of this study is to investigate the origins and the developmental consequences of variability in face scanning both in typical development and in the broader autism phenotype. Our participants were a longitudinal sample of infants aged 7 and 14 months at high risk for autism (due to having an older sibling with a diagnosis) and low-risk controls. We aimed to establish whether any early differences in allocation of attention to a face in high-risk infants might contribute to subsequent outcomes at 36 months.

Methods: Participants were 54 infants at high risk for ASD and 50 low-risk controls recruited through the British Autism Study of Infant Siblings (BASIS). We employed Tobii eye-tracking techniques to record infants' looking behaviour. There were four different trial types (with a repetition of each by a different actress). Each trial began with a 5-second period where the face was still, followed by one of four dynamic sequences. Conditions 1-3 had one moving region, while no other face part was moving: (1) the eyes showed gaze shifts towards or away from the infant (2) the mouth displayed vowel articulation movements (3) the hands displayed upward to downward motion next to the face (4) the eyes, mouth, and hands moved displaying a 'peekaboo' sequence. The measures calculated were proportion of looking to the cued location in conditions 1-3, and the ratio of eyes to mouth looking index (henceforth EMI) in condition 4.

Results: Structural equation modelling, controlling for non-verbal Mullen t-score, demonstrated that EMI at 7 and 14 months did not predict either risk group or subsequent clinical outcome at 36 months. However, an autoregressive cross-lagged model showed that EMI at 7-month did predict 36-month expressive language (EL), though not receptive language (RL). Finally, we found that a latent variable reflecting infants' looking behaviour during the simple, single cue conditions was a strong predictor of EMI during the peekaboo condition, and indirectly predicted EL.

Conclusions: Individual variation in attentional distribution reflects default biases, orienting to motion cues and learning from prior experience. Looking behaviour during the simple cue conditions and complex dynamic conditions is strongly related, with the latter directly predicting subsequent expressive language. Scanning of social scenes is not atypical early in development in high-risk infants who subsequently develop ASD but it is possible that atypical interactions with the social environment result in increasing behavioural differences over the course of development.

* The BASIS Team: S. Baron-Cohen, P. Bolton, S. Chandler, J. Fernandes, H. Garwood, K. Hudry, L. Tucker, A. Volein.

138.008 8 Eye-Tracking Measures of Reading Comprehension and Autistic Traits. N. J. Caruana and J. Brock*, *Macquarie University*

Background: Reading comprehension difficulties are widely reported in autism. Frith and Snowling (1983) reported that children with autism had difficulty choosing the contextually appropriate meaning and pronunciation of homographs – ambiguous written words – when reading sentences aloud. This finding has been replicated on numerous occasions and is cited as key evidence for the "weak central coherence" account of autism. However, the precise cognitive mechanisms involved have not been ascertained.

Objectives: We developed eye-tracking measures of contextual facilitation and contextual integration during reading comprehension. As a first step, we investigated individual differences in effect size as a function of subclinical autistic traits in a neurotypical population.

Methods: Eye-movements of 71 undergraduate students were measured as they silently read sentences on a computer screen. In addition, participants completed the Autism Quotient, a questionnaire measure of autism-like traits. Experiment 1 involved a predictability manipulation in which a target word was either highly predictable or entirely unpredictable based on the preceding context. Contextual facilitation was indexed by a reduction in fixation time on target words as a function of predictability. Experiment 2 involved an ambiguity manipulation whereby half of the sentences contained a homograph that was disambiguated by a subsequent word, and half the sentences replaced the homograph with an unambiguous synonym or semantic associate. An increase in go-past time for words that disambiguated an earlier homograph was taken as a measure of contextual integration.

Results: The predictability and ambiguity manipulations were both highly significant, but only the ambiguity effect interacted with AQ scores. Individuals with high levels of autistic traits were relatively slower to saccade past a disambiguating word, indicating greater difficulty integrating the disambiguating word with the preceding homograph.

Conclusions: The current study is the first to our knowledge to use eye-tracking to investigate the relationship between reading comprehension and autistic traits. Future studies will use the same materials to test adults on the autism spectrum and will help elucidate the cognitive mechanisms underpinning "weak central coherence".

138.009 9 Non-Specificity of Theory of Mind in Children with and without Autism Spectrum Disorder (ASD): Evidence From a New Non-Verbal False Sign Task. L. S. Iao*[1] and S. R. Leekam[2], (1)*University of Hong Kong*, (2)*Cardiff University*

Background: It is well-known that children with Autism Spectrum Disorder (ASD) have problems with understanding mental states, especially false beliefs. However, a standard false belief task involves mentalising as well as representational understanding. If children with ASD have a general difficulty in understanding representations, this challenges the view that mentalising is a domain-specific problem in ASD.

Objectives: The current study tested whether children with and without ASD's difficulty on false beliefs may be explained as a problem in understanding representations rather than mental states specifically.

Methods: A new non-verbal false sign task (Iao, 2011), was modeled on the non-verbal false belief and false photograph tasks devised by Apperly et al. (2004, 2007) which used a minimum level of language, eliminated the requirement of inhibiting one's knowledge about reality, and controlled for incidental executive demands. 18 children with ASD and 18 children without ASD (verbal mental age and non-verbal intelligence quotient matched) were tested on these non-verbal false sign (FS), false belief (FB) and false photograph (FP) tasks.

Results: Performance of children with ASD was significantly worse than that of children without ASD on the FB and FS tasks, but not on the FP task. When performance on the FP task or verbal mental age was controlled, the correlation between the FB and FS tasks remain significant for both children with and without ASD.

Conclusions: This equivalence found between the FB and FS tasks in children with and without ASD suggests that their difficulty on false beliefs may be explained as a general cognitive difficulty in understanding representations. This finding provides further support for the non-specificity claim of Theory of Mind. However, whether impaired representational understanding causes mentalising impairments or vice versa has not yet been established.

138.010 10 An Investigation of Jumping to Conclusions in Asperger Syndrome. C. Jänsch and D. Hare*, *University of Manchester*

Background:

Clinical accounts have described symptoms of psychosis in individuals with Asperger syndrome and a number of research studies have reported elevated levels of delusional beliefs in this population. Research into psychosis has highlighted data-gathering biases that may be related to delusional beliefs.

Objectives:

The current study aimed to investigate whether a data gathering bias, in the form of jumping to conclusions, was more evident in individuals with Asperger syndrome than a general population sample and to explore potential links with paranoia.

Methods:

The study compared the performance of the Asperger syndrome group (N=30) with a control group (N= 30) on two experimental tasks: a theory of mind task designed to assess mental state decoding ability, The Reading the Mind in the Eyes Test, along with The Beads task, used to assess data-gathering style. Self-report questionnaires were also employed to measure levels of depression, general anxiety, social anxiety, self-consciousness and paranoid thoughts.

Results:

The Asperger syndrome group performed less well than the control group on the Reading the Mind in the Eyes Task with regard to accuracy, but responded more quickly. Those with Asperger syndrome tended to make decisions on the basis of less evidence on the Beads Task and 50% demonstrated a 'jumping to conclusions bias'. Higher levels of depression, general anxiety, social anxiety and paranoid thoughts were reported in the AS group. Levels of depression and general anxiety were found to be associated with levels of paranoid thoughts, but data-gathering style appeared to be unrelated to paranoia.

Conclusions:

The study indicated that those with Asperger Syndrome tend to make decisions on the basis of limited evidence and many display a jumping to conclusions bias in their data-gathering style.

138.011 11 Awareness but Avoidance: Gaze Behaviour in Adolescents with ASD Versus Controls. S. C. Louwerse*[1], J. N. van der Geest[2], J. H. Tulen[2], F. C. Verhulst[3] and K. Greaves-Lord[3], (1)*Erasmus MC - Sophia's Children's Hospital*, (2)*Erasmus MC*, (3)*Erasmus MC - Sophia's Children's Hospital*

Background: Eye contact is an important aspect of social interaction and communication. Previous studies indicated that individuals with ASD look less at the eye-region than typically developing (TD) controls when social stimuli are presented. It is yet unclear whether individuals with ASD avoid the eye region in general, or whether this is related to social relevance, such as eye contact.

Objectives: The objective of this study was to determine the gaze behaviour of adolescents with ASD compared to TD adolescents, while looking at pictures of faces making direct eye contact versus faces with their eyes closed.

Methods: Participants in this study were 64 adolescents with ASD (mean age 16 years, mean total IQ = 98) and 48 TD adolescents (mean age 16 years, mean total IQ = 109). Twelve pictures of individuals with a natural face expression were shown for six seconds. Two conditions were used in the current study: 6 pictures with direct eye contact and 6 pictures with eyes closed. Eye tracking was recorded by means of the Tobii T120. The proportion of the fixation time toward the eyes relative to the entire fixation time was calculated. Differences between ASD and TD were studied in a repeated measures design, including IQ as a covariate.

Results: Both groups spend significantly more time looking at the eye region for the faces in the direct eye contact condition than in the eyes closed condition (main effect of condition: p = .001). Adolescents with ASD spent significantly less time looking at the eye region in the direct contact condition than their TD peers (p = .044) but not in the eyes closed condition (p = .955).

Conclusions: Both individuals with and without ASD spend more time looking at the eye region of faces showing direct eye contact, than at faces with their eyes closed. We conclude that adolescents with ASD do not avoid the eye region of faces in general. However, they do spend less time looking at the eye

region of faces with direct eye contact (triggering social contact) than TD controls. Adolescents of ASD seem to be aware of direct eye contact, but they tend to avoid this social cue more than their TD peers.

138.012 12 When Cartoon Differ From Real Faces: Affective Priming in Children with High-Functioning Autism. D. Rosset*[1], D. Da Fonseca[1], M. Picut[1], M. Viellard[1], T. Krouch[1], F. Poinso[2] and C. Deruelle[2], (1)*Autism Ressource Center*, (2)*Neurosciences Institute of La Timone*

Background: Recognition of emotional facial expressions has been widely reported to be atypical in Autism Spectrum Disorders (ASD). Because most studies have focused on *explicit* processing, little is known about the implicit components of emotional information processing. Interestingly, recent research indicates that atypicalities of emotion recognition in ASD apply to real human, but not cartoon, faces.

Objectives: This study investigated implicit emotion processing in children with ASD via an affective priming task in which emotions were displayed on 1) real (photographed) or 2) cartoon faces.

Methods: 26 children with high-functioning autism and 26 typically developing (TD) controls, matched on chronological age completed the affective priming task. Faces portraying happy or angry emotions were briefly presented (70ms; "primes"), followed by emotional scenes that were either congruent or incongruent in emotional valence with the primes. Participant judged whether scenes were pleasant or unpleasant. There were four priming conditions: happy/angry real faces, happy/angry cartoon faces, presented in a mixed design. A "congruency effect," computed for each group, was defined as faster Response Time for same-valence primes and scenes relative to different-valence prime-scene pairs.

Results: The TD group exhibited a significant congruency effect only with the *negative real faces*. In contrast, the ASD group exhibited a significant affective priming effect only in *negative cartoon faces*.

Conclusions: Findings revealed that while typically developing children were significantly influenced by implicit processing of emotions displayed on real faces, children with ASD were influenced only by emotions portrayed as cartoons. Implicit processing of emotional information appears to be disrupted for real but not for cartoon faces in ASD. This result is consistent with previous reports showing that explicit emotion processing is also affected for real but not for cartoon faces. We discuss the implications, including potential differences in face-processing expertise.

138.013 13 Negative Versus Positive Emotion Identification in Children with Autism Spectrum Disorders. J. Lorenzi*, K. F. Ostmeyer-Kountzman and A. Scarpa, *Virginia Tech*

Background: Prior research on emotion identification in autism spectrum disorders (ASD) has not produced consistent results. Although some studies have indicated no differences in emotion identification for individuals with ASD as opposed to controls (Capps, Yirmiya, & Sigman, 1992; Ozonoff, Pennington, & Rogers, 1990), other studies have reported deficits in emotion identification for those with ASD (Hobston, Ouston, & Lee, 1989; Macdonald et al., 1989). Deficits related to specific emotions, such as fear, have also been identified (Pelphrey, Sasson, Reznick, Paul, Goldman, & Piven, 2002). This study aims to clarify the ability of children with ASD to identify emotions in dynamic, talking videos, as many previous studies have used static photographs, which are less representative of real-life social interactions.

Objectives: To examine the ability of children with ASD to identify emotional expressions in dynamic videos as compared to children with typical development, when matched on mental age.

Methods: Participants included 8 children with diagnoses of Autistic Disorder (n = 4) or Asperger's Disorder (n = 4) between the ages of 7 and 12 (7 boys, 1 girl), and 18 children with typical development between the ages of 4 and 12 (9 boys, 9 girls). Participants observed 20 brief videos (under 5 seconds) of adult women talking while exhibiting one of five emotions (happy, sad, angry, scared, and excited). Video clips were rated in advance by faculty and graduate students for their child-appropriateness and success in communicating the

desired emotion. Following each video clip, participants were asked, "How does she feel?" Participants' responses were documented and scored for accuracy, and mental ages were computed based on scores from the *Kaufman Brief Intelligence Test, Second Edition* (KBIT-2; Kaufman & Kaufman, 2004).

Results: Preliminary analyses indicated that the group with ASD identified positive emotions (i.e., happy and excited) with significantly less accuracy than did the group with typical development, $t(24) = -2.982$, $p = .006$, although the two groups did not differ in their ability to identify negative emotions (i.e., sad, angry, and scared), $t(24) = -0.242$, $p = .811$. The group with ASD and the group with typical development evidenced comparable mental ages, $t(23) = -1.320$, $p = .200$.

Conclusions: Results indicate that children with ASD were equally able to identify negative emotions as their counterparts with typical development, but did not perform as well as those with typical development when asked to identify positive emotions such as happy and excited. Therefore, children with ASD may be perceiving similar levels of negative emotions but fewer positive emotions in others. It is possible that the positive emotions are being misidentified as negative emotions by children with ASD, which could indicate a bias towards attributing negative emotions in others. This would be important to clarify in future research as such biases pose a risk for future emotional and behavioral difficulties (Meyer, Mundy, Van Hecke, & Durocher, 2006).

138.014 14 Spontaneous Facial Emotion Discrimination in Individuals with Autism Spectrum Disorders and Fragile X Syndrome. H. R. Mace*[1], J. Moss[1], C. Oliver[1], G. Anderson[2] and J. McCleery[2], (1)*Cerebra Centre for Neurodevelopmental Disorders, University of Birmingham*, (2)*University of Birmingham*

Background: Previous studies of emotion recognition have found that individuals with autism spectrum disorder (ASD) and fragile X syndrome (FXS) perform similarly to carefully matched typically developing individuals on explicit measures of emotion recognition. However, previous studies using eye tracking measures have highlighted atypical looking patterns in individuals with ASD and FXS during emotion processing. Although it appears that this does not affect explicit emotion recognition, it has not yet been investigated as to whether atypical looking patterns during emotion processing impacts spontaneous emotion discrimination.

Objectives: To examine and compare the spontaneous discrimination of faces posed in happy and disgusted expressions from neutral faces, using eye-tracking in a passive habituation/dishabituation paradigm.

Methods: Participants were fourteen individuals with ASD, nine individuals with FXS, and twelve typically developing individuals. We measured eye gaze patterns during the passive viewing of pairs of human faces. Participants were presented with either two neutral faces, side by side, or one neutral face alongside a disgusted or happy face. Neutral-neutral pairs were presented on 80% of trials, whereas neutral-disgust and neutral-happy pairings were presented on 10% of trials each. Looking patterns during neutral-disgust and neutral-happy trials were examined for preferential looking times to the novel (disgust, happy) emotional expressions. We also measured eye gaze patterns to the eyes and mouth region of the facial stimuli.

Results: Both typically developing participants and participants with ASD looked at both the disgusted and happy faces more than the neutral faces during the critical trials. This suggests that both of these groups spontaneously recognised the difference between neutral and disgusted and neutral and happy faces. Participants with FXS discriminated disgusted from neutral faces, but not happy from neutral faces. Individuals with ASD looked significantly more at the mouth region than both the TD and FXS individuals. In addition, participants with ASD and FXS exhibited a non-significant tendency to look less at the eye region than TD individuals.

Conclusions: These results suggest that individuals with ASD, like TD individuals, can spontaneously distinguish between different emotions. However, individuals with FXS do not spontaneously distinguish happy from neutral faces. These results highlight a possible discrepancy between explicit emotion recognition, which previous research has suggested is largely intact in FXS, and spontaneous emotion discrimination. These results also suggest that the underlying mechanisms subserving spontaneous emotion discrimination

in ASD and FXS may differ. Individuals with ASD looked more at the mouth than both those with FXS and TD individuals. Therefore, it is possible that emotion discrimination in ASD is more heavily affected by information obtained from the mouth area. However, individuals with FXS may not have obtained the information required for emotion discrimination from either the eye or the mouth area, at least for happy faces, as they exhibited less looking at the eye region and no increase in looking at the mouth area.

138.015 15 Individuals with Autism Exhibit Reduced Sensitivity to Infant Cuteness. N. J. Sasson*[1], D. J. Faso[1], D. D. Langleben[2] and R. C. Gur[2], (1)*University of Texas at Dallas*, (2)*University of Pennsylvania*

Background: Konrad Lorenz theorized that the neotenous physical features of the baby schema (e.g., round face and large eyes) confer an adaptive advantage by motivating caretaking behavior that increases the likelihood of offspring survival (Lorenz, 1943). Indeed, recent empirical evidence indicates that infant photographs manipulated to be more neotenous not only elicit higher ratings of cuteness and feelings of caretaking in typically developing (TD) adults, but also generate greater activation in the nucleus accumbens, a neural structure mediating the processing of reward value (Glocker et al, 2009a,b). For individuals with autism spectrum disorders (ASD), impairments in social interaction may in part result from reduced reward value assigned to social stimuli (Mundy and Neal, 2001; Dawson et al, 2004; 2005). The current study examined whether adults with ASD are less responsive to infant cuteness, a salient social reward for TD individuals.

Objectives: To determine whether adults with ASD differ from TD adults in their perceived cuteness of systematically manipulated baby schema.

Methods: As detailed in Glocker et al 2009, photographs of 17 infants were anthropometrically altered to produce three naturalistic portraits that displayed either high (round face, high forehead, big eyes, small nose and mouth), low (narrow face, low forehead, small eyes, big nose and mouth) or unmanipulated baby schemas. These 51 images were rated on perceived cuteness on a 5 point Likert scale by 9 adults with ADOS-confirmed diagnoses of ASD and 14 TD comparison participants. The groups did not differ in age or estimated IQ. In a second control condition, participants rated the same images on the size of the infant's eyes.

Results: A mixed model ANOVA, co-varying gender, with group (TD vs ASD) as the between group factor and condition (cuteness vs eye size) and baby schema (low, medium and high) as the within group factors produced a significant three way interaction between group, condition and baby schema ($F(2, 20) = 3.85$, $p = .039$, $h_p^2 = .278$). Follow-up tests revealed that this interaction was driven by the groups differing across the three baby schema types for cuteness ratings, yet performing similarly across the three baby schema types for eye size ratings. Both the TD and ASD groups therefore increased their eye size ratings to increasingly neotenous baby images, but this manipulation only elicited an increase in cuteness ratings for the TD group.

Conclusions: The present study reports reduced sensitivity in ASD to infant cuteness. Although the ASD group was comparable to the TD group in detecting the physical changes associated with increasing neoteny in infant faces, they were alone in failing to modulate their cuteness ratings in accordance with these changes. These findings suggest that individuals with ASD may be less affected by characteristics of infant cuteness, and provide additional evidence for abnormal reward processing of social stimuli in ASD. We anticipate that these results will persist within the much larger sample that will be obtained by the start of the conference.

138.016 16 Alignment of Induced EEG Oscillations Improves Analysis of Autism and ADHD Responses in Facial Categorization Task. E. R. Gross, A. S. El-Baz, G. Sokhadze, L. L. Sears, M. F. Casanova and E. M. Sokhadze*, *University of Louisville*

Background: Children diagnosed with Autism Spectrum Disorder (ASD) often lack the ability to recognize and properly respond to emotional stimuli. Similarly, emotional deficits characterize children with Attention Deficit/Hyperactive Disorder (ADHD). Theory of Mind (ToM) Impairment may explain the presence of these deficits in patients with ASD, and may also be applicable to other conditions, including ADHD. Simultaneous evaluation of ToM impairment in both conditions may promote a better understanding of the

emotional deficits in both conditions, and possible relationships between ASD and ADHD.

The deficits seen in ASD and ADHD may affect the induced electroencephalographic (EEG) gamma oscillations that occur following an emotional stimulus; however, analysis is complicated by the varying latencies of the oscillations, which are not fixed at a definite point in time post-stimulus. A more accurate analysis may be achieved by utilizing a data alignment method, which reduces the attenuation observed in the averaged EEG response. This improved analysis may be used to better evaluate changes in the induced gamma oscillations between ASD, ADHD, and control subjects.

Objectives: To compare emotional recognition differences in ASD, ADHD, and control subjects by utilizing a data alignment technique programmed in MATLAB.

Methods: A forced-choice test was designed where subjects were asked to categorize a picture of a human face into one of two groups: male or female, angry or disgusted, and fearful or sad. EEG data was collected from ASD (n=10), ADHD (n=9) and control (n=11) subjects via a 128 channel EGI system. Data was then processed through a continuous wavelet transform and bandpass filter designed to isolate the gamma frequencies from 35-45 Hz. A MATLAB program was then used to align the trials within each subject x experimental condition x EEG site pairing (e.g. Subject A, Angry/Disgusted, P3) by maximizing the Pearson-product moment correlation coefficient between trials. The power of the induced gamma response for a 400 ms window was then calculated and compared between subject groups, and to an analogous power value obtained from the original, unaligned dataset.

Results: The main effect of alignment was significant in parietal and occipital topographies analyzed ($F=995.89$, $p<0.001$). A three-way Experimental Condition (Angry/Disgusted, Gender) x Alignment x Subject Group (ASD, ADHD, Controls) interaction was significant in the parietal and occipital topographies ($F=2.68$, $p=0.030$). This three-way interaction was most prevalent in the P3-P4 channels ($F=3.43$, $p=0.048$) and P7-P8 channels ($F=4.304$, $p=0.025$).

Conclusions: Data alignment significantly reduced the attenuation of the averaged induced gamma oscillations, which increased the calculated induced gamma power. Alignment improved the differentiation of induced gamma power in the subject groups, revealing significant differences that would have gone unnoticed using traditional analysis methods. Group differences in the aligned dataset were most noticeable in the anger/disgust recognition test, whereas the power in the gender recognition test appeared to be more constant from group to group. This technique may be applied to future induced gamma studies in autism, and other neurodevelopmental conditions.

138.017 17 Distribution of Autistic Traits in a Taiwanese Population of Children Aged 6-8 Years. C. L. Chang*[1], L. C. Lee[2], R. A. Harrington[2], I. T. Li[3], P. C. Tsai[2], P. Yang[4] and F. W. Lung[5], (1)*Kaohsiung Armed Forces General Hospital*, (2)*Johns Hopkins Bloomberg School of Public Health*, (3)*Calo Hospital*, (4)*Kaohsiung Medical University* , (5)*Taipei City Hospital*

Background: It is well accepted that Autism Spectrum Disorders (ASDs) represent one end of a larger spectrum of quantitative impairment that is continuously distributed in the general population. The Social Responsiveness Scale (SRS) is an instrument that characterizes quantitative impairments in social awareness, cognition, communication, motivation, and repetitive behavior/restricted interests that define ASD, and provides a more subtle characterization of individual symptoms than using traditional classification systems. This tool is particularly feasible for assessing autistic traits in large, population-based studies because it can quantify the spectrum of dimensional impairments of ASD. Implementing the SRS in a large population will allow it to be standardized across different settings and against different norms and subgroups such as gender, age, or racial/ethnical background.

Objectives: To examine the distribution of dimensional autistic traits in a large Taiwanese population of children aged 6-8 years.

Methods: Caregiver-reported SRS data were collected by an epidemiologic autism study recently conducted in PingTung Taiwan. Raw scores of the total SRS and five subscales

(social awareness, social cognition, social communication, social motivation, and autistic mannerisms) were compared between male and female children. As recommended in the literature, a raw score of >=70 in males and >=65 in females is a cut-point that provides evidence for the presence of an ASD. Based on these cut-points, we defined clinical vs. non-clinical groups separately for males and females. Comparison of social demographic characteristics between groups was examined by calculating Odds Ratios (OR) and 95% Confidence Intervals (CI).

Results: This study includes participants who completed the SRS and whose child's sex is known. As a result, 1384 males and 1507 females are included in the analysis. Of those, 172 males and 185 females met the recommended clinical cut-off. SRS total scores, social awareness, social communication and autistic mannerisms are significantly higher in males than females with p-values all <0.0001. While social cognition is higher in males than females ($p<0.05$), no significant difference in social motivation. The male clinical group (SRS>=70), as compared to the male non-clinical group, is 3.11 times (95%CI: 1.87-5.18) more likely to have father's education <=middle school, and 4.52 times (95%CI: 2.62-7.79) more likely to have mother's education <=middle school. Similar association patterns are observed in females where the odds of having father's education <=middle school is more than 5 times (OR=5.29, 95%CI: 3.14-8.92) higher, and having mother's education <=middle school 4 times (OR= 4.43, 95%CI: 2.64-7.45) higher, in the female clinical group (SRS>=65) than the female non-clinical group. Additionally, males in the clinical group are almost 3 times (OR=2.82, 95%CI: 1.71-4.66) more likely than males in the non-clinical group to be born preterm.

Conclusions: Parental education level is highly associated with SRS clinical status, as children who met the SRS clinical cut-point are more likely to have their parents' education <=middle school. It is not clear how parental education is associated with SRS measured behaviors. Further investigation on how psychometrics of the Chinese mandarin SRS, and potential cultural expectations, may have affected reporting on child behaviors will be discussed.

138.018 18 Dr. M. W. Wan*, *University of Manchester*

Background: Infant siblings of children with autism spectrum disorder (at-risk sibs) –who are themselves at genetic risk of autism –are more likely to exhibit early social communicative impairments, and other atypicalities, than typically developing siblings (low-risk sibs). Taking a developmental transactional model, the appearance of early infant atypicalities in those infants at risk may disrupt parent-infant interaction which may in turn amplify existing social atypicalities through their experiencing of less optimal social interactive environments. This theory does not suggest that parent-infant interactions are a primary cause of atypical behaviour. A few studies to date suggest that early parent-infant interactions show specific subtle but consistent differences in at-risk sibs in early-middle infancy. The current study follows up a group of at-risk sibs for whom group differences were found in parent non-directiveness/sensitive responsiveness and infant liveliness at 6-10 months during parent-infant interaction.

Objectives: (1) To compare the global mother-infant play interaction characteristics between at-risk sib infants at 12-15 months with low-risk sib controls; (2) To examine whether 12-month parent-infant interaction predicts 24-month ADOS score beyond the contribution of early behavioural atypicalities (AOSI score).

Methods: Forty-four at-risk and 48 low-risk sibs were videotaped in 6-min mother-infant unstructured play interactions within the British Autism Study for Infant Siblings (BASIS) rated, blind to dyad information, on a global rating scheme which involved 2 parental, 3 infant and 2 dyadic scales. The Autism Observation Scale for Infants (AOSI) was administered independent of interaction coding at 12 months, and the at-risk sib group were administered the Autism Diagnostic Observation Schedule (ADOS) at 24 months.

Results: Compared to the low-risk group, the at-risk group showed significantly lower scores in parent sensitive responsiveness, parent non-directiveness, infant attentiveness to parent, and mutuality, after controlling for infant age. Twelve-month AOSI score predicted 24-month symptomatology. The four areas of interaction, tested in individual linear regression models, predicted 24-month ADOS score independent of 12-month AOSI and infant age/developmental level, with dyadic mutuality as a particularly

strong predictor. In all models, the variance accounted for by AOSI score was no longer significant, except that which tested parent non-directiveness, in which both were independent predictors.

Conclusions: Parent, infant and dyadic features of parent-infant interaction, which were identified as being associated with ASD risk at 12 months, were stronger predictors of 24-month ADOS score than 12-month markers (AOSI), lending support to the transactional model. The findings support the role of parent-infant interaction in emergent ASD development – along the lines being targeted in by very early (prodromal) intervention, such as in iBASIS.

138.019 19 Did You See That Change? A Study of Dyspraxia, Eye Movement and Visual Perception in Autism. L. Chukoskie*[1], M. Miller[1], C. Kanan[1], M. Dorai[1], J. Townsend[2] and D. Trauner[2], (1)*UCSD*, (2)*University of California, San Diego*

Background: The literature on looking behavior of individuals with autism is extensive, as is the literature on spatial attention differences in autism. Yet, we lack an understanding of the way in which lower level visual, motor and attentional mechanisms contribute to the biases in looking behavior often observed in individuals with autism. Similarly, although there is evidence for deficits in overall motor coordination in autism, this work has not been extended to include eye movement. There are no attempts to compare motor control of eye movement with gross motor coordination and ability to perform skilled gestures (praxis). These functions are of particular developmental importance, as early sensory and motor abilities provide a scaffold for higher level skills such as social communication. If eye movements are inaccurate or slow, social information is lost along with the opportunity to learn from that particular social situation.

Objectives: Using a battery of tasks, we studied the interactions among eye movement, visual motor integration, visual perception and both fine and gross motor skills. We examined associations between various aspects of the tasks to test whether atypical looking behavior observed in natural settings might be affected by fundamental visual motor deficits.

Methods: We tested children with autism and typically developing age- and performance IQ-matched school-aged children who were recruited from an existing sample of children enrolled in studies of neural and cognitive development. Each child was evaluated using selected oral motor and limb apraxia subtests from the Florida Apraxia Screening Test. Visual-motor integration was evaluated using the standardized Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI) and VMI supplemental tests in Visual Perception and Motor Coordination. To examine eye movements and their role in natural visual perception, we used Gap-Overlap and Change Blindness paradigms. Eye position samples were collected at 500Hz using the SR Research EyeLink 1000. Images for the Change Blindness task were naturalistic scenes that included social and non-social content that was balanced in terms of low-level salience, eccentricity and size.

Results: In preliminary analyses, we found significant group differences in several tasks as well as correlations in performance across tasks.

Children with autism performed more poorly on the VMI, Visual Perception and Motor Coordination tests, and a number of the Apraxia tasks.

Compared to typically developing children, the children with autism were slower to initiate saccades to a target, and their saccades were less accurate. Children with autism also showed significantly greater variability in timing and accuracy of eye movements. Greater dyspraxia, poorer motor coordination and visual-motor integration were significantly associated with reduced control of eye movement. These findings are consistent with a model in which dyspraxia is an underlying cause of the eye movement deficits seen in children with ASD.

Conclusions: Oculomotor dyspraxia may explain some of the difficulties observed with eye contact and visual search often found in autistic individuals. These findings may contribute to the development of more appropriately directed clinical interventions.

138.020 20 Emotional Understanding in Children with and without Autism Spectrum Disorder. S. M. Merwin*, P. A. Rao and R. J. Landa, *Kennedy Krieger Institute*

Background:

In typically developing children, emotional understanding emerges around the age of 24 months, and shows the greatest increase between the ages of 4 and 10 years. Studies of emotional understanding in children with ASD reveal that, although they label as many emotions as typical children, they have more difficulty identifying their own emotions and are more likely to reference inanimate objects than living things when identifying emotions. Previous studies have examined emotional understanding in children with ASD using a wide range of techniques. However the majority of these techniques involved the use of experimental tasks (e.g., face recognition, interpreting a script) that had very little relationship to interpersonal experience.

Objectives:

To examine emotional understanding in children with and without ASD within an interpersonal framework during a developmental period when emotional understanding shows the greatest increase.

Methods:

Participants included 10 children with a diagnosis of ASD and 10 children without a diagnosis of ASD , matched for age (5-8 years), gender (50% males), race (all Caucasian), and FSIQ (mean=103; SD=11.23; range=82-128). As part of an annual assessment, all children were administered Module 3 of the Autism Diagnostic Observation Scale (ADOS) by a trained clinician. An emotional understanding coding system was developed to document use of contextually appropriate emotion-related language in the following ADOS tasks: Description of Picture, Telling a Story from a Book, and Emotions.

Results:

During the Picture and Book tasks, the ASD group was more likely than the No-ASD group to label emotions (80% ASD and 50% No-ASD); however the difference was not statistically significant, Fisher's exact test, $p > .05$. During the Emotion task, a higher percentage of the No-ASD group acknowledged and responded appropriately to emotion questions (gave a response that was on topic) for four of the five emotions: Happy, Scared, Angry, and Sad. However, the between-group difference was statistically significant for only one emotion (Scared; Fisher Exact test, $p = .04$). Children with and without ASD also differed in what they referenced in describing these emotions. The No-ASD group was more likely to reference an animate being (person, animal; 60% of No-ASD; 40% of ASD); the ASD group was more likely to reference an inanimate entity (object or an action) without reference to the agent (60% of ASD; 20% of No-ASD; Fisher exact test, $p = .18$).

Conclusions:

Results support previous research in emotional understanding in children with and without ASD. Compared with their unaffected peers, children with ASD in the current study were more likely to label emotions during a structured task (Picture and Book), but were less likely to respond appropriately to questions about their emotions, and when they did respond, they were more likely to mention an inanimate than animate source of emotional experience. The ADOS appears to provide a contextual framework for examining emotional understanding in children with and without ASD. However, further research with larger samples is needed to verify these findings.

138.021 21 Infant Siblings At Risk for ASD: Directed and Non-Directed Gesture Use in Infants and Related Maternal Communication Behaviours. S. Mitchell*[1], W. Roberts[2], J. A. Brian[3] and L. Zwaigenbaum[4], (1)*University of Toronto*, (2)*The Hospital for Sick Children*, (3)*Bloorview Research Institute* , (4)*University of Alberta*

Background: Infants at risk for ASD show impairments in gesture use by 12 months of age. Conventionally defined, a gesture is an action produced with the hands, arms, fingers, body or face; that is directed to a person; and serves a communicative function. However, our previous work examining infant gesture use during a communication assessment with a clinician (i.e., clinical context) showed that

infants at risk for ASD produced gestures but did not always *direct* these gestures to a communication partner.

Objectives: In this study, we examined directed and non-directed gesture use in 15-month-old infant siblings at risk for autism (AR-ASD) and low risk control (LRC) infant siblings during a naturalistic, play interaction with their mothers (i.e. home context). In addition, we also examined three maternal behaviours that we hypothesized would be related to gesture use.

Methods: Seventeen, infant -mother dyads were recruited from a longitudinal study of the emergence of autism symptoms in infants with an older sibling with ASD (AR-ASD, $n = 8$; LRC, $n = 9$). Infant-mother dyads were videotaped in their homes. Infant gestures were coded as *directed* or *non-directed*. Evidence that a gesture was directed (d+) included: (a) giving an object to a person, (b) touching a person, (c) coordinating a gesture with eye gaze or vocalization, (d) producing a gesture in response to a statement. Gestures without evidence of directness were coded as non-directed (d-). Gesture rates (per minute) were calculated for each infant. Three maternal behaviours were coded: (a) rate of gestures, (b) rate of prompts to encourage infant gesturing (e.g., model, verbal or physical prompt), and (c) responsiveness to infants' gestures.

Results: Two one-way ANOVA's were conducted to evaluate the hypothesis that AR-ASD infants have a lower rate of d+ gestures and a higher rate of d- gestures than LRC infants in a home context. AR-ASD infants had a lower rate of d+ gestures, $F(2, 15) = 14.83$, $p = .002$, partial $h^2 = .32$, and a higher rate of d- gestures, $F(2, 15) = 7.17$, $p = .014$, partial $h^2 = .44$. To examine maternal behaviours that may be related to infants' gestures, two one-way ANOVA's compared the mean rates of gesture use and use of prompts. No significant differences were found between groups in the mean rate of maternal gesture use, $F(2, 15) = .416$, $p = .529$, or the mean rate of maternal use of prompts $F(2, 15) = .481$, $p = .498$.

Conclusions: Fifteen-month old AR-ASD infants have a lower rate of d+ gestures and a higher rate of d- gestures than LRC infants in a home context. Mothers of infants at risk for ASD and those with no risk appear to gesture and prompt infant gestures at similar rates. Because mothers may be more likely to respond to their infants' *directed* gestures, maternal responsiveness to directed and non-directed infant gestures will be explored separately. Targeting directedness (e.g., adding eye gaze or vocalization) to make non-directed gestures communicative may be important in intervention.

138.022 22 Group Differences in Feature Scanning While Learning Novel Faces. J. A. Walsh* and M. D. Rutherford, *McMaster University*

Background:

Past research has suggested that the way typical individuals look at a familiar face is measurably different from how they look at a novel face, as measured by eye gaze patterns. It has also been suggested that individuals with autism spectrum disorder (ASD) do not show differential eye gaze patterns when looking at novel versus familiar faces such as that of a family member.

Objectives:

To investigate group differences between individuals with ASD and control participants across 17 exposures as novel faces (and as a control novel houses) become familiar.

Methods:

Twelve participants with high-functioning ASD or Asperger's (9 males; Mean age = 28.08 years, SD= 6.29) and 16 typical participants (14 males, Mean age = 27.44, *SD* = 6.76) passively viewed 17 unique images of 6 individuals and 6 houses while eye gaze information was collected via eye tracking technology. Specifically we measured changes in the number of fixations and total fixation duration within two areas of interest (eyes and mouth for faces; upper and lower feature for houses). Participants completed separate blocks of upright and inverted faces and houses.

Results:

Both groups showed evidence of learning for both faces and houses; eye gaze patterns for both groups changed systematically with increased exposures. Interestingly, the effect of exposures was not significantly different between groups demonstrating that the process of learning novel faces

and houses was similar in both groups. Analysis of mean number of fixations and total fixation duration per exposure revealed significant group differences: the participants with ASD showed no differences in eye gaze patterns for the eyes and mouth areas of the face in both upright and inverted faces. In contrast, the typical group showed a focus on eyes compared to the mouth and this difference was more evident in the inverted faces compared to the upright faces. There were no group differences in the effects of time and mean gaze patterns for upright or inverted houses, indicating that group differences in learning complex stimuli are specific to social stimuli.

Conclusions:

The process of novel faces becoming familiar appears to be similar in individuals with ASD and typical individuals. The areas of the faces that individuals focus on differ between groups and this difference is even more evident for inverted faces, for which learning is a more complex social cognitive task. These group differences are specific to complex social stimuli.

138.023 23 Manipulation of Physical Contingencies Induces Change in Visual Scanning of Natural Scenes in Infants with ASD Relative to Typically Developing Infants. A. Trubanova*[1], J. B. Northrup[2], D. Lin[3], A. Klin[1], W. Jones[1] and G. Ramsay[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*University of Pittsburgh*, (3)*Harvard Medical School*

Background: In recent research involving preferential attention to point-light displays of biological motion, we found that two-year-olds with autism did not orient to social contingencies but attended instead to non-social, physical contingencies that were disregarded by control children. In later studies, we also found that infants with ASD varied their fixation on the faces of others as a function of the physical contingencies embedded therein. In addition, while social context altered preferential viewing patterns in typically developing infants, detection of audiovisual synchrony was not greatly influenced by social context in infants with ASD.

Objectives: The goal of the current project is to investigate what guides visual attention in infants with ASD by inducing changes in their visual scanning of naturalistic social scenes through experimental manipulation of audiovisual synchrony embedded in those scenes, and to quantify those visual scanning patterns as predictors of outcome severity.

Methods: Infants with autism (ASD, N = 15) and typically developing infants (TD, N = 15), ages 12-24 months, watched a 15-minute series of 35 naturalistic clips. These clips were composed of caregivers interacting with an infant, together with a variety of time-varying, moving objects that were dynamically synchronized with the caregiver's speech. Specifically, we co-varied object rotational motion, rocking motion, and luminance with the amplitude envelope of each utterance, and dynamically varied the degree of synchrony between caregiver and object throughout the movie. Eye-tracking technology was used to track infants' looking patterns, using the relative fixation time on caregiver and object as our dependent measures.

Results: Results show that, overall, TD infants spend significantly more time fixating on the caregiver's face compared to the non-social toy while infants with ASD do not show this distinction, fixating equal amounts of time on the two stimuli. With increasing synchrony of the rotational toy, however, we induced changes in the infants' scanning, guiding their attention more towards the rotational toy and diminishing their attention to the face. This change in visual scanning occurs more frequently and significantly faster in infants with ASD compared to the TD infants, who take longer to pick up on the synchrony and to attend to the toy. In addition, results show that those infants with ASD who preferentially attend to the toys exhibit more impaired social behavior, as measured by the ADOS Social Affect Score.

Conclusions: Overall, this study suggests that non-social, physical contingencies in a naturalistic setting can be highly distracting to infants with ASD. These findings indicate an early interruption of typical social experience and suggest one mechanism by which infants with ASD may fail to attend to important social cues in their environment. Furthermore, by measuring individual sensitivity to non-social contingencies, and inducing changes in visual scanning behavior, we may

learn how to develop effective early interventions for infants with ASD by either minimizing the impact of distracting environmental cues, or by using cues that may be innately attention-getting to infants with ASD to foster socially relevant learning.

138.024 24 Parent-Child Interaction Quality and Empathy in Toddlers At Risk for An ASD. N. M. McDonald*[1], H. Gordon[1], J. K. Baker[2] and D. S. Messinger[1], (1)*University of Miami*, (2)*California State University Fullerton*

Background: Individuals with autism spectrum disorders (ASDs) have difficulty empathizing with others. These empathy deficits are apparent as early as 12 months of age and predict later ASD diagnosis and symptom severity (Hutman et al., 2010; McDonald & Messinger, 2011). In typically developing children, affective synchrony, and parental responsivity and warmth in early parent-child interactions, contribute to differences in empathy development (e.g., Feldman, 2007; Kochanska et al., 1999). However, little is known about the relation between early parent-child interactions and later empathic responding in children at-risk for an ASD.

Objectives: To investigate the influence of early parent-child interaction quality on individual differences in empathic responding in children at-risk for an ASD.

Methods: Participants were 66 children at high-risk for an ASD who had an older sibling with a confirmed ASD diagnosis. Parent-child interaction was measured during free play sessions at 15 and 18 months of age. Interactive behaviors were reliably rated using the following ratings from the NICHD ECCRN scales: Emotional Supportiveness (mean of the Parent Sensitivity, Respect for Autonomy, and Positive Regard ratings; Scale: 1-7) and Affective Mutuality, a dyadic code (Scale: 1-7). Means of the 15- and 18-month ratings were calculated for analyses. Empathic responding was measured by examining children's responses to their parents' distress at 24 and 30 months. Children were reliably rated on the quality of their empathic responding (Global Empathy; Scale: 1-7; Young et al., 1999).

Results: In linear regression analyses, 15- & 18-month Emotional Supportiveness predicted 24-month Global Empathy, $F(1,55)=3.56$, $p=.06$, $R^2=.06$, at a marginally significant level, but did not predict 30-month Global Empathy, $F(1,47)=1.59$, *ns.* Parents who displayed higher levels of responsivity, warmth, and respect for their child's autonomy at the 15 and 18 months tended to have children who displayed higher levels of empathic responding at 24 months, but not at 30 months. Additionally, 15- & 18-month Affective Mutuality predicted 24-month Global Empathy, $F(1,55)=5.26$, $p<.05$, $R^2=.09$, as well as 30-month Global Empathy, $F(1,47)=3.81$, $p=.06$, $R^2=.07$, at a marginally significant level. In dyads characterized by high levels of synchrony and mutuality of emotions, children had higher levels of empathic responding at 24 months, and tended to have higher levels at 30 months.

Conclusions: This is the first known study to examine the relation between indices of early parent-child interaction quality and later empathic responding in children at-risk for an ASD. Consistent with research on typically developing children, children of dyads characterized by high levels of affective synchrony during interactions in the second year of life displayed more empathy at 24 months of age. Parental emotional supportiveness alone was not significantly associated with child empathy. This suggests that the child's role in early interactions is central to the later development of empathic behaviors. Overall, the quality of early parent-child interactions appears to be important for social outcomes in high-risk siblings. Future goals include investigating genetic and other possible contributors to empathy variation in children at-risk for an ASD.

138.025 25 Parsing Heterogeneity in Autism Spectrum Disorders Using Measures of Dynamic Visual Scanning. J. M. Moriuchi*[1], K. A. Rice[2], W. Jones[1] and A. Klin[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*University of Maryland*

Background: Eye-tracking technology has been widely adopted in autism research to evaluate social attention, but at present, most work has focused on summary measures of visual fixations on specific regions-of-interest, such as the eyes or mouth. While these measures have generally revealed group differences between children with an autism spectrum disorder (ASD) and typically-developing (TD) children, they

miss some aspects of how children engage with and respond to dynamically changing social environments. Recent research with school-age children with ASD revealed that while children with different IQ profiles had similar overall amounts of visual fixation on regions-of-interest, the social adaptive value of what they fixated significantly differed based on IQ profile. To better understand how those differences emerge and are manifest in dynamic visual scanning, our laboratory has developed a novel approach to map and quantify the time-varying visual salience of stimuli in the environment, allowing us to determine not just overall amount of eyes fixation, but whose eyes were fixated and at which moments in time.

Objectives: The aims of the current study are (1) to assess alterations in time-varying visual salience as a diagnostic predictor of ASD and (2) to investigate how different patterns of time-varying visual salience are related to an individual's level of social and cognitive functioning.

Methods: Eye-tracking data were collected while school-age children with ASD (n=109) and chronological age-matched TD peers (n=26) viewed video scenes of children and adults engaged in social interaction within naturalistic visual settings. The ASD sample represented a broad range of level of social disability and cognitive functioning. A subset of children with ASD (n=37) matched to TD peers on verbal, nonverbal, and full-scale IQ were used for between-group comparisons whereas the full ASD group was used for within-group examinations of ASD heterogeneity. Examining data from TD participants, the visual salience of all areas of the onscreen image was calculated by kernel density analysis through the duration of the videos to create a continuous measure of normative time-varying visual salience. We derived measures of deviation therefrom for each participant and then compared across matched diagnostic groups as well as across cognitive profile subgroups of children with ASD based on full-scale IQ and the discrepancy between verbal and nonverbal IQ.

Results: Preliminary analyses suggest that deviations from normative time-varying visual salience are more robust classifiers of ASD than summary visual fixation measures and that the degree of deviation is related to level of social disability. Ongoing analyses are examining how an individual's cognitive profile may modulate the relationship between time-varying visual salience and social functioning.

Conclusions: The present study proposes that a measure of time-varying visual salience may be a reliable and useful diagnostic marker for autism. In addition, results on differences in dynamic visual scanning patterns in cognitive profile subgroups of children with ASD not only suggest differences in etiologies, but may also support targeted interventions tailored to an individual's specific learning style.

138.026 26 Inferring the Facial Expression From the Social Context in Children with Autism Spectrum Disorders. S. Matsuda* and J. Yamamoto, *Keio University*

Background:

Individuals with autism have various kinds of difficulties on the cognition of facial expressions. Therefore, we need to consider comprehensive analysis for perception, conceptualization, comprehension, verbal-naming, imitation, appreciation of the situation, prosodic inference, self-other mapping for examining the cognition of faces, and facial expressions. We have developed the comprehensive face and facial expression learning support system called Face-Expression Expert System (FEEP), which is capable as an assessment tool and an intervention tool. FEEP would establish relationships between facial expression, emotion-words, prosody, action, and descriptive sentences, covering wider developmental age.

Objectives:

In the present study, we assessed selection of facial expression in children with autism when they looked at actions between two people.

Methods:

Ten boys (between 4 to 10 years old) diagnosed with autistic disorder or PDD-NOS participated in the study. Japanese standard scale of development was used to assess their developmental age. Their autism severity was rated by CARS (Schopler, Reichler, DeVellis, & Daly, 1980). Participants watched movie clips of interactions of a man and a woman. In each clip, the woman acted to induce the man to be

emotional (eg, take his toy.) Then, the man's face turned to be mosaic masked. Then, the clips had four types of ending; "happy," "sad," "angry," and "surprised." All clips were silent, and clip lengths were between 6 to 15 seconds. At the end of clips, four colored pictures of facial expressions were presented. Participants were required to choose the picture, which facial expression was corresponding to the man's mosaic masked face. In order to select the correct picture, participants had to take both a woman's action and a man's action into account.

Results:

Total percentages correct for the task were calculated for each participant in each emotion. The participants' mean percentage of correct response was 73.3%. There was a significant correlation between the percentage of correct response and the participants' developmental age, $r = 0.71$, $p < 0.01$. "Happy" was the most successfully recognized emotion (83.3%), and "sad" was the least (63.3%). Despite these findings, there was no statistically significance in types of ending, $F(3, 27) = 1.54$, n.s. Error patterns were examined using confusion matrix. Participants confused "angry" as "sad" the most (25.0%).

Conclusions:

Our findings indicated that the abilities of selecting facial expression through actions between two people correlated with developmental age.

138.027 27 Direct Evidence for Configural Face Processing in ASD: Use of a Gaze-Contingent Stimulus Presentation. J. Steyaert*[1], K. Evers[2], G. Van Belle[3], I. L. J. Noens[4] and J. Wagemans[2], (1)*University Hospital Maastricht*, (2)*K.U. Leuven*, (3)*University of Louvain La Neuve (UCL)*, (4)*K.U.Leuven*

Background: Children with an Autism Spectrum Disorder (ASD) have impairments in social reciprocity, which may be related to face processing, as indicated by early signals, such as absence or delay of gaze, delayed gaze following, diminished attention to faces, and an absence of social smile (Volkmar, Chawarska, & Klin, 2005). Face identity recognition research, however, has provided mixed evidence for an atypical face processing strategy in children with ASD, using a variety of stimuli and paradigms. Whereas some researchers find strong indications for a disturbed configural face processing and a local processing style, other studies did not support that. However, most of this evidence is rather indirect.

Objectives: Using gaze-contingent stimulus presentation, we wanted to provide more direct evidence for local and global face processing strategies in children with ASD. This technique allows to manipulate the kind of information available at or around fixation, experimentally inducing a more local or global processing strategy.

Methods: Two groups of 10-to-14-year old boys without intellectual disabilities (IQ >= 70), group-wise matched for age, VIQ, PIQ and TIQ, were tested. The ASD group consisted of 16 boys with a diagnosis based upon a multidisciplinary assessment according to DSM-IV-TR PDD-criteria. The typically developing (TD) group comprised 14 boys with a Social Responsiveness Scale (SRS) score below cut-off for autism.

A same-different task was used with two static neutral faces presented side by side on a computer screen. Whereas the target face was always presented in full view, the amount of information available in the match face was manipulated, using a gaze-contingent stimulus presentation technique. In the window view, a gaze-contingent foveal window restricted the participants' view to the information of the fixated feature, allowing local processing, but preventing configural face processing. In the mask view, a gaze- contingent foveal mask covered the high-resolution information at the fixated location, necessary for a local processing of the fixated features. Thus, the foveal mask prevented local processing, but configural face processing based on the rest of the information around the mask is still possible.

Results: Both groups performed better in the foveal mask condition, in comparison to the foveal window condition, suggesting that both groups employed a global (configural) processing strategy. In the foveal window condition, the ASD group did not perform better than the TD group, suggesting that they were not better at using a local strategy. In the foveal mask condition, the ASD group did not perform worse than the

TD group, suggesting that they were not worse at using a global (configural) strategy.

Conclusions: Using a gaze-contingent stimulus presentation, we provided direct evidence for an intact configural face processing style in 10-to-14-year old boys with ASD. Further analyses will focus on the spontaneously fixated regions (e.g., first fixations) and the scanning behavior (e.g., saccade length). We will also present data from an on-going study with younger children (6-to-10-year-olds), using the same paradigm.

138.028 28 What Engages Children with Autism Spectrum Disorders When Viewing Naturalistic Social Scenes?. S. Shultz*[1], A. Klin[2] and W. Jones[2], (1)*Yale University*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: A central focus of autism research is to understand the experience of individuals with autism as they navigate the social world. Eye-tracking provides a means to 'see the world through the eyes of others', demonstrating that people with ASD spend more time looking at bodies and objects than at faces. While these findings indicate altered visual salience in ASD, they fail to capture a critical aspect of a viewers' experience: how engaged they are with what they're attending to. Engagement becomes critical when one considers that not all looks towards a stimulus are equal. Fixation may reflect active engagement or a passing glance, made without extracting important information. Although children with ASD look less at eyes compared to TD children, they do attend to eyes as much as 30% of the time when viewing movies. What is the experience of children with ASD when focusing on socially relevant stimuli?

Objectives: (1) When children with ASD and TD children fixate on the same region of a scene are children with ASD as engaged as TD children? And (2) What types of stimuli engage children with ASD?

Methods: Engagement was quantified by measuring eye-blink inhibition while children with ASD (n = 49) and TD children (n = 26) viewed movies of social interaction. People spontaneously inhibit blinks when processing salient stimuli to minimize the loss of visual information that occurs when blinking. Exactly when inhibition occurs marks the viewers' subjective assessment of how engaging a stimulus is (Shultz, Klin, & Jones, in press). Here, we used blink inhibition to measure between-group differences in engagement when both groups fixated on the same part of a scene. In addition, we examined where children with ASD were fixating when they were highly engaged.

Results: When both groups fixated on eyes and mouths, children with ASD showed reduced blink inhibition relative to TD children, suggesting reduced engagement. However, when both groups fixated on bodies and objects, children with ASD showed significant blink inhibition, suggesting increased engagement. Ongoing analyses are aimed at further exploring the type of stimuli perceived as most engaging by children with ASD.

Conclusions: Measures of eye-blink inhibition indicate that even when children with ASD look at eyes and mouths at the same time as TD children, they are not as engaged, suggesting that their experience of viewing these stimuli may differ fundamentally from that of TD children. This has implications for interventions and clinical assessments, which consider eye contact and gaze towards socially relevant stimuli to be a sign of social ability. The current results caution against interpreting these behaviors as definitive indicators of social ability by demonstrating that simply fixating on these stimuli does not indicate that they are being processed by children with ASD in the way that we might expect. Children with ASD may be driven to this stimulus for different reasons than TD children. What is driving the attention and engagement of children with ASD and the ontogeny of this altered engagement are important questions for future research.

138.029 29 Combining Viewing Patterns and Socio-Emotional Insight Questions in Dynamic Social Scenes in Children with Autism Spectrum Disorder (ASD). K. Evers*[1], F. Hermens[1], I. L. J. Noens[2], J. Steyaert[3] and J. Wagemans[1], (1)*K.U. Leuven*, (2)*K.U.Leuven*, (3)*University Hospital Maastricht*

Background: Given that social impairments are one of the core features in Autism Spectrum Disorders (ASD), it is not surprising that a lot of research focused on emotional

processing in individuals with ASD. Despite mixed findings, most researchers using stimuli with a high ecological validity (e.g., complex emotions embedded in a social context) found evidence for problems with emotion processing in children with ASD. Since the pioneer study of Klin et al. (2002), many studies focused on emotion processing strategies using eye-movement recording. Despite the evidence for atypical scanning patterns provided by Klin et al. (2002), not all researchers found major differences in viewing style, or they found evidence for more subtle differences between both groups.

Objectives: We wanted to provide insight into the socio-emotional processing of children with an Autism Spectrum Disorder (ASD), using facial expressions within a dynamic complex social context. Therefore, we combined two lines of research in the emotion processing field, by examining the relationship between viewing patterns and socio-emotional insight, using complex social scenes.

Methods: Two groups of 10-to-14-year old boys without intellectual disabilities (IQ >= 70), group-wise matched for age, TIQ, VIQ and PIQ, participated in this experiment: an ASD group of children with a diagnosis based upon a multidisciplinary assessment according to DSM-IV-TR PDD-criteria and a typically developing (TD) group, representative for the general population. Five dynamic episodes, selected from a Dutch-spoken soap series for adolescents, were shown, while eye-movements were sampled monocularly at 500 Hz using an Eyelink II system (Pupil Only Mode). At the end of each episode, a questionnaire was used to test the children's understanding of the social-emotional events.

Results: We did not find group differences in global scanning parameters (in none of the five episodes): there were no differences concerning fixation count, fixation duration, or saccade amplitude. In addition, four dynamic regions of interest (ROI) were created: face, body, eyes, and mouth. We could not provide evidence for differences in viewing time in the selected ROIs for one video clip analyzed so far.

Conclusions: We compared viewing patterns of children with and without ASD when watching dynamic social scenes. No evidence for difference in global scanning parameters was found. Preliminary results showed no differences in proportion viewing time in 4 ROIs: face, body, eyes, and mouth. Future analyses could comprise more subtle scanning parameters, such as first fixations, mouths on speaking and non-speaking persons, and alternations between socially interacting individuals. Moreover, separate analyses will focus on different emotional expressions and different fragments (e.g., more subtle socio-emotional aspects on which qualitatively strange responses were made).

138.031 31 Attention Capture by and Preference for Faces with Direct Gaze in Toddlers with ASD, DD, and TD. K. O'Loughlin*, S. Macari, F. Shic and K. Chawarska, *Yale University School of Medicine*

Background: Faces are prioritized in the attentional system and capture attention at the early stages of visual information processing, e.g., when typical adults are simultaneously presented with a face and an object, their saccadic responses are initiated more rapidly towards the face (Crouzet et al., 2010). Consistent with these behavioral findings are electrophysiological studies suggesting faster brain responses to faces than non-faces in typical infants (De Haan & Nelson, 1999) and adults (Bentin et al., 1996). Furthermore, faces with direct gaze attract and hold attention to a greater degree than faces with averted gaze in infants (Farroni et al., 2002) and adults (Senju et al., 2006) . To date, neither of these attentional biases has been studied in toddlers with autism.

Objectives: We examined: 1) attention capture to faces and objects; and 2) preferential orienting to faces with direct gaze in 18-24 month old toddlers with autism spectrum disorder (ASD), developmental delay (DD), and typical development (TD).

Methods: Eighty toddlers were tested in a visual preference paradigm: ASD (N=32; M=1.85yrs), DD (N=18; M=1.62yrs), and TD (N=30; M=1.63yrs). Two conditions were presented: 1) Gaze where a face with direct gaze was paired with the same face with averted gaze (4 trials) and 2) Object, where nondescript objects were presented in an upright and inverted position. Each trial lasted 5s and was preceded by a 1s central fixation point. Saccadic reaction time and direction of the first saccade were coded by three coders with 85% inter-rater reliability.

Results: Mixed models diagnosis x condition ANOVA indicated that toddlers in each group initiated their first saccade toward one of the two stimuli (target or distracter) *faster* in Gaze (M=270ms, SD=79) than in Object (M=323ms, SD=104) conditions (p=.001). There were no effects of diagnosis (p=.73) or diagnosis x condition interaction (p=.80). However, in the Gaze condition, only TD and DD controls directed their first saccade toward the target (direct gaze) (p=.01 and p=.01, respectively). In the Object condition, the control groups performed at chance level. Toddlers with ASD performed at chance level in both conditions.

Conclusions: This study is the first to demonstrate that the presence of faces (relative to objects) accelerates the generation of saccades in toddlers with and without social disability. It is unclear whether saccadic responses were facilitated by the same process in all three groups, e.g., inherent salience versus ubiquitous familiarity of facial stimuli. This finding is consistent with our previous work (Chawarska, Klin, & Volkmar, 2003) suggesting that the very early and elementary stages of face processing in toddlers with ASD might be preserved. Despite this advantage, toddlers with ASD were less likely to direct their first saccade to the face with greater biological significance (i.e., direct gaze). This is consistent with other studies suggesting impairments in higher-order face processing in toddlers with ASD including deficits in scanning and recognition (Chawarska & Shic, 2009; Bradshaw et al., 2011).

138.032 32 Spontaneous Gaze Following within a Naturalistic Social Situation in Children and Adolescents with Autism Spectrum Disorders. E. Birmingham[1], K. H. Johnston*[1], T. Foulsham[2], B. Larryant[3], A. Stemer[1], A. Kingstone[3] and G. Iarocci[1], (1)*Simon Fraser University*, (2)*University of Essex*, (3)*University of British Columbia*

Background: A core characteristic of autism is reduced *social attention*, specifically reduced "Response to Joint Attention (RJA)" or "gaze following" (Leekam et al., *J. Child Psych. & Psychi*. 1998; Mundy *Devel. and Psychopath.* 1995). Studies of gaze following have included semi-naturalistic interactions with infants and young children (where an experimenter sits in front of child, initiates eye contact, and turns his/her head to an object in the room) or computer-based studies (where an image of a face with averted gaze is presented at the center of the screen). Findings from these studies are mixed: some studies have revealed reduced or abnormal gaze following in individuals with autism (e.g., Dawson et al., *JADD* 1998) while others have not (e.g., Chawarska et al., *Child Dev*. 2003). Although the reason for this inconsistency is unclear, a common characteristic of gaze following paradigms is that the gaze cue is *pre-selected* for the participant, which may lead participants with autism to attend to the cue in a way that is artificial and not representative of how they would respond in a more natural environment (Birmingham et al., in press). There is a paucity of research in which the gaze cue is not pre-selected for the individual (i.e., research in which the individual is free to *select* gaze as an important stimulus). Given the evidence showing reduced orienting to social stimuli in autism (Dawson et al., *JADD* 1998), it is critical to examine *spontaneous gaze following* within naturalistic social situations.

Objectives: Here we present a preliminary study on spontaneous following within a naturalistic social interaction. In this novel paradigm, participants play an interactive game with an experimenter, who pseudo-randomly delivers task-irrelevant head turns when the child is not attending to the experimenter. Using a portable eye tracker, we are examining participants' allocation of attention, both to the experimenter's gaze (*gaze selection*) and in response to the experimenter's gaze (*gaze following*).

Methods: Data collection for this project is in progress, however, data from 21 participants has been collected. Children and adolescents with high functioning autism (i.e., IQ >85 as measured by the *Stanford Binet Intelligence Scale*; Roid, 2003) between the ages of 8 and 15, will be matched to a sample of typically developing (TD) controls. Eye tracking measures and video observations of social attention will be correlated with scores on the *Social Responsiveness Scale* (Constantino & Gruber, *WPS* 2005), to explore relationships between social attention and parent ratings of social functioning.

Results: We expect that individuals with autism will show reduced gaze selection and reduced or delayed gaze following relative to TD individuals. In addition, we expect that

other, more qualitative characteristics of shared attention, such as integration with facial expression and social responses, will be different in participants with autism.

Conclusions: This study will provide a novel analysis of gaze selection and following in a naturalistic setting. The findings may have important implications for the design of effective intervention strategies and for our theoretical understanding of the development of social cognition among children with autism.

138.033 33 Viewing Patterns of Naturalistic Scenes Differ Between Typically Developing Children and Those with Autism Spectrum Disorders in the Second Year of Life. P. Lewis*, S. Habayeb, T. Tsang, W. Jones and A. Klin, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Previous research has shown that, compared to typically-developing peers, 2-year-olds with Autism Spectrum Disorders (ASD) fixate more on the mouth and less on the eyes when watching videos of infant-directed caregiver approaches. These atypical patterns of looking indicate altered patterns of engagement with the social world: decreased fixation on the eyes is correlated with more severe social disability (as measured by the ADOS 1 Social Algorithm). Similar results have been observed in adolescent and school-age children, demonstrating the extent to which patterns of visual fixation can serve as performance-based metrics of social functioning. However, the extent to which these metrics quantify relevant behaviors in the second year of life is not yet known.

Objectives: This study will advance this line of research into the 2nd year of life, testing the extent to which (a) differential patterns of visual fixation are apparent in 12-24 month-old children with ASD, and (b) whether those patterns of visual fixation are related to social and communicative competence. We hypothesize that like older cohorts, 12-24 month-olds with ASD will fixate less on the eyes and more on mouths, bodies, and objects; and that these patterns will be correlated with level of social disability.

Methods: 12-24 month-olds with ASD (ASD, N = 48), controls with developmental delays but without ASD (DD, N = 14), and typically-developing children (TD, N = 48), watched video clips of actresses engaged in child-directed caregiving activities. Data were collected using eye-tracking, and visual fixation was quantified as the percentage of time spent fixated on each region of interest throughout all movies. Between-group comparisons measured level of fixation between children with ASD and TD and DD controls. Within-group analyses tested for correlations between visual fixation and scores on the Mullen Scales of Early Learning, Vineland Adaptive Behavior Scales, and the Autism Diagnostic Observation Schedule (ADOS).

Results: In comparison with typically-developing controls, 12-24 month-old children with ASD show increased fixation on body and object areas. Contrary to our initial hypothesis, mean level of ASD and TD eye fixation was not significantly different in this age group. However, this similarity appears to be driven by a developmental change in TD behavior: relative to typically-developing 2-year-olds, 12-24 month-old TD children show increased fixation on the mouth. TD fixation on mouths was highly correlated with verbal function: more mouth looking in this age group correlated with better verbal function. In children with ASD, however, this was not the case: fixation on eyes and mouth was uncorrelated with verbal and nonverbal function, but was instead correlated with level of social disability; more mouth looking and less eye looking both predicted more severe impairment in social disability.

Conclusions: These results demonstrate one way in which social visual engagement relates to processes of normative socialization in typical children. In contrast, for children with ASD, the data reveal that by 12-24 months, these children are already on an altered course of development, in which fixation on eyes and mouths does not fulfill its normative role in social adaptive action.

138.034 34 Special Interests in Adults with Autism and Their Potential for Employment. J. C. Kirchner*[1], S. Dern[2], D. Müller-Remus[2] and I. Dziobek[1], (1)*Freie Universität Berlin*, (2)*Auticon*

Background:

Special Interests are a defining characteristic of many individuals on the autism spectrum (Winter-Messiers, 2007).

Even though a core problem for many individuals with autism is unemployment (Baumgartner et al. 2009), there is little knowledge about the potential of those Special Interests for employment possibilities. In the last years there have been founded a growing number of IT-companies (e.g. Specialisterne, Passwerk) which are specialized in employing individuals on the autism spectrum and other initiatives trying to bring individuals with autism into permanent job positions (e.g. autworker, Arbeit nach Maß). However, to our knowledge there are no studies which systematically assessed types of Special Interests and abilities. Additionally there is more knowledge needed about the general set-up which individuals with autism need in their working space to work accordingly to their potential. The research presented here is part of a feasibility study for a new start-up company (Auticon) in Berlin, Germany, which seeks to specialize in employing individuals with autism.

Objectives:

The study is an exploratory approach to describe Special Interests and measure their potential for employment in individuals with autism. Furthermore interfering factors (such as noise) or facilitating factors (such as flexible hours) which may affect job performance in individuals with autism are assessed.

Methods:

With a newly compiled self-report questionnaire the study is currently conducted in Berlin, Germany. The questionnaire was developed in close consultation with a focus-group of autistic adults to ensure accessibility, respect, inclusion and relevance of items for autistic adults. Individuals with autism are contacted through internet panels and mailing lists to fill out the online questionnaire. Only subjects who report an official diagnosis of autism are included. The questionnaire comprises qualitative (e.g. description of Special Interests) and quantitative elements (e.g. ratings of skills).

Results:

Preliminary data (based on 24 individuals on the autism spectrum) show a wide range of Special Interests in individuals with autism with potential for application in work tasks (e.g. informatics, natural sciences). Subjects spend an average time of 18.5 hours (SD: 12.06) per week with that Special Interest and estimate their level of abilities in this tasks on a scale from basic knowledge (0) to superior knowledge (5) as good knowledge (M: 3.8, SD: 1.16). As interfering with their job performance “mobbing by colleagues” (40,9 %) and “unpleasant sounds” (36,4%) were the factors reported most often, while “the supervisor knowing about the employee being autistic” was most often rated as a facilitating factor (68,2 %).

Conclusions:

Special Interests represent important abilities in individuals on the autism spectrum which may be important for employment strategies. Taken together with the consideration of interfering and facilitating factors for job performance our study can help to develop successful employment strategies for individuals with autism. More in-depth results about types of Special Interest, current job situation and job satisfaction will be reported at the conference.

138.035 35 Too Much, Too Little, Too Late: Structure of Personal Narratives of Emerging Adults with and without Autism Spectrum Disorder. A. McCabe*, A. Hillier and C. Shapiro, *University of Massachusetts Lowell*

Background: Problems with pragmatic language are the major defining linguistic characteristic of autism. Narrative is an aspect of pragmatic language that has not received much attention in individuals with autism spectrum disorders (ASD). Personal narratives have received even less attention in this population despite being more functional than fictional ones. Prior studies have mostly focused on children rather than adults with ASD.

Objectives: Our main objective was to collect personal narratives from adolescents and young adults on the autism spectrum and compare them to matched typically developing adolescents and young adults. Personal narratives are the way we form and maintain relationships with others, including friends, family, teachers, doctors, law enforcement individuals, among others. We were interested in the challenges with personal narrative experienced by those with ASD.

Methods: We used the Conversational Map Approach (McCabe & Rollins, 1994) to collect personal narratives in conversation from those with ASD and a matched comparison group. Interviews were then transcribed and the narratives identified. Narratives were scored using High Point Analysis.

Results: As hypothesized, narratives from individuals with ASD were significantly less complex in high point structure compared to their typically developing peers. There were no significant differences between the groups on three other measures, length in words, length in propositions, or words per proposition. Individuals in the comparison group produced significantly more conjunctions per proposition than did individuals with ASD.

Conclusions: As predicted, emerging adults with ASD produced narratives that were significantly poorer in quality than their typically developing peers, though the narratives of the two groups did not differ in length (in words or propositions) or sentence complexity. The profile of narrative structures for those with ASD was very different - they either included too much detail or not enough detail. The impoverished form of their narratives makes it more difficult for them to make sense of their emotional experiences. The narratives of those with ASD tended to be either rambling or skeletal, and it is likely that this interferes with virtually all their social interactions on a daily basis. Interventions should focus on facilitating the ability of those with ASD to tell personal narratives in order to improve their quality of life.

Cognition and Behavior Program
139 Cognition and Behavior II

139.036 36 Children with ASD Do Not Benefit From Being Oriented to the Most Informative Part of the Face When Classifying Emotions. L. Whitaker*, C. Jones and D. Roberson, *University of Essex*

Background:

Individuals with autistic spectrum disorders (ASD) have been observed to show atypical patterns of eye gaze during face processing. However, these findings alone do not shed light on what facial cues individuals with ASD are using to classify facial expression. Different areas of the face have been found to be critical when encoding certain facial expressions. Happiness is predominantly signified by the mouth area, and anger through the eye and brow line (Smith et al., 2005). If a non-critical area of the face is occluded then critical areas should become more salient, resulting in enhanced recognition ability. The current study therefore aims to explore whether individuals with ASD can benefit from having their attention directed to the most informative part of the face when classifying an emotional expression. Failure to benefit would suggest a fundamental difficulty with extracting pertinent information from facial cues.

Objectives:

To determine whether individuals with low functioning ASD benefit from being directed to a part of the face that aids the identification of a specific emotion.

Methods:

A group of eighteen children with low functioning ASD (Age: 10;8 years, VIQ: 64.5, NVIQ: 100.6) and eighteen typically developing (TD) children (Age: 8;8 years, VIQ: 92.7, NVIQ: 101.4) participated in an emotion classification task. Photographs of faces expressing angry, sad, happy and (positive) surprised expressions were presented in three conditions: full face, wearing sunglasses (eyes occluded) and wearing a mask (mouth occluded), following Roberson et al. (under review). Each condition was divided into two parts. In the first participants had to decide if each person was feeling 'happy' or 'not happy' and in the second participants had to decide if each person was feeling 'angry' or 'not angry'.

Results:

For the baseline full face condition, the TD group performed better than the ASD group at classifying angry faces, but did not differ in their ability to classify happy faces. To assess for group differences in the relative effect of occluding parts of the face, difference scores were calculated for each group to determine the benefit of the mask or the sunglasses compared to the baseline full face condition. Compared to the ASD group, the TD group showed significantly greater benefit of the mask when classifying angry faces and significantly greater benefit of the sunglasses when classifying happy faces.

Conclusions:

When classifying emotional expressions, the TD group demonstrated greater benefit than the ASD group when oriented to the most informative part of the face. Indeed, there was no evidence that the ASD group benefited significantly from being cued to the eyes for identification of anger or to the mouth for identification of happiness. This is compatible with the hypothesis that poor emotion recognition ability in ASD is not merely a function of diminished attention to core features. Rather, it suggests a difficulty in extracting relevant information from core regions.

139.037 37 Evidence That the Local Processing Bias in Autism Is Modulated by the Social Deficits. S. N. Russell-Smith*, M. T. Maybery and D. M. Bayliss, *University of Western Australia*

Background: In their novel theoretical account in which they posit autism and positive schizophrenia to be diametrically opposed disorders, Crespi and Badcock (2008) claim that autistic and positive schizophrenia traits contrastingly affect preference for local (i.e., piecemeal) versus global (i.e., integrative) processing. Specifically, these authors argue that while individuals with positive schizophrenia tend to process information at a more global level, individuals with autism process information at a more local level. While our previous study provided initial support for these claims, this work also highlighted that there is limited understanding of the precise basis of the local processing bias in autism. A specific question raised was whether this processing bias is a general characteristic of individuals with autism, or whether this bias is modulated by specific autistic traits.

Objectives: The current study aimed to further investigate the basis of the local processing bias in autism by exploring how particular subsets of autism symptoms relate to performance on the Embedded Figures Test (EFT). This task requires one to resist experiencing an integrated visual stimulus or gestalt in favour of seeing a composition of single elements, and thus has been used commonly in the autism literature to assess processing style preference.

Methods: Since a diagnosis of autism requires the presence of social deficits, impairments in communication, and restricted interests and repetitive behaviours, separating the relationship between a local processing bias and different facets of the disorder in autism samples is difficult. Therefore, the current study used the Autism Spectrum Quotient (AQ) to identify students with high levels of specific autistic-like features. In accord with the notion that the autism spectrum consists of independent behavioural domains, investigations of the factor structure of this measure have found it to comprise largely independent factors. Since the most consistently replicated AQ factors reported by ourselves and other authors have been "Social Skills" and "Details/Patterns" factors, which neatly divide the social and non-social aspects of autism, these factors were of most interest to the current investigation. Accordingly, using a group based design (N=80), the current study compared the EFT performance of high and low scorers on these two factors. The study was then replicated with a second independent sample.

Results: Surprisingly, in the two samples tested, superior EFT performance was found to significantly relate to higher "Social Skills" scores (i.e., greater social difficulty), but not to higher scores on "Details/Patterns". Therefore, the results suggest that the local processing bias in autism may link specifically to the social deficits.

Conclusions: The finding that it was only the social dimension of the AQ that relates to superior performance on the EFT is interesting, especially in the context of other recent studies that have concluded that the local processing bias in autism is not linked to autistic traits per se, but is instead linked to correlates of autism such as systemizing. The current results have potential implications for our understanding of the basis of the social deficits in autism, as well as the diagnostic specificity and treatment of the disorder.

139.038 38 Bullying and Victimization In Children with Asd; The Mediating Role of Basic and Moral Emotions. C. Rieffe*[1], M. Camodeca[2], L. B. Pouw[1], A. Lange[1] and L. Stockmann[3], (1)*Leiden University*, (2)*University of Chieti*, (3)*Center for Autism*

Background: Social problems in children with ASD are part of their diagnosis. However, the question we should ask ourselves is to what extent these social problems can be explained by problems in the emotion regulation as we also

observe in TD children. Moral emotions, such as shame and guilt, play an important role in peer bullying in TD children. In children with ASD, these moral emotions might be less influential, yet dysregulation of the basic emotions might be more important in understanding the origin of bullying.

Objectives: In this study we examined the extent to which emotion dysregulation of basic and moral emotions are related to bullying and victimization in children with ASD, as compared to their TD peers.

Methods: The study included 130 children and young adolescents (64 with ASD, 66 TD, Mean Age 140 months), who filled out self-report questionnaires about their levels of guilt, shame, anger, fear, bullying behaviors and how often they were victim of bullying behaviors by others.

Results: Consistent with the literature, also when using self-report questionnaires, children with ASD report more often being bullied by their peers than TD children, but they report the same level of bullying others. Additionally, the outcomes showed that less guilt was associated with more bullying in both groups, but this association disappeared when delinquency was added to the model for TD children; More anger was also strongly and uniquely associated with more bullying and victimization in children with ASD but not in TD children; And fear was uniquely associated with victimization in TD children, but not in children with ASD.

Conclusions: These outcomes support the notion that lack of guilt is an essential antecedent of bullying for TD and ASD children. However, unlike TD children, emotion dysregulation, particularly anger, plays an important role in victimization as well as bullying in children with ASD. In sum, these outcomes suggest that bullying behaviors in children with ASD are not related to cold-blooded antisocial behaviors as can be observed in TD children, but to emotion dysregulation instead.

139.039 39 The Effect of Perspective and Training on Imitation in Autism. E. Gowen*[1], K. S. Wild[2] and E. Poliakoff[1], (1)*University of Manchester*, (2)*Mental Health Research Network*

Background:

Imitation is important for learning new skills, along with social activities such as play and developing affiliations. Therefore, exploring imitation ability in autism is particularly relevant. In our previous work we showed that neurotypical participants imitated changes in hand movement speed in the absence, but not presence, of visual goals[1-2]. However, an autistic group failed to modulate their movement speed under either condition, adding to evidence that autistic people are more impaired on goal-less than goal-directed imitation tasks [3-4]. In the current work, we investigated whether perspective or training would improve goal-less imitation.

Objectives:

Usually we view people from the "other" or *allocentric* perspective, rather than from our "self" or *egocentric* perspective. However, imitation from the former is more challenging, as visual-spatial transformation is required. Our **first objective** was to investigate whether imitation in the autistic group would improve in the egocentric perspective, during goal-less imitation, due to the removal of cognitively demanding spatial transforms. Our **second objective** was to investigate whether training would improve goal-less imitation for the autistic group by both providing practice, and by increasing the visual saliency of the movement.

Methods:

Thirteen high functioning autistic adults and matched controls observed and then imitated video clips of hand movements, while their own hand movements were recorded. Observed movements were either directed towards visual targets (goal condition) or no targets (goal-less condition) and were of fast or slow speed. Imitation ability was characterized as the degree to which participants modulated their movement speed between fast and slow trials. Clips were presented from either the allocentric or egocentric perspective. Halfway through the experiment a training phase occurred in which the finger in the clips was painted red to increase saliency of the movement.

Results:

Participants appeared to benefit from the egocentric perspective, as imitation speed was faster for both groups.

However, modulation of imitation speed was only observed in the goal-less allocentric view for controls. Training increased imitation speed in both groups, indicating that the task became easier following training, although it did not increase the modulation of imitation speed for either group. Finally, movement variability was reduced following training in the autistic group for the goal-less condition.

Conclusions:

The autistic group benefitted from an egocentric perspective and training, suggesting they are able to map other people's actions onto their own motor system and that training can facilitate imitation. The lack of effect of the egocentric perspective or training on modulation of imitation speed for both groups highlights that task familiarity affects which aspects of the movement are imitated.

1. Wild.K et al. (2010). Exp Brain Res, 204**,** 353-60
2. Wild.K et al. (2011). JADD under review
3. Hamilton et al. (2007) Neuropsychologia, 45**,** 1859-68.
4. Hobson and Hobson (2008) J Exp Child Psychol, 101**,** 170-185.

139.040 40 Perception and Discrimination of Emotional Faces in Children with Autism Spectrum Disorders. C. Wang* and M. Jiang, *Nankai University*

Background: It has been indicated that individuals with ASD demonstrate marked abnormalities in the processing of faces and facial expressions. However, the literature on face processing in ASD has so far been largely mixed. Objectives: Our study aims to investigate emotional face processing and discrimination in children with ASD, mental retardation (MR) and typically developing (TD) children in China. Methods: 17 children with ASD, 22 children with mental retardation (MR) and 28 typically developing (TD) children attended two experiments. In experiment one, their gaze behavior was measured via an integrated T120 120 HZ eye tracker (Tobii Systems) when they watched videos of sad, happy and neutral faces (one female actress and one male actor). A multi-factor repeated measurements ANOVA with factors area of interest (AOI) (all areas, background, body, face, eyes, mouth), emotion (happy, sad, neutral) and group (ASD, TD, MR) was applied to gaze fixation durations. Experiment two is emotion discrimination task, which participants were required to choose one matched picture with the target one from six emotional faces (happy, angry, sad, surprised, afraid, disgusted). And the emotional faces were also presented in four different types (normal, inverted, blurred, inverted and blurred). Results: Significant difference was found on the average length of the face fixations of happy video ($F(2.64)=6.08$, $p=0.004$), with prolonged fixations for TD (3246 ms, SD 1083 ms) compared to those with ASD (4298 ms, SD 781 ms; $p=0.002$). When a face fixation of neutral video did occur, the time taken to make fixation on the square containing the face differed significantly between groups ($F(2.64)=25.04$, $p<0.001$). It was also found that the individuals with ASD spent less time viewing face of sad video than TD ($p=0.001$), and MR spent less time than TD ($p=0.021$), but ASD and MR did not differ ($p=0.550$). Contrary to some former results, this study showed that there was no significant difference on the amount of time fixating on the eyes of happy videos between ASD and TD ($p=0.991$), but MR had prolonger fixations than TD ($p=0.022$) and ASD had less fixation duration than MR ($p=0.038$). There was a significant effect of groups on faces of happy, neutral and sad video, but the effects disappeared when using blurred or inverted or inverted and blurred images. Conclusions: A central feature of ASD is an impairment in social attention, such as the eyes and face. Our results confirmed the former findings that the impairment in ASD may not be a unitary phenomenon. We also found that Chinese children with ASD and MR are able to understand and respond to emotions and their discrimination abilities do not differ from their TD peers.

139.041 41 Play and Emotional Availability in Mother-Child Interaction with ASD Children. A. Bentenuto[1], S. De Falco[1], G. Esposito[1], M. H. Bornstein[2] and P. Venuti*[1], (1)*University of Trento*, (2)*NIHCD*

Background: The role of parents in the play development of typically and atypically developing children is a recurrent topic in the literature (Bornstein, Haynes, O'Reilly, & Painter, 1996; Bruner, 1975; Fiese 1990; Howes, Unger, & Matheson, 1992; Noll & Harding, 2003). There is compelling evidence that

caregiver involvement in child play activities enhances the complexity, the duration, and the frequency of more advanced child play both in typically developing children and in children with intellectual disabilities (Cielinski et al. 1995 Bornstein et al. 1996, 2002; Venuti et al. 1997, 2008). This study investigates mother–child interaction and its associations with play in children with Autism Spectrum Disorder. Autism Spectrum Disorders (ASDs) are severe, neurodevelopmental disorders characterized by impairments in social interaction and communication, and restrictive repetitive or stereotypic patterns of behavior.

Objectives: Significant empirical research has confirmed the view that children with autism are predisposed not to engage in spontaneous pretend play. Concerning children with ADS, few studies have investigated parent–child interaction in terms of the overall emotional quality of dyadic interaction and its effect on child play.

Methods: A sample of 30 mothers of children with ASD (age 4 years) took part in this study. The diagnosis of participants with ASD was confirmed through clinical judgment by an independent clinician based on the DSM-IV as well as through the Autism Diagnostic Observation Schedule (ADOS - Lord, Rutter, DiLavore, & Risi, 2003). Data were collected during two consecutive 10-min play sessions videotaped continuously. A set of standard, age-appropriate toys that represent feminine, masculine, and gender-neutral categories was used (Caldera, Huston, & O'Brien, 1989). During the session, the mother was asked to play individually with her child, as she typically would. In particular, we studied whether the presence of the mother in an interactional context affects the exploratory and symbolic play of children with ADS and interrelations between children's level of play and dyadic emotional availability. Emotional availability (EA) in mother–child dyads and in father-child interaction was coded using the Emotional Availability Scales (EAS, 4rd ed.; Biringen et al., 2008). The EAS include four parent scales (Sensitivity, Structuring, Nonintrusiveness, Nonhostility) and two child scales (Responsiveness, Involving). The play sessions were independently coded from the same videotapes in accordance with a mutually exclusive and exhaustive category system that included eight levels and a default (no play) category (see Bornstein et al., 1996; Bornstein & O'Reilly, 1993; Tamis- LeMonda & Bornstein, 1996).

Results: We found that dyadic emotional availability and child play level are associated in children with ADS, consistent with the hypothesis that dyadic interactions based on a healthy level of emotional involvement may lead to enhanced cognitive functioning.

Conclusions: These results will be interest for the implementation of intervention programs focused on the parent-child relationship and on specific dimensions of child development.

139.042 42 Gender Differences in Theory of Mind and Its Impact on Social Skills. R. M. Hiller*, N. Weber and R. L. Young, *Flinders University of South Australia*

Background: Boys are diagnosed with Autism Spectrum Disorder (ASD) at a rate of approximately five times more than girls. Further, when diagnosis is sought for girls (who are not intellectually disabled), it is more likely that they will reach criteria for the less severe Pervasive Developmental Disorder (Not Otherwise Specified). Although it is accepted that genetic vulnerability can account, in part, for these sex differences, discrepancies may also emerge due to environmental protective factors that may contribute to the development of the disorder and possibly its ontogeny.

Objectives: For this project we specifically examined gender differences in theory of mind ability. It is argued here that the development of theory of mind in girls is typically more advanced and may play a protective role in the impact autism may have on the development of social skills. The use of a five-step model in theory of mind development (Wellman & Liu, 2004) allowed us to specifically examine whether gender differences were present overall or only present for specific theory of mind abilities, that are said to develop across early childhood. It is predicted here that girls are likely superior on specific theory of mind skills, and that these specific abilities will show greater association to social abilities. Gender differences in executive function ability were also examined, as it is thought to be a prerequisite of theory of mind development.

Methods: N=68 typically-developing children (n= 41 boys, n=27 girls) were recruited from childcare centres. These children ranged in age from 24 months to 61 months (M=44.81, sd=10.82). Typically developing children were targeted as we were assessing factors that may protect children from reaching the criteria for an autism diagnosis. Five theory of mind abilities were assessed based on the five-step tasks proposed by Peterson, Wellman and Liu (2005). Five executive function tasks were implemented from a range of sources. Social measures were taken from peer-play observations, parent-ratings, and teacher-ratings.

Results: Gender was not a unique predictor of variance on any executive function task. Gender was, however, a unique predictor of variance on the Knowledge Access theory of mind task, favouring females. This task (the third proposed step in theory of mind development) was found to be associated with higher pro-social behaviour and lower rates of aggression during play. Observations and teacher-report of game preference also suggest that girls have more opportunity to practice theory of mind skills through their more frequent use of verbal pretend role-plays as a game preference.

Conclusions: While there were no gender differences on the majority of the executive function and theory of mind tasks, the Knowledge Access theory of mind task did produce a gender difference favouring females. Moreover, analysis of each theory of mind task showed that it was only this third task, which was associated with better social ability. Due to this association between Knowledge Access and better social abilities, this aspect of theory of mind may indeed be acting as a protective factor against the severity with which autism may develop.

139.043 43 Measuring Play Constructs Across Measures in Young Children with ASD: Context Matters. J. M. Pierucci*[1], A. B. Barber[1], M. E. Crisler[2], M. K. DeRamus[3] and L. G. Klinger[4], (1)*University of Alabama - ASD Clinic*, (2)*University of Alabama*, (3)*Autism Spectrum Disorders Clinic, University of Alabama*, (4)*TEACCH, University of North Carolina School of Medicine*

Background: Play is an important developmental skill that fosters appropriate language skills, provides opportunity for social interaction, and increases knowledge. Additionally, play is a vital component of developmental interventions in children with ASD (Ingersoll & Dvortcsak, 2009; Lifter, 2000). While play is included in diagnostic and developmental measures, no research, to date, has examined the relation of play constructs across measures.

Objectives: The aim of the current study was to examine play in toddlers and preschoolers with ASD. Specific goals included: (1) to explore how play is assessed across five standard measures and whether play scores on these measures are related; and (2) to assess how play related to children's developmental level.

Methods: Eighteen participants (*M*=34 months; *SD*=5.82; range: 26-55 months; 13 males; 5 females) with ASD participated in a diagnostic assessment. The following measures were obtained: (1) ABAS-II: Adaptive Behavior Assessment System- Second Edition, (2) ADI: Autism Diagnostic Interview, (3) ADOS- Autism Diagnostic Observation Schedule, (4) CARS2-ST: Childhood Autism Rating Scale- Second Edition, (5) CSBS-ITC: Communication and Symbolic Behavior Scales Developmental Profile, and (6) MULLEN- Scales of Early Learning. For each measure, play constructs were developed, which were comprised of items that examined play.

Results: Pearson's correlations were conducted to examine whether play constructs were related to each other. Results revealed that play constructs for ABAS-II, CARS2-ST, and ADI were significantly related with CSBS-ITC, respectively (*r*=.75, *r*=-.54, *r*=-.66). Additionally, play constructs from ABAS-II and ADI were significantly correlated, *r*=-.57, *p*=021. There was a less clear relation between observational measures of play with no relation found between play constructs measured by the ADOS and the CARS (*r*=.11).

Pearson's correlations were conducted to examine the relation between play constructs and developmental level, as measured by scales from the MULLEN. Results revealed that fine motor skills were significantly correlated with the majority but not all play constructs (*r*'s ranging from .59 to .71) Visual reception was significantly correlated with the play construct from CSBS-ITC, *r*=.73, although visual reception was not

related to other play measures. Receptive language skills were significantly related with play constructs from ABAS-II and CSBS-ITC (r=.51, r=.60). Lastly, expressive language was significantly correlated with play constructs from ADOS and CSBS-ITC (r=.74; r=-.59).

Conclusions: Results revealed strong correlations between some play constructs. Although these data revealed that play measures were significantly related, the context differed across measures (e.g., observed play vs. caregiver reports), which can contribute to methodological differences in measurement of play. Further, while play constructs were significantly related to children's developmental levels, this relation was also influenced by the context of the rating. Overall, it is important to measure play in a variety of contexts to determine the best possible play based intervention for children with ASD.

139.044 44 Drawing Out Inner Feelings: Visual Expression and Recognition of Emotions in Drawings by Children with ASD. J. C. P. Longard*[1], S. E. Bryson[2] and I. Gericke[3], (1)*Dalhousie University*, (2)*Dalhousie University/IWK Health Centre*, (3)*Concordia University*

Background: A lack of emotional reciprocity is a cardinal feature of Autism Spectrum Disorders (ASDs). Affected individuals have difficulty identifying emotions expressed by others (e.g., Hobson, 1986), and they, themselves, tend to be emotionally non-expressive (e.g. Czapinski & Bryson, 2003; Snow et al., 1987; Yirmiya et al., 1989). One outstanding question is whether difficulties with the expression and recognition of emotion in ASD extend to visual arts. We addressed this question by asking children with ASD and typical controls to depict various emotions in their drawings, and to identify the emotion depicted in the drawings of other children.

Objectives: The primary objective of this study was to determine whether young school-aged children with ASD could depict identifiable emotions in their artwork, and recognize the emotions depicted in the artwork of other children.

Methods: Forty children aged 4 to 9 years participated in this study. Children with ASD were matched to typical controls based on expressive and receptive language skills, using the *Oral and Written Language Scale* (Carrow-Woolfolk, 1996). This study was conducted in two phases. The first phase, which involved expressing emotions, included a total of 8 children, half of whom had ASD. Modelled after Driessnack (2006), children were asked to make four drawings depicting themselves in a situation in which they felt one of four different emotions: happiness, sadness, anger, and fear. This yielded a total of 32 drawings, which were used as stimuli in the second phase. The second phase of the study, which involved recognizing emotions, included a total of 32 new participants, half of whom had ASD. Following Misalidi and Bonoti (2008), each child was asked to look at the drawings and choose which of the four emotions they recognized in each one, with the aid of small cue cards with the labels "happy", "sad", "angry", and "scared". Responses judged correct (i.e., those with a match between the emotion the child artist intended to express and the emotion selected by the participant) were given 1 point and all other answers were given a score of 0.

Results: The number of correct responses in the recognition phase of the study was analyzed using a 2 (Artist: ASD vs. Typical children) by 2 (Viewer: ASD vs. Typical children) by 4 (Emotion: Happy, Sad, Angry, and Scared) mixed analysis of variance (ANOVA). Interestingly, drawings made by children with ASD received significantly higher ratings of agreement (50.59%) than drawings made by control children (36.33%), $F(2,31) = 45.547$, $p < .001$. Additionally, there was a non-significant trend toward better recognition scores in the typical control children, $F(2,31) = 3.677$, $p > .065$.

Conclusions: While children with ASD may have some difficulty recognizing emotion in the drawings of other children, we provide preliminary evidence that the representation of emotion in drawings may be a relative strength in some children with ASD (examples of which will be provided). Given the potential this latter finding has for better understanding the inner feeling states of children with ASD, this line of inquiry warrants further study.

139.045 45 Future Thinking, Theory of Mind, and Executive Function in Children with Autism. L. K. Hanson* and C. M. Atance, *University of Ottawa*

Background:

Thinking about the future is an integral aspect of human cognition that drives a significant portion of our behaviour. Future-directed processes, such as anticipation and prospection, and future-directed behaviours, such as planning and delay of gratification allow us to act in the present in anticipation of a need or state that will only be experienced in the future. Future thinking (FT) is a component of human cognition that allows us to anticipate possibilities, plan ahead, and control aspects of our environments and our relationships with others (Suddendorf & Corballis, 2007). Recently, researchers have proposed that FT may also be related to theory of mind (ToM) and executive function (EF) (Suddendorf & Corballis, 2007). ToM is the ability to understand and attribute mental states to self and others, and EF includes inhibition, working memory, and generativity, skills that allow an individual to solve a problem or accomplish a goal (Premack & Woodruff, 1978; Welsh & Pennington, 1988). FT, ToM, and EF all undergo significant development during the preschool years and past research has found that EF and ToM are closely related in typically-developing children. (Carlson & Moses, 2001). Past research has also found that EF and ToM are frequently impaired in autism. Thus, it is important to investigate FT, a potentially related cognitive skill, in a group of children with autism. Research into FT is still in its infancy, and the exact structure of FT is unknown, although several tasks have been developed that are thought to measure FT in preschool children.

Objectives:

The current study has two objectives: (1) to investigate FT in children with autism by examining whether they demonstrate a deficit in this area, similar to the deficits found in other cognitive skill domains, including ToM and EF, and (2) to determine the relation between FT, ToM, and EF skills in children with autism.

Methods:

English-speaking children with autism between the ages of 3 and 7 have been recruited to participate in this study. Children with autism are matched using raw scores on the Wechsler Preschool and Primary Scale of Intelligence - Third Edition (WPPSI-III) to a group of typically-developing children between the ages of 3 and 5. All participants complete two testing sessions. During the first session, children complete selected subtests of the WPPSI-III, and the Childhood Autism Rating Scale - Second Edition is completed based on behavioural observations and information obtained on a parent questionnaire. During the second session, children complete a series of FT, ToM, and EF tasks in a counterbalanced order.

Results:

Data collection for this study is ongoing, but initial results suggest that children with autism have more difficulty on future thinking tasks than typically-developing children, matched on verbal ability.

Conclusions:

It is critical to understand the precise cognitive domains impacted by autism because this research will increase knowledge of how children with autism understand and plan for the future, in turn, helping us to target interventions appropriately.

139.046 46 Facial Emotion Recognition and Gender Categorization Abilities As Predictors of Social Functioning in Adults with High-Functioning Autism. L. Sperle*[1], C. A. A. Best[1], K. Rump[2], H. Z. Gastgeb[1] and M. S. Strauss[1], (1)*University of Pittsburgh*, (2)*Children's Hospital of Philadelphia*

Background: Individuals with autism display deficits in various face processing skills, including facial emotion recognition (Rump et al., 2009) and facial gender categorization (Newell et al., 2010). Face processing abilities have important implications for the development of fundamental social interaction skills (Tonks et al., 2007). However, no known studies to date have tested whether these face processing abilities relate to social behavior among adults with high-functioning autism (HFA).

Objectives: The present study examined the extent to which facial emotion recognition and gender categorization abilities relate to social behavior in adults with HFA. It was expected that better performance in facial emotion recognition and gender categorization tasks would be associated with lower

social impairment as reflected in scores on the Social Responsiveness Scale (SRS).

Methods: Adults with HFA *(n=26; M_{age}=23.8Y)* completed a facial emotion recognition task that consisted of ambiguous morphed faces along neutral to target emotion continua. The target emotions were anger, fear, sadness and disgust. In addition, participants (*n=28; M_{age}=23.6Y)* completed a facial gender categorization task of faces that ranged in their typicality of gender (e.g., more or less masculine looking men). All participants were administered the Autism Diagnostic Observation Scale (ADOS), the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) and the Social Responsiveness Scale (SRS).

Results: Results indicate that emotion recognition accuracy for ambiguous faces was negatively associated with the overall SRS score (r=-.49, p=.01). Interestingly, the SRS subscale of social motivation had the highest correlation with facial emotion recognition performance (r=-.54, p<.01), indicating that as social motivation deficit scores increased, facial emotion recognition accuracy decreased. With regard to gender categorization, as adults with HFA's accuracy scores for more typical gendered faces increased, overall SRS scores decreased (r=-.46, p=.01). Additionally, participants who had higher autism mannerisms SRS subscale scores tended to be less accurate at gender categorization for more typical faces (r=-.46, p=.02) but not for emotion recognition (r=-.31, p>.05).

Conclusions: Both facial emotion recognition ability and facial gender categorization ability were associated with social behavior among adults with HFA. Specifically, higher accuracy at these face processing tasks was related to lower social impairment scores. This supports the applicability of face processing skills to actual social functioning and potentially the development of fundamental social interaction skills. Surprisingly, higher social motivation was related to better facial emotion recognition performance. Although the causal direction of this relationship cannot be ascertained from the present study, the role of social motivation on socially salient cognitive skills was an interesting finding that requires further investigation. In addition, the association between autism mannerisms and poorer facial gender categorization ability suggests that prototypical face processing deficits are indicative of autism symptomatology.

139.047 47 Social Orientation Among School-Age Children with Autism. J. A. Hobson*[1], P. Hobson[2], R. Edey[3], R. Hithersay[4] and C. S. Mich[5], (1)*Institute of Child Health, UCL*, (2)*University College London and Tavistock Clinic, London*, (3)*Institute of Child Health*, (4)*University College London*, (5)*Stanford University School of Medicine*

Background: Failure to orient to social stimuli (e.g. one's name) is an early-occurring impairment in autism. Research by Dawson and colleagues (1998; also 2004) reported that when presented with social (hand clapping / name calling) and non-social (rattle / musical toy) stimuli, children with autism tended to orient less, a failure more pronounced for social stimuli.

Objectives: We examined the 'social' quality of orientation in relation to sounds among school-age children with autism, who we predicted a) would be less likely to orientate towards testers and b) when they orientated, this would be less interpersonal in quality.

Methods: Participants were 12 children (2 girls) with ADOS-confirmed autism and 12 children (4 girls) with learning disability / specific language disorder. Groups were matched for age (M = 8 years; 3 months). Cognitive ability scores on the Kaufman Brief Intelligence Test – 2nd Edition (Kaufman & Kaufman, 2004) were 84 (range = 43 – 116) for participants with autism and 67 (range = 40 – 97) for those without autism. While the child worked on an independent task at a desk, with two testers seated several feet behind him/her, a series of eight sounds occurred in fixed order and four fixed positions: clearing the throat, a sentence about buying a present for the child's birthday using the child's name, a telephone, a person calling 'hey you', a sewing machine, a neutral spoken sentence, thunder, and a doorbell. If the child turned to the testers, they acknowledged the child's response and redirected the child back to his / her task.

Results: Two independent raters achieved excellent agreement (Kappa = .8) in ratings of orientation to the testers. The 60 video clips which involved social orientation (autism n

= 24, comparison n = 36) were coded by two fresh raters for degree of social contact with the testers on a scale of 0 – 3, with excellent inter-rater reliability (ICC = .81). Children with autism orientated to the testers almost as often as those in the comparison group (autism *M* = 2.08; comparison *M* = 3.00), and with similar distribution across most of the eight stimuli e.g., on hearing a sentence containing the child's name, approximately half of the children in each group turned to look at the testers. Children with autism were less likely to orientate to the testers when a telephone rang (autism 2 of 12, comparison 7 of 12: Fisher's Exact $p = .045$), and in response to the sound of a person calling 'hey you' (autism 1 of 12, comparison 6 of 12, Fisher's Exact $p = .034$). Social orientation bids made by children with autism were rated as less interpersonal ($M = 1.38$) than those made by children without autism ($M = 1.94$), $p < .05$, one-tailed.

Conclusions: There were only subtle group differences in orientation to the sounds, and modest but significant differences in degree of social contact. Children with autism may learn to orientate to social signals, even though the quality of the orientation may be atypical.

139.048 48 Visual Processing Strategies Used for Face Perception in School-Aged Autistic Children. J. Guy*[1], K. Morin[2], C. Habak[3], H. R. Wilson[4], L. Mottron[1] and A. Bertone[5], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Perceptual Neuroscience Laboratory for Autism and Development (PNLab)*, (3)*Visual Perception and Psychophysics Lab, Université de Montréal, and Centre de Recherche, Institut Universitaire de Gériatrie de Montréal*, (4)*Biological & Computational Vision*, (5)*McGill University*

Background: Human face perception is considered essential for developing typical social interaction skills that are crucial for day-to-day functioning. Consequently, atypical processing of face information has been linked to the social differences that characterize autism. One prominent hypothesis suggests that the unique, detail-oriented visual processing style used by autistics may negatively affect their ability to identify faces when a global analysis is optimal, such as, when faces are presented from different viewpoints. Various studies have assessed the nature of face perception in autism primarily using face images presented only in a front-view orientation. Yet, the effective identification of faces in real-life settings often requires an integration of information across viewpoints (e.g. front and profile). Studies assessing abilities of face identity discrimination in typically developing children and adults have found significant age related differences in abilities, specifically when different head orientations (views) are considered (Mondloch et al., 2003, Habak, Wilkinson & Wilson, 2008). Assessing face identification abilities across ages and viewpoint is therefore important in understanding how and when differences in such abilities emerge between autism and typical development.

Objectives: To assess the face identity discrimination abilities of school-aged autistic and non-autistic participants in a view specific manner, where access to local face attributes is available (same view) or minimized (different views).

Methods: Ten autistic and ten typically-developing school aged children matched for full-scale IQ and age (8 to 12 years) performed a face identity discrimination task using synthetic, computer-generated face images (Wilson et al., 2002). These face images consist of simplified (hair and skin texture removed), ecologically-validated stimuli, extracted from traditional face photographs in both frontal ("front") and 20° side ("side") viewpoints. A target face was presented for 1000 milliseconds and then followed by two choice faces, one of which had the same identity as the target. Performance was measured using face identity discrimination thresholds (amount of facial geometry change needed to discriminate between faces) for conditions where the target and choice faces were presented in the same view (front-front view) and in different views (front-side view).

Results: As was found in a similar study examining facial identity discrimination across viewpoints in adolescents and adults with and without autism (Morin et al., IMFAR 2010), mean identity discrimination thresholds for the autistic group were higher for the viewpoint change condition (front-side view) when compared to the typically-developing group.

Conclusions: A decrease in performance for the viewpoint change condition, as indicated by higher mean identity discrimination thresholds, suggests that facial identity discrimination in school-aged autistic children may be more difficult when (i) access to local cues, such as individual facial features, is minimized, and/or (ii) increased dependence on a global, integrative analysis is introduced to the face task. These findings will be presented along with those from non-social tasks comparing local and global spatial perception, in order to assess whether minimized access to local information specifically affects socially-contingent face perception, or generalizes across complex types of visuo-spatial information in autism.

139.049 49 Nonverbal Communication in Children with Autism Spectrum Disorders Interacting with Their Mothers: The Importance of An Accurate Analysis of Gestural Production. M. Mastrogiuseppe*[1], O. Capirci[2], S. Cuva[1] and P. Venuti[1], (1)*University of Trento*, (2)*Institute of Cognitive Sciences and Technologies (ISTC), CNR*

Background:

Gestures are a specific type of communicative actions, with an important role in shaping intersubjective understanding (Iverson & Thelen, 1999; Capirci et al., 1996). Children with Autism Spectrum Disorders (ASD) exhibit deficits in their spontaneous use of meaningful gestures and unlike children with language and/or cognitive delay, they do not tend to use gestures to compensate for social communication difficulties (Rapin, 2006). Despite the obvious importance of this issue for children with ASD, the literature on gestures in this population is relatively small. Moreover, research on this topic is not very specific and often is focused on "joint attention" gestures, notably pointing (Mundy et al., 2009); it is also focused on the quantity of gestures rather than on their quality. The study of gestures in children with ASD might give many insights about the construction of communicative intentionality, help understanding different autism phenotypes and maybe potentially different therapeutic approaches.

Objectives:

Aim of the present study is to analyze gestural communication in spontaneous interaction between children with ASD and their mothers, focusing on the identification of different types of gestures and on the quality of their execution.

Methods:

Sixty mother-child interactions were analyzed: thirty children with ASD (ASD group), thirty children with other developmental disorders (DD group) matched on mental age evaluated using Griffiths Mental Developmental Scales. Preliminary results refer to the analysis of twenty interactions: ten children with ASD (chronological age: M=4.6, SD=0.8; mental age: M=3.4, SD=1.3), ten children with DD (chronological age: M=4.1, SD=1.3; mental age: M=3.5, SD=1.4). Videos were analysed with a specific coding scheme (Capirci et al., 2007) allowing a quantitative and qualitative analysis of gesture production: types (function and form), space of execution and associated gaze.

Results:

Analyses show significant differences between the two groups of children in all the investigated domains. The overall frequency of gesture production is much lower in the ASD group. As for gestures' type and form, children with ASD use mainly contact gestures (pointing-touching and proximal pointing), while the DD group use more distal pointing and more conversational and representative gestures. Further differences emerge from the analysis of gestures' quality: children with ASD tend to produce gestures in a peripheral space, usually not alternating gaze between the partner and the object while producing gestures.

Conclusions:

Through a detailed analysis of communicative gestures in interaction between mothers and children with autism, this study allows to identify:

(i) specific characteristics of gestural communication in children with autism in respect to children with other DD;

(ii) possible correlations between cognitive function and gestural performances;

(iii) different subgroups of children with ASD who may be more or less sensitive to a possible gestural training in communication skills.

An area of future research will be that of analyzing caregivers' responses to children' communicative actions in order to better understand the way in which the communicative profile of children with ASD may influence, and be influenced by, child-mother interaction.

139.050 50 Do Children with ASD Use Imitation to Acquire Negation Markers?. C. A. Navarro-Torres*, A. Tovar, D. A. Fein and L. Naigles, *University of Connecticut*

Background:

Children with ASD have been reported to use echolalia, where they imitate others' utterances without fully understanding their structure or meaning (Gerenser, 2009). To what extent does this or other kinds of imitation help them acquire grammar? Some research has found that children with ASD use more complex negation and question forms prior to using the less complex forms (Eigsti et al., 2007; Hoff, 2009), although others have reported that children with ASD do not produce more complex forms first in imitated utterances (Tager-Flusberg & Calkins, 1990). No studies have yet directly compared children's development of negation markers with their caregivers' usage. By hypothesis, if children are learning via imitation, their early usage of negation should follow their caregivers' patterns of usage quite closely.

Objectives:

We investigate the acquisition of negation markers in children with ASD and TD children, comparing their usage with that of their caregivers.

Methods:

We included 11 TD toddlers (MA = 19.86 months at Visit 1, 9 males), and 10 children with ASD (MA=32.83 months at Visit 1, 8 males); the groups were matched on the CDI (ASD=92.6; TD=118.27) and Mullen VR (ASD=27.8, TD=24.45) at Visit 1. At 6 visits each 4 months apart, children engaged in 30-minute, semi-structured play sessions with their parents, which were transcribed and coded for all utterances that included any morphosyntactic negation marker (e.g., *no, not, none, can't, don't, doesn't, won't, isn't, aren't, wasn't*). Data from visits 1 and 2 are reported here.

Results:

At visits 1 and 2, most of the negation markers in both groups of children were "no" (In the TD group, 99% at visit 1 and 85% at visit 2; in the ASD group, 85% at visit 1 and 80% at visit 2). Uses of "not" and "don't" increased at visit 2 in both child groups (TD: 7% *don't*, 3% *not*; ASD: 10% *don't*, 3% *not*); the groups did not differ at either visit. In contrast, the caregivers' usage of negation markers was much more diverse, including 41%-43% *no*, 16-19% *not*, 21%-26% *don't*, 2-3% *can't*, 4% *didn't*, 1-2% *isn't*, and 1% *won't*. Chi-square tests revealed that the distribution of negation marker frequency differed significantly between the adults and children (TD: X^2=11.13, p<.001; ASD: X^2=7.94, p=.0048).

Conclusions:

Children with ASD's use of negation markers was not different from TD children's usage; in contrast, both groups differed significantly from their caregivers' patterns of use. These findings suggest that both TD children and those with ASD are not learning negation markers by simply imitating their caregivers, but are instead analyzing their morphosyntactic input selectively. Future analyses will examine the children's usage through visit 6, to determine whether the children with ASD increase in the complexity of negation structures in the same pattern as TD children, as well as whether the ASD children are using their negation markers with the same meanings as TD children (e.g., as denials, rejections, commands, assertions).

139.051 51 Visual Scanning of Familiar and Unfamiliar Faces in 12-Month-Olds Later Diagnosed with ASD. J. B. Wagner*[1], R. Luyster[1], H. Tager-Flusberg[2] and C. A. Nelson[1], (1)*Children's Hospital Boston/Harvard Medical School*, (2)*Boston University*

Background: Eye-tracking studies have provided evidence of atypical scanning of faces in individuals with ASD as well as their first-degree relatives. Prospective work examining infants

with an older sibling with ASD provide an opportunity to look for markers of atypical face processing, some of which might relate to the broader autism endophenotype, and importantly, others that might be predictive of later ASD outcome

Objectives: The present work examined measures of visual scanning during the first year of life in infants as it might relate to later ASD outcome. Many infant sibling studies have thus far focused on differences between high-risk and low-risk infants, but with children reaching an appropriate age for ASD classification, we can now begin studying the relationship between early measures and later ASD outcome.

Methods: As part of a longitudinal study of infant siblings of children with ASD and typically-developing children, 12-month-olds were presented with side-by-side neutral images of their mother and a stranger. A Tobii eye-tracker monitored eye gaze during presentation. The present analyses focused on looking behavior during the first 10s of presentation and examined looking time to each picture as well as looking to the eye, mouth, and face regions. Proportion of looking to each of these three regions was also analyzed.

Eighteen children who had eye-tracking data at 12-months and an ASD assessment on a follow-up visit at 24- or 36-months were classified into three groups for the present analyses: (1) children classified as having ASD ('outcome'); (2) children at high risk for ASD but who have been classified as typically developing ('HRA-'); (3) children at low-risk for ASD who have been confirmed to be typically developing ('LRC-'). Each child in the outcome group was matched to a child in both the HRA- and LRC- groups based on initial cognitive ability.

Results: Preliminary results include 6 infants per group and are presented descriptively due to the limited sample size. Data collection is ongoing and an additional 10-20 children will soon be old enough to be included in the present analyses. The proportion of time spent on the face was similar for LRC- (*M*=0.98, *SD*=0.04) and HRA- (*M*=0.95, *SD*=0.06), and smaller for the outcome group (*M*=0.87, *SD*=0.10). Proportion of time on the mouth region was similar for outcome (*M*=0.11, *SD*=0.14) and HRA- (*M*=0.11, *SD*=0.15) and smaller for LRC- (*M*=0.03, *SD*=0.06). For proportion of time on eyes, HRA- resembled outcome when scanning mom's face (*M*=0.36, *SD*=0.39 and *M*=0.32, *SD*=0.39, respectively; LRC-: *M*=0.74, *SD*=0.14), but when scanning stranger's face, HRA- more closely resembled LRC- (*M*=0.64, *SD*=0.38 and *M*=0.63, *SD*=0.40, respectively; outcome: *M*=0.51, *SD*=0.43). Total time on eyes was similar for LRC- (*M*=3637ms, *SD*=1775) and HRA- (*M*=3672ms, *SD*=2953) and reduced for outcome (*M*=2814ms, *SD*=2961).

Conclusions: Preliminary analyses show infant face scanning patterns that are similar for the broader autism endophenotype and other patterns that appear to differentiate outcome and non-outcome children. As samples grow, this work will be important for identifying early markers of ASD.

139.052 52 Social Environment Influences on Mental State Understanding in Children with or without Autism. T. Gliga*[1], A. Senju[2], T. Charman[3], M. H. Johnson[4] and .. The BASIS Team[5], (1)*Birkbeck College*, (2)*Birkbeck, University of London*, (3)*Institute of Education*, (4)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (5)*Birkbeck College University of London*

Background: How much the development of mental states understanding benefits from environmental input is a controversial issue. In favor of such effects stand repeated findings showing that having an older siblings helps performance in classical theory of mind tasks (Perner, Ruffman & Leekam, 1994). This is believed to happen because the presence of older siblings creates more opportunities for confronting beliefs and reality and for parental intervention to discuss mental states or intentions. Such environmental effects are welcome in populations that struggle with understanding mental states, as is the case with children with autism.

Objectives: We investigated the impact of having a typically developing sibling or not on performance in an implicit false belief task (Southgate, Senju & Csibra, 2007) in children with or without ASD-like social and communicative difficulties. Because some of these children had developed autism themselves yet others were developing typically we could observe the contribution of both social environment (siblings status) and clinical profile on performance in this task.

Methods: Forty-seven 3-year-old children participated in this task and either had a diagnosis of ASD (Sib- ASD, n=17), manifested subclinical ASD-like characteristics (Sib-Other, n=12) or were developing typically (Sib-TD, n = 18). All children had an older sibling with ASD. Children were classified as either having no typically developing siblings or having more than one sibling, which in this case meant that they also had typically developing siblings. The false belief task was similar to Sally-and-Ann with the difference that instead of asking where the character would search for an object we measured children's anticipatory looking towards the location where the character would search, using an eye-tracker (Tobii 120).

Results: Because Sib-ASD and Sib-ATY performed similarly we analyzed them as one group (Sib-Aty, n=29). Group (Sib-Aty and Sib-TD) and Number of TD siblings (None, One or more) were entered in a logistic regression. The model including the interaction between Group and Siblings best predicted performance (Rsq = .139; Group x Siblings b = -3.4, sig = .025). This was due to a significant effect of the number of siblings on performance for the Sib-TD group (b = 2.5, sig = .04), only Sib-TD with a TD sibling performing above chance. The number of TD siblings was non-consequential for Sib-Aty, which performed equally poorly.

Conclusions: It was speculated that implicit measures of mental state understanding do not depend on language proficiency, therefore they might be less prone to environmental influences of the kind that would be created when interacting with siblings. We found that having an older typically developing sibling does improve performance for typically developing children but, interestingly, not for children that manifested themselves clinical or sub-clinical ASD like symptoms. The environmental enrichment provided by siblings is therefore mediated by their phenotypic profile, the ASD phenotype making children less likely to benefit from sibling social interaction. Future studies should investigate whether children with ASD require longer time to show beneficial environmental effects.

139.053 53 The Relationship Between Theory of Mind and Autobiographical Memory Retrieval. B. Dritschel*[1], G. Rajendran[2] and A. Jones[1], (1)*University of St Andrews*, (2)*University of Strathclyde*

Background:

Considerable research has demonstrated that autistic spectrum disorders are associated with an impaired theory of mind (e.g. Baron-Cohen, 1995). Much evidence for theory of mind deficits has come from the false belief paradigm. Recently evidence using a new false belief task has demonstrated that individuals with ASD have both impaired understanding of their own mind as well as the mind of others (Williams & Happé, 2009). Another problem associated with autistic spectrum disorder is the impaired ability to retrieve autobiographical memories (Crane & Goddard, 2008). Only one study has investigated the relationship between theory of mind and autobiographical memory retrieval and this study did not assess theory of mind deficits for information about the self (Adler et al. 2010).

Objectives:

The present study investigated the following issues. First we investigated whether theory of mind deficits will be present in theory of mind tests for both self and other s as compared to controls. Secondly within the ASD sample the deficits for theory of mind beliefs for self will be more impaired than the ToM deficits for others. Third relative to controls the ASD participants will be poorer in retrieving autobiographical memory. Fourth there will be a relationship between theory of mind and the ability to retrieve autobiographical memories, particularly for false belief questions relating to self.

Methods:

Children between the ages of 6 and 12 with ASD and matched controls completed 1.) a ToM task assessing both self and other false belief understanding; 2.) an autobiographical memory task assessing both episodic and semantic retrieval3.) the British Picture Vocabulary test 4.) the Childhood Autism Spectrum test

Results: Thirteen children with ASD performed significantly less well on the other person false belief task compared to 18 controls. The ASD group also performed significantly less well

on the a autobiographical memory task in terms of both episodic and semantic recall; 3.) the ASD group's performance on both the self and other person ToM task was positively correlated with the ability to recall episodic autobiographical memories

Conclusions:

Counter to Williams and Happé, that there did not seem to be a disparity between the understanding of one's own beliefs and the beliefs of others. However, there appear to be deficits in retrieving both semantic and episodic autobiographical memory retrieval in line with previous research. Further there appears to be a relationship between theory of mind and episodic autobiographical memory in ASD, participants. In particular poorer performance on the plasters task was associated with greater difficulty in retrieving episodic memories.

139.054 54 The Relationship Between Inhibition and Social Skills in Children with High Functioning Autism Spectrum Disorders. R. L. Matchullis*, A. McCrimmon, K. Jitlina and A. A. Altomare, *University of Calgary*

Background: Individuals with high functioning autism spectrum disorders (HFASDs) are characterized by severe social skill deficits despite intact cognitive abilities. Executive function (EF) deficits have been implicated in many behaviours demonstrated by individuals with HFASDs, including negative reactions to change, rigidity, and perseveration. However, few studies have been robust in their measurement or specific in their selection of EF type. Moreover, few researchers have attempted to explore the relationship between specific EF abilities, such as inhibition, and social skill deficits in this population.

Objectives: To investigate the nature of and strength of relationship between inhibitory dysfunction and social skills in children with HFASDs.

Methods: A total of 25 children with HFASD (including Asperger's syndrome, high functioning autism, and Pervasive Developmental Disorder - Not Otherwise Specified) between the ages of 8-12 were compared to 25 gender- and age-matched typically developing children on measures of inhibition and social skills. Diagnosis of the clinical sample was confirmed through the use of the ADI-R. Inhibitory ability was evaluated via both task-based performance measures (Delis Kaplan Executive Functioning System) and standardized parent-report rating scales (Behaviour Rating Inventory of Executive Function). Social skills were evaluated through standardized parent and self-report rating scales (Social Skills Improvement System). Comparisons between the clinical and control groups were conducted followed by correlational analyses within each participant group.

Results: Preliminary results indicate significant inhibitory dysfunction and poorer parent-rated social skills in children with HFASD. In addition, a significant moderate negative correlation was found between these domains.

Conclusions: The importance of a possible relationship between inhibitory ability and social skills in children with HFASD and implications for future research are discussed. Further, the unique nature and practical value of obtaining information on children's inhibitory ability and social skills through parent-report are highlighted.

139.055 55 Face Processing and Its Correlation to Theory of Mind in Autism Spectrum Disorders. J. C. Bush*[1], C. Chevallier[1], K. Rump[1], J. Parish-Morris[2] and R. T. Schultz[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background: Previous research has shown that individuals with Autism Spectrum Disorders (ASD) have impaired facial identity recognition and emotion recognition and are less likely to attend to faces when compared to typically developing controls (TDCs). Facial recognition and processing are important tools utilized to engage in social behaviors, which are often significantly impaired in individuals with ASD. Many have suggested that social functioning deficits found in ASD can be attributed to a deficient or a lack of theory of mind (ToM). However, no studies have investigated the correlation between face processing and ToM deficits in ASD.

Objectives: The present study investigated face processing abilities in individuals with ASD using the *Let's Face It! (LFI)* skills battery (Tanaka & Schultz, 2008). These results were

compared to performance on ToM measures, as assessed by the Attribution of Intention (AIT) task (Brunet et al., 2003).

Methods: One hundred and twenty seven participants with ASD (103 male, 6.2-17.9 years old) and 58 TDCs (43 male, 6.1-16.9 years old) were matched on age (ASD: *M* = 10.1 ± 2.9; TDC: *M* = 10.2 ± 3.0), IQ (ASD: *M* = 105.8 ± 16.9; TDC: *M* = 109.4 ± 13.3), and sex ratio. ADI-R, ADOS, and expert clinical judgment were used to confirm diagnoses. Participants completed an abbreviated LFI battery, which consisted of one facial identity matching task (Match Maker Identity) and two facial expression matching tasks (Match Maker Expression and Name Game) and the AIT task.

Results: Individuals with ASD performed significantly worse in all three LFI tasks (Identity: $t(185) = -3.337$, $p = .001$, $d = .529$; Expression: $t(185) = -5.579$, $p < .0001$, , $d = .827$; Name Game: $t(185) = -4.517$, $p < .0001$, $d = .659$) and in the AIT task ($t(185) = -2.958$, $p = .004$, $d = .470$) when compared to the TDC group. Furthermore, performance on the three LFI tasks was significantly correlated to the AIT task in both groups (ASD group: r = .518, p<.0001; r = .372, p<.0001, and r = .368, p <.0001, for Identity, Expression and Name Game respectively; TDC group: r = .554, p<.0001; r =.304, p = .021, r = .564, p<.0001, for Identity, Expression and Name Game respectively).

Conclusions: Differences in facial identity and emotion recognition as well as in ToM were found in this large sample. Furthermore, face processing skills and higher cognitive functions were strongly correlated. The directionality of this relationship should be further explored in order to better understand social deficits in autism.

139.056 56 Friendship Networks and Social Inclusion in Young People with Autism. L. Calder[1], V. Hill[2] and E. Pellicano*[2], (1)*Haringey Council*, (2)*Institute of Education*

Background: Children with autism spectrum conditions are increasingly included in UK mainstream classrooms. Existing research indicates that friendship is a particularly significant factor in the overall experience of mainstream school for these children and yet this remains a poorly understood and under-researched area.

Objectives: This study used a unique combination of quantitative, qualitative and social network methods to examine the friendships of children with autism relative to typically developing children in mainstream primary schools. The objectives were to examine (1) the self-rated friendship quality of children with autism compared to that of their typical peers; (2) parents' and teachers' views of the child's friendships and their self-perceived role in developing and maintaining children's friendships; and (3) the extent to which children with autism were considered to be included in social networks in the classroom.

Methods: Twelve children with autism and 12 typically developing peers, of similar age, verbal ability and nonverbal ability, were assessed from culturally-diverse Year 6 mainstream classrooms. Cognitive assessments, questionnaires and semi-structured interviews were conducted with children with autism and detailed interviews were also conducted with the autistic child's parents and primary school teacher. The perspective of classroom peers was sought through a socio-cognitive mapping exercise.

Results: Children with autism generally rated their friendships less in terms of support and closeness than matched typical peers. There was, however, much variability in autistic children's ratings of their friendship quality which, unexpectedly, was related neither to children's cognitive ability nor to their theory of mind ability. Parents were found to play an active role in supporting friendship development through direct instruction for managing interactions while teachers indicated that autistic children's friendships were given low priority in schools. Encouragingly, the children themselves generally reported satisfaction with their current friendships and, although no child with autism was found to be socially excluded, the friendship experiences of children with autism varied widely, with some children being part of dyadic reciprocal friendships, some children having links to one or two low status members of the class group, and some children centrally included within high status friendship groups within the classroom. Motivation appeared to be a key factor in accounting for these differences.

Conclusions: These findings elucidate for the first time the attitudes of autistic children, their peers, teachers and parents

towards friendship in a school setting. The results have important implications for parents, teachers, and practitioners working with children with autism educated within mainstream provision. In particular, children's social motivation appears to play a crucial role in determining the extent and nature of their friendships, and children's reported satisfaction with their friendships could determine the level of intervention needed to support these friendships.

139.057 57 The Emergence of Imitation: Preliminary Findings From a Prospective Study of Younger Siblings of Children with Autistic Spectrum Disorders. A. Boudreau*[1], I. M. Smith[2], J. Brian[3], S. E. Bryson[2], N. Garon[4], W. Roberts[5], C. Roncadin[6], P. Szatmari[7] and L. Zwaigenbaum[8], (1)*Dalhousie University*, (2)*Dalhousie University/IWK Health Centre*, (3)*Holland Bloorview Kids Rehabilitation Hospital*, (4)*Mount Allison University*, (5)*University of Toronto*, (6)*Peel Children's Centre*, (7)*Offord Centre for Child Studies, McMaster University*, (8)*University of Alberta*

Background: Imitation deficits are well documented in autistic spectrum disorders (ASD; Rogers & Williams, 2006). Indeed, imitation deficits are among the predictors of ASD by as early as 12 months of age (Zwaigenbaum et al., 2005) and accuracy of early imitation is reduced in infants at risk for ASD (Young et al., 2011). However, little is known about the atypical, versus typical *emergence* of imitation. That is, few studies have examined qualitative differences in pre-imitative behavior (approximations to imitation, Kaye & Marcus, 1981; Nichols, 2005). Further, no infant sibling study has examined emerging imitative abilities as early as 9 months.

Objectives: (1) To replicate a hierarchy of precursors of imitation in low-risk (LR) control 9-month-olds. (2) To extend the findings to a high-risk (HR) infant sibling sample, compared with low-risk controls.

Methods: HR and LR participants were evaluated at 9 months of age using the imitation task from the Autism Observation Scale for Infants (AOSI; Bryson et al., 2008). The AOSI is a semi-structured play schedule that measures early signs of ASD (Bryson et al., 2008). Each infant sat on a parent's lap, facing an examiner across a small table. The examiner presented the infant with 3 actions (oral-facial movements or actions with objects) and 1 to 3 trials per action, depending on the infant's successful performance. Video records of 9-month AOSI administrations were coded using Noldus Observer software and a novel detailed coding scheme. Imitation was scored in 3 ways: (1) total imitation, (2) best score across actions, and (3) approximations to imitation (predictable hierarchical patterns of behavioral responses to the model; e.g., touching model's hands after model claps).

Results: We compared infants' imitation scores (i.e., total imitation, best score and approximations to imitation) between groups using 3 one-way ANOVAs. Infants were grouped according to 36-month outcome as: (1) siblings *with* ASD (ASD siblings); (2) siblings *without* ASD (non-ASD siblings); and (3) low-risk controls (LR). Preliminary results from the first 30 infants coded (*n*'s = 8 ASD siblings, 10 non-ASD siblings, 12 LR) replicated a hierarchy of 'approximations to imitation' in the LR group. Further, ASD siblings demonstrated fewer self-directed approximations than the LR controls. Finally, the ASD siblings imitated less frequently across actions (e.g., best score) than did the non-ASD siblings and LR [F (2, 27) = 3.72, p = .037].

Conclusions: The study provides initial evidence supporting the use of a hierarchy of approximations to imitation as a novel approach to studying the atypical emergence of imitation skills. Preliminary findings suggest HR siblings differ from LR controls both in frequency of fully imitative acts and in quality/level of approximations to imitation. Moreover, these differences are evident by age 9 months. The results may have implications for understanding psychological mechanisms underlying the emergence of imitation deficits, and for early detection and intervention in ASD.

139.058 58 Social Cognition and Emotion in Autism and Personality Disorders: A Functional Perspective. J. C. L. M. Duijkers*[1], C. T. W. M. Vissers[2], W. J. Verbeeck[3], A. Arntz[4] and J. I. M. Egger[2], (1)*Centre of Excellence for Neuropsychiatry, Vincent van Gogh Institute for Psychiatry*, (2)*Donders Institute for Brain, Cognition and Behaviour, Centre for Cognition, Radboud University Nijmegen*, (3)*Vincent van Gogh Institute for Psychiatry*, (4)*Maastricht University*

Background:

Although autism spectrum disorders (ASD) and personality disorders (PD) are considered to be different diagnostic classes, multiple similarities in appearance can be identified. Both patients with ASD and patients with PD show problems in interpersonal behaviour and emotional areas.

Objectives:

These problems can be understood in the context of social cognition (SC) and emotion (E). Measuring aspects of those can contribute to a better understanding of ASD and PD, by focusing on a functional level, instead of just onto the topographical surface.

Methods:

The present study explored SC and E in patients with ASD or PD (ASD group n =51; PD group n = 68; non-patient control data (derived with permission from PEN Nijmegen), matched with ASD group n = 52; control data matched with PD group = 65). Tests included the Mayer-Salovey-Caruso-Emotional-Intelligence-Test (MSCEIT), Emotional-Quotient-Inventory (EQ-i), Bermond-Vorst Alexithymia Questionnaire (BVAQ), and Strange-Stories-Task (SST).

Results:

Between groups analyses suggest that the ASD patients estimate themselves as more impaired on the ability to read emotions, but better on intrapersonal functioning, than the PD patients. On tests mapping the ability to read and regulate emotions, no differences are found between the ASD group and PD group. Impairments on self-report and ability measures of SC and E are found for both groups, as compared to non-patient data.

Conclusions:

When looking at the similarities and differences in the results between the ASD and PD group on the neuropsychological measures of SC and E, one could state the following. The presence of a negativity bias in patients with PD may influence their (social) functioning and vice versa. Having a tendency for negative cognitions and a low self-regard can thus colour one's functioning on emotional ability measures. Furthermore, patients with ASD may have a weaker ability to reflect as compared to patients with PD, leading to a lower sense of (intrapersonal) emotional insight/suffering. Further research is needed to find out which neuropsychological mechanisms underlie the present findings. Results suggest that a dimensional approach and cognitive profile of strengths and weaknesses, can contribute to a better understanding of the similarities and differences between ASD and PD.

139.059 59 Psychometric Analysis of the Empathy Quotient (EQ). C. Allison*[1], S. Baron-Cohen[1], S. Wheelwright[2], M. H. Stone[3] and S. J. Muncer[4], (1)*Autism Research Centre, University of Cambridge*, (2)*University of Southampton*, (3)*Aurora University*, (4)*Teesside University*

Background: Empathy allows us to make sense of the behaviour of others, predict what they might do next, understand how they feel, feel connected to the other person, and respond appropriately to them. Empathy involves an affective and a cognitive component. Individuals with an autism spectrum condition (ASC) have reduced levels of self-reported and parent-reported empathy - measured by the Empathy Quotient (EQ) - relative to typical controls.

Objectives: This study assessed the dimensionality of the EQ using two statistical approaches: Rasch and Confirmatory Factor Analysis (CFA). The purpose of the study was to apply the Rasch model to a large EQ dataset to create a unidimensional measure of empathy. This model was examined alongside other proposed EQ models using CFA.

Methods: Data included in the analysis were collected at the websites of the Autism Research Centre (ARC), University of Cambridge. Participants included N = 658 with an autism spectrum condition diagnosis (ASC), N = 1375 family members of this group, and N = 3344 typical controls. The mean age of the whole sample was 30.4 years (SD = 11.4, range 16.0–78.0). The EQ consists of 40 statements to which participants have to indicate the degree to which they agree or disagree. Data were applied to the Rasch model (Rating Scale) using WINSTEPS. CFA was conducted using Amos. For each model, the chi square value and degrees of freedom, the Comparative Fit Index (CFI) and the root mean square

error of approximation (RMSEA) and its confidence intervals was calculated.

Results: The Rasch model explained 83% of the variance. Reliability estimates were greater than .90. A sex difference was observed, with females (M = 0.31 SD = 0.98 logits) scoring significantly higher than males (M = -0.37 SD = 0.88; t(4836.63) = 26, p < 0.0005), d = 0.69. Participants with ASC scored significantly lower (M = -1.31 SD = 0.75) than controls (M = 0.23 SD = 0.88; t(927.78) = 48.51, p < .0005.), d = 1.17. Analysis of differential item functioning (DIF) demonstrated item invariance between the sexes. Principal Components Analysis (PCA) of the residual factor showed separation into Agree and Disagree response subgroups. CFA suggested that 26-item model with response factors had the best fit statistics (RMSEA.05, CFI .93). A shorter 15-item three-factor model had an omega of .779, suggesting a hierarchical factor of empathy underlies these sub-factors.

Conclusions: The EQ is an appropriate measure of the construct of empathy and can be measured along a single dimension. The Rasch analysis revealed clearly that a response factor (to account for 'Agree' or 'Disagree' responses) was required. The study highlights how different statistical approaches (Rasch and CFA) to measurement can be complementary, producing very similar results.

139.060 60 Differences In VISUAL FIELD Preference In EMOTION RECOGNITION BETWEEN CHILDREN with AUTISM Spectrum DISORDERS and Typical DEVELOPMENT. R. Hansen*[1] and F. R. Ferraro[2], (1), (2)*University of North Dakota*

Background:

Research has demonstrated that for the neurotypical population, reacting to and recognizing facial emotions improve when using the left visual field by employing the right brain hemisphere's configural processes. Findings suggest that individuals with autistic spectrum disorders (ASD) seem to have intact neuronal circuitry for emotion recognition. However, they rely more on analytical "piecemeal encoding" mediated by the left hemisphere rather than recruiting the right hemisphere's "perceptual Gestalt" processes. Thus, an ASD right visual field preference for emotion recognition has been suggested.

Objectives:

The current study compared the effects of isolating visual fields on tasks of facial affect assessment performed by children with ASD and those with typical development (TD). ASD participants were expected to show a right visual field preference, while TD participants were predicted to demonstrate a left visual field preference as noted by fastest beats-per-minute finger pulse rate (BPM), shortest reaction time (RT) and highest percent accuracy (PA) when using the designated visual field to view facial stimuli. The study also explored the usefulness of a right visual field preference to predict overall autistic symptom levels in the context of executive functioning deficits.

Methods:

Participants (*N* = 64) consisted of two equal-sized groups of children (5 – 19 yrs old) with ASD and TD matched by age and gender. Mixed design included two development groups (ASD,TD) and three within-group visual field conditions (both, BVF; left, LVF; right, RVF). Participants wore eyewear with an opaque lens occluding one eye and the inner medial aspect of the other eye to isolate different visual fields. Facial affect stimuli depicting happy, sad and angry emotions were presented across BVF, LVF and RVF conditions. BPM over each visual field block, RT for each trial and PA over each visual field block were measured. Executive function and autistic trait levels were quantified using a pediatric Executive Function Index (EFI) and the Autism Spectrum Quotient (AQ).

Results:

ASD participants demonstrated significantly slower BPM, longer RT and lower PA in performing emotion attribution tasks when compared to TD controls. When using the RVF, ASD participants demonstrated significantly faster BPM compared to pulse rates when using LVF or BVF. Shorter RT and higher PA were observed when ASD participants used the RVF to assess facial emotions compared to response and accuracy rates when using the LVF. Pulse rates of TD participants trended toward a left visual field preference.

Greater differences between LVF and RVF performance along with greater differences between BVF and RVF performance in BPM, RT and PA were found to be predictive of increased autistic trait level. Regression models explained half of the variance in autistic trait level when impairments in executive functioning were included.

Conclusions:

These findings provide support of a right visual field preference in ASD facial affect processing. Right visual field preference may be a potential endophenotype, contributing to the social deficits seen within the spectrum. The usefulness of including left visual field practice in social skills therapy to improve facial affect comprehension in children with ASD is being explored.

139.062 62 Early Joint Attention Predicts Children with Asd's Subsequent Performance on Comprehension Tasks. J. Park*[1], S. Tek[2], D. A. Fein[1] and L. Naigles[1], (1)*University of Connecticut*, (2)*Johns Hopkins University*

Background: Joint attention (JA) occurs when two individuals focus on the same object or event. Children's ability to engage in JA significantly predicts their subsequent language development (Bruinsma et al., 2004; Rollins & Snow, 1998) both in TD children and those with ASD. However, research has only assessed the relationship between early JA and later language *production*. It is possible that both JA and speech are governed by children's developing motor abilities (Roos et al., 2008); therefore, it is essential to explore the relationships between JA and later language *comprehension*.

Objectives: In this longitudinal study, we compared aspects of children's JA during parent-child interactions with their later performance on intermodal preferential looking (IPL) tasks assessing word learning and grammatical comprehension.

Methods: Children were recorded every four months for a total of 6 visits. At the onset of the study, the ASD children (*n*=17; *MA*=32.9 months) and TD control children (*n*=18; *MA*=20.6 months) were matched on CDI vocabulary production scores (TD mean=118.7 words, ASD mean=94.7 words). Parents and children participated in 30-minute semi-structured play sessions at each visit. Sessions were coded for the number and duration of episodes in which children either responded to or initiated JA. Children also viewed IPL tasks at each visit (e.g., Swensen et al., 2007; Naigles et al., in press) two assessed word learning (NounBias: Do children map novel words onto objects; ShapeBias: Do children extend novel words to objects of the same shape), two assessed grammatical comprehension (WordOrder: Do children understand sentences in SVO order; Aspect: Do children understand that *–ing* is used for ongoing events and *–ed* for completed events), and one assessed children's ability to use transitive frames to learn causative verbs (Syntactic Bootstrapping). Our measure of IPL performance calculated children's *increase* in looking at the matching scene during test trials relative to baseline trials.

Results: Preliminary analyses revealed significant correlations among JA measures within and across visits (rs>.508, *p*s< .05;ASD: rs>.482, *p*s< .05). Numerous significant pairwise correlations between JA and IPL comprehension measures were found, therefore, regressions were then performed with children's Mullen VR, Vineland, CDI production scores entered before the comprehension score (to partial out effects of general cognition, social abilities, and language). TD children who engaged in more or longer JA episodes at visits 1 or 2 performed better on Noun Bias at visit 2 and Wh-Questions at visit 3 (βs ≥.526, *p*s<.05). ASD children who engaged in more or longer episodes of JA at visit 1, 2 or 3 performed better on Syntactic Bootstrapping at visit 3, Shape Bias at visit 4, Wh-Questions at visit 4 and Aspect at visit 5 (βs ≥.511, *p*s<.05).

Conclusions: Stronger JA abilities facilitate the emerging comprehension of several aspects of language; therefore, JA's influence on language development seems not purely based on shared motor development. Moreover, JA tends to exert its influence *early* in language development (Hoff & Naigles, 2002),with ASD children showing effects somewhat later because they are developing more slowly (Fein et al. 1996).

139.063 63 Selective Deficits in Mental State Attributions in Individuals with Velocardiofacial Syndrome (22q11.2 Deletion Syndrome). J. Ho[1], P. D. Radoeva*[2], M. Jalbrzikowski[1], C. Chow[1], J. Hopkins[1], K. M. Antshel[2],

W. Fremont[2], R. J. Shprintzen[2], C. E. Bearden[1] and W. R. Kates[2], (1)*University of California, Los Angeles*, (2)*SUNY Upstate Medical University*

Background: Velocardiofacial syndrome (VCFS; 22q11.2 deletion syndrome) is a genetic disorder resulting from the deletion of the 11.2 band on one copy of chromosome 22. Individuals with VCFS have a high prevalence of psychiatric disorders, including Autism Spectrum Disorders (ASD, up to 40-50%), narrowly defined autism (up to 19%), and schizophrenia (25-30%). VCFS individuals have social deficits, including social withdrawal and poor social competence. However, little is currently known about the relationship of these difficulties to Theory of Mind (ToM) skills.

Objectives: Our goal was to evaluate ToM in children and adolescents with VCFS with and without ASD, relative to typically developing controls, using an Animations Task designed to assess implicit aspects of mentalizing. We hypothesized that *ToM* scores would be lower in VCFS individuals than in controls, and furthermore, would be lowest in VCFS+ASD individuals, intermediate in VCFS-ASD individuals and highest in controls.

Methods: We administered a video-based task at two separate sites, UCLA and SUNY Upstate Medical University, according to the protocols described in Castelli et al (2000) and Abell et al (2000), respectively. Video clips displayed two types of interactions: *ToM* videos depicted interactions that represented complex mental states, and *Random* videos depicted simple movements around the screen. Participants' verbal descriptions of the videos were rated for intentionality (ie., mentalizing) and appropriateness. Across the two sites, 63 individuals (31 females) with a molecularly confirmed diagnosis of 22q11.2 deletion (VCFS; 16 (25%) of whom met diagnostic criteria for an ASD), and 43 controls (24 females) participated in the study. We conducted 2x2x2 Repeated Measures ANOVAs (RMANOVA) on the Intentionality and Appropriateness scores, with main factors *Condition*, *Site* and *Group*. We then assessed the specific effect of ASD by conducting 2x3 RMANOVAs, separately for each site, and correlated Intentionality and Appropriateness scores with Social Responsiveness Scale (SRS) T-scores, covarying for *Site* and *Age*.

Results: RMANOVAs for both Intentionality and Appropriateness revealed a significant Condition X Group interaction: at both sites, individuals with VCFS had lower *ToM* scores than controls, but the two groups performed similarly for the *Random* condition. For the ASD analyses, Upstate showed a significant Condition X Group interaction for both Intentionality and Appropriateness, such that both VCFS patients with and without ASD performed significantly worse than controls on the *ToM*, but not *Random*, condition. UCLA showed a significant Condition X Group interaction for Intentionality only, whereby VCFS-ASD patients performed significantly worse than controls on the *ToM*, but not *Random*, condition. The Intentionality and Appropriateness scores for *ToM* (but not *Random* videos) were significantly correlated with SRS scores.

Conclusions: VCFS patients, regardless of the presence of ASD, showed impairments in mentalizing and ToM abilities, which may underlie real-life problems with social interactions. Future studies could further explore the developmental trajectory of social cognition deficits in VCFS patients with and without ASD, and any relationship with prodromal symptoms for schizophrenia. A better understanding of the social deficits of VCFS patients with and without ASD is essential for the future design of targeted behavioral interventions.

139.064 64 Understanding of Intentions in Action by High Functioning Children with Autism Spectrum Disorder. J. D. Knutsen* and D. A. Frye, *University of Pennsylvania*

Background:

The ability to attribute intentions to others is essential for successfully interpreting and participating in social interaction. Research examining the recognition and understanding of intentions in others by children with Autism Spectrum Disorder (ASD) has produced mixed results (e.g., Russell & Hill, 2001; Williams & Happé, 2010). Previous work involved task paradigms designed to investigate children's awareness of whether an action was carried out intentionally or by accident, but many core components that underlie the understanding of intention in others have yet to be examined in children with ASD.

Objectives:

Investigate whether children with high-functioning ASD (HFASD) understand two core components that underlie intention attribution in others: (A) distinguishing desires and intentions; (B) understanding that different intentions may motivate one and the same action.

Methods:

Participants were recruited through the Autism Instructional Methods Survey (AIMS) study (Mandell et al., 2010), a recently completed randomized field trial. Inclusion criteria for participation included verbal mental age within the normal range (≥ 80), assessed using the Differential Ability Scales (DAS-II). Preliminary data are presented for 12 children with HFASD (11 boys, mean age 8:1). Children completed two measures of intention understanding that examined the ability to differentiate between (A) intentions and desires (Schult, 2002), and (B) two intentions for an identical action (Baird & Moses, 2001). In the *intention-desire distinction* measure (A), children heard stories in which the character's intention or desire either was or was not satisfied. For the *same action-two intentions* measure (B), participants were told stories in which two characters performed an identical action motivated by substantially different desires and intentions. Multiple control conditions were included for both measures. Enrollment is ongoing.

Results:

For the *intention-desire distinction* measure (A), 55% of participants correctly distinguished between an intention and a desire when there was a conflict between the two, whereas 92% were correct on the control task. In the *same action-two intention* measure (B), 58% of participants correctly answered the target intention question, whereas 75% were correct on the control task. These preliminary results are similar to the pattern of responses observed in the original data from typically developing (TD) 4-year-olds (Baird & Moses, 2001; Schult, 2002). Compared to TD preschoolers, participants in this study performed more poorly on the intention-fulfilled/desire-unsatisfied task (Schult, 2002) slightly better on the intention-unfulfilled/desire-satisfied task (Schult, 2002), and more poorly in the same-action different intention task (Baird & Moses, 2001). Data collection is ongoing and will include a comparison group of TD children individually matched on VMA.

Conclusions:

These preliminary findings suggest that children with HFASD are delayed in understanding two core components that underlie intention attribution in others: (A) the difference between intentions and desires, and (B) the fact that identical actions may be motivated by different intentions. Clarifying our knowledge of how children with ASD understand the intentions of others may inform theories of social competence, moral reasoning, and academic development.

139.065 65 Emotional Functioning and Social Problems in Young Children with ASD. E. Oberwelland[1], C. Rieffe*[2] and L. Stockmann[3], (1)*Leiden University*, (2)*Developmental Psychology, Leiden University*, (3)*Center for Autism*

Background: The origin of externalizing problems in early childhood is related to children's emotional functioning. Two aspects of emotional functioning are important in this respect: the ability for understanding and regulating the own emotions, and the ability for empathy, understanding and responding to others' emotions.

Objectives: In this study we examined the extent to which empathic capacities in preschool children with ASD are related to adaptive social functioning as compared to their typically developing (TD) peers.

Methods: Parents of 59 children with ASD (mean age 4 years, 7 months, range 21-72 months) en 49 TD children (mean age 4 years, 3 months, range 19-76 months) filled out questionnaires about their child regarding their social functioning (CDI, Ireton, 1992); empathy (Rieffe, Ketelaar & Wiefferink, 2010); and the degree of autistiform characteristics (ECI, Gadow & Sprafkin, 1997).

Results: Compared to their TD peers, parents of children with ASD score their children lower on adaptive social functioning, they note more behavioral problems, and they observe less empathic understanding and behaviors in their child with ASD.

Yet, the level of empathic contagion does not differ. Additionally, regression analyses show that the level of empathy contributes to the prediction of more adaptive social functioning, but not when controlled for the level of autistiform characteristics.

Conclusions: These outcomes suggest a mediating role of the severity of the autistiform characteristics in the relation of empathy and social functioning in children with ASD.

139.066 66 Regulation of Activity Level and Affective Responses in Toddlers with ASD. A. Dowd*, E. Gisin, F. Shic, S. Macari and K. Chawarska, *Yale University School of Medicine*

Background: Atypical temperamental characteristics are commonly seen in people with ASD: adults and older children with ASD have highly comorbid disorders including anxiety, ADHD, mood disorder, or behavioral problems (Simonoff et al, 2008), and parents frequently recall atypical temperament and behavior in early development, with 30-50% recalling abnormalities within the first year (Zwaigenbaum et al, 2005). Despite these findings, little research has explored the relationship between temperamental phenotypes and the core symptoms of ASD.

Objectives: 1) To compare the frequency of atypical behavioral and emotional reactivity in toddlers diagnosed with AUT, PDD, and DD, and to examine if any temperamental characteristics are associated with AUT in particular. 2) To assess the relationship of temperament to the symptoms and severity of ASD. 3) To explore if such characteristics are identifiable in early infancy in a sample of 12-month-olds later diagnosed with ASD.

Methods: Two samples were considered: (1) clinic-referred 18-36 month-olds with autism (AUT, n=180), PDD-NOS (n=68), and non-ASD developmental delays (DD, n=83), and (2) 12-month-old infants at high- and low-risk for ASD, later diagnosed with ASD (n= 12), with atypical features and delays (ATYP, n=34), and as typically developing (TYP, n=37). Subjects were assessed using the Mullen Scales of Early Learning (Mullen) and Autism Diagnostic Observation Schedule (ADOS-G: Toddlers, ADOS-T: Infants), and by a parent interview (Vineland-II). Behavioral and emotional reactivity were quantified based on three summary items: Range of Affective Expressions (Items B3/B4), Overactivity (Item E1), and Anxiety (Items E3/E4) of ADOS-G and T, respectively. The items were recoded into 0/1 categories with 0 denoting no atypical features, and 1 capturing presence of abnormalities in the area.

Results: The toddlers with AUT were significantly more behaviorally active ($X^2(2)=20.12, p=.001$) and exhibited more restricted range of affective expressions ($X^2(2)=73.75, p=.001$) during the ADOS-G, while no significant differences in anxiety were found. After controlling for nonverbal DQ in toddlers with ASD (autism and PDD-NOS combined), higher activity levels were positively associated with autism severity scores ($p=.035$). Toddlers with a more restricted range of affective expressions had higher autism severity scores ($p=.001$), lower verbal DQ ($p=.001$) and poorer adaptive communication skills ($p=.001$). However, higher level of anxious apprehension, was associated with higher verbal DQ ($p=.002$) and adaptive communication scores ($p=.042$). The 12-month-olds later diagnosed with ASD similarly exhibited high activity levels ($X^2(2)=11.1, p=.004$) and more limited affective expressions ($X^2(2)=27.14, p=.001$). In contrast to the toddlers, these infants also exhibited significantly lower levels of anxiety than their typically developing peers ($X^2(2)=5.75, p=.056$).

Conclusions: Toddlers with autism exhibit marked difficulties in regulating their activity level and affective responses. These difficulties are apparent even in 12-month-olds who are later diagnosed with ASD. Regardless of the level of cognitive functioning, high activity level and restricted affective range were associated with more severe symptoms of autism and lower verbal communication. However, more anxious toddlers tended to have higher levels of verbal ability. The results suggest that the temperamental dimensions associated with regulation of activity level and affective responses are linked with the early syndrome expression and represent potentially important area for investigation.

139.067 67 Social Motivation Is Correlated with Face Processing Skill in Children with ASD. N. A. Tonge*[1], C. Chevallier[1], J. Parish-Morris[2], J. Letzen[1] and R. T. Schultz[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*

Background: Numerous studies have found that children with autism spectrum disorders (ASD) have face processing impairments compared with typically developing controls (e.g. Wolf et al., 2008) yet, the precise etiology of these deficits remains unknown (Schultz 2005). Recent theories posit that early neurodevelopment is derailed due to diminished social interest (Grelotti et al., 2002). In line with this idea, eye tracking experiments have revealed that toddlers and children with ASD display a preference for inanimate objects over people (Nakano et al., 2010; Shic et. al., 2011). Due to this diminished social interest, children with ASD would then fail to develop expert face processing skills like identity and emotion recognition. Despite the influence of the social motivation framework, however, the relationship between social motivation and face processing skills has not yet been directly addressed.

Objectives: Our primary goal was to test whether reduced social motivation is correlated with performance on face and emotion recognition tasks in children with ASD. We used gaze pattern in a passive viewing task as our measure of social motivation, and a computer task specifically designed to assess face processing skill. We expected to find a positive correlation between face processing skills and social motivation in children with ASD.

Methods: 14 children with ASD and 18 typically developing children matched on age (Mean=9.6 ± 2.95), IQ (Mean=119.93 ± 14.31) and sex ratio, passively viewed a series of scenes depicting dynamic images of facial expressions and moving objects. Two tasks from the Let's Face it! Skills battery were used to assess face processing skill: one testing face recognition (LFI identity) and the other testing emotion recognition (LFI expression) (Tanaka et al., 2010).

Results: Fixation count, fixation duration and time to first fixation to faces and objects were analyzed. Unlike TD children, children with ASD were not significantly more likely to fixate on faces before objects (ASD: $t(13)=.80$, $p=0.44$, $d=.344$; TD: ($t(17)=3.70$, $p=.002$, $d=1.36$) and had shorter fixation duration on faces compared to their TD counterparts ($t(30)=-2.24$, $p=.03$, $d=.804$). In the ASD group, fixation duration was positively correlated with accuracy on the LFI expression task ($r=.689$, $p=0.006$) while number of fixations on objects was negatively correlated with task accuracy ($r=-.689$, $p=.006$). Additionally, children with ASD who performed better on the LFI identity task looked fewer number of times at objects of high autism interest (e.g., trains, airplanes) ($r=-.539$, $p=0.047$).

Conclusions: Consistent with previous studies, we found that children in the ASD group have differences in gaze pattern compared with TD counterparts, suggesting a tendency to prioritize objects over people (Nakano et al 2010). In the current study, the ASD group's gaze patterns were correlated with facial recognition skills, lending evidence to the theory that social motivation relate to face and emotion processing skills.

139.068 68 Social Responsiveness in Relation to Peer Interactions in Preschoolers: The Role of Executive Functions. H. A. Henderson*, L. Mohapatra, K. E. Ono and D. S. Messinger, *University of Miami*

Background:

Younger siblings of children with autism (Sibs-ASD) are at heightened risk for the development of clinical and subclinical cognitive and social deficits. Subtle deficits in both social responsiveness and executive functioning may limit children's ability to engage in cooperative and competent peer interactions in everyday environments. Examining the relations between social responsiveness, executive functioning, and peer competence provides a foundation for understanding the mechanisms underlying social deficits among young children at varying levels of risk for the development of ASDs.

Objectives:

The goals of the current study are: (a) to examine the associations between parent reports of social responsiveness and executive functioning, and observations of children's social behavior with an unfamiliar peer in a sample of children varying in ASD risk and (b) to test whether executive functions mediate the relation between social responsiveness and social behavior with peers.

Methods:

Preliminary data are presented on 33 4- to 6-year-old children (mean age 5.78 years). Eighteen (12 males) were the younger siblings of children with autism (Sibs-ASD) and 15 (10 males) were the younger siblings of typically-developing children (Sibs-COM). Groups were matched on age, $t(31)=-.21$, *ns* and verbal IQ, $t(31)= -.05$, *ns*. Parents completed the Social Responsiveness Questionnaire (SRS; Constantino, 2004) and Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000). Of interest were the SRS Total T-score as an index of social deficits along the autism spectrum and the BRIEF GEC T-score as an index of executive deficits. Each participant was paired with a gender-, IQ- and age-matched typically-developing peer from the community and observed during a peer interaction paradigm. A composite measure of *Observed Social Dysregulation* was created by summing standardized codes of (a) Negative Affect during a 10-minute free play episode and (b) the Quality of Cooperation (reversed) during a 5-minute cooperative puzzle task.

Results:

Sibling status was unrelated to SRS Total, $t(31) = 1.68$, $p = .10$, reflecting the wide range of variability in social responsiveness within each sibling group. A series of regression analyses revealed that: (a) Higher SRS Total scores and BRIEF GEC scores were independently associated with more Observed Social Dysregulation, $F(1, 32) = 12.57$, $p = .001$ and $F(1, 30) = 7.85$, $p = .009$, respectively and (b) the association between SRS Total scores and Observed Social Dysregulation was partially mediated through the effect of BRIEF GEC scores. That is, the highly significant relation between SRS Total Scores and Observed Social Dysregulation was reduced to non-significance once BRIEF GEC Scores were controlled for.

Conclusions:

Consistent with past literatures with both typically-developing and at-risk young children, social responsiveness and executive functioning deficits were individually associated with behavior and affect dysregulation during peer interaction. Across the combined sample of Sibs-ASD and Sibs-COM, the relation between social responsiveness and maladaptive peer behaviors was partially mediated by differences in general executive abilities. These findings suggest that targeting executive abilities, which are thought to underlie the development of self-regulation, may facilitate more competent peer interactions for children with elevated autism-related social deficits.

139.069 69 Physiologic Responses to Emotion-Eliciting Task for Children with ASD. H. Dauterman*[1], B. J. Wilson[1], R. Montague[2], C. Manangan[1], K. Hamilton[1] and R. Miller[1], (1)*Seattle Pacific University*, (2)*Seattle Children's Hospital*

Background:

Children with autism spectrum disorders (ASD) have difficulty regulating emotion (Baron-Cohen, 2002). Emotion-eliciting tasks are often used to assess these skills. For example, The Children's Gambling Task (CGT; Kerr & Zelazo, 2004), an affective decision-making task, requires children choose between two stacks of cards that vary based on rewards and losses. The inherent failure feedback provided during this task requires children to successfully regulate their emotions in order to persevere and succeed. Some children perform well throughout the task despite negative feedback while others initially perform well but their performance drops off during the task. It is important to understand factors that may influence these different response patterns. No research to date has looked specifically at cardiac functioning in response to the CGT for children with typical development (TD) or ASD.

Children with ASD typically show varied cardiac functioning when compared to their TD peers (Ming et al, 2005). Specific to emotion regulation, research suggests that vagal tone, a measure of parasympathetic influence on the heart, is associated with the ability to self-sooth (Porges, 2007). Researchers have observed that children with ASD tend to exhibit less variable heart rate and lower baseline vagal tone than children with TD. These issues may functionally make it more difficult for them to adapt to various contexts and successfully regulate their emotions (Althaus et al., 2004).

Objectives:

The current study aims to document differences in cardiac functioning between children with ASD and those with TD. Additionally, we plan to investigate potential differences in cardiac functioning profiles based on different response patterns elicited by the CGT.

Methods:

Sixty-three children between the ages of 3:3 and 7:2 participated in the current study. Children's cardiac functioning will be compared between a baseline and a challenge condition. During the baseline phase, the children listened to a neutral story while cardiac data were collected. Next, during the challenge phase, children completed the CGT. Cardiac data from the task will be compared with baseline measures offline. Inter-beat interval, heart rate variability, and vagal tone will be calculated from these data.

Results:

We anticipate that our ASD group will display decreased heart rate variability and vagal tone. Further, we expect cardiac functioning across both groups to predict the distinctive response patterns observed in the CGT. Specifically, in the ASD sample, we expect reduced heart rate variability and vagal tone to relate to disadvantageous decision-making on the CGT.

Conclusions:

We expect to find that children with greater heart rate variability and vagal tone are able to successfully regulate their emotions more effectively and persevere with advantageous decision-making following failure feedback.

The clinical implications of these findings underscore the importance of teaching self-regulation strategies and coping skills to children with ASD during intervention. These skills may help counteract their reduced physiological functioning and serve to increase their success in a variety of challenging contexts.

139.070 70 Emotion Regulation of Preschoolers with ASD During Dyadic Interaction with Mother and Father: Behavioral and Physiological Markers. Y. Hirschler-Guttenberg*, O. Golan, S. Ostfeld-Etzion and R. Feldman, *Bar-Ilan University*

Background:

Emotion regulation (ER), defined as the ability to cope with increased levels of emotion by manipulation of internal arousal and external social environment, is a main developmental task in early childhood. Clinical and preliminary empirical evidence reveal ER difficulties in young children with Autism Spectrum Disorders (ASD). However, the ability of individuals with ASD to regulate their emotions during emotionally challenging situations has received little empirical attention.

Alongside constitutional factors, parental environment was shown to play a central role in the development of ER strategies in typically developing children and in children with developmental difficulties. Studies have demonstrated that despite the primary deficits in ASD, parents can enhance developmental processes in children with ASD. However, behavioral and physiological aspects of ER in young children with ASD, during interaction with their parents have not been previously explored.

Objectives:

To examine emotional expression patterns and behavioral and physiological aspects of ER in young children with ASD and typically developing (TD) controls, during dyadic interaction with their mothers and with their fathers.

Methods:

15 pre-school children with ASD and 15 TD controls, matched on mental age, were videotaped during play activities, while interacting with their mothers and (separately) with their fathers. The interaction included free-play and play procedures eliciting mild frustration and fear. Videos underwent global and micro analyses, yielding measures of emotional expression, ER behaviors, and interaction. In addition, cardiac vagal tone was measured during the interaction, as a measure of physiological ER.

Results:

During the frustrating activity, children with ASD used more simple ER strategies (e.g., protest, withdrawal, idiosyncratic behavior) and fewer sophisticated ER strategies (e.g., distraction, play) than the TD group. During the fear eliciting activity, higher levels of vagal tone were measured in the ASD group, suggesting their ER was less efficient than that of the TD group. No group differences were found in emotional expression. An analysis of parent-child interaction measures revealed that although children with ASD were less involved and less compliant the TD children during the interactions, there were no group differences in parental measures of sensitivity, intrusiveness and limit-setting, or in dyadic measures of reciprocity and negative dyadic states. In the ASD group's father-child dyads, child compliance and dyadic reciprocity are positively correlated with the use of sophisticated ER strategies, and negatively correlated with the use of simple ER strategies. No correlations between interaction measures and ER behaviors were found in the TD group.

Conclusions:

This study supports previous descriptions of emotion regulation difficulties in preschoolers with ASD, demonstrating them both behaviorally and physiologically. Furthermore, this study supports previous findings about the parenting qualities of mothers and fathers of children with ASD, which are equivalent to those of parents to typically developing children. Lastly, this study emphasizes the central role of fathers in the development of ER strategies amongst children with ASD.

139.071 71 Eye Contact Enhances the Accuracy of Hand Imitation In Children with ASD. Y. Kikuchi*[1], Y. Tojo[2], H. Osanai[3] and T. Hasegawa[4], (1)*Japan Society for the Promotion of Science*, (2)*Ibaraki University*, (3)*Musashino Higashi Gakuen*, (4)*The University of Tokyo*

Background: Eye contact modulates social responses, for example it enhanced hand mimicry in typically developing (TD) adults (Wang et al., 2010). Children with autism spectrum disorder (ASD) had difficulty in imitation and they showed reduced attention to a model's face when observing hand actions (Vivanti et al., 2008). In contrast, children with ASD imitated less accurately in the direct-gaze condition compared to TD children but not in the averted-gaze condition (Vivanti et al., 2011). Thus, the effects of eye contact in imitation remain unclear and more studies are necessary.

Objectives: We investigated whether children with ASD performed more accurately in imitation of the hand postures when the eye contact was established.

Methods: Participants consisted of 22 children with ASD (mean 9.7 years; range 6-12 years) and 26 TD children (mean 8.5 years; range 6-12 years) matched on the verbal mental age. Eight unimanual postures from the Japanese syllabary characters of sign language and these 180° rotated postures were presented. Participants sat opposite to the model. In Face block, participants were asked to look at the model's face and to imitate the hand postures. In Object block, the model wore a colorful flower on the top of her head and bowed to hide her face. Participants were asked to look at the flower and to imitate the hand postures. Twelve children with ASD and 13 TD children were tested for the face block first, and the other the object block first. Form (e.g. number of fingers, correct position of fingers) and Orientation (the child's palm was to the model when the model's palm to the child, and vice versa) were analyzed.

Results: On both Form and Orientation, children with ASD performed less accurately than TD children ($p < .05$), but the performance was better in Face condition compared to Object condition across the group ($p < .05$). In Orientation, the interaction was marginally significant ($p = .09$). The performance of Orientation was better in Face condition compared to Object condition in children with ASD ($p < .01$) but not in TD children ($p > .6$). Moreover, whereas children with ASD performed less accurately than TD children in Object condition ($p < .01$), the group difference did not reach significance in Face condition on Orientation ($p = .07$).

Conclusions: Although children with ASD imitated the hand postures less accurately than TD children, they performed better when the eye contact was established.

139.072 72 Who Is Talking and about What ? Conversation about Personal Events in Autism. S. Goldman*[1], D. DeNigris[2] and K. Nelson[2], (1)*Albert Einstein College of*

Medicine, (2)*The Graduate Center, The City University of New York*

Background: Through early conversations, children learn to enter into the narrative discourse about the past (Fivush & Nelson, 2004). Developmental approaches propose that mental development is an interactive product of the child in transaction with socio-cultural supports and practices. Differing communicative styles among parents and children are established in response to the parent's view of the child's ability to participate acively. Prior research on children with Autism Spectrum Disorders-ASD (Goldman, 2008) reported difficulties in narrative organization and lack of high-point (i.e., the climax). Here, we focus on the parents' strategies to enter into the child's discourse about past events. Autobiographical memory emerges from dialogues and negotiations supported by the shared minds, often lacking in children with ASD, which may disrupt their meaningful narrative involvement

Objectives: The aims are (i) to examine dyadic interactions during parent-child conversations about past events among three groups of children and (ii) to identify parents' strategies to elicit autobiographical memories.

Methods: Parent-child conversations about autobiographical memories were recorded and transcribed for three groups of schoolage children: 11 high-functioning with ASD (HFA), 11 non-autistic with developmental language disorders (DLD), and 8 typically developing (TD) matched for chronological age and non-verbal IQ. The coding focuses on: (a) conversational transactions and (b) narrative productions. Conversations were coded for (1) number of turns taken by parent and child, (2) number of events initiated by parent and child, (3) parent's probing strategy, and (4) child's level of participation. Narrative productions were coded for (1) time of each event and (2) event topic.

Results: Results showed no differences in number of turns taken by parent and child among the three groups. Analyses revealed that all parents initiated more events. Compared to HFA and DLD, TD children more often chose the topic. We identified different parent probing strategies, relative to diagnostic group, which tended to be associated with the child's level of participation. HFA children remembered events from a more recent past while TD and DLD recalled older memories. No differences in event topic were found.

Conclusions: Analysis of parent-child conversations about past events provides an opportunity to better understand the dynamics within the dyads relative to the child's social deficits. These results shed light onto parents' and children's differing roles. Parents of HFA and DLD children appeared to be concerned with their child's performance as if it were part of a cognitive assessment. Specifically, parents of HFA children focused on the accuracy of their child's responses and his/her overall performance, while TD dyads interacted in a more natural way. This might be related to the fact that HFA and DLD children do not practice past event conversations with their parents as often as TD children. Parents of ASD children naturally adjust their conversational style to their child's communication difficulties.

We highlight the relationship between parents' strategies to elicit memories and children's ability to contribute meaningfully to the conversation. Strengthening meaningful dyadic narrative throughout childhood may enhance participation in personal remembering and a sense of self in time, place, and with others.

139.073 73 Face, Mouth, Versus Eyes: A Comparison of Emotion Recognition in Children with ASD and Typical Development. B. J. Wilson, K. E. McKee*, J. L. Berg, K. Hamilton, M. Gorman and E. Werst, *Seattle Pacific University*

Background: Many studies suggest emotion recognition is positively correlated to children's social competence. Children with autism spectrum disorder (ASD) have deficits in emotion recognition compared to their typically developing (TD) peers (Rump Giovannelli, Minshew, & Strauss, 2009). Whereas TD children demonstrate proficient emotion recognition skills early childhood, children with ASD have delayed development of these skills (e.g., Rump et al., 2009). Some studies suggest children with ASD have more difficulty recognizing fear and anger than do their TD counterparts (Kuusikko, 2009; Rump, et al., 2009). Other research indicates that children with ASD focus primarily on the mouth during emotion recognition tasks; whereas TD children focus primarily on the eyes (Klin, Jones, Schultz, Volkmar, & Cohen, 2002). A recent study specifically

examined these group differences in gaze patterns in relation to particular areas of the face (eyes, mouth, or other). It was discovered that better emotion recognition accuracy was positively correlated with visual fixation on the eyes rather than the mouth for both groups (Bal et al., 2010). To date, no studies have examined these groups on their emotion recognition of full faces compared to recognition in just eyes and just mouths.

Objectives: The objectives of this study are to assess differences in emotion recognition ability in children with ASD and TD children and to investigate group differences in children's ability to recognize emotions shown only in the eyes or mouth.

Methods: The present study currently consists of 36 typically developing children and 20 children with ASD, all between the ages of 3 and 6 years, 11 months; however, data collection is ongoing. The emotion recognition task uses a computer-based program to assess emotion recognition. This program uses photographs to show images of full faces, eyes, or mouths that gradually transition from neutral into one of four emotions. The program software records each participant's correct responses.

Results: One-way ANOVAs were used to examine group differences in emotion recognition. When viewing full faces children with ASD were less likely to recognize sad expressions. When viewing just mouths, children with ASD were slower to identify happiness. Lastly, children with ASD were less successful in identifying angry eyes and fearful eyes than their TD counterparts. However, the results regarding just eyes were only marginally significant. In order to increase the power of our analysis, we are continuing data collection. Additional results will be presented.

Conclusions: Thus far the present study has confirmed past research suggesting that children with ASD have deficits in emotion recognition, especially in identifying negative emotions. However, it expands on current knowledge by comparing their ability to identify emotions using different parts of the face. This may be used to inform future interventions and create successful strategies for helping children with ASD improve their emotion recognition skills.

139.074 74 Social Attribution to 'Triangles Playing Tricks' Is Diminished and Improves Less with Age in Children with High Functioning Autism Spectrum Disorders. E. Bal*[1], B. Yerys[1], J. L. Sokoloff[1], M. Celano[2], L. Kenworthy[1], J. Giedd[2] and G. L. Wallace[3], (1)*Children's National Medical Center*, (2)*National Institute of Mental Health*, (3)*NIMH,National Institute of Mental Health*

Background: Children with autism spectrum disorders (ASD) have shown deficits in Theory of Mind (ToM) skills, the ability to attribute thoughts and feelings to others. Using the "Triangles Playing Tricks" task, which requires social attribution to relatively impoverished animations, previous studies showed that individuals with ASD provided fewer and less accurate mental state descriptions and ascribed less intentionality to ToM animations than did typically developing (TD) individuals (Abell et al., 2000; Campbell et al., 2006; Castelli, Frith, Happé, & Frith, 2002). However, these studies have been limited to either low functioning children with ASD or high functioning adolescents/adults. Thus, performance of high functioning children with ASD on this task remains an open question. Further, age-related changes in these social attribution skills have not been explored in children with ASD.

Objectives: The current study seeks to extend prior work by evaluating age-related changes in social attribution in high functioning children with ASD. We hypothesize that children with ASD will receive lower appropriateness and intentionality ratings on the "Triangles Playing Tricks" animations than TD children. In addition, we hypothesize that the relationship between age and performance on ToM animations will be greater among TD children than children with ASD.

Methods: Forty-one high functioning children with ASD (IQs>80) and 58 TD children between the ages of 6 and 17 (*M*=10.65; *SD*=2.36) participated in the study. The groups did not differ in age, sex ratio, or full scale IQ. Participants were asked to give descriptions of various animations of moving triangles in different conditions, including a goal-directed condition (e.g., the triangles interact in simple ways) and a ToM condition (e.g., one character appears to react to the other's mental state).

Results: In both the goal-directed and ToM conditions, children with ASD received lower intentionality and lower appropriateness scores than TD children (*p*s<.05). This pattern of diagnostic group differences remained the same (*p*s<.05) in the ToM condition when examining younger (ages 6-10 years) and older (11+ years) groups of children separately, but only younger children with ASD exhibited impaired performance in the goal-directed condition (age groups were determined by a median split). Adding verbal IQ as a covariate did not alter any of these findings. A series of linear regressions revealed that in addition to group and age effects, a group by age interaction term also predicted appropriateness and intentionality scores in the ToM condition (*p*s<.05) with greater correlations between age and ToM performance in the TD group than the ASD group.

Conclusions: Consistent with previous research, we show that among high functioning children with ASD, there was a reduced tendency to attribute social meaning to animations designed to elicit mentalizing. Extending prior work, we find that while both groups showed age-related improvements in ToM performance, these correlations were greater among TD children than children with ASD. This result suggests that with increasing age during childhood and early adolescence, individuals with ASD may fall further behind their typically developing peers in social attribution abilities.

139.075 75 Early Attentional Processing of Affective Faces in Toddlers with ASD. J. Garzarek*, S. Macari, K. Chawarska and F. Shic, *Yale University School of Medicine*

Background: Toddlers with ASD view scenes with human faces atypically, choosing instead to divert their visual attention to less social aspects of presented scenes (Chawarska & Shic, 2009; Jones, Carr, & Klin, 2008; Pierce, Conant, Hazin, Stoner, & Desmond, 2011; Shic, Bradshaw, Klin, Scassellati, & Chawarska, 2011). It is not clear whether these atypical gaze patterns are associated with early attentional biases to social information; similarly it is unknown if limited attention to neutral faces extends to emotional faces.

Objectives: To examine the effect of facial affect on attention capture and looking time in toddlers with ASD and typical development.

Methods: Toddlers with ASD (N=57; Age: M=21.1, SD=2.1 months) and typically developing (TYP) toddlers (N=66; Age=19.5, SD=2.1 months) were tested using a preferential looking eye-tracking paradigm examining attention capture by and preferences for: 1) upright vs. inverted faces (4 trials); 2) happy vs. neutral faces (2 trials); and 3) fearful vs. neutral faces (2 trials). The child's own anxious apprehension in a context of play-based interactions was estimated based on the global summary score (E3) on the ADOS-G. A linear mixed-model diagnosis (2) by condition (3) analysis was conducted for: a) likelihood of the first saccade to be directed towards the target (attention capture); b) looking time ratio at the target.

Results : The attention of TYP, but not ASD, toddlers was captured by upright ($p<.05$) and fearful faces ($p<.01$). Interestingly, both ASD and TYP groups looked longer at the target in the Fearful condition compared to other conditions ($p<.01$); in the Fear condition the total time spent looking at fearful faces was greater than chance (.5) for both ASD and TYP groups ($p<.001$). However, toddlers with ASD looked less at fearful faces as compared to TYP controls ($p<.05$). Greater levels of anxiety as observed on the ADOS-G in the ASD group were associated with longer looking time at the fearful faces ($r = .33$, $p<.05$).

Conclusions: Consistent with results in older children and adults, faces in general and affective faces in particular capture the attention of TYP toddlers, but not toddlers with ASD, suggesting impairments in an elementary attentional bias toward these salient stimuli. Fearful expressions elicited greater attention in both groups; though the response in ASD was less pronounced. The level of the child's own fearful responses to play probes during the ADOS-G was positively associated with the duration of looking at the fearful face. Thus, while basic mechanisms related to sustained attention to fearful faces may be intact in autism, toddlers with ASD are likely to process information about fearful faces differently than age-matched controls.

139.076 76 The Development of Anticipatory Smiling in Infants At Risk for Autism Spectrum Disorders. D. N. Gangi*, C. J. Grantz, B. Lambert and D. S. Messinger, *University of Miami*

Background: Infant-initiated joint attention (IJA), which typically emerges during the first year of life, is an important precursor of later social competence. IJA is impaired in children with Autism Spectrum Disorder (ASD) and may be impaired in their high-risk siblings. However, there are multiple types of IJA that may be impacted differently by high-risk status. IJA can occur with smiling in anticipation of the social partner, smiling in reaction to the social partner, or no smiling. IJA with anticipatory smiling—the current study's focus—occurs when an infant looks at an object, smiles, and then turns the smile toward a social partner, communicating preexisting positive affect to a partner. In typically developing infants, anticipatory smiling behavior within IJA increases from 8 to 12 months of age and is uniquely associated with later social outcomes. Fewer early anticipatory smiles may be a specific IJA deficit in children at risk for an ASD with implications for later social competencies.

Objectives: Determine whether there are deficits in IJA with anticipatory smiling, reactive smiling, or IJA with no smiling in infant siblings of children with an ASD (high-risk siblings) compared with infant siblings of typically developing children (low-risk siblings).

Methods: High-risk (n = 56) and low-risk (n = 26) infant siblings were administered the Early Social Communication Scales (ESCS) at 8, 10, and 12 months of age. During the ESCS, IJA episodes (in which the infant gazes at the social partner to share information about an event or object) were coded for smiling behavior. IJA was coded as involving an anticipatory smile (gaze at object, smile, turn while smiling to gaze at examiner), reactive smile (gaze at object, gaze to examiner, then smile), or no smile (no smile during gaze to examiner).

Results: Hierarchical linear modeling was used to examine group differences based on high-risk status in the development of frequency of IJA with anticipatory smiling, reactive smiling, and no smiling. The best fit model for IJA with anticipatory smiles included risk group status as a predictor at the intercept, $\chi^2 = 6.19$, $p = 0.01$. High-risk siblings produced fewer IJA with anticipatory smiles than low-risk siblings ($\beta_{01} = -1.88$, $t(79) = -2.58$, $p = 0.01$). Linear ($\beta_{10} = 5.54$, $t(80) = 4.39$, $p < 0.001$) and quadratic ($\beta_{20} = -2.34$, $t(80) = -3.97$, $p < 0.001$) coefficients did not differ by status. There was no significant effect of risk group status on IJA with reactive smiling or IJA with no smiling.

Conclusions: High-risk siblings produced fewer IJA with anticipatory smiling between 8 and 12 months than low-risk siblings, indicating that communicating positive affect may be a specific impairment in children at risk for developing an ASD. We are currently investigating whether this apparent impairment predicts later diagnostic and social outcomes.

139.077 77 Making the Choice: Style, Path, or Goal? Imitation in Autism Spectrum Disorders. J. Mussey*[1] and L. G. Klinger[2], (1)*University of Alabama*, (2)*TEACCH, University of North Carolina School of Medicine*

Background:

Imitation is a primary way in which young children learn language and social interaction (Kuhl, 2007; Meltzoff, 2007). While most clinicians would agree that there is something different about the way in which children with ASD imitate, it has been difficult to capture this difference in research. While imitation of actions on objects has generally been found to be less impaired, the "style" in which an action is performed is impaired in individuals with ASD (Hobson & Hobson, 2008).

Objectives:

Rather than focus on whether children with ASD can imitate, this study focused on how children with ASD imitate. When forced to choose between imitating a person's goal or the path taken to accomplish the goal, typical toddlers choose to imitate path (Wagner, Yocum, & Greene-Havas, 2008). The present study asked whether children with ASD imitate style and whether they prefer goal or path when exact imitation is precluded.

Methods:

Participants included 25 young children with ASD (chronological age: mean = 43 moths; range 25-68 months) and two groups of children with typical development (29 matched on chronological age, mean = 43 months; 28 matched on receptive language ability, mean = 37 months). Children completed an imitation choice task in which the

component parts of an action with an object were examined. The components included a "style" or type of movement (i.e., hopping, sliding), a "path" or direction of motion (i.e., up, down), and a "goal" toward which the motion is directed (i.e., on a cup, in a cup). Children had the opportunity to imitate exactly what they had seen the examiner do with their toy in one condition. In the second condition, exact imitation was precluded to examine children's preferences in which components they chose to preserve when imitating.

Results:

Across both the exact and choice conditions, children with typical development showed more imitation of style than did the children with ASD ($F = 18.67$, $p < .001$). In the exact imitation condition, children with ASD showed equally high rates of path and goal imitation compared to both groups of children with typical development. However, when forced to choose between imitating goal or path, children with typical development chose to imitate path ($M = .43$; positive value indicates path preference) while children with ASD did not show this preference ($M = -.13$; value near zero indicates no preference) ($F = 24.38$, $p < .001$).

Conclusions:

Results suggest that the components that children with ASD choose to imitate differ from those that children with typical development prefer. These results may help explain some of the discrepant findings previously reported in the imitation literature. Specifically, children with ASD "do" imitate, but "how" they imitate is different. This may have important implications for refining measures to assess imitation abilities in a more detailed manner. Additionally, these results have implications for designing and implementing interventions that address imitation or use imitation to teach other skills as merely teaching imitation of a behavioral goal does not capture the true nature of imitation.

139.078 78 Temperamental Risk Factors for Bullying in HFA.
A. K. Stefanatos*[1], A. R. Neal-Beevers[1], L. Sperle[2] and B. C. Gamber[1], (1)*University of Texas at Austin*, (2)*University of Pittsburgh*

Background: In typical development, temperament has been used to predict individual differences in various social-emotional outcomes. Surgency is a temperament style characterized by increased approach behaviors, which has commonly been associated with greater social competency, more appropriate emotion-regulation behaviors and greater self-esteem (Dennis et al., 2010; Davey et al., 2003). However, a few studies have found increased Surgency to be associated with higher rates of peer rejection and externalizing problems (Gunnar et al., 2003; Eisenberg et al., 1996). Negative Affect is a temperament style characterized by increased fearfulness, which has been associated with generally negative outcomes such as lowered social competence and increased internalizing and externalizing behaviors (Rothbart et al., 2005). While the impact of these two temperament styles on social-emotional development have been widely studied in typically developing populations, relatively few studies have examined the impact of these traits in individuals with autism.

Objectives: The objective of this study was to extend previous work examining the role of Surgency and Negative Affect on the report of peer victimization in adolescents. Specifically, this study was intended to investigate whether a diagnosis of ASD moderates the effect of temperament style on overt peer victimization.

Methods: The participants were 21 individuals (19 male, 2 female) previously diagnosed with High Functioning Autism (HFA), and a control group of 19 typically-developing individuals (17 male, 2 female), matched on gender and mental age (M_{HFA}=198.55; M_{TD}=191.63). Participants between the ages of 12 and 15 completed the Early Adolescent Temperament Questionnaire-Revised (EATQ-R; Capaldi & Rothbart, 1992) and participants between the ages of 16 and 21 completed the Adult Temperament Questionnaire (ATQ; Ellis & Rothbart, 2001). Information on participants' peer victimization experiences was obtained with the Social Experiences Questionnaire (SEQ; Crick & Grotpeter, 1996). All participants were additionally administered the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) in order to confirm diagnostic status.

Results: Multiple regression analyses were conducted in order to explore the relationship between temperament style,

diagnosis and the experience of peer victimization. The regression model including Diagnosis, Surgency and an interaction term was significant in predicting overt victimization (see Table 1), although there were no main effects for Diagnosis or Surgency. A second model involving Diagnosis, Negative Affect and an interaction term was also tested and no significant effects were found.

Conclusions: As anticipated, higher levels of Surgency were associated with lower reports of overt victimization on the SEQ for typically-developing adolescents. However, for individuals with HFA, higher levels of Surgency were associated with higher reports of overt victimization. This provides support for the idea that approach motivation processes may influence certain individuals with HFA to be more active and interactive in social situations, which in turn exposes them to greater risk for being bullied (Sutton et al., 2005). Implications for understanding the dynamic influences of temperament on the social-emotional development of individuals with HFA are discussed.

Table 1. Regression Analysis by Dependent Variable (DV)

	R	Adj.R^2	Beta	p-value
DV: Overt Victimization	.452	.204		.054
Diagnosis			.347	.037
Surgency			-.942	.056
Diagnosis X Surgency			.992*	.046

139.079 79 Advanced Theory of Mind Assessment in Adults with High-Functioning Autism. M. L. McEntee*[1], S. Kuo[1], E. Lacey[1], M. A. Andrejczuk[1], L. Bosley[1], A. Cooper[1] and B. Gordon[2], (1)*The Johns Hopkins University School of Medicine*, (2)*The Johns Hopkins University*

Background: Theory of mind (ToM) is the ability to attribute mental states to one's self (first-order) & others (second-order) in order to explain and predict behavior. Typically developed by age 11, this cognitive construct is substantially delayed in children with autism. There is conflicting data as to whether ToM deficits are present in adults with autism. This discrepancy has been attributed to the difficulty level of ToM task used, as adults with high-functioning autism (HFA) have been able to pass simple ToM measures developed for children while continuing to experience difficulty in social interactions that require understanding the beliefs and intentions of others. However, there are few studies that employ the use of advanced ToM measures in adult populations, particularly in adults with autism.

Objectives: To compare ToM in adults with high-functioning autism using two advanced theory of mind assessments.

Methods: Five adults with HFA (ages 19-40, 80% male) completed a battery of cognitive assessments. Autism diagnosis was confirmed by ADI-R and ADOS. Theory of mind measures included the revised adult version of Reading the Mind in the Eyes and Strange Stories Test as modified by Fletcher et al. 1995 and White et al. 2009. Language abilities, which have been associated with ToM performance, were assessed using the Comprehensive Assessment of Spoken Language (CASL).

Results: Despite having normal IQ, participants' performance on both ToM tasks showed impairment compared to general population norms. Mean score on the Reading the Mind in the Eyes test in this sample was below that of normal controls and the HFA/Asperger population. Likewise, mean scores on the modified Strange Stories were lower in this sample than the reported means for normal controls (Fletcher et al. 1995, White et al. 2009) and other adults with autism (White et al. 2009) for all story types (mental, physical, and unlinked sentences). The pattern of performance on Strange Stories was consistent with reported findings for normal controls, with average scores highest on mental state stories and lowest on the unlinked sentences control task. Scores on the CASL revealed an overall weakness in general language skills. The strongest deficit was seen in supralinguistic tasks which included tests of non-literal language, ambiguous sentences, meaning from context, and inference.

Conclusions: Adults with HFA scored significantly below normal controls on both advanced ToM measures in this study, which indicates that the revised adult Reading the Mind in the Eyes and modified Strange Stories tests are sensitive enough to identify ToM deficits in this population. While participants in this study had lower performance than normal controls and other autism populations, their pattern of results was more consistent with normal controls than other individuals with autism. Greater sample sizes are needed in studies using advanced ToM measures to determine the prevalence and areas of ToM deficits in this population and to assess the value of language skills as a predictor of ToM performance.

139.080 80 Predicting Emotion Recognition Bias From Emotion Description in Adolescents with and without Autism. L. D'Abreu*[1], A. R. Neal-Beevers[1], L. Sperle[2], T. Wells[3], B. C. Gamber[1] and A. K. Stefanatos[1], (1)*University of Texas at Austin*, (2)*University of Pittsburgh*, (3)*Brown University*

Background:

Impairment in social interaction is a hallmark characteristic of autism spectrum disorders (ASD). Two areas of impairment include accurately interpreting one's own emotions and identifying the facial affect of others. Previous studies have identified patterns of emotion recognition bias in high functioning autism (HFA) which are thought to cause misinterpretation of other's emotions and harm social interactions (Macdonald et. al. 2006). It may be possible that a person's concept of his or her emotions influences emotion recognition bias. This has not been examined.

Objectives:

The current study aims to determine how adolescents with HFA compare to neurotypical (NT) peers in their open-ended descriptions of emotions and in labeling emotionally ambiguous facial expressions, and to describe the relationship between emotion description and emotion identification bias.

Methods:

8 HFA and 8 NT adolescents participated in a study of ambiguous emotion recognition. The groups were matched on gender and mental age (MA), with a mean MA of 15.54 (SD =2.76) for the HFA and 15.29 (SD =1.53) for the NT adolescents ($t(7)=0.477$, n.s.). All adolescents were administered the Autism Diagnostic Observation Schedule (Lord et. al., 1989) to confirm diagnostic status. During the ADOS, participants described how certain emotions make them feel. Their responses were coded using a modified Linguistic Inquiry and Word Count system (Pennebaker & Francis, 1999). Participants were then presented images of ambiguous facially expressed emotion, which were created as morphs of two expressions, and were forced to choose between each morph's comprising emotions, as in Beevers et. al. (2008). Individual bias scores were calculated as the mean difference between the proportion of morphs participants labeled as each emotion and the percentage of the morph actually represented by that emotion. Positive bias scores represent a higher tendency to label one emotion over another in these ambiguous faces.

Results:

Results indicate that HFA adolescents were biased toward labeling an ambiguous face as happy $t(6) =3.608$, $p <.05$, and biased against labeling an ambiguous face as sad $t(6) =-3.966$, $p<.01$ when compared to NT adolescents. No significant between group differences were observed for emotion description.

Linear regression analysis revealed that the incidence of internal descriptors of fear (e.g. "I feel hollow inside") rather than external descriptors (e.g. "I begin to tremble") was a highly significant predictor of anger bias ($\beta = .788$, $p < .001$), accounting for 59.1% of the variance in anger bias scores.

Conclusions:

This is the first study which investigates the association between emotion description and emotion identification bias. Preliminary data indicate that propensity to describe fear in terms of internal feelings rather than through external signs is predictive of bias in labeling ambiguous faces as angry. Those using internal descriptors may perceive more threat in

their environment as they percieve more people with angry expressions. That there were no significant group differences in this regard suggest that this effect is not specific to people with HFA, but may be shaped by temperament and environmental factors.

139.081 81 Development of Advanced Theory of Mind Paradigm. T. Oswald*, M. A. Winter-Messiers, C. Palmrose, A. M. Schmidt and L. Moses, *University of Oregon*

Background:

Studies utilizing measures of more advanced ToM, including Happé's Strange Stories (Happé, 1994), the faux pas test (Baron-Cohen et al., 1999), and Eyes test (**Baron-Cohen, 1999)** do not consistently find ToM impairments in higher functioning individuals with ASD (e.g., Speck et al., 2010). Given that higher functioning adolescents with ASD, however, have difficulties with social situations and relationships, as demonstrated by their lack of quality friendships and greater risk for social marginalization and victimization, it is important to develop advanced theory of mind measures that properly characterize their true ToM impairments. Some researchers argue that children with ASD do not acquire a genuine ToM, but rather they learn compensatory skills to mask their deficits (e.g., Happé, 1995). To examine this hypothesis, it is necessary to develop more sophisticated measures of ToM that involve novel social contexts for individuals with ASD so they will not have had the opportunity to develop compensatory strategies to handle the situations. Such measures would allow researchers to evaluate whether higher functioning children and adults with ASD are truly impaired in ToM or whether they can actually out-grow their impairments in ToM.

Objectives:

The objective of the current study was to develop a valid measure of advanced ToM that would be sensitive enough to detect subtle theory of mind impairments in higher functioning individuals with ASD.

Methods:

Participants consisted of 16 typically developing controls (10 males; 6 females) and 17 higher functioning individuals with ASD (11 males; 6 females) ranging in age from 10.2 – 17.9 years (M = 14.64, SD = 2.06). The newly designed paradigm consists of 16 vignettes, representing one of the following ToM concepts: evasion, backhanded compliment, indirect request, and hinting one is being insensitive. These stories involve two primary characters engaged in a complex social interaction. The participant must employ sophisticated ToM reasoning in order to understand the subtle nuances of the social interactions. Following each story are two questions that prompt first-order and second-order ToM reasoning and two questions that assess comprehension of important details that provide the building blocks for understanding the psychological reasons for the characters' behaviors. ToM was also measured using Happe's Strange Stories.

Results:

Regarding the new advanced ToM paradigm, preliminary results based on a univariate analyses of variance (ANOVA), controlling for composite IQ and age, revealed a main effect of group, such that the ASD group (M = 52.53, SD = 14.56) demonstrated worse ToM performance than the TD group (M = 69.72, SD = 6.14), $F(1, 27) = 17.76$, $p < .001$. As expected there was no significant group difference in story comprehension, $p = .91$. Confirming the validity of this new measure, Happe's Strange Stories correlated well with this new advanced ToM paradigm, $r(27) = 0.46$, $p = .02$.

Conclusions:

These findings indicate that the newly designed advanced ToM paradigm is a valid measure of sophisticated ToM which can be used to detect more subtle theory of mind deficits in higher functioning older children and adolescents with ASD.

Cognition and Behavior Program

140 Cognition and Behavior III

140.083 83 Daily Living Skills of Adolescents and Adults with Autism Spectrum Disorders: Growth Curve Trajectories Over a 10-Year Period. L. E. Smith*, M. J. Maenner, J. S. Greenberg and M. M. Seltzer, *Waisman Center, University of Wisconsin-Madison*

Background: In recent years**,** increasing attention has been given to understanding the behavioral phenotype of autism spectrum disorders (ASDs) during adolescence and adulthood. However, virtually no studies have explored changes in daily living skills of individuals with ASD later in the lifespan, even though such functional abilities are often cited as important factors for successful adult outcomes.

Objectives: The present study aimed (1) to investigate the longitudinal course of daily living skills in a large, community-based sample of adolescents and adults with ASD over a 10-year period and (2) to provide a benchmark for the level and change in daily living skills among the individuals with ASD by exploring change in daily living skills among similarly-aged individuals with DS.

Methods: Adolescents and adults with ASD (n=397) were drawn from an ongoing, longitudinal study of individuals with ASD and their families. The individuals with ASD ranged in age from 10 to 52 years at Time 1 (*M* = 22.06, *SD* = 9.82). The majority of the sample was male (74.7%) and had a comorbid diagnosis of intellectual disability (68%) Additionally, 167 adolescents and adults with Down syndrome (DS) were drawn from a longitudinal study of aging families of individuals with intellectual and developmental disabilities. Individuals with DS ranged in age from 13 to 56 years at Time 1 (*M* = 31.6, *SD* = 7.2).

Procedures were identical for both the ASD and DS samples. Parents reported on their son or daughter's daily living skills using the Waisman Activities of Daily Living (W-ADL) Scale at 4 time points over a 10-year period.

Results: We utilized latent growth curve modeling to examine change in daily living skills over time. For the ASD sample, child age and intellectual disability status were included as predictors of initial level of daily living skills as well as linear and quadratic change over time. Daily living skills were improving for the individuals with ASD during adolescence and their early 20s, but plateaued during their late 20s, and started to decline during their early 30s. Older individuals had higher scores at the beginning of the study and also began to plateau at a faster rate than younger individuals. Having an intellectual disability was associated with lower initial levels of daily living skills and a slower rate of growth over time. For the DS sample, a different pattern of change was observed. There was a significant positive linear slope, but the quadratic latent factor was non-significant, indicating that individuals with DS were gaining daily living skills over time and that there was no significant curvature in the change.

Conclusions: Findings indicated that individuals with ASD gained daily living skills through their 20s but began to loose skills by their early 30s. This pattern is markedly different from what was observed with individuals with DS who did not show declines in skills. It will be critical for future research to explore what environmental factors and interventions may be associated with continued gains of living daily skills for adults with ASD.

140.084 84 Head Lag in Infants At Risk for Autism. J. E. Flanagan*[1], R. J. Landa[1], A. Bhat[2] and M. Bauman[3], (1)*Kennedy Krieger Institute*, (2)*University of Connecticut*, (3) *Lurie Center/ LADDERS*

Background: Delayed motor functioning in school-aged children with autism has been reported by numerous researchers, but limited research has focused on motor abnormalities during infancy in this population. Poor postural control, defined as poor head control while being pulled up from a supine position during pull to sit maneuver, has been documented to be an early predictor of developmental problems in other populations (e.g., cerebral palsy, preterm infants). Postural control in infants at risk for ASD has not been examined in the literature to date.

Objectives: We examined the association between head lag at 6 months of age in high risk infants and diagnosis of autism at 36 months. Next, we examined whether the presence of head lag is more prevalent in infants at high risk versus low risk infants for autism.

Methods: One sample of 40 high-risk infants (siblings of children with autism) was studied prospectively from 6-36 months; diagnostic classifications of autism or non-autism were obtained. A subsequent between-group comparison was conducted with a new sample of 20 high- and 21 low-risk infants.

Results: Head lag was significantly associated with autism spectrum disorder at 36 months (p=0.02) and was more frequently observed in high- than in low-risk infants (p=.018)

Conclusions: Although head lag is not specific to autism, it may be an early indicator that the nervous system is not developing appropriately in high risk infants. Results highlight the importance of early motor assessment in high risk infants for ASD. These findings may yield important information on early manifestation of autism which may lead to earlier medical screening and detection. This may result in earlier multidisciplinary intervention aiming to facilitate better outcomes in motor, social, and communicative development and minimize disabilities in children at high risk for autism.

140.085 85 Repetitive Stereotyped Behaviour Impacts Gesturing Behaviour Across Childhood in Children with ASD. V. Lee*[1], S. Georgiades[2], P. Szatmari[2], S. E. Bryson[3], E. Fombonne[4], P. Mirenda[5], W. Roberts[6], I. M. Smith[3], T. Vaillancourt[7], J. Volden[8], C. Waddell[9] and L. Zwaigenbaum[8], (1)*McMaster University*, (2)*Offord Centre for Child Studies, McMaster University*, (3)*Dalhousie University/IWK Health Centre*, (4)*Montreal Children's Hospital*, (5)*University of British Columbia*, (6)*The Hospital for Sick Children*, (7)*University of Ottawa*, (8)*University of Alberta*, (9)*Simon Fraser University*

Background:

Children with ASD exhibit repetitive stereotyped behaviours (RSB), such as repeated involuntary arm, head and body movements. Research suggests a link between RSBs and impairments in IQ (Mirenda et al, 2010), but deficits in other domains have yet to be explored. The current study is a preliminary investigation into the impact of stereotyped behaviours on communicative gestures.

Gestures require the coordination of the body to produce intentional and communicative actions. Thus, a deficit in motor control could potentially influence the ability to produce useful gestures. Furthermore, communicative gestures (i.e. pointing,) are important because they are the precursors to the development of language (Iverson & Goldin-Meadows, 2005). Therefore, exploring the relationship between motor deficits, as exhibited through RSBs, and gesturing could add a critical component to the understanding of communicative development in children with ASD. Finally, research in this area can potentially inform interventions targeted to communicative development, especially for children with ASD with deviant motor behaviours.

Objectives:

This study investigates the relationship between stereotyped behaviours on gesturing skills in children with ASD. Specifically, we will examine the extent to which variations in motor skills (fine and gross motor), visual-motor coordination, and RSBs predict gesturing behaviour later in development, while accounting for cognitive scores (IQ).

Methods:

The sample for analyses included 167 children diagnosed with ASD from the Pathways in ASD study who were assessed at ages 2 to 4 years and 11 months (T1) and 4 to 7 years (T2). Fine and gross motor scores were measured using the parental reports on the Vineland Adaptive Behavioural Scale. Standardized cognitive (IQ) and visual-motor scores were measured using the Merril-Palmer-Revised. RSBs were measured using a subscale of the parental report Repetitive Behaviour Scale-Revised and standardized before analysis. Finally, a gesture composite was abstracted from the non-verbal communication scores in the Autism Diagnostic Interview-Revised, reversed coded and standardized. Multiple regression and correlation analysis were used to test whether IQ, visual-motor, or RSBs predicted subsequent gesturing abilities later in childhood.

Results:

RSBs predicted deficits in the presence of spontaneous gesturing behaviour across both time points, even after

accounting for fine and gross motor skills, cognitive scores and visual-motor scores ($F(1,7)=4.55$, $p<0.001$). To further investigate this relationship and to control for the documented relationship between IQ and stereotyped behaviour, children were divided into two groups, low and high IQ as segregated by the median. Analysis revealed a significant negative correlation between RSBs and gesturing behaviour. However, this relationship was stronger in children with lower IQ ($r= -0.35$, $p<0.01$) than for those with higher IQ ($r=-0.22$, $p < 0.05$).

Conclusions:

Study findings suggest that children with ASD who have elevated stereotyped behaviours may be at risk of using less spontaneous gestures during development, perhaps due to an inability to produce them. Future studies can identify whether this negatively impacts language development in later childhood. Finally, interventions for children with stereotyped behaviours might benefit from inclusion of exercises that promote communicative gestures to circumvent the potential impact of a lack of motor control.

140.086 86 The Motor and Learning Questionnaire: Assessing 3 Domains of the Mullen Scales of Early Learning Via Parent Report. K. Libertus* and R. J. Landa, *Kennedy Krieger Institute*

Background: Motor skills are a critical component of healthy development and – especially in young children – motor development can act as rate-limiting factor for development across domains. Further, motor deficits are commonly observed in a number of developmental disorders, including Autism Spectrum Disorders (ASDs). Therefore, individual differences in motor abilities are important predictors for developmental outcomes. In contrast to the language domain, parent-report measures of motor development are rare but needed when direct administration is not possible or time constrains limit the number of measures that can be collected. Here, we report findings on the Motor and Learning Questionnaire (MLQ), a novel parent-report measure that is based on the widely used Mullen Scales of Early Learning (MSEL) and assesses behavior in Gross Motor, Fine Motor, and Visual Reception domains.

Objectives: To develop an indirect parent questionnaire of motor and cognitive functioning and to compare it with a standardized direct-observation measure (MSEL) in the same children.

Methods: Participants were 36 infants (aged between 3-18 months) who participated in a study on early detection of ASDs. The majority of participants had an older sibling with ASD. The MLQ was mailed to each family and completed by a parent prior to their visit to our lab. Subsequently, all infants were tested on the MSEL by a trained experimenter. Scores from the MLQ were calculated using a ceiling criterion method (same scale as MSEL scores) and using MLQ-original scores, which incorporate parent's certainty.

Results: Pearson correlation coefficients were calculated to compare scores of the MLQ and the MSEL. Correlations were highly significant between the two measures in all domains: Gross Motor ($r_{36} = .93$, $p < .01$); Fine Motor ($r_{36} = .90$, $p < .01$); Visual Reception ($r_{36} = .71$, $p < .01$). Paired-sample t-tests revealed no differences between MLQ and MSEL scores in all three domains (all $ps > .4$). MLQ-original scores are on a different scale than the MSEL but additionally reflect parent's response certainty. Correlations between the MSEL raw scores and MLQ-original scores where excellent in the Gross Motor domain ($r_{36} = .94$, $p < .01$), and strong in both the Fine Motor ($r_{36} = .88$, $p < .01$) and the Visual Reception domains ($r_{36} = .87$, $p < .01$). Completion of the MLQ took parents approximately 16 minutes.

Conclusions: Parent reported scores on the MLQ are highly correlated with the directly assessed MSEL scores and parents did not systematically overestimate their child's abilities on the MLQ. Further, the MLQ extends the MSEL scores by incorporating parent's certainty. Thus, the MLQ provides experimenters with an alternative way to obtain MSEL scores from families when direct assessment is not possible or not desirable. The MLQ is not meant to replace the MSEL, but rather to be used alongside the MSEL (e.g., in short-term treatment designs or to improve measure validity) or in situations where administration of the MSEL is not possible (e.g., for web-based surveys). Correlations between the MLQ and another motor scale – the Peabody Scales of Motor Development – are currently being explored.

140.087 87 Dietary Intake and Parents' Perception of Mealtime Behaviors and Feeding History in Chinese Children with Autism: Comparison with Typically Developing Children. L. Xia*[1], W. Xia[2], C. H. Sun[2] and L. J. Wu[2], (1)*The First Hospital of Harbin Medical University*, (2)*Harbin Medical University*

Background: Autism is common and clinically neurodevelopmental disorder. Many children with autism are reported to have associated gastrointestinal disorders and associated symptoms, which could influence the absorption and utilization of dietary nutrients.

Objectives: This case-control study aimed to assess the nutrient intake and parents' perception of mealtime behaviors and feeding history in Chinese children with autism.

Methods: A total of 21 children (3-9 years-old; 14 boys and 7 girls) with autism and 21 typically developing children matched for age, gender, and ethnicity were enrolled in this study. The parents of children with autism and children with typical development completed the mealtime behavior survey and 3-day food records. Anthropometric data were expressed as Z scores.

Results: Nutrient intakes were similar for both groups of children, with most nutrient intakes close to or exceeding recommended amounts except vitamin A, vitamin B6, and folate. The percentage of vitamin C and calcium intakes below 80% of Dietary Reference Intakes (DRI) recommended by Chinese Nutrition Society of autistic children were present in 57.1% and 42.9%, respectively, which were found to be higher compared with the typically developing children (23.8% and 14.3%, respectively). Compared with parents of typically developing children, parents of children with autism were more likely to report that their children resisted trying new foods and had problems in foodintake, and they were less likely to describe their children being given nutritional supplement, having a meal independently, and being absorbed in diet during mealtime. Moreover, more autistic children had constipation, chronic diarrhea, food or drug allergy, self-injurious behavior, tantrums, aggression or oppositional behavior, and had a family number with allergy or immunity diseases.

Conclusions: These findings indicate that the intakes of several nutrients for children with autism might be inadequate, and the dietary behaviors of autistic children are probably negative.

140.088 88 Utility of the Psychoeducational Profile-3 for Assessing Children with Autism Spectrum Disorders. M. Fulton*[1] and B. D'Entremont[2], (1)*The University of New Brunswick*, (2)*University of New Brunswick*

Background: Reliable and valid estimates of cognitive and language abilities of children with autism spectrum disorders are crucial as they have implications for diagnosis, treatment, and prognosis (Delmolino, 2006; Koegel, Koegel, & Smith, 1997; Lovaas, 1987). However, it can be difficult to assess this population due to difficulties with noncompliance and attention (Koegel et al., 1997; Villa et al., 2010). The Psychoeducational Profile-3 (PEP-3) was designed to assess children with autism spectrum disorders and has undergone two revisions since it was created in 1979. Empirical support for the revised version of the measure suggests it may be a valuable assessment tool. Few studies have examined the psychometric soundness of the newest version, the PEP-3. Additionally, the authors suggest that the new version may be useful for facilitating diagnoses of autism spectrum disorders (Schopler, Lansing, Reichler, & Marcus, 2005). In this regard, it would be useful to know how the PEP-3 relates to symptoms of autism spectrum disorders.

Objectives: This study explored the convergent and discriminant validity of the PEP-3 for assessing the development of cognitive and language skills in clinically referred children with autism spectrum disorders with various levels of functioning. This study also examined the relationship between PEP-3 scores and autism spectrum disorder symptomology.

Methods: Data was collected from the files of 136 children with an autism spectrum disorder who had completed the PEP-3 between 2005 and 2010. Age equivalent scores were collected from the PEP-3, the Child Development Inventory (CDI), the Vineland Adaptive Behavior Scale 2nd Edition (VABS-2), and the Autism Diagnostic Observation Schedule (ADOS).

Results: Spearman Rho correlations indicated that the PEP-3 was significantly correlated with the CDI, VABS-2, and MPR and that similar domains tended to be more strongly correlated than dissimilar domains. Importantly, the PEP-3 cognitive and language domains were strongly correlated with the cognitive and language domains on the CDI, VABS-2, and MPR. Mean difference scores indicated some significant differences between the measures assessing cognitive and language domains. Regarding the association with autism spectrum disorder symptomology, the results indicated that the PEP-3 was significantly negatively related to the ADOS total score, $r(82) = -.40$, $p < .001$. A between subjects MANOVA with diagnosis (Autistic Disorder, Asperger's, and Pervasive Developmental Disorder- Not Otherwise Specified) as the independent variable indicated a significant multivariate effect of diagnosis on PEP-3 scores, $F(18, 148) = 2.28$, $p < .05$. Post hoc comparisons indicated significant differences between some of the diagnostic groups on the PEP-3 subtests.

Conclusions: The PEP-3 was found to provide a measure of cognitive and language development that is comparable to other commonly utilized standardized measures of development for children. The findings suggest that the PEP-3 cognitive and language domains may useful for determining diagnostic categories on the autism spectrum.

140.089 89 Using a Newly Developed Computer-Based Program to Evaluate Learning of Visuomotor Procedures in Children with Autism: A Pilot Study. L. Sparaci*[1], M. Vespignani[2], D. Formica[3], L. D'Elia[4], G. Valeri[5] and S. Vicari[6], (1)*Children's Hospital Bambino Gesù*, (2)*École Polytechnique Fédérale de Lausanne (EPFL)*, (3)*Università Campus Bio-Medico*, (4)*Children's Hospital Bambino Gesù*, (5)*Children's Hospital Bambino Gesù* , (6)*U.O.C. Neuropsichiatria Infantile, Dipartimento di Neuroscienze, Ospedale Pediatrico Bambino Gesù*

Background: The ability to learn visuomotor procedures is particularly important for children, as it underlies the capacity to acquire the complex movement sequences that characterize communication environments, such as gestures or writing abilities. Recent studies have shown altered learning of visuomotor procedures in children with autistic spectrum disorders (ASD), using different visually guided motor tasks (i.e. serial reaction time and pursuit rotor task), underscoring how this may influence the development of appropriate social communicative skills. However, a task aimed at learning of visuomotor procedures, similar to handwriting, in children with ASD and easily employable in educational or clinical environments was still lacking.

Objectives: Inspired by the recent literature, we designed a computer-based program that allows, with the aid of a digital tablet, to evaluate learning of visuomotor procedures, similar to the ones involved in handwriting. After extensive trials on children with typical development, we conducted a preliminary study to assess the effectiveness of this program in evaluating these abilities in children with ASD.

Methods: Fourteen children participated to this pilot study: seven children with ASD (chronological age 7;7 ± 2.0; IQ 94.3 ± 19.0), seven children with typical development (TD, chronological age 7;4 ± 1.6; IQ 105.7 ± 12.7), matched on gender, chronological age and non-verbal cognitive level, evaluated using Raven's Progressive Matrices. Overall visuomotor abilities of all children were also evaluated, using the VMI Test. The designed computer program required to track movements of a target presented on the computer screen using the digital pen and tablet. The program allowed to establish: overall time on target and overall distance from target, but it also allowed to reconstruct the movement strategies employed in the tracking process. Task trials were devised to evaluate effectiveness of the computer task in measuring: implicit visuomotor learning after practice, decrement in performance in presence of an altered stimulus, consolidation of acquired skills after a delay and specific strategies employed during learning.

Results: Showed that all children displayed implicit learning of the chosen visuomotor procedure, but children with ASD showed different performance, compared to children with TD, in presence of an altered stimulus, in relation to consolidation and in strategies adopted to track the moving target, therefore providing novel data on altered learning of visuomotor sequences in children with ASD.

Conclusions: Initial observations seem to indicate that this novel computer-based program may allow to gain a better understanding of specific aspects of visuomotor procedure learning, which are altered in children with ASD. Our future endeavor will be to better this tool in order to elaborate a program that may inform teachers and dedicated therapists on differential learning strategies adopted by children with ASD, while constructing a learning task that recruits abilities required during handwriting acquisition.

140.090 90 Goal-Directed Action Control in Children with Autism. H. M. Geurts* and S. de Wit, *University of Amsterdam*

Background: Repetitive behavior is a key characteristic of autism spectrum disorders (ASD) which has been related to disfunctions in the fronto-striatal circuitry. This repetitive behavior is also seen as a reflextion of more general inflexible behaviour, but studies trying to measure this inflexibility with cognitive control lab tasks often failed. Therefore, cognitive control might not be a sufficient way to understand the observed behavior as it might be related to the balance of different cognitive systems.

Objectives: The aim of the present study was to investigate the hypothesis that this abnormal behavioral repetition results from a tendency to over-rely on habits at the expense of flexible, goal-directed action.

Methods: To this end, we tested 25 children with ASD and 25 age- and gender-matched typically developing controls (between 8-12 years) on an instrumental task. Initially, children learned to press keys to different pictorial stimuli in order to gain valuable outcomes (i.e., stimulus-response-outcome). Subsequently, in the critical “slips-of-action” test stage, some of these outcomes were no longer valuable, and children were asked to refrain from key pressing when they were shown stimuli that signaled the availability of those outcomes, while continuing to respond for the still-valuable outcomes. A baseline test, in which responding could be based on stimulus- as opposed to outcome-value, was included to control for general task characteristics. We also tested whether task performance was correlated with parent reports on repetitive behavior in the children.

Results: Importantly, we found no evidence for a disruption in the balance between goal-directed and habitual behavioral control in ASD. Children with ASD learned equally well as controls, and were not impaired at flexibly adjusting their behavior to devaluation of the outcomes. Moreover, taskperformance did not related to repetitive behavior in daily life. However, exploratory analyses revealed that the subset of ASD children who were not taking medication in our study did in fact show a general impairment across the slips-of-action and the baseline tests, relative to ASD children on medication and to controls.

Conclusions: In contrast with earlier studies, in the current study the children with ASD did not differ from controls in the way they learned stimulus-response-outcome associations. Moreover, the balance between goal-directed and habitual behavioral control did not seem to be disrupted while for example in patients with obsessive compulsive disorder such a disbalance was observed. These findings will be discussed in the context of potential deficits in ASD in goal-directed action and in cognitive control more generally.

Goal-directed action control in children with autism

140.091 91 Preserved Mimicry in Children with Autism; Enhanced Mimicry in Children with Williams Syndrome. E. J. Moody*[1], D. N. McIntosh[2], A. Lindsay[3], A. Turner[2] and S. Hepburn[4], (1)*University of Colorado, Denver*, (2)*University of Denver*, (3)*University of Colorado Denver School of Medicine*, (4)*University of Colorado Denver, Anscutz Medical Campus*

Background: Upon seeing an emotional facial expression typically developing individuals rapidly mimic the expression. These responses typically occur within the first second after seeing the expression (Moody, McIntosh, Mann, & Weisser, 2007). Deficits in rapid mimicry have been found in adults and children with Autism Spectrum Disorder (ASD) (Beall, Moody, McIntosh, Hepburn, & Reed, 2008; McIntosh, Reichmann-Decker, Winkielman, & Wilbarger, 2006), and are theorized to influence social functioning (Moody & McIntosh, 2006). Recent research has found that children with ASD may be able to spontaneously mimic under some task demands, but that the response may be delayed relative to typically developing children (Oberman, Winkielman, &

Ramachandran, 2009). It is still unclear what features lead to spontaneous mimicry in those with autism, and whether mimicry in those with other social disorders, such as Williams Syndrome, is preserved relative to those with ASD.

Objectives: To determine if children with ASD spontaneously mimic dynamic expressions of expressions and other actions, and to compare the levels of mimicry to typically developing controls and children with Williams Syndrome.

Methods: 28 children with ASD, 21 typically developing children and 7 children with Williams Syndrome were shown 3000 ms videos of actors making happy and angry expressions, and arm wrestling with instructions to "just watch." Activity over their cheek (zygomaticus major), brow (corrugator supercili) and forearm (forearm flexor) was monitored with electromyography (EMG) while they watched these videos. Maximal reactivity occurred 2000 to 3000 ms post stimulus onset; the pattern of activity during this period was analyzed using 100 ms windows, as described below.

Results: Separate MANOVAs were run for each Stimulus (happy, anger and arm wrestling) with Muscle (corrugator, zygomaticus, forearm flexor) entered at a within-subjects factor, Diagnosis (ASD, typical, Williams Syndrome) entered as a between-subjects factor and Time (100 ms windows between 2000 to 3000 ms post stimulus onset) as a repeated measure. All groups demonstrated muscle specific mimicry to emotional expressions (i.e., increased zygomaticus to happy; corrugator to angry expressions), and combined flexor and corrugator activity to Arm Wrestling. There was a significant Time by Diagnosis by Muscle interaction for responses to Angry videos, $F(2, 40) = 1.50$, $p = .03$. No other three-way interactions were significant. In all models those with Williams Syndrome had greater absolute levels of mimicry than those with ASD and typically developing controls. Those with ASD did not have different levels of mimicry than typically developing children.

Conclusions: Children with Williams Syndrome may have greater levels of mimicry to dynamic expressions relative to children with ASD and typically developing children. Children with ASD showed similar levels of mimicry as those who are typically developing. These findings suggest that those with ASD may be able to spontaneously mimic dynamic facial expressions of emotion under minimal task demands. Future research should work to establish which situations those with ASD are likely to mimic spontaneously and the nature of mimicry in those with Williams Syndrome.

140.092 92 Illusion Susceptibility Indicates a Two-Factor Structure for the Systemizing Trait of Autism. P. Dassonville* and S. Reed, *University of Oregon*

Background: Several theories suggest that individuals on the autism spectrum should show a decreased susceptibility to visual illusions, either due to an increased focus on local cues, a decreased focus on global contextual cues, or both. However, evidence for decreased illusion susceptibility in the autism spectrum disorders has been mixed. Recently, though, these disparate results have been reconciled by the finding that the autistic trait of systemizing negatively covaries with susceptibility to visual illusions driven by contextually-induced distortions of an observer's egocentric reference frame, but not with illusions driven by allocentric distortions (Walter et al., 2009).

Objectives: The current study sought to determine whether the relationship between systemizing and illusion susceptibility can be attributed to a heightened processing of local cues, an attenuated processing of global cues, or some combination of the two.

Methods: Scores on the Systemizing Quotient – Revised (SQ-R, Wheelwright et al., 2006) were compared to measures of susceptibility to the *Rod-and-Frame Illusion* (RFI) in a large neurotypical population ($n = 162$). Depending on the size of the illusion-inducing frame, the RFI is thought to be driven by a weighted combination of local, low-level orientation contrast effects (more prominent with small frames) and globally-induced distortions of the observer's egocentric reference (more prominent with large frames). Susceptibilities to these two components of the illusion were measured using recently-developed techniques designed to isolate the two (Dassonville & Williamson, 2010).

Results: Replicating previous results, higher SQ-R scores were found to be associated with a decreased susceptibility to the large-frame RFI, suggesting a decreased tendency to use

global contextual cues. However, SQ-R scores were also found to be associated with an *increased* susceptibility to the small-frame RFI, indicating an additional increased tendency to rely on local orientation effects. Interestingly, susceptibilities to the large- and small-frame RFI were uncorrelated, suggesting that local processing biases do not necessitate impairments in use of global contextual information and that, while comorbid in high systemizers, these may be two orthogonal perceptual processes. To further examine the relationship between these perceptual processes and systemizing, a principal components analysis was conducted to isolate factors in SQ-R that might correlate with the local and global effects of the RFI. Two factors were extracted that accounted for 92.8% of the variance in the SQ-R. High scores on factor 1, consisting of items measuring 'analytical tendencies', were associated with decreased global effects of the RFI, while high scores on factor 2, consisting of items measuring a 'need for sameness', were associated with increased local effects. An examination of factor score distributions also indicated that while men scored significantly higher on 'analytical tendencies', women scored significantly higher on 'need-for-sameness'.

Conclusions: These results suggest that the systemizing trait of autism contains a two-factor structure, with components that separately measure analytical tendencies and a need for sameness. While analytical tendencies are associated with a decreased tendency to use global contextual cues, a need for sameness is associated with a heightened processing of local cues.

140.093 93 Evidence for Veridical Perceptual Mapping in Savant Syndrome: A Case Study. L. Bouvet*[1], S. Donnadieu[2], S. Valdois[1] and L. Mottron, M.D.[3], (1)*Université Pierre Mendes France*, (2)*Université de Savoie*, (3)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: In a recent development of the enhanced perceptual functioning (EPF) hypothesis (Mottron & Bonnel, Bouvet, Samson, Burack, Heaton, submitted) we postulated that absolute pitch (i.e., the ability to name a pitch without a reference note) in autism has a more perceptual origin than in the typical population. We also argued that absolute pitch, savant syndrome (i.e., exceptional ability in a neurodevelopmentally atypical individual) and synaesthesia (i.e., perception of stimulation occurring indirectly via exposure to an apparently unrelated stimulus) share a common mechanism. We proposed that the mechanism of veridical mapping, a bottom-up associative mechanism between aspects of perceptual information that share a common structure, can account for the high prevalence of these phenomena in autism.

Objectives: We present the case of an autistic savant person, F.C., 25 years old, who possesses absolute pitch as well as other savant abilities (mental and calendar calculation). First, as absolute pitch in the typical population does not involve superior auditory abilities (Miyazaki, 2004), we aimed to investigate if F.C.'s auditory abilities were different from those of a typical absolute pitch possessor. Second, we investigated the acquisition and development of his savant capacities in order to elucidate the mechanism of veridical mapping. Third, we also explored the links among absolute pitch, savant syndrome, and synaesthesia in F.C. and his family.

Methods: A typical adult control group (n = 13, mean age = 21,1 ±6,2) and an absolute pitch typical participant (A.P.) were recruited for this study. Auditory tests with pure tones (frequency, intensity and duration discrimination) were conducted. The performance of F.C. and the AP control participant was compared to those of the control group. Clinical investigations were conducted in order to document the acquisition of F.C.'s savant abilities. Synaesthesia questionnaires were distributed to his family.

Results: Compared to the typical controls, F.C. displayed superior performance in discriminating pure tone frequency and duration. These superior performances were not observed in A.P. We also observed that F.C. acquired absolute pitch by mapping days of the week with pitches and that he achieves mental calculation by transforming numbers into time (hours, minutes, seconds). Familial questionnaires revealed a high proportion of synaesthetes in his family (16 out of 24 individuals who filled out the questionnaire).

Conclusions: We observed superior perceptual auditory ability in F.C., an autistic savant individual. We also found evidence for the cognitive mechanism of veridical mapping in the acquisition and development of his savant abilities. These results support the idea of a more perceptual absolute pitch in autism, but also the concept of veridical mapping as a common mechanism underlying absolute pitch, savant syndrome and synaesthesia. Further attention to links among these three phenomena is warranted, and there are implications with respect to genetic components and neural substrates.

140.094 94 Computer Based Assessments of Executive Functions in Preschoolers with and without ASD: The Relations to Parent Ratings of Social and Behavioural Functioning. E. Gardiner*[1], S. Hutchison[2], M. Miller[2], U. Mueller[2], K. Kerns[2] and G. Iarocci[1], (1)*Simon Fraser University*, (2)*University of Victoria*

Background: Executive Functions (EF) refer to higher cognitive processes involved in the conscious control of thought and action. Compared to mental age (MA) matched peers, children with ASD, even those with average IQ and verbal ability, exhibit EF difficulties with inhibiting socially inappropriate actions, shifting attention flexibly, and generating goal-directed behaviour. These early EF deficits predict later perspective taking problems (Pellicano, 2010) and behaviour and emotion dysregulation (Zingerevich & LaVesser, 2008). Although deficits in EFs are characteristic of several developmental disorders, we hypothesize that in children with ASD, performance on EF tasks may be specifically related to aspects of social adaptation.

Objectives: To develop EF profiles using computer-based tasks among MA matched preschoolers with and without ASD, and explore how they relate to parent ratings of social/adaptive and behavioural functioning.

Methods: Forty preschoolers (ASD=20; TD=20), aged 36-83 months, will participate. Participants with ASD have a clinical diagnosis of ASD, and exceed cut-off scores on both the ADOS and Autism Spectrum Rating Scales-short form (ASRS). Participants in the TD group fall below ASRS cut-off. The Stanford-Binet Intelligence Scales will assess IQ. The EF battery consists of computer-based measures of inhibition (Boy-girl Stroop, Go/No-Go, and Preschool Continuous Performance Test) and working memory (Self-ordered Search; Kerns & McInerney, 2007). Parents will complete the Vineland Adaptive Behavior Scales (VABS-II), Behavior Assessment System for Children (BASC-2), and ASRS-short form.

Results: Preliminary results (TD=12) revealed positive correlations between the BASC-2 and VABS-II externalizing scales, as well as between the social skills subscale and socialization scale, respectively. Moreover, we found a reciprocal negative correlation among the social and externalizing scales between the two instruments. Self-Ordered Search (SOS) was associated with the externalizing and social indices of both measures, and with the BASC-2 behavioural symptoms scale. The Continuous Performance Test was negatively correlated with VABS-II socialization and positively correlated with the externalizing scale. Similar correlations are expected in the autism sample. Based on pilot data with a 3-year-old with autism, we predict that SOS performance will not differ significantly across groups, likely due to the superior visual-spatial search abilities often observed in this population. These children may correctly and efficiently select targets even though they must keep in mind a series of previous search choices, both correct and incorrect. However, we anticipate that children with ASD will perform significantly less well on inhibition tasks compared to the TD sample.

Conclusions: This study represents a significant advancement with regard to the measurement approach and developmental period assessed. In children with ASD, computer based, as compared to manual tasks of EF, may provide a more valid assessment of EFs as more precise information on reaction time is provided, the computer tasks are more intrinsically motivating, and socially-mediated aspects of task administration are reduced. The preschool years are an ideal developmental period to assess EFs, as this is a time in which cognitive control demands significantly increase, particularly in social contexts.

140.095 95 A Pilot Study on the Relationship Between Restricted Repetitive Behaviors and Mothers' Stress. M. Kuroda*[1] and N. Inada[2], (1)*Shukutoku University*,

(2)*National Institute of Mental Health, National Center of Neurology and Psychiatry*

Background: Autism spectrum disorder (ASD) is a range of complex neurodevelopment disorders characterized by "social impairments," "communication difficulties," and "restricted repetitive behaviors" (RRBs). Because of the severe and pervasive nature of the disorder, parents of children with ASD experience great stress associated with caring for their children. RRBs can occupy most of the waking hours of an individual and interfere with daily family activities (Gordon, 2000). It is obvious that the RRBs of the children with ASD disturb the usual lives of their parents and can lead to parenting stress.

Objectives: We aimed to examine the relation between RRBs and mothers' stress, and also which kind of RRBs leads to the highest amount of parenting stress.

Methods: The participants comprised 43 mothers of children with ASD (children's mean age = 11.23 ± 3.5,) and 9 mothers of typically developing children (children's mean age = 10.33 ± 4.72). **Scales:** The Repetitive Behavior Scale-Revised (RBS-R) is a recently developed questionnaire that captures the breadth of RRBs in ASD (Bodfish, 2000). RBS-R contains 43 items, which have been conceptually grouped into six subscales: (a) stereotyped behavior; (b) self-injurious behavior; (c) compulsive behavior; (d) ritualistic behavior; (e) sameness behavior; and (f) restricted behavior. Stress Response Scale (SRS): This includes 18 items for evaluating anxiety and stress.

Results: To test for differences of the stress between the groups, a t-test was performed with the SRS score as the dependent variable and the group (ASD/typically developing) as the independent variable. The results showed little significant difference ($t(54)$ = 1.91, p = .062). No correlations were found between the total scores of the RRBs of children with ASD and their mothers' stress. However, correlations were found in two subscales of RBS-R—ritualistic behavior (r=0.43, p<.01) and restricted behavior(r=0.34, p<.05)—with SRS scores .

Conclusions: There are various kinds of RRBs in the children with ASD. Not all of them affected the mothers' stress. We found that only ritualistic behavior (performing activities of daily living in a similar manner) and restricted behavior (limited range of focus, interest, or activity) affected the mothers' stress. This result suggests that these behaviors pose more difficulties in the daily lives and lead to the highest amount of parenting stress. In our future study, we intend to examine parenting stress by using the stress scale specializing in parenting. In addition, we require many more participants.

140.096 96 Cognitive and Behavioural Correlates of Handedness in Autism and the Broader Phenotype. D. L. Floris*[1], L. R. Chura[2], R. J. Holt[3], S. Baron-Cohen[2] and M. D. Spencer[2], (1)*University of Cambridge*, (2)*Autism Research Centre, University of Cambridge*, (3)*Autism Research Centre, University of Cambridge*

Background:

Autism is associated with a greater than average rate of non-right-handedness, comprising both left- and mixed-handedness. Alongside deficits in left-hemisphere functions such as language and communication, this has given rise to the view that autism and some of its neurocognitive impairments might be due to an atypical pattern of cerebral lateralization.

Objectives:

To investigate whether left-handedness is (a) more common in adolescents with autism as compared to their unaffected siblings and typically developing controls, (b) associated with neurocognitive disadvantage and (c) correlated with clinical measures of impaired social communication and repetitive and stereotyped behaviour. We predicted that in view of the shared genetic risk for autism, adolescents with autism and their siblings would show a similar pattern in handedness and its cognitive correlates.

Methods:

Male adolescents with autism (n=35), their unaffected siblings (n=12) and typically developing controls (n=20; age: 12-18 years) were assessed for handedness using the Edinburgh Handedness Inventory. Raw handedness scores ranged from -100 to +100. The Stockings of Cambridge task from the Cambridge Neuropsychological Test Automated Battery

(CANTAB) was applied to measure executive function in terms of planning as this has been linked to handedness in previous research. Communication abnormalities and stereotyped behaviours were measured using subdomains of the ADI-R and ADOS-G.

Results:

(a) Handedness showed a marked leftward shift in adolescents with autism in comparison to their siblings (p=.004), but not in comparison to controls. (b) Mean number of moves on the Stockings of Cambridge task was significantly related to a leftward handedness shift in the whole sample (r=-.355; p=.006) and in adolescents with autism (r=-.446; p=.013). (c) Communication abnormalities measured with the ADOS-A showed a trend towards correlation with a leftward handedness shift (r=-.331; p=.064). However, leftward raw handedness scores correlated significantly with higher scores on repetitive and stereotyped behaviour subdomains of the ADI-C (r=-.497; p=.004) and ADOS-D (r=-.502; p=.003). (d) Mean moves on the Stockings of Cambridge and the ADI-C (r=.398; p=.018) and ADOS-D (r=.379; p=.030) subscales showed a significant correlation.

Conclusions:

Functional asymmetry may be impaired in autism, but appears intact in siblings, suggesting that it may relate to autism itself rather than to the familial risk of the condition in the broader phenotype. Repetitive behaviour and not impaired communication abilities seems to be related to a leftward shift as well as to poorer executive function in males. Future research should also include brain structural correlates of asymmetry to corroborate these findings neuroanatomically, and to further test anomalous cerebral specialization in autism.

140.097 97 Sensitivity to Visual and Proprioceptive Error During Motor Adaptation in Children with Autism. M. K. Marko*[1], S. H. Mostofsky[2] and R. Shadmehr[1], (1)*Johns Hopkins University*, (2)*Kennedy Krieger Institute*

Background: When a force field perturbs a reaching movement, the brain adapts the motor commands and improves performance on the subsequent try. This adaptation is generalized to other movements. From the coordinate system of this generalization we recently inferred that in children with autism spectrum disorder (ASD) there may be an increased reliance on proprioceptive sensory feedback as compared to typically developing (TD) children.

Objectives: To directly examine and quantify autism-associated differences in sensitivity to proprioceptive vs. visual feedback during motor adaptation.

Methods: Children with ASD, ages 8-12, and TD age matched controls participated in the experimental task. Subjects were seated in front of a robotic manipulandum. Above their hand and parallel to their lap was a screen in which cursor and target positions were displayed, obstructing their hand from view. Children were instructed to hold the manipulandum and make ballistic reaching movements to a target 8-cm from their starting position. On random trials a perturbation was imposed, consisting of two components. A proprioceptive perturbation was generated by a force field, displacing their hand perpendicularly from the direction of movement. A visual perturbation was generated by scaling the hand's trajectory and displaying that with the cursor, thus creating a smaller, equal or greater visual error than proprioceptive error. By varying the magnitude of both perturbations, and measuring the learning resulting from each error trial, we could determine the sensitivity to both visual and proprioceptive error.

Results: Current results are based on examination of 5 children in each group. To assess sensitivity to proprioceptive error, fields of three magnitudes were applied in either direction while visual error was clamped with a gain of zero. Though proprioceptive perturbations were the same, adaptation was greater for the ASD group than for the TD group (two-way ANOVA, main effect of group [$F(1,24)=7.06$, $p=0.01$]). This indicates a greater sensitivity to proprioceptive error in children with ASD. Adaptation with respect to visual error was comparable among the two groups. However, after accounting for the increased adaptation to proprioceptive error, the ASD group showed decreased visual sensitivity. This is particularly noticeable when considering the relative decrease in adaption from a gain of one, in which there is both visual and proprioceptive error, to a gain of zero, in which there

is only proprioceptive error, for a constant field. The TD group showed decreased learning in response to the decrease in visual error. The ASD group, however, was less affected by the loss of visual error with a trend towards significance (one-tailed t-test, p=0.095). This suggests adaptation to visual errors in the ASD group may be largely due to the underlying proprioceptive error.

Conclusions: The results of this study support the hypothesis that during motor adaptation, children with ASD show both an increased sensitivity to proprioceptive error and a decreased sensitivity to visual error when compared to TD children. These findings have important implications for improvements in therapeutic practices and highlight key brain regions for future research.

140.098 98 Sensory Symptoms in Autism Families. H. H. Goldsmith and L. Meyer*, *University of Wisconsin-Madison*

Background: Despite widespread recognition that sensory symptoms co-occur with autism, little is known about the precise nature of these symptoms or their patterning in family members. Although sensory overresponsivity is moderately heritable in families in general, genetic influences on sensory symptoms in autism families have not been studied. Understanding the origins of sensory symptoms in families with autistic probands is critical, given their probable inclusion in the upcoming DSM-V criteria.

Objectives: We studied the subscales of the Child Short Sensory Profile in relation to autism using a family study design to estimate genetic and environmental influences on sensory symptoms in families with autistic probands.

Methods: Fifty-four pairs (23 monozygotic) of proband-ascertained twins (i.e., at least one twin is autistic) and their families participated, with a mean twin age of 8:5. We classified participants as being on the autism spectrum based on the Autism Diagnostic Observation Schedule and the Social Communication Questionnaire. A parent (usually the mother) completed the Child Short Sensory Profile for each twin and any non-twin siblings and completed the Adult Sensory Profile for him or herself.

Results: As expected, twins in the autism group have significantly more sensory symptoms than their typically developing cotwins, across all of the sensory domains ($t(101) = 5.41$, $p < 0.0001$) as well as for the specific tactile sensitivity, taste/smell sensitivity, underresponsive/seeks sensation, auditory filtering, low energy/weak, and visual/auditory sensitivity sections of the Child Short Sensory Profile. We focus here on the summary score from all of the sensory domains. Monozygotic twins are more concordant for categorical sensory atypicality than are dizygotic twins (84% vs. 46%). When controlling for autism concordance, zygosity is not a significant predictor of twin similarity in sensory symptoms. In addition, dizygotic twins are no more similar to one another in sensory symptoms than individual twins are to their non-twin siblings. Both of these findings support the validity of the twin method for inferring genetic influences.

Conclusions: Sensory symptoms of all types measured by the Child Short Sensory Profile are elevated in autism. Monozygotic twins are more similar to one another in total sensory symptoms than dizygotic twins when at least one member of each pair qualifies for an autism diagnosis, but a rigorous estimation of genetic influences on sensory sensitivities and their association with autism awaits more comprehensive biometric modeling.

140.099 99 Perception of Motion Complexity Is Deficient in Adults with Autism Spectrum Disorder. J. L. Haworth*[1], W. Fisher[2], S. Vallabhajosula[1] and N. Stergiou[1], (1)*University of Nebraska at Omaha*, (2)*Munroe-Meyer Institute, University of Nebraska Medical Center*

Background: Preference for biological motion is characteristic of typically developing children but not for individuals with autism spectrum disorder (ASD) (Blake et al., 2003). However, this does not appear to be due to a sensory deficit in individuals with ASD, as they remain responsive to non-social, physical contingencies of object motion (Klin et al., 2009). These observations suggest that some underlying property of object motion must be salient or relevant to observers without ASD (but not those with ASD) that facilitates differentiation between biological and non-biological sources. Much work has sought to elucidate this property, as summarized in depth by Dakin and Frith (2005), including

such factors as signal-to-noise interference and first/second order properties of stimulus motion. However, a definitive underlying characteristic of biological motion providing such visual salience has not been identified. Work in biomechanics has revealed that the kinematics resultant from biological sources of motion can be characterized by specific nonlinear measures of temporal structure of the movement variability; including entropy and local stability (Stergiou, et al., 2003). In fact, the health of a biological system is related to an optimal state of this variability; characterized by the presence of mathematical chaos examined in the movement over time. Contrastingly, stereotypic/rigid or noisy movements are not desirable. We hypothesize that the underlying deficit in the perception or identification of this variability may be characteristic of ASD, and the functional basis for the lack of discrimination of biological motion.

Objectives: To evaluate the perception and motor replication of visual stimulus movement variability; in adults with and without ASD.

Methods: Five adults without, and 2 with, ASD stood quietly on a force platform (AMTI, Accusway) and viewed an oscillating point-light, under two conditions. The motion of the point-light was driven either by sinusoidal (SN, stereotypic movement condition) or chaotic rhythm (CH, chaotic movement condition). Measures of postural sway and gaze (via eye-tracking) were collected during each condition for 1 minute at 50 Hz. Sample entropy was used to quantify the temporal structure of the variability in each measure.

Results: Individuals with ASD exhibited significantly different gaze response to both stimulus conditions, compared to those without ASD (SN, p=0.009; CH, p=0.013). Although this finding is clearly interesting and potentially important, our primary hypothesis was that individuals without ASD would show clear differentiation between the two conditions whereas those with ASD would not; which is what we observed. That is, adults without ASD exhibited greater complexity of their gaze behavior towards the more complex motion (CH, p=0.016), whereas adults with ASD did not differ in their gaze towards the two types of motion (p=0.544). Finally, results indicate that posture was not condition-responsive for persons with or without ASD.

Conclusions: This study provides preliminary evidence that the perception of the structure of movement variability differs for adults with ASD when compared with adults without ASD. This finding has potentially important implications relative to the lack of perception and motor response to biological motion reported for individuals with autism in prior research.

140.100 100 Autistic People Talk about Themselves: A Qualitative Analysis of Internet Discussion Forums. E. Dromi* and M. Pascal, *Tel Aviv University*

Background:

Individuals with Autism are defined in Medical and Psychological scientific publications and in the Media as having primary deficits in socialization, communication and language, as well as manifestation of repetitive activities and narrow interests (Frith, 2008). The growing awareness to the study of populations with physical or mental impairments within the framework of the social model of disability encourage scientists to look closer into the details of variability without a rigid a priori classification into pathological groups (Brownlow, 2010; Shakespeare, 2006). The present study was designed within the neural diversity theoretical framework in order to look at how individuals with autism view and discuss issues that are related to language and communication.

Objectives:

To explore the way autistic people present in internet discussion forums their own views on daily experiences, perceptions and difficulties in social interactions.

Methods:

Following: 1) gaining an approval from the group of autistic participants in an internet discussion group, and 2) getting an ethical permission from Tel Aviv University to run this study, the second author (MP) entered the internet forum on a regular basis throughout a period of 10 months. She documented the internet conversations and then performed a qualitative text analysis on a very large corpus of computer entries. The conversational rich data underwent text analysis utilizing computer software (ATLAS.TI) that supported the identification of topics, the selection of similar entries by topic, and also helped in the overall organization of the data into major

themes. It is important to note that all the categories that were identified emerged from the text itself in a process that is known as grounded theory method. That is, the themes that were discovered appeared in the discussions and were not superimposed on it.

Results:

Four main themes emerged from the data regarding communication in the eyes of autistic individuals. The first theme was the **Physical and Emotional Existence**: here we found a lot of discussion on how our participants viewed their own identity in a social environment that is mainly consisted of neurotypical (NT) individuals. Two main areas were mainly raised: a) the sensory processing of physical stimuli, and b) the social challenges and the attitudes of NT towards them. The second theme was **Interaction with other individuals**. The third theme was related to **Autistic Language**. Our participants highlighted the difference between their own unique language and the conventional language spoken around them. The forth theme was **Autistic Communication**. This is the overriding theme that demonstrated the unique style of communication of autistic people. It shows that autistic communication is different and not necessarily inadequate or impaired.

Conclusions:

The social model of disability and the availability of internet discussion forums open up new fascinating ways for a better understanding of the experiences, perceptions and internal mental states of people with autism.

140.101 101 Do Sensory Processing Deficits Impact on Speech Encoding in ASD? Evidence from an Experimental Study of Intellectually High-Functioning Adults. J. Mayer* and P. Heaton, *Goldsmiths College, University of London*

Background: Whilst sensory disturbance is well documented in ASD, relatively little is known about the impact of atypical auditory processing on speech perception in intellectually high-functioning adults. Previous research carried out with children with ASD has revealed enhanced sensitivity to the psychoacoustic qualities of speech but the extent that this is characteristic in adults has yet to be investigated.

Objectives: To determine whether the spectral and temporal characteristics of speech influence recall of grammatically simple and complex sentences.

Methods: 50 sentences with either subordinate or non-subordinate clauses were utilized to assess the effect of grammatical complexity on sentence recall. In order to isolate perceptual as well as higher-order speech processing deficits, speed and pitch manipulations were carried out on the stimuli. 19 HFA adults and intelligence and age matched typically-developing controls participated in the study. ANOVAs were conducted to analyse the main effects of grammatical complexity, perceptual manipulation, and group. Correlational analyses were then used to examine the extent to which sensory processing abnormalities and scores on standardised measures of language and communication were associated with reduced performance in response to perceptual and higher-order changes in the experimental stimuli.

Results: Results showed that whilst the ASD group obtained significantly lower scores than controls on standardised measures of language and communication, the effects of grammatical complexity on sentence recall did not differ across groups. Whilst sensory abnormalities across all modalities including the auditory domain were observed in the ASD group, reduced sentence recall, in response to speed manipulations, was not significantly different to that of controls.

Conclusions: We conclude that memory for speech is unaffected by grammatical complexity in ASD and that this effect is robust enough to be sustained when speech stimuli are distorted. The associations between sensory processing abnormalities, level of symptom severity and speech perception will be further discussed

140.102 102 Impact of Sensorimotor Deficits in Adaptive Behavior in ADHD Associated with or without HFA. C. Mattard-Labrecque*[1], M. Couture[2] and L. BenAmor[1], (1)*Laval University*, (2)*Sherbrooke University*

Background: The association of Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder

(ASD), mainly High Functioning Austism (HFA), was reported in several studies (Goldstein and Schwebach, 2004; Frazier et al., 2001) although these two diagnoses are considered mutually exclusive according to the criteria of DSM-IV-TR (APA, 2000) thus the growing interest in the particularities of children with a dual diagnosis. Actually, very few studies have explored the characteristics of this group on their sensorimotor and adaptive skills despite the impact of sensorimotor impairment on the clinical and functional characteristics (Hilton et al., 2007; Baker et al., 2008; Ben-Sasson et al., 2008; Yochman et al., 2004; Mangeot et al., 2001; Jasmin et al., 2009). The study of sensorimotor and adaptive characteristics, and their impact on the daily functioning of children with a dual diagnosis, HFA + ADHD compared to those with ADHD alone, could help better understand the complex links between these two disorders.

Objectives: The two objectives of this study are: 1- Compare sensory, motor and adaptive skills in children of the same age with a dual diagnosis of HFA + ADHD with those with ADHD alone. 2 - Determine the impact of sensorimotor deficits on the children's autonomy. Our hypothesis is that children with HFA + ADHD will have greater sensory, motor and adaptive impairment than those of children with ADHD alone, and that this will influence moderately the level of autonomy in adaptive behavior.

Methods: Thirty children aged 5-14 years diagnosed with HFA + ADHD (n = 13) or ADHD alone (n = 17) were recruited from four establishments in the greater Quebec City region (Canada) and evaluated with sensory *(Sensory Profile),* motor *(Bruininks-Oseretsky Test of Motor Proficiency-II)* and adaptive evaluations *(Adaptive Behavior Assessment System-II).* Analysis of variance was used to compare the sensory, motor and adaptive functioning between the two groups, and correlation analysis examined the influence of sensorimotor disorders on the children's autonomy.

Results: Compared to children with ADHD alone, children with HFA + ADHD scores were significantly lower in three of the four sensory quadrants, such as low registration, sensation avoidance and sensation sensitivity; in three of the six sections of the Sensory Profile on the treatment of sensory visual, vestibular and tactile information; in three of the eight specific motor skills, such as balance, running speed and agility and strength/endurance and in 8 of 9 adaptive functions, such as communication, functional academics, self-direction, leisure, social, community use, health and safety and self-care. For all children, a decrease in autonomy is correlated with sensory ($r = 0,667$, $p < 0.001$) and motor disorders ($r = 0,571$, $p = 0002$).

Conclusions: Children with HFA + ADHD have more sensorimotor and adaptive disorders than those with ADHD alone. These disorders have a negative effect on their daily functioning. The assessment and appropriate intervention for sensorimotor deficits in ADHD with or without HFA would potentially improve the children's autonomy.

140.103 103 Impaired Peripheral Sound Localization Is Associated with Repetitive Behaviors and Sensory Abnormalities in Individuals with ASD. J. H. Foss-Feig*[1], C. N. Wilson[2], J. Cockhren[1], J. R. Pryweller[1], C. A. Necessary[3], C. P. Burnette[4], R. A. Stevenson[5], J. K. Siemann[1] and C. J. Cascio[5], (1)*Vanderbilt University*, (2)*Yale University*, (3)*Vanderbilt University School of Medicine*, (4)*University of New Mexico*, (5)*Vanderbilt University Medical Center*

Background: Auditory processing abnormalities are reported frequently among clinical descriptions and experimental findings regarding autism spectrum disorders (ASDs). Failure to orient to environmental sounds, including to respond to one's name, is a common feature in ASD, and difficulties with sound localization could contribute to auditory orienting and attention deficits. However, the ability of individuals with ASD to spatially localize sounds has been remarkably understudied.

Objectives: To evaluate sound localization abilities of individuals with ASD, in comparison to controls, and to examine whether these abilities relate to social, communication, repetitive behavior, and sensory processing symptoms central to the ASD phenotype.

Methods: Participants were 22 individuals with ASD (Mean Age: 19.91 years; Mean IQ: 108.18) and 36 control participants (Mean Age: 16.89 years; Mean IQ: 110.22). Groups did not differ in age or IQ score (*p*s = 0.70 and 0.58, respectively). All participants completed a task in which pure-tone beeps (28 kHz) were randomly presented from speakers positioned at 30,

90, and 150 degrees around a 180-degree arc, where the "90-degree" speaker was located directly in front of participants' heads, at a distance of 1.1 meter. Beeps were presented alone, or with either spatially-congruent or spatially-incongruent visual flashes; for the present study, only trials containing auditory stimuli in isolation are analyzed. Participants used a joystick to indicate the spatial location from which each sound was emitted. For each participant, mean localization accuracy was calculated at each speaker position as the absolute value of the mean response angle, subtracted from the true speaker position angle. Between-group differences in localization ability were evaluated using an ANCOVA, covarying for IQ. Parents of participants completed the ADI-R to measure broad diagnostic features, and the RBS-R and SEQ to report in more detail on repetitive behaviors and sensory symptoms, respectively. Partial correlations between spatial localization abilities and parent report measures were conducted, covarying for IQ.

Results: For localizing auditory cues, individuals with ASD performed less accurately than controls at both peripheral locations: 30-degree, $F(2,58)= 2.862$, $p=.096$; 150-degree, $F(2,58)= 4.949$, $p=.030$. No group differences in auditory cue localization abilities were seen for the central (i.e., 90-degree) target ($p=.871$). For participants with ASD, poorer auditory spatial localization abilities at the 150-degree location were associated with increased repetitive behaviors on the ADI-R ($r= .623$, $p=.004$) and RBS-R ($r= .577$, $p=.008$). Poorer auditory spatial localization skills were also associated with increased sensory hypo-responsiveness ($r= -.401$, $p=.08$), sensory seeking ($r= -.568$, $p=.009$), and atypical auditory ($r= -.406$, $p=.076$) behaviors on the SEQ. No correlations with social or communication scores from the ADI-R were observed.

Conclusions: Relative to control participants, individuals with ASD demonstrated impaired spatial localization abilities for auditory stimuli emitted from peripheral locations. Within the ASD group, more impaired sound localization abilities were associated with increased repetitive behaviors and broad sensory processing abnormalities, but not with social or communication functioning.

140.104 104 The Developmental Trajectories of Multisensory Integration Differ Between Autistic and Typicaly Developed Individuals.

R. A. Stevenson*[1], J. K. Siemann[2], H. E. Eberly[2], B. C. Schneider[2], T. G. Woynaroski[1], J. H. Foss-Feig[2], S. M. Camarata[1] and M. T. Wallace[1], (1)*Vanderbilt University Medical Center*, (2)*Vanderbilt University*

Background: Kanner's original description of Autism is rife with descriptions of sensory impairments. Reports of sensory impairments have become widespread in the ASD literature including impairments in multisensory integration. A major factor influencing multisensory integration is the temporal relationship between sensory signals. One measure of the temporal aspect of multisensory integration is the temporal binding window (TBW), a probabilistic construct defining the interval of time within which auditory and a visual stimuli are perceptually bound. Complementing known temporal processing deficits, recent work shows that ASD individuals have an atypical TBW. It remains unclear how this difference between ASD and typically developed (TD) children develops.

Objectives: We achieved three aims. We measured the developmental trajectory of the TBW in children with ASD, contrasted these findings with measures taken from a cohort of TD children, and provided a correlational link between the low-level measure of the TBW and a communication-specific measure of multisensory integration, the McGurk Effect.

Methods: Participants- 24 ASD (6-18yo) and 40 TD children matched for age, IQ, and visual and auditory acuity. To measure the TBW, participants completed a simultaneity judgment task. Flashes of light and auditory beeps were presented at varying stimulus onset asynchronies from audio-first 500ms (AV) to visual-first 500ms (VA). Additionally, participants completed a McGurk task in which they reported their perception to congruent /ba/ and /ga/ utterances and an illusory condition with an auditory /ba/ presented with a visual /ga/ (the McGurk stimulus).

Results: Participants were binned into three age groups, 6-9, 10-13, and 14-18 (ASD n=8 each). In the youngest TD group, the TBW was wide and symmetrical, with a high proportion of stimuli perceived as synchronous even with long SOAs. The first developmental change in the TBW was a narrowing with the AV conditions, producing an asymmetrical TBW which

reflects the temporal statistics of the natural environment where auditory input lags behind visual input due to differences in the speeds at which sound and light travel. The developmental change consisted of a general narrowing of the TBW. When compared with these TD results, ASD individuals showed wider and more symmetrical TBWs, an effect that became increasingly exaggerated with age, suggesting that these developmental changes had failed to occur across age groups. Finally, there was a significant difference in perception of the McGurk illusion, with ASD individuals reporting the illusion less than TD individuals. Importantly, this measure of speech integration was significantly correlated with individual's TBW. Thus, the narrower the TBW, the greater the McGurk Effect, a proxy for integration of audiovisual speech.

Conclusions: The development of temporal multisensory function was severely impaired in ASD relative to TD groups. The ASD group failed to develop an asymmetrical TBW that mirrors the natural statistical relationship between audiovisual stimuli in the environment. Despite the fact that the TBW was measured using highly reduced stimuli its width was significantly correlated with the perceptual fusion of complex speech stimuli, suggesting that this low-level deficit may cascade into deficits of higher-level cognitive processes such as speech perception.

140.105 105 Investigating the Structure of Restricted and Repetitive Behaviours in High-Functioning ASD. O. Baykaner*[1], W. P. Mandy[2], S. Staunton[3], D. H. Skuse[1] and C. Willis[3], (1)*Institute of Child Health*, (2)*University College London*, (3)*Great Ormond Street Hospital*

Background:

By definition, people with Autism Spectrum Disorder (ASD) have Restricted and Repetitive Behaviours (RRBs); and these have implications for their adaptive function, capacity to learn and well-being. Despite this RRBs have received relatively little attention from researchers compared to the social-communication aspects of the autism syndrome. In Turner's (1999) annotation of research conducted on RRBs, she identified two broad categories of RRB - 'lower-order' and 'higher-order' behaviours. It was argued that these represent continua that extend through the general population. Lower-order RRBs are defined as repetitive movements with objects and the body, whereas higher-order RRBs are related to object attachments, insistence on sameness, circumscribed interests and repetitive language. It is suggested that lower-order RRBs are related to lower intellectual abilities; whereas higher-order RRBs are associated with impairments in the meta-cognitive processes encompassed by executive functioning. 'Executive functioning' can be loosely defined as a gathering of frontally mediated processes which are accountable for planning, cognitive flexibility, conceptual thinking, rule acquirement, instigating suitable actions and inhibiting unsuitable actions, and accepting significant sensory information. These are precisely the processes that are impaired in ASD.

Objectives:

The current study examined RRBs by evaluating Turner's (1999) theory that they can be divided into lower-order and higher-order categories, distinguished by intellectual ability.

Methods:

The RRB questionnaire is part of the Developmental, Dimensional and Diagnostic Interview (3di). This is a widely used, well validated diagnostic tool is used to assess developmental disorders in children. The 3di was administered to 40 children with a FSIQ of ≥70. Quantitative methods of correlation analysis, non-metric multidimensional scaling (Shiffman, Reynolds & Young, 1981) and multiple regression were used to analyse the data.

Results:

Analysis of the 3Di questions showed using non-metric multidimensional scaling revealed that the RRB questionnaire was uni-dimensional measure; there was no evidence for a distinction between higher- and lower- order RRBs. No correlation was found between RRBs and FSIQ. Multiple regression showed only one question from the RRB questionnaire, which concerned the all-absorbing nature of special interests for those with ASD, to be a significant predictor of FSIQ.

Conclusions:

These findings suggest that, contrary to Turner's theory-based predictions, RRBs (as measured by the 3Di) are best conceptualised as manifestations of a single latent trait dimension. RRBs were not associated with lower intellectual ability. An implication for education is that the presence of severe RRBs is not indicative of low intellectual ability; and are relevant to high-functioning ASD. Further research with larger samples will be required to fully investigate the latent structure of RRB.

140.106 106 The TEACCH Transition Assessment – Preliminary Findings in a Sample of Young Adults with Autism. S. M. Butler*[1], N. R. Saghy[2], D. K. Anderson[2] and C. E. Lord[2], (1) *Weill Cornell Medical College*, (2)*Weill Cornell Medical College*

Background:

A priority of the Combating Autism Act (2006) is better addressing the needs of young adults with autism spectrum disorders. The TEACCH Transition Assessment Profile Second Edition (TTAP) is a vocational skills assessment developed for adolescents and young adults with autism spectrum disorders (Mesibov, Thomas, Chapman, & Schopler, 2007). The TTAP is primarily intended to assist in program planning in education and job placements. It has not yet received much attention in research; however, it has the potential to serve as a direct assessment and way of quantifying an adolescent or young adult's vocational skills to complement more commonly used caregiver or teacher reports.

Objectives:

This study will examine the correlations among the subscales of the TTAP, as well as the relationships among the subscales and other relevant measures.

Methods:

This sample (n=39) was drawn from an existing longitudinal cohort of individuals with autism spectrum disorders. Participants were an average age of 19 years, 4 months and 90% were male. They were administered the TTAP, as well as comprehensive battery of cognitive, language, adaptive and diagnostic measures. The mean full scale ratio IQ of the sample was 29, with a range of 7 to 67.

Results:

Items from the following subscales were administered: Vocational Skills, Vocational Behaviors, and Leisure Skills. For each item, participants were scored as "pass," "emerge," or "fail." Only passes and fails were included in analyses. In this sample, items were not normally distributed within each subscale. The Vocation Skills and Vocational Behaviors subscales both presented as linear scales, while the Leisure Skills subscale had a bimodal distribution. All of the subscales were correlated with one another at .72 or higher All the subscales were correlated with verbal ratio IQ at .65 or higher and nonverbal ratio IQ at .56 or higher. All of the subscales are correlated with non-verbal mental age at .56 or higher. Additional analyses will examine the relationship between TTAP subscores and ADOS severity scores, Vineland domain scores, and other relevant behavioral assessments.

Conclusions:

These preliminary analyses indicate that the TTAP subscales do measure a unified concept. Further analyses will examine the relationship between the subscales and other related measures.

140.107 107 Socially Contextualized Multisensory Integration in Autism. J. I. Borjon*[1], S. V. Shepherd[2], A. Trubanova[1], W. Jones[1], A. Klin[1] and A. A. Ghazanfar[2], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*Princeton University*

Background: The human brain is both pervasively social and deeply multisensory. Remarkably, perceived social cues can alter sensory perception. If a burst of noise is presented after a face exhibiting averted gaze, typically developed (TD) adults will systematically, and erroneously, perceive a shift in the sound's location. This perceptual shift is in accordance with the direction of perceived gaze: rightward eyes bias listeners to perceive sounds as if from the right, while leftward eyes bias to the left. This shift also occurs with images of arrows. Distinct neural pathways for the initial visual processing of gaze and

arrows have been demonstrated in human lesion case studies, yet fMRI studies have demonstrated only a subtle differentiation between the orienting networks activated by gaze and arrows. Thus, the extent to which gaze and arrow cues tap into purely "social" mechanisms versus more generic "attentional" mechanisms is still unknown. Individuals with autism (ASD) exhibit impaired gaze following, but intact following of non-social directional cues.

Objectives: A psychophysical paradigm will be utilized to examine the extent to which perceived gaze cues and arrows influence sound localization in individuals with autism and matched controls.

Methods: Fifteen individuals with autism and fifteen matched controls volunteered for the study. The paradigm was a variant of the Posner attention-cuing psychophysics paradigm. Participants were presented with a visual cue: a face with neutral affect gazing 30^{o} to the right or left; a double-headed arrow pointing to the right or left; or a centered fixation cross. A brief, directionally tuned broadband noise was delivered via headphones 300 ms after the visual cue. Participants were instructed to gaze continuously towards the screen and indicate by button press the sound's origin: right or left. The visual cue then disappeared and the next trial began. Reaction time and performance data were collected. Participants were monitored via video to ensure task completion.

Results: Preliminary data suggest TD participants exhibit a perceptual shift induced by gaze cues while ASD participants do not. When presented in the same paradigm as gaze cues, arrows exerted no significant bias on sound localization for both ASD and TD participants. Reaction times data for both ASD and TD participants were significantly influenced by the difficulty of identifying the sound's location regardless of the presented visual cue. Further, for both groups of ASD and TD participants, perceived arrow cues exhibited a significant congruency effect, in which participants were quicker to respond to congruent pairings of stimuli compared to incongruent pairings.

Conclusions: Prior research has shown arrow and gaze cues induce a perceptual shift in sound localization when the paradigms are independently presented. Within the same paradigm, gaze cues exerted a significant shift in perception in controls while arrows did not. For ASD participants, neither face nor arrow cues induced a significant shift in perception. These results indicate TD controls are uniquely sensitive to social cues, integrating them into a unified percept, while ASD subjects do not exhibit a response consistent with a perceptual shift.

140.108 108 Characterization and Profiling of the Tactile Sensory Behavior in Children with Autism Spectrum Disorders. M. H. Ly*, M. J. Ackerman, A. Klin and W. Jones, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Children with autism spectrum disorders (ASD) exhibit atypical sensory responses including under- and over-sensitivity to audio, visual and tactile perception. Previous reports have noted these behaviors, but little systematic research has been done to characterize typical and atypical tactile sensory behavior in children with ASD. Prior research by this lab observed increased variability between children with ASD in comparison to typically-developing (TD) children when interfacing with a novel device measuring haptic interactions between two individuals. That study led to observations of tactile selectivity with the hand and forearm during interaction with the measurement device. This selectivity was observed in children with ASD but not in TD children, leading to the present study of characterizing and profiling the tactile sensory behavior in children with ASD.

Objectives: The goal of the present study is to measure the tactile selectivity of the hand and forearm in school-age children with ASD in comparison with age- and IQ-matched TD children. We will also test the extent to which these measures relate to IQ, handedness, fine/gross motor scores and level of autistic symptomology (via ADOS scores).

Methods: A novel device was designed and built to allow a school-aged child to freely spin two independent rollers along the lateral axis for the left and right hands. Adhered to the surface of the rollers are pressure sensors that output not only the pressure applied to the roller, but also a pressure profile at that moment of contact (measured at 75Hz). These discretized pressure profiles were overlaid onto a reference of the child's hand to measure selectivity in hand use and preferred tactile

stimulation. These profiles were then correlated with metrics of cognitive function and social/communicative competence.

Results: Preliminary results reveal differences in hand use in a subset of children with ASD compared to TD children. Measures also indicate increased variability within the group of children with ASD, and the hand profiles indicate clear areas of preferential selectivity among the children with ASD.

Conclusions: These results quantify altered sensitivity and response to tactile stimulation in individuals with ASD. These results serve as a platform for future investigations of the development of haptic development: how TD children, beginning in infancy, develop selectivity in tactile perception and its effects on social/communicative processes. This will be an important part of understanding atypical behavioral and neural specialization in individuals with ASD.

140.109 109 Objective Metrics for Cognitive-Dependent Motor Learning Gains. E. B. Torres*[1], R. W. Isenhower[1], K. Fiske Massey[1], M. J. Bamond[1], D. N. Metaxas[1] and J. V. Jose[2], (1)*Rutgers University*, (2)*Indiana University*

Background: Diagnosis of autism does not correlate with prognosis. Over time, some children improve and actually leave the spectrum while others do not. It is important to quantify performance and cognitive learning gains in a manner that does not rely exclusively on paper-and-pencil methods and permits the objective evaluation of individuals longitudinally and across therapeutic interventions.

Objectives: To complement current diagnostic techniques, here we present a set of objective metrics, which depend exclusively on the statistical signatures of variability inherently present in physical movements. These metrics permit assessment of the same individual over time.

Methods: In the classroom setting a computer interface was used to adapt tasks from the children's curricula and measure natural movements. A touch screen, electromagnetic sensors (Polhemus Liberty, 240 Hz), and video recordings were synchronized and all behavioral events time-stamped and logged by the interface for later analyses. Discrete trial instruction tasks (match-to-sample) were used to evoke pointing movements familiar to the children (11 children with ASD, mean age = 9.9 years and 6 typically developing (TD) children, mean age = 4.75 years). The cognitive load of the tasks was systematically manipulated. We assessed the effects of changes in cognitive load on the hand pointing trajectories of the children. Their pointing motions were taken as a "wholesome unit" formed by a segment actively directed to the goal (the sample or target) and a segment passively carried along in transition to another active motion. The frequency distributions of the absolute maximum velocity values from the goal-directed and spontaneous movements were obtained for each child across hundreds of trials, both for novice and well-practiced trials. The former were identified with multimodal speed profiles (multiple acceleration and deceleration phases). The latter were identified with unimodal speed profiles (a single acceleration and a single deceleration phase). The continuous probability Gamma distribution was used to fit the empirical distributions using maximum likelihood estimation. Each child was represented as two data points (goal-directed and spontaneous motion) in the Gamma-distribution phase space (shape and scale).

Results: The sample clustered into different classes: The ASD children fell towards the exponential range of the Gamma-distribution while the TD children localized in the normal range of the Gamma. A linear polynomial trend best fit the data. Unfolding these clusters by performing the same fitting procedure for each individual revealed a continuum of values spanning the full Gamma range that unambiguously set apart the children with ASD (exponential-range) from the TD children (normal-range) independent of age. The scatter was characterized by a power relation. During the cognitive-dependent motor learning the points shifted to different degrees for each child. We report on this shifting and indicate its relationship with scales of current diagnostic and assessment tools used for ASD.

Conclusions: It is possible to objectively quantify cognitive-dependent motor learning in children with ASD relative to TD children longitudinally in the classroom environment. We discuss implications for the quantification over time of permanent vs. transient gains in each individual child.

140.110 110 Enhanced Processing of Pitch Direction in Children with Autism Spectrum Disorder. N. E. Foster*[1], T. Ouimet[1], A. Tryfon[1], K. A. R. Doyle-Thomas[2], E. Anagnostou[2], .. NeuroDevNet ASD imaging group[3] and K. L. Hyde[4], (1)*McGill University*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*http://www.neurodevnet.ca/research/asd*, (4)*International Laboratory for Brain Music and Sound (BRAMS)*

Background: Enhanced pitch perception of simple auditory material (e.g., pure tones) has been reported in individuals with autism spectrum disorders (ASD) relative to typically developing (TD) controls. We previously found superior perception of pure tone pitch direction in adults with ASD, even at fast temporal rates (Hyde et al., IMFAR 2011). ASD performance on this task was positively correlated with age of speech onset and brain structure in auditory cortex (Foster et al., HBM 2011). However, it is unclear whether children with ASD have the same superiority in pitch direction ability as adults, and how increasing spectral complexity affects their performance.

Objectives: Our objectives were to investigate in children with ASD: 1) whether pitch direction categorization is enhanced (as we previously found in adults with ASD), 2) whether increasing spectral complexity negatively affects performance, and 3) whether pitch direction performance is positively correlated with age of speech onset.

Methods: We are currently collecting auditory behavioral data and MRI measures in a large group of children with ASD versus TD controls in a multi-site study on brain and behavioral development (Zwaigenbaum et al., 2011). Here we present preliminary data from 5 children with ASD (mean age 11.0, range 6-15 years; mean IQ 109.4, SD 9.6), and 8 TD children (mean age 11.4, range 7-16 years). In a pitch change direction task, subjects heard two tones of different frequencies on each trial and judged whether the pitch rose or fell. Task difficulty was parametrically manipulated from a reference condition, either by successively dividing tone duration by two, or by dividing the pitch difference between the tones by two. Tones were presented at three different levels of increasing spectral complexity (pure tones, complex tones with 3 harmonics, and 5 harmonics) in separate blocks. Ethical approval was granted by the Montreal Neurological Institute Research Ethics Board.

Results: Preliminary results revealed that both groups performed best in the reference condition, with accuracy diminishing significantly when either the tone duration or the pitch difference between tones was decreased. Performance was significantly better in the ASD group versus the TD group at all tone complexity levels. As previously observed in adults, the ASD group maintained better performance even at the fastest temporal rate. There was no effect of tone complexity. Within the ASD group, performance was positively correlated with age of speech acquisition.

Conclusions: We show for the first time that pitch direction categorization is enhanced in children with ASD (as in adults), even at fast temporal rates, and at greater levels of spectral complexity. We also replicate in children with ASD a positive correlation between later speech acquisition and superior pitch direction perception. These findings contribute to a better understanding of the cognitive architecture of perceptual processing in ASD with respect to the theory of *Enhanced Perceptual Functioning* (Mottron et al, 2006). These findings are provocative since they contrast with the view that ASD individuals are generally impaired in processing information at fast temporal rates of transition and greater stimulus complexity.

140.111 111 Shifting Visual Attention During Natural Viewing in 12-24 Month-Old Children with Autism. S. Habayeb*[1], K. Knoch[2], W. Jones[1] and A. Klin[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*University of Connecticut*

Background: In an effort to quantify social visual engagement, previous research in ASD has analyzed visual fixations to regions of interest in scenes of social interaction. While these measures are indicative of differences in social processing between individuals with autism spectrum disorders (ASD) and their typically-developing (TD) peers, this method fails to capture dynamic reactions to change in visual content. One such reaction, shifting visual attention, can be thought of as an evolutionarily adaptive process that aids in our navigation of

the social world: we re-allocate limited visual resources from one stimulus to another in pursuit of a goal. Past research on shifting visual attention following movie scene cuts provides insight into such processes. Past research found that adolescents and school-age children with ASD shift attention with similar latency as TD peers, but direct their first fixations to different content locations. TD children direct the majority of first fixations towards the eyes, while adolescents with ASD are equally likely to fixate on eyes, mouth, body, or object areas. This study will downward extend this research into 12-24 month old infants.

Objectives: To determine whether 12-24 month old infants with ASD differ from their TD peers in both their reaction times to shift visual attention following a movie scene cut, as well as in their location of first fixation following a scene cut.

Methods: Children with ASD and age- and non-verbal IQ-matched TD controls, between the ages of 12 and 24 months, watched dynamic social scenes of young children playing with their peers. Scene cuts provided instances where new visual information required a viewer to shift attention from an old location (in the previous frame) to a new target location (in the current frame). Eye-tracking technology was used to collect visual scanning and fixation data. Dependent measures included reaction times to shift gaze following a movie scene cut, and location of first fixation within the scene following a cut.

Results: Preliminary results suggest that reaction times to shift visual attention following a change in visual information are similar between-groups. Preliminary results also indicate increased variability in first fixations for 12-24 month-old infants with ASD.

Conclusions: This study explores the extent to which shifting visual attention and first reactions to new visual information may serve as a proxy for "social intuition"—the adaptive reactions that guide where visual resources are optimally allocated when faced with new visual information.

140.112 112 Self-Reported Food Selectivity in Adolescents and Young Adults with Autism Spectrum Disorders. E. S. Kuschner*[1], B. L. Robustelli[2], E. Dixon[3], L. Kenworthy[1] and G. L. Wallace[2], (1)*Children's National Medical Center*, (2)*National Institute of Mental Health*, (3)*NIMH*

Background:

Picky eating is a prevalent problem in children with autism spectrum disorders (ASD). Food selectivity can negatively impact a child's nutritional intake and BMI, interfere with parent-child relationships, and increase family stress. Although picky eating has been well documented in children with ASD, less is known about food selectivity in adolescents and young adults.

Objectives:

To examine self-reported food selectivity in adolescents and young adults with ASD.

Methods:

Participants included 65 adolescents/young adults with ASD (12-28 years) and 59 adolescents/young adults with neurotypical development (12-23 years). Diagnoses were confirmed with ADOS and ADI, and groups were matched on age, VIQ, PIQ, FSIQ (all IQ scores ≥ 75), and socioeconomic status. Exclusion criteria for the ASD group included any known comorbid medical, genetic, or neurological disorder that may affect cognitive functioning. Participants completed the self-report Adult/Adolescent Sensory Profile (AASP; Brown and Dunn, 2002).

Results:

Adolescents and young adults with ASD were more likely to be classified as food neophobic or afraid of eating new/unfamiliar foods when compared to typically developing peers (χ^2=6.51, p<.001). The adolescents and young adults with ASD were also more likely to report disliking textured foods, such as applesauce, cottage cheese, or chunky peanut butter (p<.001, η^2=.17). This group difference remained significant after accounting for more global avoidance of tactile stimuli (p=.001, η^2=.08). Finally, the ASD group was less likely to enjoy strong tastes, such as spices in foods or strong mints/candies (p<.005, η^2=.06), but this difference appears to be accounted

for by more generally diminished sensory seeking behaviors that cut across sensory modalities.

Conclusions:

When reporting on their own food selectivity and eating behaviors, adolescents and young adults with ASD described a preference for familiar foods and a dislike of foods with particular textures or strong tastes. Although globally lower sensory seeking behaviors accounted for the preference for milder foods, broader sensory avoidance did not explain the reported dislike of food textures. These findings suggest that there is something uniquely unpleasant about food textures for these individuals with ASD, and that this sensory experience may underlie food preferences and picky eating. These data also demonstrate the utility of the taste and food items within the Oral Sensory domain on the AASP (a standardized and commonly used clinical tool) as measures of food neophobia and food preference. Further research examining specific aspects of foods and taste processing (e.g., textures, flavors) is needed to fully understand the causes of food selectivity in adolescents and adults with ASD.

140.113 113 Low-Level Auditory-Motor Synchronization in Children with Autism Spectrum Disorder. A. Tryfon*[1], N. E. Foster[1], T. Ouimet[1], K. A. R. Doyle-Thomas[2], E. Anagnostou[2], .. NeuroDevNet ASD imaging group[3] and K. L. Hyde[1], (1)*McGill University*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*http://www.neurodevnet.ca/research/asd*

Background: The “mirror-neuron system” (MNS) refers to a group of neurons that fire when performing an action as well as observing that same action performed by another (Rizzolatti et al., 2004). Studies in vision point to an atypical functioning of the MNS in individuals with autism spectrum disorder (ASD) versus typical development (TD). A parallel MNS-like system is thought to exist in the auditory domain in the context of auditory-motor synchronization (Chen et al., 2008). Just as in vision, recent evidence suggests that the MNS may also be affected in the auditory domain in ASD (Russo et al., 2008; Wan et al, 2010). However, no one has examined low-level auditory-motor synchronization in ASD versus TD children.

Objectives: The objectives of the present research were 1) to adapt a previously used auditory-motor synchronization task (Chen et al., 2008) for use in a child population, and 2) to test for group differences between ASD and TD children on this auditory-motor synchronization task.

Methods: We are currently collecting auditory behavioral data and MRI measures in a large group of children with ASD versus TD controls in a multi-site study on brain and behavioral development (Zwaigenbaum et al., 2011). Here we present preliminary data from 7 children with ASD (mean age 10.0, range 6-15 years; mean IQ 105, SD 12.4) and 10 TD children (mean age 11.2, range 7-16 years).

In a child-friendly version of an auditory-motor synchronization task (Chen, et al., 2008), subjects were asked to tap in synchrony with auditory rhythms of varying levels of complexity (easy, simple, and complex). Subject performance was measured based on mean absolute asynchrony (tap onset minus target onset). Ethical approval for this research was obtained by the Montreal Neurological Institute and Hospital Research Ethics Board.

Results: Preliminary results revealed that all children (both ASD and TD) exhibited a complexity effect with worse performance (greater asynchrony) on more complex rhythms. However, children with ASD show overall better performance (lower asynchrony) relative to TD.

Conclusions: We provide preliminary behavioral evidence that low-level auditory-motor synchronization is atypical in children with ASD relative to TD. These findings are provocative since they are in contrast to the view that ASD individuals are generally impaired in cross-modal processing. However, the finding that children with ASD show enhanced auditory-motor integration in this low-level context is consistent with current models of enhanced low-level processing in ASD. These results signal potential alterations in the ‘auditory MNS’ system in ASD. To this aim, we are currently conducting correlations between these auditory-motor behavioral measures and brain structural measures in the same participants.

140.114 114 Auditory Global-Local Processing in Children with Autism Spectrum Disorders. T. Ouimet*[1], N. E. Foster[1], A. Tryfon[1], K. A. R. Doyle-Thomas[2], E.

Anagnostou[2], .. NeuroDevNet ASD imaging group[3] and K. L. Hyde[1], (1)*McGill University*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*http://www.neurodevnet.ca/research/asd*

Background:

The human brain processes sensory information at different perceptual levels: at a "global" (i.e., whole) level, or at a "local" (i.e., detail) level. Research from the visual domain suggests that individuals with autism spectrum disorder (ASD) have a more local-based processing style compared to typically-developing (TD) individuals (Plaisted et al., 1999). Similarly, findings in audition show a local advantage in ASD. However, auditory global processing in ASD is less clear, with studies showing either intact (Heaton, 2005) or impaired global processing (Foxton et al., 2003). Moreover, the stimuli used in previous auditory global-local studies (called "interval-contour" stimuli) have been criticized for not measuring true global-local distinctions.

Objectives:

The main objectives of the present research were: 1) to better characterize global-local processing distinctions in the auditory domain using new and improved auditory global-local stimuli; and 2) to test for group differences in auditory global-local processing between children with ASD versus TD.

Methods:

We are currently collecting auditory behavioral data and MRI measures in a large group of children with ASD versus TD controls as part of a multi-site study on brain and behavioral development (Zwaigenbaum et al., 2011). Here we present preliminary data from 8 children with ASD (mean age 10.8, range 6-15 years; mean IQ 104, SD 12.4), and 9 TD children (mean age 10.7, range 7-13 years).

We used a new class of auditory global-local stimuli adapted from a study by Justus and List (2005). These stimuli confer advantages over previous "interval-contour" stimuli in that they were designed to allow the independent manipulation of global and local structure (and are thus a better measure of true global-local distinctions), as well as direct comparison with analogous stimuli in the visual domain. Stimuli consisted of 9-tone melodies, each comprised of three triplet (3-tone) sequences. The global pattern was defined as the first tone of each triplet pattern, and the local pattern was defined as a single triplet. Participants were asked to discriminate between ascending and descending pitch direction at the global and/or local level. Ethical approval for this research was obtained by the Montreal Neurological Institute and Hospital Research Ethics Board.

Results:

Preliminary findings in TD children showed a strong global advantage wherein global patterns were detected faster and more accurately compared to local patterns. In comparison, children with ASD showed a trend for a less pronounced global advantage, which appears to be driven by enhanced processing of local structure compared to TD.

Conclusions:

We extend previous findings by demonstrating a less pronounced global advantage (due in part to enhanced local processing) in ASD. However, we can conclude with greater confidence relative to previous work that global-local auditory processing differs in ASD versus TD. Our preliminary findings are consistent with findings from studies in vision that used analogous visual global-local stimuli, suggesting that global-local processing is a perceptual phenomenon that is pervasive across sensory domains. Results are consistent with current models of enhanced perception in ASD (Mottron et al., 2006).

140.115 115 Abnormal Parent-Reported Sensory Behaviors in ASD and ADHD. E. L. Wodka*, M. M. Talley and S. H. Mostofsky, *Kennedy Krieger Institute*

Background: Abnormal sensory behaviors are among the most common behavioral concerns of parents of children with autism spectrum disorders (ASD), often causing significant family stress. Recent reports have suggested that abnormal sensory behaviors are also present in other developmental disabilities (e.g., Attention Deficit/Hyperactivity Disorder: ADHD, Tourette Syndrome). It is, however, unclear whether the nature or severity of these behaviors differs among disorders or is more specific to ASD.

Objectives: To examine differences between parent-reported sensory behavior in children with ASD, ADHD, and typically developing (TD) children using the Sensory Processing Measure (SPM).

Methods: Data came from ongoing studies examining motor skill development and learning in children with ASD and ADHD. Diagnosis of autism was made using the Autism Diagnostic Interview-Revised (ADI-R), and the Autism Diagnostic Observation Schedule (ADOS-G). Diagnosis of ADHD was made using structured parent interview, (Diagnostic Interview for Children and Adolescents, Fourth Edition: DICA-IV) and ADHD-specific and broad behavior rating scale (Conners' Parent Rating Scale-Revised, Long Form, CPRS-R). To measure sensory behavior, the SPM was administered. The SPM is a parent-report of sensory behavior assessing sensory processing, praxis, and social participation; individual subscale and total sensory systems were examined by group. Groups included ASD (n=34), ADHD (n=25) and TD (n=53). The age of the sample ranged from 8-12 years (M=10.4, SD=1.3), and participants were included with at least average intelligence (Wechsler Intelligence Scale for Children-Fourth Edition: WISC-IV Perceptual Reasoning Index: PRI): ASD (M=105.6, SD=14.1), ADHD (M=101.2, SD=10.8), and TD (M=109.4, SD=1.7). Results of an ANOVA revealed a main effect for PRI ($F_{(2,109)} = 3.6$, p=.03), with bivariate analyses revealing a significant difference only a between ADHD and TD (t(2,56)=-1.3, p=.006).

Results: ANOVA revealed highly significant differences (p <.001) between groups across all subscales of the SPM (e.g., SPM Total Sensory Systems: $F_{(2,111)} = 81.1$, p<001). Bivariate analyses revealed for every subscale (i.e., Social Participation, Vision, Hearing, Touch, Body Awareness, Body Motion, Planning, and Total Sensory Systems), ASD were rated by parents as having significantly worse sensory behavior than ADHD, who were rated as having significantly worse sensory behavior than TD children. Of note, although ADHD were rated as having statistically more sensory behavior difficulties than TD children, both ADHD and TD children were reported to fall within 1 SD of the mean across subscales (e.g., SPM Total Sensory Systems M_{ADHD}=53.6, SD=8.6, M_{TD}=44.3, SD=4.8); only children with ASD were rated as 1 SD above the mean across subscales (e.g., SPM Total Sensory Systems M_{ASD}=62.8, SD=7.6), suggesting some clinical impairment.

Conclusions: Though parents of children with both ASD and ADHD report greater concern than TD children with regard to abnormal sensory behaviors, the level of concern is statically and clinically greatest for children with ASD across multiple aspects of sensory functioning (e.g., hearing, vision, touch). As such, as described in the literature, abnormal sensory behaviors may not be specific to ASD, but may be more substantial in this disorder.

140.116 116 The Role of Motor Coordination in the Facial Expression of Emotion in Autism Spectrum Disorders. C. J. Zampella*, E. G. Smith and L. Bennetto, *University of Rochester*

Background: Deficits in emotional functioning have consistently been acknowledged as a primary characteristic of autism spectrum disorders (ASD) since Kanner's original description in 1943. Given that emotional cues are an important component of social interaction, impairments in the understanding and expression of emotion have the potential to have significant ramifications for social-communicative functioning. A growing body of literature exists on the perception and recognition of emotional expressions in ASD, but comparatively fewer studies have investigated how individuals with ASD express emotion. These studies have relied largely on parental report, observations of young children within social interactions, and subjective coding systems of emotional expressiveness. The present study aimed to address a gap in the literature in this area by quantitatively measuring and characterizing facial movement during a controlled emotional expression task.

Objectives: The primary purpose of this study was to objectively examine facial movement in children and adolescents with ASD and their typically developing peers during a facial imitation task.

Methods: Participants were typically developing children and adolescents (n=28) and children and adolescents with ASD (n=29). Groups were well-characterized and matched on age, gender, and intellectual ability. Exclusion criteria included any comorbid neurological or psychiatric disorders that could

affect facial motility or emotional functioning. Reflective markers were placed on facial landmarks corresponding to key muscles involved in facial expression. Participants observed a video of a model making various facial expressions, and were asked to imitate those expressions. Movement in both the X and Y coordinate directions was captured for each marker, and was then analyzed using an automated tracking software system (Vicon Motus). Both meaningful (e.g., happy, mad) and non-meaningful (e.g., scrunching eyebrows, showing teeth) expressions were examined. After participants completed the imitation task, naïve raters were asked to watch videotapes of their expressions and provide qualitative ratings. The relationship between facial movement and viewers' ratings was then assessed.

Results: Preliminary analyses indicate that global patterns of muscle movement at the time of maximum facial displacement are largely similar in individuals with ASD and typically developing controls. However, the data suggest group differences in how particular regions of the face move as an expression unfolds over time (including movements at expected locations, as well as those not commonly associated with a certain expression). Preliminary data also point to a relationship between facial movement and the clarity with which an expression is perceived.

Conclusions: Children and adolescents with ASD seem to move the regions of their face in quantitatively different ways relative to their typically developing peers. This is suggestive of impairments in emotional expression in ASD, even among high-functioning individuals. Importantly, differences appear to occur at localized regions and time-points, rather than globally. This underscores the importance of fine-grained analyses of facial movement and emotional expression in this population.

140.117 117 Development of Oculomotor Function in the First Two Years of Life in Children At High- and Low-Risk for Developing Autism Spectrum Disorders. T. Tsang*[1], C. J. Zampella[2], A. Klin[1] and W. Jones[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*University of Rochester*

Background: Previous research has investigated properties of visual saccades and fixations in school-aged children and toddlers with autism spectrum disorders (ASD) using a natural viewing paradigm. The results confirm findings from two separate bodies of literature, indicating that basic mechanisms of oculomotor function are intact in children with ASD, but that children with ASD differ from their typically-developing (TD) peers in terms of the social content on which they preferentially focus. Other research using longitudinal methods to study viewing patterns of naturalistic scenes has also found that children with ASD exhibit a preference for different aspects of a social scene than TD children. However, the developmental trajectory of oculomotor function during a natural viewing task has not yet been explored between these groups. The current study intends to address that topic.

Objectives: To characterize developmental changes of oculomotor properties of visual fixations and saccades during natural viewing of social scenes and to compare oculomotor function in infants with ASD and TD infants.

Methods: Fixation and saccades were identified from data in a longitudinal study using eye-tracking equipment to examine the viewing patterns of naturalistic scenes in infants at high- and low-risk for developing ASD. Eye-tracking data were collected at months 2, 3, 4, 5, 6, 9, 12, 15, 18, and 24 months while infants viewed videos of actresses engaging in child-directed caregiving behaviors and of toddlers interacting in playground settings. Diagnoses were given at 36 months, assigning infants into ASD (n = 15) and TD (n=48) groups. The following properties and content of eye movements were analyzed cross-sectionally and longitudinally, and then compared between groups: fixation duration; frequencies of saccade and fixations; relationship between saccade amplitude and duration; and relationship between saccade velocity and amplitude.

Results: Preliminary analyses suggest that while basic properties of saccades and fixations undergo developmental change, they do not differ between infants with ASD and typically-developing controls.

Conclusions: Physiological properties of eye movements appear to develop normally in young children with ASD. This

suggests that differences in visual scanning of social content, observed previously in infants with ASD relative to typically-developing peers, are not the result of oculomotor impairment, but rather reflect differences in what aspects of a social scene are most salient.

140.118 118 Itchy and Scratchy: Contagious Scratching and Yawning in Adults with Autism Spectrum Disorder. F. S. McEwen*[1], R. Booth[2], S. Luz[3], P. F. Bolton[4] and F. Happe[2], (1)*Institute of Psychiatry, King's College London*, (2)*Institute of Psychiatry*, (3)*University College of London*, (4)*Institute of Psychiatry, Kings College London*

Background: Contagious yawning may act as a marker of traits like empathy and mimicry. Children with Autism Spectrum Disorders (ASD) seem to be less susceptible to contagious yawning than typically developing (TD) children. This could be explained by reduced attention to eyes, which are a more potent trigger of contagious yawning than the mouth. Contagious scratching is phenomenally similar but does not rely on attention to eyes.

Objectives: To compare susceptibility to contagious yawning and scratching in adults with and without ASD; To ask if contagious effects were associated with autistic symptoms/traits, empathy and alexithymia, and theory of mind.

Methods: Participants were 21 adults with a childhood diagnosis of ASD (M=24 years) and 24 TD adults (M=28 years) matched on Full Scale IQ. Participants were unaware of the purpose of the experiment. They watched two naturalistic videos of a person who yawned or scratched and were questioned afterwards about what they noticed about the person's behavior and how they felt while watching. Participants were discretely filmed and videos were coded for frequency and duration of yawning and scratching (30% tapes were blind double-coded). Other measures included: Autism Diagnostic Observation Schedule; Autism Spectrum Quotient; Interpersonal Reactivity Index; Toronto Alexithymia Scale; theory of mind battery.

Results: Contagious Yawning: A similar proportion of ASD (29%) and TD (38%) individuals showed an increase in yawning in response to the yawn video ($\chi^2(1)=0.40$, p=.53). TD adults increased their yawning while viewing the yawn video compared to a control (scratch) video more than adults with ASD (t(43)=1.62, p=.05, d=0.49). Contagious Scratching: A similar proportion of ASD (57%) and TD (63%) individuals showed an increase in scratching in response to the scratch video ($\chi^2(1)=0.13$, p=.71). There was no difference between groups in the amount of scratching during the scratch video when compared to the control (yawn) video (t(27.72)=1.26, p=.22, d=0.38). Participants noted the yawning and scratching, confirming that they attended to the task. About half of each group reported feeling like yawning or scratching. In the TD group feelings closely matched behavior, but in the ASD group these were dissociated. Susceptibility to contagious effects was related to lower levels of autistic traits, lower alexithymia, and higher theory of mind task performance.

Conclusions: Adults with ASD were less susceptible than TD adults to contagious yawning and there was some association between contagious effects and autistic traits, understanding others' minds, and understanding emotions. The variation in contagious effects in both groups means that it is unlikely to have value in terms of diagnostic protocols. Subjective reports of being affected by contagious yawning did not match behavior shown by adults with ASD. Behavior could have been masked by factors such as anxiety, or there could be a general dissociation between feelings and behavior. Other people rely on our expressive behavior during interactions and a lack of matching behavior by adults with ASD could evoke discomfort in others, further contributing to difficulties in social communication. If this is true it would support the targeting of socially embedded imitative behavior in interventions.

140.119 119 Attention, Arousal, and Affect Regulation From 4 to 42 Months: Comparisons of Children with ASD, with ASD Siblings, and with Neonatal Medical Risk for Developmental Disorders. J. M. Gardner*, B. Z. Karmel, I. L. Cohen, E. M. Lennon, R. L. Freedland, P. M. Kittler and M. J. Flory, *New York State Institute for Basic Research in Developmental Disabilities*

Background:

Risk for Autism Spectrum Disorders (ASD) due to medical (eg NICU) or familial (eg siblings) factors places infants at greater risk for regulatory difficulties that can lead to a variety of

impairments, particularly in attention, arousal, affect, and motor systems. System inter-relationships change over time. ASD risk can alter the sequence of changes through influences on developing neural systems. In this regard, early deficits in Arousal-Modulated-Attention (AMA) have been reported (Karmel et al., 2010) in NICU infants at 4 months post term age (PTA) who were later diagnosed with ASD. These infants preferred high rates of visual stimulation when less aroused, more similar to that found in neonates than at 4 months. How such early types of regulatory deficits affect subsequent neurobehavioral functioning remains unclear.

Objectives:

To examine regulation from 4-42 months in children diagnosed with ASD, in non-ASD-diagnosed siblings, and to compare these groups to a high-medical risk sample in the development of attention, arousal, motor activity, and affect.

Methods:

Medically at-risk infants recruited as newborns for longitudinal follow-up studies were compared on measures of regulation from 4-42 months PTA. Three groups were defined: 1. Dx Autism Spectrum Disorder (ASD: n =53) ; 2. siblings of Dx ASDs (SIBs: n =42), and 3. no identified ASD, remainder of population (OTHERs: n >330). We measured: visual preferences to paired checkerboard patterns flashing at 1, 3, or 8 HZ (4 months); affect, arousal, and motor activity to multimodal visual, auditory, and tactile stimulation from a puppet saying “peekaboo” (4 & 7 months); affect to a novel arousing robot introduced into an open field (19, 22, & 25 months); and temperament estimated by caregiver responses using the Toddler Behavior Assessment Questionnaire – TBAQ (Rothbart/Goldsmith (25, 34, & 42 months).

Results:

We found increased preference for greater visual stimulation: ASDs>SIBs>OTHERs at 4 months; greater attention and less motor activity to multimodal stimulation during “peekaboo” in ASDs>SIBs and OTHERs at 7 but not 4 months; more positive affect to a novel arousing robot ASDs>SIBs>OTHERs at 19 months, but ASDs >SIBs and OTHERs at 22 and 25 months. Caregiver temperament ratings indicated ASDs displayed more ANGER (ASDs>SIBs>OTHERs at 25 months; ASDs>SIBS and OTHERS at 34 and 42 months), and experienced less PLEASURE (ASDs<SIBs<OTHERS at 25 months; ASDs<SIBs and OTHERs at 34 and 42 months).

Conclusions:

Findings indicate that children with ASD show distinctly different but consistent patterns of regulatory deficits over age and measures as compared to ASD-risk children as early as 4 months of age. Findings with ASD siblings depended on age and task but shift appeared to shift more toward non-ASD over age. As none of these siblings were diagnosed, any regulatory deficits from problems at earlier ages require further exploration, potentially emanating from intervention or other sources.

140.120 120 Automatic Retrieval of Videos of Stereotyped and Repetitive Movements. A. Ciptadi*, A. Rozga, G. D. Abowd and J. Rehg, *Georgia Institute of Technology*

Background:

Collecting large corpora of video data has become common practice among researchers and clinicians studying autism (e.g., Watt et.al., 2008). One of the difficulties in analyzing video data stems from the need for human coders to browse all of the content in order to manually annotate the occurrence of specific behaviors of interest, a time intensive and laborious process. We demonstrate a collaboration between computer vision research and developmental psychology aimed at developing automated tools to speed up the annotation process. The specific context of this initial work was to assist in the automatic retrieval of gross motor physical stereotypies from video based on a single example identified in the video by a human coder.

Objectives:

Develop a computer vision algorithm that, given a single example of a behavior of interest occurring in a video, automatically retrieves instances of similar behaviors from the video database.

Methods:

One of the ways humans perceive action is by observing local movement patterns and then abstracting a coherent structure by looking at the relations between these patterns [Johansson, 1973]. For example, when two children play a ball game with their feet, we can characterize that activity by the movement pattern of the ball, the movement pattern of the feet and how the different local movements interact with each other. We devised a computer vision algorithm to parse a video into a set of signals that correspond to the timing pattern characteristic of local movements. We then compare the similarity between any two given snippets of the video by looking at the similarity of two sets of signals extracted. Using this as a basis, we rank all snippets from the video based on one example snippet containing a particular behavior. First we measure similarity between every single snippet in our database and the target (example) snippet. Then, we rank the videos based on the similarity score.

Results:

We applied our method to two sets of videos: a 30-minute session of a child with autism engaged in a structured teaching activity at a table with a therapist, and a 30-minute free play session between a child with autism and a familiar adult. In both videos, the children exhibited stereotyped and repetitive movements that were annotated by a developmental psychologist with expertise in autism. These behaviors included hand flapping, clapping, jumping, and close visual inspection of objects. Our preliminary results indicate on average our method is able to rank 90% video snippets of behaviors that include gross body movement (hand flapping, jumping) in the top 20% of the retrieval results. This means an expert will only have to go through 20% of the video to see 90% of the relevant behaviors, representing a 5-fold saving in time.

Conclusions:

Our preliminary results show great promise in automatically retrieving exemplars of gross motor movement from video recordings, and have relevance for research on stereotyped and repetitive behaviors in autism. In future work, we aim to improve the accuracy and extend the range of behaviors that can be retrieved.

140.121 121 The Relationship Between Repetitive Behaviors and Executive Function in Children with Autism Spectrum Disorder. L. E. Kester, A. J. Moffitt*, J. H. Miles and S. E. Christ, *University of Missouri*

Background: It has been hypothesized that the manifestation of repetitive behaviors and restricted interests in individuals with ASD may be related to impairments in executive function. Past attempts to validate this theory, however, have yielded mixed results. Prior studies that have utilized broad measures of executive functioning (e.g., Wisconsin Card Sorting Task) have generally yielded positive results; whereas studies that employed measures thought to primarily tap an isolated component of executive functioning often fail to find a relationship with repetitive behaviors. One possible explanation is that ASD-related impairment in executive function and its relationship to repetitive behaviors may be most evident in situations in which concurrent demands are placed on multiple aspects (e.g., inhibitory control, task switching) of executive function.

Objectives: The goal of the present study was to test the hypothesis that the presence of secondary executive demands (e.g., task switching needs) would mediate the relationship between laboratory-measured inhibitory control and day-to-day manifestations of repetitive behaviors.

Methods: A sample of 22 children (mean age: 14.4 years, SD = 2.4) with high functioning (IQ >70) ASD completed an antisaccade eye movement task. In this task, participants were presented with a central fixation point flanked to the far left and right by peripheral boxes. After a short delay, the fixation point was replaced briefly with a colored symbol (e.g., a red X or green O) followed by a brightening of one of the peripheral boxes. Importantly, the colored symbol indicated whether the participant should look towards the subsequent brightened box (a prosaccade) or away from it (an antisaccade). Participants completed 20 practice trials, followed by 192 experimental trials. Trial types were intermixed thus resulting in 4 critical conditions: (1) 'Baseline' trials associated with minimal executive demands = prosaccade trial that follows another prosaccade trial, (2) 'Inhibition Only' trials associated with inhibitory but not switching demands = antisaccade trial that follows another

antisaccade trial, (3) 'Switching Only' trials associated with switching but not inhibitory demands = prosaccade trial that follows an antisaccade trial, and (4) 'Inhibition+Switching' trials associated with both inhibitory and switching demands = antisaccade trial that follows a prosaccade trial. The severity of repetitive behavior symptoms exhibited by participants was assessed using the Repetitive Behavior Scale (RBS; Lam & Aman, 2007).

Results: Data was analyzed using a multiple regression approach. Performance in the combined Inhibition+Switching condition of the antisaccade task explained a significant portion of variance in repetitive behavior symptomatology (as measured by the RBS), ΔR^2=.19; $\Delta F(1,17)$=5.4; p=.03. In contrast, performance in the Inhibition Only condition and Switching Only condition explained little variance in RBS score, ΔR^2<.07; $\Delta F(1,17)$<1.5; p>.24 in both instances.

Conclusions: Consistent with our hypothesis, the relationship between day-to-day manifestation of repetitive behaviors and our laboratory test of executive function was evident only when concurrent demands were placed on more than one aspect of executive function (i.e., both inhibitory control and task switching). This research represents a promising step towards understanding (and bridging) the gap between the laboratory-based assessment and everyday functioning.

140.122 122 Motor Learning in Children with Autism Spectrum Disorder. A. K. Wegrzyn*, J. H. Miles and S. E. Christ, *University of Missouri*

Background: In addition to experiencing difficulties with social communications, individuals with an autism spectrum disorder (ASD) frequently experience problems in other domains of functioning such as motor control and learning. Past studies have generally reported that individuals with ASD show improved performance on motor tasks at a rate similar to that of healthy non-ASD individuals. Additional behavioral and functional neuroimaging research (e.g., Gidley Larson et al., 2008; Müller et al., 2003), however, suggests that the neurocognitive processes underlying motor learning in individuals with ASD may differ from those associated with motor learning in typically developing individuals.

Objectives: The goal of the current study was to further advance our understanding of ASD-related differences in motor movement control and learning. To this end, we isolated and examined the ballistic and corrective submovements associated with performance of a rapid aimed limb movement in a sample of children with ASD and a demographically-matched group of typically developing children without ASD.

Methods: A sample of 25 males with ASD ranging in age from 8.15 to 18.09 years (M = 13.01, SD = 7.17) and a comparison group of 34 typically developing males without ASD ranging in age from 8.08 to 18.25 years (M = 12.94, SD = 8.74) participated. A 3D motion tracking system was used to record hand position while participants performed a rapid aimed limb movement (Abrams & Pratt, 1993). Participants were instructed to move their right hand as quickly as possible from a starting position on the right to a target position on the left. Participants completed 10 blocks consisting of 10 trials per block (100 total movements).

Results: Data analysis revealed an overall main effect of trial block on task performance, with movement duration decreasing with increased practice, $F(4,228) = 5.2$, $p = .001$, partial eta^2 = .08. In addition, the rate of this improvement did not differ significantly between the ASD group and non-ASD group, $t(57) < 1$, $p = .38$. The main effect of diagnosis was also not significant, with the ASD and control groups taking comparable time to complete the aimed limb movement, $F(1, 57) = 2.2$, $p = .15$, partial eta^2 < .04 in both instances. Analysis of movement subcomponents, however, revealed a significant group difference. For the non-ASD group, repeated practice of the task was accompanied by an increase in the proportion of overall movement time devoted to ballistic as compared to corrective submovements, $F(4,132) = 9.7$, $p = .001$, partial eta^2 = .23. In contrast, no such change in the proportions of submovements was observed for the ASD group, $F(4,96) = 1.5$, $p = .21$, partial eta^2 = .06.

Conclusions: Analysis of movement subcomponents revealed significant ASD-related differences in motor learning that were not otherwise evident by inspection of overall measures of task performance (e.g., reaction time, movement time). Taken together, these findings support the hypothesis that, while

motor learning per se is not impaired in ASD, individuals with ASD utilized different strategies in learning as compared to healthy non-ASD individuals.

Cognition and Behavior Program
141 Cognition and Behavior IV

141.123 123 Screening for Social Disability At 12 Months Using the First Year Inventory. J. P. Rowberry*, G. M. Chen, D. Campbell, C. Weitzman and K. Chawarska, *Yale University School of Medicine*

Background:

The challenge of early screening for ASD is identifying which behaviors reliably detect emerging social disabilities. The First Year Inventory (FYI), a parent-completed questionnaire, assesses a 12-month-old's risk of ASD. A retrospective study of the FYI suggests differing levels of social disability detection between its domains; no prospective data have been published.

Objectives:

To examine:

1. Which domains of the FYI at 12 months differentiate infants who are likely to experience marked social disability at 24 months
2. The concurrent association between parental report of behaviors on the FYI and clinicians' ratings on the ADOS-T at 12 months

Methods:

Participants included 84 families of 12-month old infants (110 families expected by May 2012): 50 with and 34 without a familial history of ASD. Parents completed the FYI prior to direct assessment of the child's social-communicative skills with the Autism Diagnostic Observation Schedule-Toddler module (ADOS-T). The 61 questions on the FYI comprise two domains (Social Communication and Sensory-Regulatory), each domain consisting of four constructs. ADOS-T yields Social Affect and Restricted and Repetitive Behaviors (RRB) scores. At 24 months, the infants were reassessed, and classified as having ASD (n=12), broader autism phenotype (BAP,n=9)), non-social developmental delay (DD,n=21)) or no diagnosis (ND,n=42)). Analysis was conducted using between-group ANOVA with Bonferroni correction for multiple comparisons. Pearson's r correlation was used to asses associations between parent report and direct assessment of social skills.

Results:

Preliminary analysis showed no difference between the ASD and BAP groups; they were combined into a social disability group (SD,n=21) for subsequent analysis. The groups differed in the Social Communication domain ($F(2,83)=7.72, p=.001$), such that SD>ND ($p=.001$) and SD=DD ($p=.195$). There were no between-group differences for Sensory-Regulatory domain ($p=.888$). We then analyzed scores on the four constructs of the Social Communication domain. Differences were found for two: Social Orienting and Receptive Communication ($F(2,83)=4.931, p=.010$), such that SD>ND ($p=.015$), SD=DD ($p=1.00$) and DD>ND ($p=.048$) and Imitation ($F(2,83)=11.0, p=.001$),such that SD>DD ($p=.001$) and SD>ND ($p=.001$).

There was significant correlation of the ADOS-T Social Affect and the FYI Social Communication domain scores ($r=.430, p=.001$) and all of its constructs; including Social Orienting and Receptive Communication ($r=.424, p=.001$) and Imitation ($r=.366, p=.001$). There was no correlation between the Sensory-Regulatory domain and the ADOS-T Social Affect or RRB scores.

Conclusions:

Our preliminary results suggest that:

1. The Social Communication domain and Social Orienting and Receptive Communication construct of the FYI differentiated infants with social or developmental delays from those with no diagnosis. The Imitation construct differentiated infants with social deficits from infants with non-social or no delays and constitutes a promising area of focus regarding screening for social delays at 12 months.

2. While significant, the associations between parent and clinician ratings of social skills were relatively modest.

3. Given the overlap in presentation between infants who later develop ASD versus those with broader autism phenotype; a realistic and clinically relevant aim of screening at 12 months might be the identification of infants at risk of a variety of social deficits who should be monitored closely and treated as needed.

141.124 124 The Childhood Routines Inventory in Children with Autism Spectrum Disorders. T. D. Challman*[1], D. W. Evans[2], S. M. Myers[1], S. Lazar[2], P. T. Orr[1], A. Moreno de Luca[1] and D. H. Ledbetter[1], (1)*Geisinger Health System*, (2)*Bucknell University*

Background: Until recently, the study of restricted, repetitive behavior (RRB) in autism spectrum disorders (ASD) has been largely neglected relative to the research on the language and social deficits associated with ASD. This may be due in part to the high prevalence of repetitive behavior that presents in other, non-ASD neurodevelopmental disorders, which might obscure the diagnostic utility of RRB.

Objectives: We aim to examine the similarities and differences in RRB in children with ASD relative to a heterogeneous non-ASD sample, as well as to subgroups varying in ASD and cognitive status. First, we explore the factor structure of the Childhood Routines Inventory (CRI), a measure of RRB (Evans, Leckman, Carter, Reznick, Henshaw, King & Pauls, 1997) on a large sample of children with neurodevelopmental disorders, and then compare the CRI factors across various clinical subgroups.

Methods: Over 1000 consecutive patients at a clinic for neurodevelopmental disorders in rural Central PA, USA received the CRI by postal survey. Caregivers of three-hundred seventeen children (mean age 62 months, range 12-194 months) with a wide range of neurodevelopmental disorders completed the CRI. The CRI measures 19 RRB along a 5-point Likert scale.

Results: First, we conducted a principal components analysis of the CRI using Varimax rotation. Consistent with earlier work with the CRI, the "'Just Right" and "Repetitive Behaviors" factors emerged. However, a third factor was retrieved – "Sensory Sensitivities", with the 3 factors accounting for a total of 58% of variance. Following the factor analysis, children were classified into one of three diagnostic groups: those with ASD, those with intellectual disability or global developmental delay (ID/DD) but no ASD, and those with another neurodevelopmental disorder (ND) without ASD or ID/DD. Next, ANOVAs compared the three groups on each of the three CRI factors (weighted by factor loadings). Groups differed on all three weighted factor scores: Just Right ($F(2, 309)=4.56$, $p=.01$; Repetitive Behavior ($F(2, 309)=9.81$, $p< .0001$ and Sensory Sensitivities ($F(2,309)=10.02$, $p< .0001$. Post hoc tests revealed that on all three ANOVAs the ASD group engaged in more Just Right, Repetitive Behavior and had more Sensory Sensitivities than both the ID/DD and ND groups.

Conclusions: These findings add to the growing body of literature on RRB in children with neurodevelopmental disabilities. Our findings suggest that the structure of the CRI varies depending on the clinical status of the population. In children with neurodevelopmental disorders, a third factor (Sensory Sensitivities) emerges that has not appeared in factor analysis with typical populations. All three factors differentiated children with ASD from children with other neurodevelopmental disorders. The CRI, unlike other measures of RRB, results in a range of scores and distribution that facilitates the exploration of RRB in a variety of clinical populations.

141.125 125 Intermodal Perception and Attention Shifting in Children with Autism Spectrum Disorders. J. M. Bebko*, C. A. McMorris, L. N. Hancock and S. M. Brown, *York University*

Background: Two cognitive processes have been hypothesized to act as the foundation for social-communicative functioning (e.g., Bahrick & Todd, in press): 1) the disengagement and shifting of attention; and 2) intermodal perception. Previous research has shown that both attention shifting and intermodal perception are impaired in children and adolescents with Autism Spectrum Disorders (ASD).

Although researchers have hypothesized that a disturbance in intermodal perception could lead to further impairments in orienting and disengaging attention to multimodal and dynamic events, limited research exists examining how these two processes are interrelated. The present studies examine the linkages between attention and intermodal processing in children with ASD.

Objectives: Through a series of three studies, we examined children with ASD's ability to shift their attention when presented with multimodal stimuli (both social and nonsocial), increasing in complexity (basic sounds to stories).

Methods: Children with ASD, typically developing children and children with intellectual disabilities, all matched on age and verbal ability were tested using a preferential-looking paradigm, Two identical dynamic images on the right and left sides of the screen (Study 1 and Study 2) or four images on the screen (Study 3) were presented. Stimuli varied in complexity across the three studies, ranging from: a) simple vowel sounds and high frequency sounds (Study 1); b) brief stimuli categorized as either high- (man reciting story), low- (man counting) or non-linguistic (mousetrap) stimuli (Study 2); and c) linguistic (women telling a story) and non-linguistic (piano) stimuli, using a four-screen array (Study 3). For each trial, although all visual tracks were identical, only one screen was synchronous (i.e., the auditory and visual information matched).

Results: Data analyzed to date (one study is currently being analyzed) indicate no differences in shifting attention abilities between ASD and other groups, with comparable numbers and durations of eye fixations across groups for these dynamic stimuli. However, children with ASDs spent less time looking to synchronous screens when linguistic stimuli were presented versus non-linguistic.

Conclusions: The findings of apparently intact general attention shifting skills with dynamic linguistic stimuli, yet differences in selective attention, reflected by less intermodal coordination for those same linguistic stimuli, help to clarify how these two cognitive processes (attention and intermodal perception) are interrelated in children with ASD. Understanding that relationship provides an important link towards evaluating their roles as foundational components for the development of social-communicative functioning in children with and without ASDs.

141.126 126 The Unique Impact of Autism on the Detection of Temporal Synchrony in Intermodal Processing: What Are the Roles of Intellectual and Language Variables?. L. N. Hancock*, S. M. Brown and J. M. Bebko, *York University*

Background: Intermodal perception (IMP) plays an integral role in early perceptual development. Individuals with autism often exhibit ineffective sensory processing, and integration of information across auditory and visual modes appears impaired (Iarocci & McDonald, 2006). Deficits in this sensory processing may be related to some of the communication impairments that characterize autism (Bebko et al. 2006). Furthermore, there is limited research investigating the added effects of background noise on the processing of speech in persons with an Autism Spectrum Disorder (ASD).

Despite the high rates of intellectual disabilities and the specific linguistic-related IMP difficulties observed in children with autism, identifying the roles of intellectual functioning and language ability in the IMP skills of children with autism has not been well researched. Appropriate comparison groups are needed to fully understand the degree to which IMP difficulties are limited to autism or are more broadly associated with intellectual disabilities.

Objectives: The present study's objectives were to compare performance on linguistic and non-linguistic IMP tasks: (1) between children with Asperger Syndrome (AS), who diagnostically have no significant language delay, children with autism, and children with typical development (TD) and; (2) between children with an intellectual disability (ID) with no evidence of a PDD, children with autism, and children with TD.

Methods: Participant groups were matched on chronological age, verbal mental age and nonverbal mental age. Groups of participants with AS (n=10), Autism without an Intellectual Disability (ASD without ID; n=11), and TD (n=11) were matched with each other; similarly, the ID (n=10) and Autism

with an Intellectual Disability (ASD with ID; *n*=11) groups were matched with each other.

The present study used eye-tracking with a modified preferential looking design, which involved displaying four identical videos, offset in time, with an auditory track synchronous to only one of the videos. Videos contained either linguistic (person telling a story) or non-linguistic (hand playing a piano) stimuli. Background noise was added to a portion of trials and the signal to noise ratio (SNR) was manipulated.

Results: For the conditions with no background noise, Autism with or without ID differentially predicted performance for the linguistic trials only. The TD, AS, and ID participants were more likely to show a preference for the synchronous screen compared to the Autism with and without ID groups. Group membership did not predict performance in the non-linguistic trials.

When background noise was added, rates of preferential looking decreased as the SNR increased for the Linguistic condition only. There was no trend found for the Non-linguistic condition.

Conclusions:

The current study was the first to explore IMP in AS and ID populations through the use of a 4-screen modified preferential looking paradigm and has extended our understanding of the impact of autism on IMP. These findings suggest a unique interaction of autism with the ability to detect intermodal temporal synchrony in linguistic contexts, which is not found among children with other forms of intellectual disability or in Asperger Syndrome. Implications of these findings are discussed.

141.127 127 Examining Relationships Between Perceptual Bias and Autistic Traits Using Typically Developing Individuals. E. Myrtetus*[1] and K. M. Curby[2], (1)*Drexel University*, (2)*Temple University*

Background:

A core feature of autism spectrum disorders is a detail oriented perceptual processing style with such individuals tending to be more preoccupied with object features rather than wholes. Typically, individuals can more rapidly respond to the "big picture" or global aspects of a stimulus compared to the fine details or local features. This is referred to as global precedence.

Objectives:

The current study investigated whether individuals with sub-clinical autistic traits, as measured by the Autism Spectrum Quotient, show a reduction in the global precedence.

Methods:

Participants completed a speeded letter task with Navon hierarchical stimuli and the Cambridge Face Memory Test for Faces.

Results:

All participants responded faster to compatible trails over incompatible, and to global over local stimuli.

However, in global, compatible trials there was a negative trend between AQ and accuracy. As AQ increased accuracy decreased.

Conclusions:

Results were consistent with suggestions that individuals typically exhibit a form of global precedence, responding to global, "big picture" aspects of a stimulus faster than local details.

The main effect between compatibility and accuracy was to be expected because individuals generally respond faster to compatible stimuli than incompatible, as we see in Stroop and other classic visual tests.

One possibility to explain the negative trend between AQ and accuracy ing global, compatible trials is that the higher a participant's AQ score the less he/she benefitted from the compatible condition. If they are processing the local features,

small letters, first anyway, then the small and large letters being the same would not produce a significant advantage.

141.128 128 Use of the Differential Abilities Scale for the Assessment of Children with Autism Spectrum Disorders. R. Aiello*, L. A. Ruble and E. Wilcox, *University of Kentucky*

Background: Children with autism spectrum disorders can be particularly challenging to assess using standardized measures when one considers the type of behavior required for a psychological evaluation. For example, many intelligence assessments require participants to imitate the actions of the administrator, to answer questions verbally, and to understand the directions given by the administrator. It is imperative that intelligence assessments not only provide a valid and reliable assessment of children, but also allow for administration that minimizes disruptive behaviors and maximizes attention during the process. Unfortunately, few studies have documented the behavior of children with ASD during the assessment process.

Objectives: In order to better understand the assessment process, the following research questions are posed:

1. What is the relationship between intelligence, language abilities, and autism severity for children with ASD?

2. What are the patterns of test session behavior displayed by children with ASD during the assessment?

3. Are observed testing behaviors related to the level of performance on the intelligence assessment?

Methods: The *Differential Abilities Scales* was administered to 48 children with ASD who were between the ages of 3 and 8 years old. In order to examine the relationship between language abilities and intelligence, the *Oral and Written Language Scales* was administered to all participants. The *Childhood Autism Rating Scales* was also completed during the assessment sessions in order to examine the relationship between autism severity and intelligence amongst the participants. All assessments were videotaped for further analysis of the participants' testing behavior. Videotaped test sessions will be coded by two raters for both off task and on task behaviors in 10-second intervals using the procedure and coding manual detailed by Akshoomoff (2006).

Results: Simple linear regression will be used to describe the relationship between scores obtained on the DAS and the OWLS. Pearson's correlation will also be employed to explore the relationship between the CARS and the DAS. Descriptive analyses will be used to explore the patterns of on and off task behaviors of the participants during the intelligence assessment sessions. To address the relationship between observed test session behavior and scores obtained on the DAS, partial correlations will be performed using the amount of time engaged in on task and off task behaviors and the General Conceptual Ability score and subscale scores obtained by the participants, while holding constant language abilities and autism severity.

Conclusions: An analysis of the data is still ongoing; however, it is anticipated that a linear relationship will be demonstrated between language abilities and intelligence for children with ASD. It is also hypothesized that autism severity will be related to certain aspects of intelligence as measured by the DAS. It is also anticipated that the children in the study will exhibit more off task behaviors than on task behaviors, and that a relationship will be found between test session behaviors and scores obtained on the intelligence assessment.

141.129 129 Reward Processing in Children and Adolescents with Autism Spectrum Disorders and Children and Adolescents with ADHD. E. Demurie*[1], H. Roeyers[1], D. Baeyens[2], J. R. Wiersema[1] and E. Sonuga-Barke[3], (1)*Ghent University*, (2)*Lessius University College*, (3)*University of Southampton*

Background: Children with autism spectrum disorders (ASD) show deficits in their motivational processing, as they seem to be hyposensitive to social reinforcement (Garretson Fein, & Waterhouse, 1990). Some recent fMRI studies in adults with ASD show abnormalities in brain activation during receipt of reward. It seems that the diminished neural responses to rewards are particularly present when social rewards were used (Scott-Van Zeeland et al., 2010). However, abnormal reward processing is not a specific characteristic of ASD, as children with Attention Deficit/Hyperactivity Disorder (ADHD) also display abnormalities in reward sensitivity (Sagvolden et

al., 1998). Children with ADHD show an aberrant sensitivity to reward amount (Luman et al., 2005). The abnormal reward sensitivity in ADHD can also be seen in the aversion for delay and delayed reinforcement in children with ADHD (Sonuga-Barke, 2002).

Objectives: In our research, processing of monetary versus social rewards (objective 1) and rewards with varying degrees of delay (objective 2) has been investigated in children with ASD, children with ADHD and a typically developing control group.

Methods: Objective 1: Two adapted versions of the Monetary Incentive Delay Task were used to study the effects of monetary and social reward anticipation on task performance. 40 typically developing control children and adolescents, 31 children and adolescents with ASD and 35 children and adolescents with ADHD participated. All children and adolescents were between 8 and 16 years old and had an estimated full scale IQ of 80 or more. **Objective 2:** 46 typically developing control participants, 34 participants with ASD and 39 participants with ADHD performed a hypothetical monetary temporal discounting task. They were instructed to make repeated choices between a small variable reward delivered immediately and a large constant reward delivered after a variable delay.

Results: Objective 1: Monetary and social reward improved accuracy and RT in all groups. The higher the anticipated reward, the more accurate and faster were responses. Independent of these effects there was a differential effect of reward type. Both clinical groups, but not controls, responded faster for monetary than social rewards. **Objective 2:** Monetary rewards were discounted faster in the ADHD group compared to the controls and the ASD group.

Conclusions: The results while not supporting hyposensitivity to changes in reward amount in ASD and ADHD, do suggest that both groups are generally less motivated in settings where social as opposed to monetary rewards can be earned. On the other hand, unlike participants with ADHD, children with ASD did not show steeper temporal discounting of hypothetical monetary rewards compared to typically developing controls.

141.130 130 Speed Discrimination Abilities in Typical Development and in Children with Autism. C. Manning*[1], D. Aagten-Murphy[2], T. Charman[3] and E. Pellicano[3], (1)*Centre for Research in Autism and Education, Institute of Education*, (2)*Università degli Studi di Firenze*, (3)*Institute of Education*

Background: Despite much research focusing on visual motion processing in individuals with autism, relatively little has focused on the processing of speed. Autobiographical reports suggest that the world is 'moving too fast' for at least some individuals with autism (e.g., Williams, 1992), and it has been shown that slowing down video presentations can aid recognition of facial expressions in individuals with autism (Gepner et al., 2001). Children with autism might therefore show impaired speed processing abilities, particularly for fast moving stimuli. Furthermore, previous research has shown that some individuals with autism have elevated motion coherence thresholds (e.g., Milne et al., 2002; Pellicano et al., 2005). Since both speed processing and global motion processing rely on integrating neuronal responses in extrastriate cortex (area MT/V5), difficulties in these two processes might co-occur in autism.

Objectives: The aims of this study were threefold: 1) to investigate age-related changes in speed discrimination abilities in typically developing children about which, at present, very little is known, 2) to address whether such speed discrimination abilities are atypical in children with autism, and 3) to examine the relationship between speed discrimination abilities and motion coherence abilities in both typical development and autism.

Methods: To address our first objective, we measured speed discrimination thresholds using random dot stimuli in a typically developing sample of children aged 5, 7, 9 and 11 years and adults (total n = 116), with two different reference speed conditions (1.5 deg/sec and 6 deg/sec). To address our second and third objectives, we are administering both speed discrimination tasks and motion coherence tasks using the same reference speed conditions (1.5 deg/sec and 6 deg/sec) to a group of children with autism aged between 6 and 13 years, and an age- and non-verbal ability-matched typically developing comparison group.

Results: The typically developing sample showed age-related improvements in speed discrimination sensitivity for both reference speeds, with participants being more sensitive to the faster reference speed at all ages. Sensitivity to the slower reference speed became adult-like by 11 years, whereas sensitivity to the faster reference speed became adult-like by 9 years. This suggests that sensitivity to slower speeds matures later than that to intermediate speeds. Data collection with individuals with autism is still ongoing.

Conclusions: In typical development, there is a reasonably protracted development of speed discrimination abilities, with adult-like levels being reached later for the slow reference speed than the faster reference speed. If individuals with autism show particularly pronounced impairments in processing faster speeds specifically, this would suggest a deviant rather than a delayed pattern of development. We will examine the association between speed discrimination and motion coherence detection in both typical development and in autism.

141.131 131 More EEfRT Than It's Worth? Effort-Based Decision Making in Autism Spectrum Disorders. C. Damiano*[1], J. Aloi[1], M. S. Treadway[2], J. W. Bodfish[1] and G. S. Dichter[1], (1)*University of North Carolina*, (2)*Vanderbilt University*

Background: The ability to choose an efficient goal-directed action involves careful consideration of the probability of obtaining a reward, the potential magnitude of the reward if obtained, and the effort expenditure required to complete the action. Clinical observations suggest that, in an unstructured environment, individuals with autism spectrum disorders (ASD) may make inefficient behavioral choices at the cost of other potential rewards (e.g., choosing to pursue unlikely friendships or spending an inordinate amount of effort obtaining circumscribed interests). Yet no behavioral study to date has assessed this ability in ASD.

Objectives: The current study aimed to examine effort-based decision-making processes in ASD and how these processes might be influenced by reward probability and magnitude. A secondary aim was to examine how patterns of decision-making might be related to the restricted interest and repetitive behavior domain of ASD [indexed by the Interview for Repetitive Behaviors (IRB) (Bodfish, 2003) and the Interests Scale (IS) (Bodfish, 2003)].

Methods: We compared the performances of adults with ASD (N=20) to IQ-matched control adults (N=38) on the Effort Expenditure for Reward Task (EEfRT) (Treadway et al., 2009). In this task, participants were provided with the probability of obtaining a reward and the possible reward magnitude. They were then asked to choose between an “easy task” (less motoric effort) for a small, stable reward or a “hard task” (greater motoric effort) for a variable but consistently larger reward.

Results: A repeated measures ANOVA with the factors probability, magnitude, and group detected more hard task choices in the ASD group than the control group, $F(1, 56)= 10.64$, $p= .002$, and a significant probability x magnitude x group interaction $F(4, 53)=4.12$, $p=.006$, revealed that effort-based decision making in the ASD group was less influenced by reward probability and magnitude. No differences were detected between groups in response latency, number of trials completed successfully, or the flexibility in changing responses from one trial to the next, $p >.05$. Across both groups, proportion of hard task choices was positively correlated with the Insistence on Sameness scale of the IRB, $r(56)= .28$, $p= .04$, and negatively correlated with the number of lifetime interests as indexed by the IS, $r(54)= -.36$, $p= .009$.

Conclusions: These results suggest that individuals with ASD may make less efficient behavioral choices and may expend undue effort to obtain rewards. It also suggests that individual differences in this tendency are related to greater rigidity and a narrower range of interests (i.e., more circumscribed interests). Although further research is warranted, these findings may ultimately shed light on the atypical response to social rewards and non-social rewards (such as circumscribed interests) in ASD and may have implications for ASD interventions that use rewards to motivate learning (e.g., ABA).

141.132 132 Visual Shape Discrimination in Autism: Linking Low- and Mid-Level Perception. A. Perreault*[1], C. Habak[2], L. Mottron[3], F. Lepore[4] and A. Bertone[5], (1)*Perceptual Neuroscience Laboratory for Autism and*

Development (PNLab), (2)*Visual Perception and Psychophysics Lab, Université de Montréal, and Centre de Recherche, Institut Universitaire de Gériatrie de Montréal*, (3)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (4)*Centre de Recherche en Neuropsychologie et Cognition (CERNEC), Université de Montréal*, (5)*McGill University*

Background: Studies investigating visual perception in autism have for the most part assessed lower (local) and higher (global) levels of processing in isolation. It therefore remains unknown whether altered perception at one level affects processing in the other. This relationship can be investigated through the use of Radial Frequency Patterns (RFPs; Wilkinson et al 1998; Grinter et al 2010), spatial stimuli that target mid-level visual analysis, a processing level that is involved in object perception. RFPs are closed-contour shapes that can be manipulated to create "bumps" or Radial Frequencies (RFs) along their quasi-circular contours. When RFPs have fewer bumps (i.e. 2, 3, 5 RFs), global processing is needed to discriminate them from a perfect circle, whereas local processing is advantageous when RFPs contain many bumps (i.e. 10 or more RFs). By further manipulating the local physical attributes (i.e. luminance vs texture) defining an RFP's contour, one can assess whether a local attribute differentially affects global shape perception.

Objectives: To assess whether there is a functional relationship between low level and mid level visual processing in autism.

Methods: Eighteen autistic and 17 non-autistic participants, matched for full-scale IQ and age (range 14-31 years), were asked to discriminate between perfect circles and RFPs, whose contours contained 2, 3, 5, and 10 bumps, and were either luminance- or texture-defined. The size, or amplitude, of the bumps was varied: the larger the amplitude, the easier it is to discriminate a RFP from a perfect circle. RFP discrimination thresholds were measured using a method of constant stimuli and a 2-ATFC procedure. Participants were asked which of two successively presented stimuli contained the RFP (target); the other was a perfect circle (amplitude = 0). All participants had to complete a total of 8 experimental conditions.

Results: Separate 2 (groups) X 4 (RFs) mixed factorial analyses of variance were conducted for luminance- and texture-defined RFPs. For both analyses, no significant interaction was identified. A main effect of group was found for both luminance and texture conditions ($p < 0.01$), indicating that autistics performed significantly worse across all RF conditions assessed. However, mean differences between the autistic and the control group were significantly greater across texture-defined RF conditions. As expected, a main effect of RFs ($p < 0.01$) was also demonstrated across groups, with decreased RFP discrimination found for conditions with fewer (i.e. 2 and 3) RFs compared to more (i.e. 5 and 10) RFs for both autistic and control groups.

Conclusions: Our findings demonstrate that autistics are less able to discriminate visual shapes defined by RFPs, particularly when the contours are defined by texture information. This suggests that the type of local information (luminance vs. texture) defining a shape's contour differentially affects mid-level perception in autism. Such changes at low level, local visual processing, which are associated with altered mid-level perception, may in turn contribute to autistics' atypical high level perception of objects and faces.

141.133 133 Gender Differences in Autism Spectrum Disorder: Early Markers, Autism Manifestations and Cognitive Development From Birth to Preschool Age.

R. Joshi*[1] and C. Dissanayake[2], (1)*Olga Tennison Autism Research Centre,*, (2)*Olga Tennison Autism Research Centre*

Background: Few studies to date have investigated gender differences in core deficits in social interaction (SI) and vocal communication (VC) in infants and toddlers later diagnosed with an Autism Spectrum Disorder (ASD) nor have they combined observational measures with clinical reports to understand the development of any gender differences in these children. Thus, to date, little is known about how ASD develops and manifests in girls.

Objectives: Two complementary follow-up studies were conducted. The aim in the first study was to investigate gender

differences in early markers of autism during the first two years of life in children later diagnosed with an ASD. A secondary aim was to explore the relationship between these early markers and the severity of ASD at 24-months. The aim in the second study was to investigate gender differences in early cognitive development and autism manifestations from 24- to 48-months of age in the same children.

Methods: The sample comprised children from the SACS study (Barbaro & Dissanayake, 2010) which prospectively identified infants in the community who were at risk of an ASD through the Victorian Maternal and Child Health (MCH) system. The first study analysed observational data on the early development of SI and VC collected by MCH nurses across three time points: Time 1 (0- to-12-months); Time 2 (13- to-18-months); and Time 3 (19- to-24-months), for a cohort of 66 boys and 17 girls with an ASD. The second study included a subset of 45 boys and 13 girls to investigate gender differences across time (Time 1: 24-months; Time 2: 48-months) on their cognitive abilities as assessed using the Mullen Scales of Early Learning (MSEL; Mullen, 1995), and their autism severity as assessed with the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999).

Results: Two 2 (Gender) x 3 (Time) ANOVAs assessed gender differences in SI and VC in Study 1, with no significant gender differences or Gender X Time interaction effects. Furthermore, there were no correlations between early SI and VC scores and ASD severity scores at 24-months. Similarly, no gender differences were found in Study 2 as revealed in the two 2 (Gender) x 2 (Time) MANOVAs for the MSEL and ADOS assessments.

Conclusions: The combined results from both studies indicate a similar developmental trajectory in boys and girls later diagnosed with an ASD in both, early signs during the first two years of life, and from ages 2- to 4-years on cognitive ability and autism manifestations. These findings contrast with those from recent gender studies on toddlers with ASD. The cohort is unique in providing relevant data from birth to four years of age as, to date, no such prospective community-based sample has been examined in relation to gender differences. Such studies are needed to understand similarities and differences in the early progression of ASDs in girls and boys.

141.134 134 Is Learning by Observation Impaired in Individuals with Autism Spectrum Disorder?. F. Foti*[1], L. Mazzone[2], D. Menghini[3], F. Federico[4], L. De Peppo[3], L. Reale[5], M. Guarnera[6], S. Vicari[7] and L. Petrosini[1], (1)*Centro Europeo per la Ricerca sul Cervello (CERC)/Fondazione Santa Lucia*, (2)*Child Neuropsychiatry Unit, Department of Neuroscience, Bambino Gesù Children's Hospital, Rome, Italy*, (3)*U.O.C. Neuropsichiatria Infantile, Dipartimento di Neuroscienze, Ospedale Pediatrico Bambino Gesù*, (4)*University "Sapienza" of Rome*, (5)*U.O.C. Neuropsichiatria Infantile, Università di Catania*, (6)*Division of Child and Adolescents NeuroPsychiatry, Department of Pediatrics, University of Catania, Catania, Italy* , (7)*U.O.C. Neuropsichiatria Infantile, Dipartimento di Neuroscienze, Ospedale Pediatrico Bambino Gesù*

Background:

New competencies may be learned through active experience and observation of others' experiences. Observing another person performing a complex action accelerates the observer's acquisition of the same action, multiplies learning opportunities, limits the time-consuming process of learning by trial and error and reduces the practice needed to learn the skill. Therefore, learning by observation is an accelerator of learning which belongs to the same category of processes involved in recognizing, planning and executing actions. Thus, the mechanisms involved in observational learning are retained to be similar to those involved in experienced learning and influence each other. Observational learning does not just involve copying an action but it also requires that the observer transforms the observation into an action as similar as possible to that of the actor in terms of both the goal to be reached and the motor strategies to be applied. Actually, observing others' action involves generation of an image of oneself performing the same action. In other words, imitators can use third-person information to create first-person knowledge. Observational learning requires the coordination of complex cognitive functions such as action representation, attention, effort and motivation and at same time understanding others' gestures, reading their minds and emotions and making inferences about their behaviors. Given

that individuals with autism spectrum disorders (ASD) show atypical patterns of visual attention when observing social stimuli, we investigated whether differences in visual attention when observing an action to be imitated may affect learning by observation in patients with autism.

Objectives:

We designed the present research to study the features of learning by seeing and learning by doing in individuals with ASD. In particular, the following questions were addressed: Can individuals with autism learn novel actions via observation? Do they gain an understanding of action-effect relations? Though observational learning is a main focus of education and training, there are only few experimental research studies investigating these issues in children with autism.

Methods:

For this purpose, the performance of a group of individuals with ASD (mean age 10 years and 3 months, 10;03 SEM ± 0;08) was compared with that of an age- and gender-matched group of typically developing (TD) individuals on a task that involved learning a visuo-motor sequence of "correct" items. The participants learned the sequence either by performing the task after observing an actor detect the sequence (observational training) or by actually performing the task by trial and error.

Results:

Results demonstrate that ASD participants were able to learn a sequence by observation and became as efficient as TD participants in detecting a sequence by trial and error after a task of lerning by observation. Moreover, regardless of the learning modalities, ASD individuals exhibited a higher number of perseverative errors and longer times in comparison to TD participants.

Conclusions:

Our results demonstrate that in individuals with ASD the ability to learn by observation is not impaired. The present results have important implications for developing interventions to stimulate and improve learning in ASD children.

141.135 135 Cognitive ASSESSMENT of CHILDREN with ASD. J. Bellando*[1], T. Katz[2], E. Leuthe[3] and T. Clemons[4], (1)*University of Arkansas for Medical Sciences*, (2)*University of Colorado*, (3)*University of Colorado Denver School of Medicine - The Children's Hospital Denver*, (4)*EMMES Corp*

Background: Many children with autism spectrum disorders present with behavioral difficulties that necessitate the use of an abbreviated measure of intelligence. The authors of the Stanford- Binet Intelligence Scales, Fifth Edition (SB5) (Roid, 2003) report a correlation of .81 between the Full Scale IQ (FSIQ) and Abbreviated IQ (ABIQ) for children ages 2 to 5 and a correlation of .87 for children ages 6 and above. Coolican, et. al, (2008) examined the performance of children with ASD on the SB5 and determined that ABIQ scores accounted for 89.9% of the variance in the FSIQ, and that ABIQ overestimated FSIQ in 15 out of 17 cases.

Objectives: To determine the relationship between the SB5 ABIQ and FSIQ in a sample of children with ASD; to determine this relationship when the sample is stratified on level of cognitive functioning; and to determine the rate of false positives/negatives for children with scores above and below 70.

Methods: This study utilizes the Autism Treatment Network (ATN) Registry data. 519 children (male = 441; ages 2-17 years) who had a SB5 FSIQ (thus, generating an ABIQ) were included in the study. Correlations between the FSIQ and ABIQ and a regression analysis were performed to determine the proportion of variance in the FSIQ accounted for by the ABIQ. Subjects were also split into High Functioning (IQ >70) vs. Low Functioning groups. Correlation coefficients were run between ABIQ and FSIQ for these two groups. FSIQ scores and ABIQ scores were analyzed to examine the rate of false positives (ABIQ <70 and FSIQ > 70) and false negatives (ABIQ > 70 and FSIQ < 70).

Results: The correlation between the ABIQ and the FSIQ for the entire sample was r=.899 (p<.0001) and a regression using the FSIQ as the dependent variable showed a strong

relationship (r=.910, p<.0001) for the entire group. There was a weaker (but significant) correlation between ABIQ and FSIQ for the 212 subjects with IQ scores < 70 (r=.672) while the relationship between ABIQ and FSIQ for subjects with cognitive levels > 70 was stronger (r=.806, p<.0001). There was 90% agreement for individuals (n=178) who were low functioning on the FSIQ and the ABIQ (10% rate of false positive) and 85% agreement rate for individuals (n=341) who were high functioning on the FSIQ and the ABIQ (15% false negatives).

Conclusions: Results show a strong relationship between abbreviated and full cognitive measures of intelligence in a sample of children with ASD. Compared to Roid's rate of false positives for the SB5 standardization sample (<1%), we see an increased rate of false positives and false negatives. This suggests that while the ABIQ may both over and underestimate overall cognitive abilities, it is a valid estimate of intelligence.

141.136 136 Development of Visual Attention in Infants with Increased ASD Risk: A Longitudinal Assessment. R. Kincade*[1], E. J. H. Jones[1], K. M. Venema[1], M. Elsabbagh[2], M. H. Johnson[3] and S. J. Webb[1], (1)*University of Washington*, (2)*Centre for Brain and Cognitive Development, Birkbeck*, (3)*Centre for Brain and Cognitive Development, Birkbeck, University of London*

Background:

Infants who have an older sibling with ASD are at greater risk of receiving an autism diagnosis than the general population (Ozonoff et al., 2011). By identifying early risk markers, diagnosis and intervention can occur earlier and may increase effectiveness. It has been suggested that atypical visual attention may be an early risk marker, yet the evolution of visual attention in at-risk infants over time is not well known (Elsabbagh et al., 2007). Tracking the differences in attention performance between high-risk and low-risk infants longitudinally may help identify the age at which visual attention is most vulnerable.

Objectives:

To examine visual attention performance in infants with (high-risk) and without (low-risk) siblings with ASD at 6, 12, and 18 months.

Methods:

Participants were 24 high-risk siblings with an older sibling with ASD and 37 low-risk siblings with no family history of ASD. Assessments occurred at 6, 12, and 18 months. Both groups participated in the "gap-overlap" task, where reaction time to disengage from a central to peripheral stimulus was measured. There were three trial types: baseline (central stimulus disappears as peripheral stimulus appears), overlap (central stimulus remains on screen with peripheral stimulus), and gap (central stimulus disappears before the peripheral stimulus appears). The difference in overlap and baseline trials is believed to reflect efficiency in attention disengagement. Differences between gap and baseline trials are thought to indicate recognition of visual facilitation.

The task was repeated twice, with different stimulus sets, at each age point. At Visit 1, the task was administered at the end of the visit (approximately 1.5 hours after arrival) and at Visit 2 the task was administered before the visit. All data at 6 and 12 months have been collected; collection at 18 months is ongoing.

Results:

The reaction time for the overlap trial was significantly slower than the baseline and gap trials for both high-risk and low-risk groups. Both groups also showed a significantly faster reaction time in the gap trial than baseline or overlap trials. Preliminary analyses showed that 6-month-old high-risk infants, when performing the task at the beginning of the visit, showed similar disengagement trends to the control infants. When the task was performed after participating in other tasks, the high-risk group showed significantly slower disengagement than the low-risk group, replicating previous reports (Elsabbagh et al., 2009).

Conclusions:

The significant effect of trial type on 6-month-old infants' reaction time replicates previous findings. At 6 months, the

high-risk group demonstrates greater variability in performance depending on when the measurement was collected. Further analysis of 12 month and 18 month data will address age-related effects.

141.137 137 Parent Report of Executive Functioning in Individuals with a History of ASDs Who Have Achieved Optimal Outcomes. E. Troyb*[1], A. Orinstein[1], K. E. Tyson[1], M. A. Rosenthal[2], M. Helt[1], L. O'Connell[3], J. Suh[1], I. M. Eigsti[1], E. A. Kelley[3], M. C. Stevens[4], R. T. Schultz[5], M. Barton[1] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Center for Autism Spectrum Disorders, Children's National Medical Center*, (3)*Queen's University*, (4)*Institute of Living, Hartford Hospital / Yale University*, (5)*Children's Hospital of Philadelphia*

Background: A study is currently following children and adolescents who have a history of autism spectrum disorders (ASDs), but who no longer meet diagnostic criteria for such a disorder. These individuals have achieved social and language skills within the average range for their ages and receive little or no school support. Several recent studies suggest that this small subset of individuals, once diagnosed with ASDs, achieve "optimal outcomes" (OO, Sutera et al., 2007; Kelley, Naigles & Fein, 2010; Helt et al., 2008).

Objectives: This study examines parent report of executive functioning (EF) among children and adolescents who achieved OO.

Methods: Parents of 28 individuals who achieved OO completed the Behavior Rating Inventory of Executive Function (BRIEF) and their responses were compared to parent responses of 25 high-functioning individuals with a current ASD diagnosis (HFA), and 31 typically developing peers (TD). The BRIEF provides a *Global Executive Composite* score and measures eight domains of EF: *Inhibit, Shift, Emotional Control, Initiate, Working Memory, Organization of Materials, Monitor,* and *Planning and Organizing*. Higher scores indicate greater degree of impairment and scores at or above 65 indicate potentially clinically significant executive dysfunction. The groups were matched on age (M=13.28), gender and nonverbal IQ; however the groups differed significantly on verbal IQ (M(HFA)=106.81, M(OO)=115.36, M(TD)=112.04, F=7.50, p<0.01).

Results: Parent responses on the BRIEF indicated that the mean scores of the OO and TD groups did not fall in the clinically significant range on any of the subscales. Although the *Global Executive Composite* score of the OO group was significantly higher than the TD group, it was still well within the average range (M(OO)=49.52, M(TD)=43.03). The OO groups' scores on the *Inhibit*, *Emotional Control,* and *Working Memory* subscales were also significantly higher than those of the TD group, but still fell in the average range. Additionally, the OO group received significantly lower scores than the HFA group on the *Global Executive Composite* (M(OO)=49.52, M(HFA)=65.29) and on all of the subscales of the BRIEF. Mean scores of the HFA group fell in the clinically significant range on the *Shift* and *Monitor* subscales.

Conclusions: Results of this study suggest that according to parent report the executive functioning in individuals who achieved OO is intact. IQ-matched individuals in the TD group appeared to exhibit well developed EF, commensurate with their above-average IQs. While the OO group scored solidly in the average range, their scores were lower than in the TD group, suggesting that the OO group does not have the above-average EF scores despite their high-average IQs. Performance in the HFA group suggested clinically significant deficits in their ability to switch from one activity to another and in their ability to monitor their performance.

141.138 138 Stability of Cognitive and Adaptive Behaviour Standard Scores in Preschool Children with Autistic Spectrum Disorders. H. E. Flanagan*[1], I. M. Smith[2], T. Vaillancourt[3], E. Duku[4], P. Szatmari[4], S. E. Bryson[2], E. Fombonne[5], P. Mirenda[6], W. Roberts[7], J. Volden[8], C. Waddell[9], L. Zwaigenbaum[8] and S. Georgiades[4], (1)*IWK Health Centre*, (2)*Dalhousie University/IWK Health Centre*, (3)*University of Ottawa*, (4)*Offord Centre for Child Studies, McMaster University*, (5)*Montreal Children's Hospital*, (6)*University of British Columbia*, (7)*The Hospital for Sick Children*, (8)*University of Alberta*, (9)*Simon Fraser University*

Background: In school-aged children with autistic spectrum disorders (ASD), standard scores on cognitive and adaptive measures are considered to provide meaningful prognostic information and may be used to identify intellectual disability.

In preschoolers with ASD, the stability of cognitive and adaptive behaviour scores is less clear. New measures may affect the stability of early scores, and increasing access to early intervention may influence developmental trajectories.

Objectives: This study examines the stability of cognitive and adaptive standard scores between the preschool period and age 6 in three cohorts of children initially assessed at age 2, 3, or 4 years.

Methods: Data came from a longitudinal study of Canadian children with ASD (*Pathways in ASD*). The present study employs assessment data from age of diagnosis (at 2, 3, or 4 years), approximately one year later, and at age 6. Cognitive skills were assessed using the Merrill-Palmer-Revised Scales of Development (complete data for $n = 207$), and adaptive skills were assessed using the Vineland Adaptive Behavior Scales, 2nd ed. (complete data for $n = 212$).

Results: All three cohorts showed large gains in cognitive standard scores by age 6 ($p \leq .001$), with mean increases of 19, 17 and 16 points for those initially assessed at ages 2, 3, and 4 respectively. Adaptive behaviour standard scores were more stable, with mean gains of approximately 4 points for 3- and 4-year-olds ($p < .001$; these changes took place in the year following diagnosis). Fifty-seven percent of 2- and 3-year-olds and 47% of 4-year-olds experienced a significant increase in cognitive functioning (≥ 15 points) by age 6. Significant gains in adaptive functioning were less common, especially for 4-year-olds (~ 14% of 2- and 3-year-olds; 5% of 4-year-olds; $p < .001$). Significant decreases in scores were observed for some 2-year-olds (14% cognitive; 10% adaptive) and 3-year-olds (13% cognitive; 3% adaptive), and a few 4-year-olds (4% cognitive; 0% adaptive). Additional analyses will explore trajectories of change and predictors of outcome (e.g., intervention variables) using growth curve analysis.

Conclusions: Understanding the stability of measures of ability in children with ASD is important clinically, affecting such decisions as measure selection, feedback to families, and treatment planning. These results suggest caution in using very early standard scores to provide prognostic statements about cognitive ability – due to potential for significant increases. Adaptive behaviour scores appear more stable, and may provide more useful prognostic information. Changes over time may be influenced by a range of factors, including access to interventions.

Sponsors: Canadian Institutes of Health Research, Autism Speaks, Government of British Columbia, Alberta Innovates-Health Solutions, Sinneave Family Foundation.

141.139 139 Uncovering the Role of Executive Functioning in Children's Cognitive Biases. S. B. Vanegas*, D. Davidson and M. Falotico, *Loyola University Chicago*

Background: Due to the rising prevalence of autism spectrum disorders (ASD), it is important to understand how children with ASD learn and apply this information to educational strategies. Presently, three cognitive theories of autism propose distinct interpretations of how children with autism learn and function in their daily surroundings. The Weak Central Coherence (WCC) theory suggests that children with ASD focus on the details or local information and exhibit difficulties in deriving meaning and processing global information (Happé & Frith, 2006). In contrast, Systemizing theory proposes that children with ASD not only excel with details but also learn in a more systematic fashion, evaluating predictable relationships or rule-based systems (Baron-Cohen, 2002). Executive Dysfunction theory may present as the link between cognitive biases as proposed by WCC and Systemizing theory. Although these theories propose distinct interpretations of cognitive styles in children with ASD, it is imperative to understand how these theories can be reconciled with children's behaviors as well as their relation to other cognitive functions.

Objectives: The purpose of this research project is to evaluate whether children with autism are biased towards local, global, or rule-based information more so than typically developing (TD) children, and the role executive function may play in children's cognitive biases.

Methods: Children with ASD (i.e., High-functioning Autism, Asperger Syndrome, PDD-NOS), and TD children between 7 and 11 years of age were included in the present study. Weak Central Coherence was assessed using the Children's Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) and the Sentence Completion Test (Booth & Happé,

2010). Systemizing abilities were assessed using the Picture Sequencing Test (Baron-Cohen, Leslie, & Frith, 1986) and the Systemizing Quotient - Child Version (Auyeung et al., 2009). Children's executive functioning was assessed using the Behavior Rating Inventory of Executive Functioning (Gioia et al., 2000) and the Wisconsin Card Sorting Test (Kongs, Thompson, Iverson, & Heaton, 2000); core language abilities were evaluated with the Clinical Evaluation of Language Fundamentals (Semel, Wiig, & Secord, 2003). Autism traits were also evaluated using the Autism Spectrum Quotient – Child Version (Auyeung et al., 2008) to assess the role of autism traits on cognitive biases.

Results: Preliminary results showed that children with ASD do not differ from TD children on local, global and rule-based processing. However, there were significant differences in parent-reported executive dysfunction, $t(23)=4.739$, $p< .01$ and parent-reported autism traits, $t(23)= 6.874$, $p< .01$ between children with ASD and TD children. Importantly, further analyses showed that executive dysfunction and autism traits predicted systemizing behaviors and preferences, but only in children with ASD, $R^2=.415$, $F(2, 12)=4.256$, $p<.05$. No differences were observed between different ASD diagnoses (i.e., High-Functioning Autism, Asperger Syndrome, and PDD-NOS).

Conclusions: The preliminary results indicate that children with ASD may not differ from TD children in their cognitive biases, although the underlying processes may be distinct, as evidenced by differences in executive functioning. This suggests that children with ASD engage in distinct cognitive strategies to process new information.

141.140 140 Action Prediction in Children with Autism Spectrum Disorder. T. Falck-Ytter*[1], C. von Hofsten[2], C. Gillberg[3] and E. Fernell[4], (1)*Karolinska Institute*, (2)*Uppsala University*, (3)*The Gillberg Neuropsychiatry Centre, Sahlgrenska Academy, Gothenburg University*, (4)*Autism Centre for Young Children, Handicap and Habilitation*

Background: Predicting others' action goals is a basic social skill. Predictive eye-movements in action observation have been linked to the Mirror Neuron System (MNS). Very few studies have investigated predictive eye movements in ASD. Whether the MNS is matching observed actions to motor plans as efficiently in Autism Spectrum Disorder (ASD) as in neurotypical individuals is a matter of debate. In particular, it has been argued that children with ASD fail to activate a representation of the final state of an action sequence during its initial acts.

Objectives: The main aim of the study was to investigate whether prediction of an initial act is influenced by the ambiguity of the final goal of the sequence. It was hypothesized that this would be the case in neurotypical, but not in ASD. In addition, we wanted to illuminate the relationship between predictive gaze performance and the level autistic symptoms and adaptive functioning.

Methods: Eye-tracking was used to measure gaze as children (6-year-olds) with Autistic Disorder (AD, n = 40), Pervasive Developmental Disorder (PDD, n = 25) and typical development (TD, n = 21) looked at an action sequence presented on a computer monitor. The sequence consisted of a two-step action: pick up object and move it to a final location. While keeping movement parameters and initial goal constant, we changed the final goal of the sequence. In one condition, the final goal was ambiguous, and in another it was unambiguous. In a third control condition, the final goal was occluded.

Results: For the reach-to-grasp actions toward the object, there was no group difference and no effect of condition. During the latter phase, when the object was moved to the final goal, there was an effect of condition, but not of group. This effect could be explained by reactive gaze in the occluded goal condition. The groups predicted the ambiguous and unambiguous actions to a similar degree, but substantial individual differences were observed in the AD group. Children with AD who arrived with their gaze at the goal after the arrival of the hand (reactive performance) had lower levels of adaptive functioning than their 'predictive' peers, but these groups were equal in terms of the level of autistic symptoms.

Conclusions: In line with a previous small sample study, the present data suggest that on a group level, children with ASD use similar eye-movements in action observation as neurotypical individuals. That ambiguous and unambiguous

actions elicited predictive eye movements to a similar existent suggests that prediction in this context reflects a bottom-up process activated by the sight of a hand approaching a goal object, irrespective of the congruency between the initial act and the final goal. Importantly, the results suggest that prediction is more related to the level of adaptive functioning than to autism specific symptomatology.

141.142 142 The Endophenotype of Executive Function: A Pilot Study in Twins. A. Kresse*, S. Faja, S. J. Webb and R. Bernier, *University of Washington*

Background: Autism Spectrum Disorder is a heterogeneous disorder, marked by impairments across multiple domains, including social processing, communication, and executive function (EF). Given the varied distribution of impairment and functioning, it may be that ASD is comprised of distinct endophenotypes, which may be inherited separately and exist in individuals even in the absence of the full disorder. One way to measure this hypothesis is to look at these traits in monozygotic (MZ) and dizygotic twins (DZ).

Objectives: This pilot study will examine the potential for measuring EF as an endophenotype of autism, and help to determine the types of measures that may be most sensitive to the elements of EF that are shared within MZ and DZ twin pairs. We will examine performance on a battery of EF tasks and determine which show high levels of performance similarity within twin pairs. To ensure that the measure is also sensitive to the EF impairments present in autism, we will also compare the performance of ASD individuals to that of typically developing individuals.

Methods: Preliminary data was available for ten pairs of twins (8 MZ, 2 DZ) ages 8 to 21. Individuals tested included both typically developing individuals (N = 13) and those with autism (N = 7). Behavioral tasks included three Delis-Kaplan executive function (D-KEFs) battery subtests: Trail Making, Verbal Fluency, and Design Fluency (Delis et al., 2001). The parent and teacher Behavior Rating Inventory of Executive Function (BRIEF) were collected (Gioia et al, 2000).

Results: Scores on the verbal fluency tasks were correlated within twin pairs for overall letter fluency, r (7)= .7, p = .05. Performance on this task was significantly higher in typically developing individuals (M = 12.2, SD = 3.0) compared to individuals with ASD (M = 9.2, SD = 2.6), t(17) = 2.2, p = .04.

The global executive composite score derived from the BRIEF was significantly correlated within twin pairs for both parent report, r (8)= .9, p < .01, and teacher report, r(8) = .9, p < .01. In both cases, individuals with autism were rated as having poorer EF skills than those with typical development, p<.001.

Conclusions: In our small sample of preliminary data, the BRIEF questionnaire (parent and teacher) and the DKEFs letter fluency showed strong correlation within twin pairs and sensitivity to ASD impairment. The BRIEF questionnaire provides a broad view of an individual's executive functioning as a whole. The letter fluency task of the DKEFs provides more specific information about EF skills as it requires individuals to call on EF skills such as organization, initiation, and systematic retrieval. Data collection is ongoing.

141.143 143 Dot Prototype Formation in Infants: A Comparison of Infants At High- and Low-Risk for Autism Spectrum Disorder. H. Z. Gastgeb*, K. W. Chua, E. M. Dundas and M. S. Strauss, *University of Pittsburgh*

Background: Categorization is a critical cognitive ability that reduces demands on memory and allows individuals to focus on important aspects of objects while ignoring irrelevant details. Critical to categorization is the ability to abstract prototypes. Infants are able to form categories and prototypes of dots, objects, and faces within the first year of life (de Haan et al., 2001; Strauss, 1979; Younger 1990; Younger & Gotlieb, 1988). However, there is growing evidence suggesting that individuals with autism spectrum disorders (ASDs) have difficulty with aspects of categorization and prototype formation (Gastgeb et al., 2006, 2009, in press; Klinger & Dawson, 1995, 2001; Vladusich et al., 2010). Despite this, little is known about the origin of these difficulties.

Objectives: To examine the origin of prototype formation difficulties by investigating dot prototype formation ability in 6-, 11-, and 16-month-old infants who were at either high- or low-risk for developing ASD.

Methods: Infant siblings of children with ASD (high-risk infants; HR) and infant siblings of typically developing children (low-

risk infants; LR) matched on verbal, nonverbal, and total DQ scores on the Mullen were tested using a procedure modeled after Younger & Gotlieb (1988). Infants were shown six familiarization stimuli from a dot pattern category and then four test stimuli. Familiarization stimuli consisted of two paired dot patterns. First, two within category test trials were presented (prototype paired with a previously seen dot pattern), then two between category test trials were presented (prototype paired with a dot pattern from a novel category). Eye-tracking was used to determine the infants' fixation times.

Results: For within category trials, neither LR nor HR infants showed evidence of prototype formation at 6 months. However, LR infants demonstrated a novelty preference for the previously seen dot patterns at 11 and 16 months, indicating that they formed a prototype. HR infants did not demonstrate a novelty preference for either dot pattern at any age. For between category trials, all infants at all ages demonstrated a novelty preference for novel dot patterns, indicating that even though HR infants did not show evidence of prototype formation, they formed a category of dot patterns. The eye-tracking data indicated that group differences were not due to the amount of time spent looking at the familiarization dot patterns or differences in how extensively the infants scanned the dot patterns during test trials.

Conclusions: Results are consistent with previous studies that found deficits in prototype formation in individuals with ASD and extend these deficits to HR infants. Since the HR infants are yet not old enough to be diagnosed with respect to ASD, it is unknown whether prototype formation difficulties will be predictive of an ASD diagnosis or whether they represent difficulties present in the broader autism phenotype. It is possible that the results are reflective of a general difficulty with implicit learning and reduction of information into a statistical summative or central representation in HR individuals and/or individuals with ASD.

141.144 144 The Shell Game: Investigating Spontaneous Response to Gaze Cueing of Attention in Children with High Functioning Autism. S. Congiu*[1], R. Fadda[2] and G. S. Doneddu[1], (1)*Center for Pervasive Developmental Disorders, AOB*, (2)*University of Cagliari*

Background:

Deficits in joint attention development characterize autism and are thought to hinder social development and early language acquisition (Mundy & Burnette, 2005), therefore response to gaze cueing -the ability to shift visual attention in response to the observed eye gaze direction of another person- has been investigated in autism using different paradigms: Posner-style gaze-cueing tests demonstrated that purely reflexive perceptual aspects are intact even in very young children with autism (Chawarska et al., 2003; Swettenham et al. 2003) while performance in explicit gaze direction detection judgment tasks is impaired in older ones (Riby & Doherty 2009). However the use of verbally demanding tasks and explicit judgments about gaze-direction can be problematic when testing young children with autism.

Objectives:

We aimed to evaluate spontaneous response to gaze cueing of attention in young children with autism by means of an experimental stimulus in which an implicit goal elicits spontaneous response to gaze-cueing, while free visual explorations of the stimuli are recorded with an eye tracker.

Methods:

18 children with high-functioning autism (mean age 6.4 years, SD 2.1) and 18 age-matched controls (mean age 6.3 years, SD 1.10) participated. Participants were simply instructed to look at the videos presented with a Tobii-T60 eye-tracker. Each child saw 2 demonstrations and 2 test videos depicting an actor hiding an object under one of two identical opaque glasses, rotating them and then looking laterally for three times (without head turn) towards the glass that covered the object, before lifting it up. The hiding process was either visible (2 demonstrations) or hidden behind a screen (2 tests) thus in the demonstrations the observer could ignore the gaze-cue in order to find the object, while in the experimental conditions the gaze cue was the only visible feature leading to it. Statistical analysis compared fixations to key areas of the stimuli, namely Eyes, Gaze-Target and Non-Gaze-Target, qualitative analysis on gaze patterns evaluated response to gaze cueing.

Results:

The group comparison found statistically significant differences in attention towards the Gaze Target: Children with autism showed shorter fixations on the Gaze Target ($p = 0.035$) and spent lower time exploring it ($p = 0.054$). The qualitative analysis of the visual fixation patterns confirmed that children with autism as a group had a reduced tendency to follow the gaze cue (37% accuracy), compared to typical controls (82% accuracy). Finally, paired samples t-tests within groups showed that control children made a significantly higher number of fixations to the Target Vs the Non Target ($p=0.007$), spent a significantly higher time on the Target rather than on the Non Target ($p = 0.002$) and made longer fixations to it ($p<0.001$) while no statistically significant differences were found for children with autism suggesting an inefficient differentiation between Target and Non target.

Conclusions:

Our data suggest that even though children with autism were less efficient than controls in perceiving and flexibly following the eye gaze cue they showed considerable residual gaze following abilities. Implications for treatment and further research will be discussed.

141.146 146 Resilience and Executive Functions in Children with High Functioning Autism Spectrum Disorders. A. A. Altomare*, A. McCrimmon, R. L. Matchullis and K. Jitlina, *University of Calgary*

Background: Executive functions (EFs) are complex neuropsychological processes that include planning, cognitive and behavioural flexibility, inhibition, selective attention, and working memory. Researchers investigating EFs in children with High-functioning Autism Spectrum Disorders (HFASDs) have identified significant impairments in this domain. However, the link between cognitive flexibility, social deficits, and resiliency in children has yet to be examined. Given that cognitive flexibility is theorized to be related to social skills, the nature of the relationship between these domains and their impact upon resilience, or the ability to overcome adversity, is an important area of further investigation.

Objectives: The current study explores the nature and strength of the relationships among cognitive flexibility, social skills, and resilience in children with HFASDs.

Methods: Participants included 25 children ages 8-12 with Asperger's syndrome, high functioning autism, or Pervasive Developmental Disorder - Not Otherwise Specified, and 25 age- and gender-matched typically developing controls. Cognitive flexibility was examined via the behaviourally-based Behavior Rating Inventory of Executive Functioning (BRIEF) and the Delis Kaplan Executive Function System (D-KEFS). Resiliency was examined via the Resiliency Scales for Children and Adolescents (RSCA), and social skills were examined via the Social Skills Improvement System (SSIS). Comparisons between the two participants groups were conducted to investigate group differences. Correlational analyses were then conducted to examine the nature of the relationship between these domains in the HFASD population.

Results: Preliminary results indicate that children with HFASDs demonstrate significantly impaired cognitive flexibility, as measured by the Shift subdomain of the BRIEF, when compared to normative data. Preliminary results also indicated a significant moderate positive correlation between self-reported social skills and the Sense of Mastery scale score of the RSCA. Lastly, preliminary results indicate significant positive correlations between the Word Context subtest of the D-KEFS, which measures cognitive flexibility, and both the Sense of Mastery and Sense of Relatedness scales of the RSCA.

Conclusions: The current study provides additional support that children with HFASDs demonstrate impaired cognitive flexibility. Additionally, results suggest that social skills and cognitive flexibility are related to resiliency in this population. Subsequent work can build on this information by developing targeted interventions that build on and strengthen EFs and other potentially related factors within children diagnosed with HFASDs to enhance social skills and resilience in this population.

141.147 147 Piaget's "A-Not-B Task" in Infants At High and Low Risk for ASD. T. St. John*[1], A. M. Estes[2], G.

Dawson[3], S. R. Dager[2] and A. IBIS Network[4], (1)*University of Washington Autism Center*, (2)*University of Washington*, (3)*Autism Speaks, UNC Chapel Hill*, (4)*UW, UNC, WASTL, CHOP*

Background: The A-not-B task is one of the classic tests of human cognitive development in the first year of life. This task, developed by Piaget, is based on the theory of object permanence and requires an infant to find a hidden toy in one of two possible locations. The toy is initially hidden at Location A while the infant is watching. After the infant has successfully found the hidden toy on two consecutive trials, the side of hiding is reversed to Location B. The A-not-B error occurs when, after a reversal, the infant reaches for the hidden toy at the previous location. Performance is known to improve with age. By 12 months of age infants can find the hidden toy correctly even after reversals with up to 10 second delays between hiding and searching. This task requires working memory, response inhibition, and goal-directed behavior.

Objectives: To assess whether performance on the A-not-B task at 12 months is associated with 1) overall developmental level, 2) temperament, and 3) autism risk signs.

Methods: Participants are part of a larger, multi-site, longitudinal study of behavior and brain development in infants at high and low risk for ASD (ACE Infant Brain Imaging Network). Data from infants at 12 months will be reported and data collection is on-going. In the A-not-B task, a total of 24 5s and 12s delay trials will be used. 12s delay trials are administered only if the toy is successfully retrieved on two consecutive trials at the 5s delay and two reversals are completed. Two scores will be investigated; overall proportion of correct reaches at 5s and 12s, and proportion of correct reaches on reversal trials. Developmental level will be assessed with the Mullen Scales of Early Learning. Temperament will be assessed with the Infant Behavior Questionnaire-Revised. Autism-specific risk signs will be assessed using the Autism Observation Scale for Infants.

Results: Descriptive data on the A-not-B task will be presented (e.g., number of children who successfully pass the 5 s delay and the 12 s delay at 12 months). We hypothesize that at 12 months of age: 1) higher developmental level will be associated with better performance on the A-not-B, 2) temperament measures will be associated with performance on the A-not-B, and 3) increased autism risk signs will be related to poorer performance on the A-not-B.

Conclusions: The current investigation will provide evidence regarding whether difficulties on the A-not-B task, tapping the domains of working memory, response inhibition, and goal-directed behavior, are associated with cognitive development, temperament, and autism risk signs at 12 months of age. Future studies are needed to investigate whether difficulties on the A-not-B may be related to early risk for the later emergence of ASD symptoms in high-risk infants.

141.148 148 Executive Functioning in High-Functioning Autism Spectrum Disorders Assessed by Neuropsychological Tests and Parent's Reports: Its Relationships with Adaptive Functioning. M. Rosa*, O. Puig, V. Vallés, S. Lera and R. Calvo, *Hospital Clínic de Barcelona*

Background: Some previous studies in high-functioning austim spectrum disorders (HF-ASD) have showed impairments in executive functions, as in planning, inhibitory control, flexibility and working memory (Ozonoff, et al. 2004; Robinson, et al., 2009). However, no conclusive results have been obtained (Hill et al., 2004) and the study of executive dysfunction in these children has been amply critized for its excessive reliance in laboratory measures (Gilotty, et al., 2002). Others measures have been used for evaluating executive functioning, as parent's rated questionnaires which assess the child's daily functioning. By using these questionnaires, it have been founded great impairments in executive functioning, especially in flexibility (Gioia, et al., 2002) and it have been reported that the areas most associated with adaptive functioning were initiative and working memory (Gilotty, et al., 2002; Janusz, et al., 2002). Preliminary results of a large cognitive study in HF-ASD children are presented.

Objectives: The aims of the present study is to analyze the executive functioning of children with HF-ASD with both, neuropsychological tests and parent's rated questionnaires, and to determine which areas of the executive functioning are related with the adaptive functioning.

Methods: 11 male children with HF-ASD and 10 healthy comparison children were assessed. Both groups did not differ in age, which ranged between 7 and 12 years (ASD mean= 10.08, SD= 1.95; HC mean= 9.86, SD= 1.68). All patients fulfilled ASD criteria on DSM-IV and ICD-10 and ASD diagnosis were confirmed with the Autism Disorder Interview (ADI-R). Inclusion criteria included an IQ above 70 in all participants. All subjects were evaluated with a neuropsychological battery administered by a blind psychologist. Two parent reports were also administered, the Behaviour Rating Inventory of Executive Function (BRIEF), which evaluates the child's executive functioning in daily life, and the Vineland Adaptative Behavior Scale (VABS), which evaluates the child's adaptive functioning in all areas of daily life.

Results: Children with HF-ASD made significantly more errors than comparison children in flexibility when assessed with neuropsychological tests ($p= 0.04$) but it was not significantly associated with adaptive functioning. Parents' questionnaires results showed that HF-ASD children have important difficulties in all areas of executive functioning (BRIEF) ($t > 2.59$, $p < 0.019$) and in several areas of adaptive functioning (VABS) ($t > -2.15$, $p < 0.046$). When we correlated the results of both questionnaires administered to parents with each other, impairments in BRIEF inhibitory control emerged as the executive function most associated with VABS social ($r= -0.845$, $p= \leq 0.01$) and communication difficulties ($r= -0.676$, $p= \leq 0.05$). Working memory was associated with impairment in academic tasks ($r= -0.709$, $p= \leq 0.05$).

Conclusions: In this sample, HF-ASD children showed generalized deficits in everyday life executive functioning when parents inform and in flexibility when assessed with neuropsychological tests. The association between deficits in parents' reported inhibitory control and working memory with adaptive difficulties, showed the importance of intervention in the executive deficits in these children and that parental information is clinically useful for assessing everyday life, executive and adaptive deficits in HF-ASD.

141.149 149 Evaluative Conditioning in Persons with ASD. M. E. Crisler*[1], P. S. Powell[1], L. G. Klinger[2] and M. R. Klinger[1], (1)*University of Alabama*, (2)*TEACCH, University of North Carolina School of Medicine*

Background:

Studies on individuals with Autism Spectrum Disorder (ASD) report preferences for nonsocial stimuli (i.e., a bell) compared to social stimuli (i.e., a voice; Werner, Dawson, Osterling, & Dinno, 2000). The capacity for persons with ASD to learn social information, despite this lack of preference, is less clear. Indeed, findings have been mixed regarding whether individuals with ASD have difficulty distinguishing between emotions (Harms, Martin, & Wallace, 2010; Rump, Giovannelli, Minshew & Strauss, 2009). Social learning has been assessed in typically developing individuals through evaluative conditioning and priming tasks, but these tasks have not been extensively used in persons with ASD (Field 2006; Kamio, Wolf, & Fein, 2006). Evaluative conditioning tasks present a neutral stimulus followed by a stimulus that requires an evaluative judgment (e.g., social stimuli) that is then associated with the neutral stimulus.

Objectives:

For the current study, we used an evaluative conditioning task to test whether persons with ASD show social learning when neutral cartoon characters are associated with faces displaying happy expressions as opposed to angry expressions. We predicted that individuals with typical development would prefer characters associated with the happy face. If social learning is impaired in ASD, we predicted that individuals with ASD would show no preference for characters associated with a happy or angry face.

Methods:

Sixteen high functioning young adults with ASD and 15 age-matched young adults with typical development completed a computer task that paired cartoon characters with happy faces, angry faces, or a nonsocial stimulus (i.e., a gray box). Across 315 trials, each of the 12 cartoon characters was paired with either a happy face, angry face, or gray box approximately 26 times. After the learning phase, participants completed forced choice/likert ratings indicating which characters they preferred.

Results:

Emotional expression did not affect preferences for either diagnostic group. However, a significant interaction of diagnosis with social versus nonsocial pairing was indicated, $F(1, 29)=4.12$, $p=.05$, $\eta_p^2=.12$, with significantly higher preferences reflected in the ASD sample for characters paired with nonsocial (gray square) stimuli ($M=67.81$, $SD=17.28$) compared to social (faces) stimuli ($M=57.48$, $SD=13.81$). Typically developing participants preferred characters paired with social stimuli ($M=59.55$, $SD=11.68$) over nonsocial stimuli ($M=50.17$, $SD=23.69$), though this difference was not significant.

Conclusions:

Results of this study suggest that persons with ASD showed evidence of evaluative conditioning, with those characters paired with a nonsocial stimulus being preferred to those characters paired with faces. That is, learning occurred but individuals with ASD did not show a preference for any characters associated with social stimuli. While research on preferences for nonsocial stimuli in persons with ASD has largely focused on children, this study lends support for the nonsocial preference continuing into young adulthood and affecting learned information.

141.150 150 Differences in the Multisensory Temporal Binding Windows of TD and ASD Individuals As a Function of Stimulus Complexity. J. K. Siemann*[1], R. A. Stevenson[2], B. C. Schneider[1], H. E. Eberly[1], T. G. Woynaroski[1], J. H. Foss-Feig[1], S. M. Camarata[2] and M. T. Wallace[2], (1)*Vanderbilt University*, (2)*Vanderbilt University Medical Center*

Background:

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by deficits in three core domains: communication, social behavior, and restricted/repetitive interests. Kanner also described sensory processing abnormalities in ASD individuals, and there have been a number of studies describing sensory deficits that span multiple modalities. While these sensory and multisensory deficits are interesting on their own, their connection to the core domains of autism dysfunction remains poorly defined.

Objectives:

One area of critical importance for effective multisensory processing is the temporal structure of the stimuli that are being combined. Given the known changes in temporal function in autism, deficits in multisensory integration could occur if temporal processing mechanisms associated with combining cues are abnormal. An effective way to measure multisensory temporal function is the temporal binding window (TBW), the interval within which a stimulus pair is perceptually bound into a unified event. The goals of this project were to investigate and compare the multisensory TBWs of typically developed (TD) and ASD individuals as a function of stimulus complexity. Specific hypotheses include the expectation that individuals with ASD will have wider TBWs, and that more complex stimuli will be associated with wider TBWs. As a corollary of this, we expect as stimulus complexity increases, between-group differences in TBWs will increase as well.

Methods:

40 TD and 24 ASD individuals (4-18 yo) completed a simultaneity judgment task to measure their TBWs using three levels of stimulus complexity: low-level visual and auditory stimuli (simple flashes and beeps), complex inanimate objects (handheld tools), and complex animate stimuli (speech). In all cases, the auditory and visual components were paired with parametrically varied levels of asynchrony, which varied from 0-500 ms in both auditory-leading and visual-leading configurations. The participants' task was to report whether the events occurred simultaneously.

Results:

We observed a main effect of group with ASD individuals having a wider TBW than TD individuals. That is, collapsing across levels of complexity, ASD individuals were more likely to report that asynchronous stimuli were synchronous compared to their TD counterparts. Also, we observed a main effect of stimulus complexity, with increasing stimulus complexity being associated with a wider TBW. Most importantly, a significant group by complexity interaction was

measured, such that as the stimuli became more complex, ASD individuals' TBWs widened to a greater extent than for TD individuals'. Additional analyses also revealed that the TBW of ASD individuals was more symmetrical than for TD individuals'.

Conclusions:

These findings demonstrate that ASD individuals have deficits in the temporal processing of multisensory stimuli, and this effect grows with increasing stimulus complexity. Such results have important implications for better understanding how (multi)sensory deficits contribute to the changes in higher-order domains such as communication and social interactions seen in ASD. Perhaps most importantly, the hierarchal nature of the changes seen here suggest important mechanistic links between the differing levels of multisensory integration and binding – links that could potentially be capitalized upon in the development of remediation tools and methods to improve sensory function in ASD.

141.151 151 Math Ability in Autism Spectrum Disorders. M. J. Brosnan*[1], E. L. Ashwin[2], H. Johnson[2], B. Grawemeyer[2] and L. Benton[2], (1)*University of Bath*, (2)*Bath University*

Background: Autism spectrum disorders (ASD) are characterised by a triad of impairments afflicting social interaction, verbal communication and imagination. However, recent evidence suggests that alongside these deficits may exist strengths in the ability to systemise: to deal with concepts that have definitive rules, such as mathematics, physics and computers. However, the relationship between systematic abilities and how this may influence ability in different sub-topics of mathematics remains unclear. This study examined math ability in three core areas: number, geometry and statistics. We reasoned that given the difficulties with verbal context and abstract concepts associated with ASD, apparent strengths in mathematics may be largely due to performance in less verbally embedded topics such as number and geometry.

Objectives: To test the relationship between systemising strengths and performance on the sub-topics of a standardised mathematics task in individuals with and without ASD.

Methods: 23 children with ASD and 23 without ASD aged 11-15 were recruited from local specialist and mainstream schools respectively. The groups were matched for age, verbal IQ and sex. All the children completed the Systemising Quotient (SQ) and a standardised math task (comprising number, geometry and statistics questions) compiled from a bank of national curriculum questions.

Results: Systemising abilities, as measured by the SQ, showed a significant positive correlation with overall performance on the mathematics task for the ASD group. Overall, the ASD group scored lower on the mathematics task relative to the non-ASD groups. However, further analysis showed this could be attributed to relatively poorer performance on the statistics component relative to the topics of number and geometry.

Conclusions: Overall, the findings suggest that systemising ability in ASD is positively related to maths ability. However, whilst individuals with ASD may have a propensity for mathematics, this may be influenced by the format in which it is presented. This may have implications for classroom teaching and suggest ways in which more verbal and abstract topics may be presented to facilitate learning.

141.152 152 Putting the Pieces Together: Is There a Connection Between Weak Global Bias, Verbal Ability, and Object Categorization in Autism?. J. L. Amaral*[1], H. Kloos[1], C. D. Luzzi[2] and S. Collins[1], (1)*University of Cincinnati*, (2)*Memorial Children's Hospital of South Bend, IN*

Background: Autism is characterized by disrupted language development, social deficits, and atypical patterns of interacting with objects. This may stem from a tendency for children with autism to not focus on relationships between details in their environments (e.g., Happé & Booth, 2008). Typically developing (TD) children, on the other hand, tend to focus on overall impressions, a bias that appears to follow a prescribed developmental course. For example, while early on TD children tend to focus on fine grain detail to categorize objects, as their productive count-noun vocabularies grow (herein: *vocabulary size)*, they focus on an objects' overall shape (Pereira & Smith, 2009; Smith, 2003). The development of this bias toward Gestalts is important for TD children as it

may serve an adaptive function (e.g., Stephen, Dixon & Isenhower, 2009). Understanding how object categorization style relates to verbal abilities in autism may shed light on differentiated adaptive functioning.

Objectives: This study compares how vocabulary size relates to the ability to categorize objects on the basis of their overall shape (vs. fine-grain detail) for TD children and children with autism. This is a first step towards mapping out the relation between autism and the development of an adaptive tendency to detect higher-order Gestalts.

Methods: Twenty-two children with autism were compared to 59 TD children using methods adapted from Pereira & Smith (2009). Parents completed standardized questionnaires (MacArthur-Bates Communicative Development Inventories; Fenson et al., 1994) to indicate their child's vocabulary size. Children then participated in a force-choice task where they were asked to identify a target object from a field of two distractors. In each trial, the objects came from one of three categories. In one category, the objects possessed rich details of shape, color, and texture. In the second color and textural information were removed. In the third, objects were built from abstract, broad-stroke forms (geometric shapes), which only afforded categorization based on overall shape.

Results: Children from both diagnostic groups were subdivided based on their vocabulary sizes: groups of children with under 100 noun vocabularies and groups of children with between 100 and 200 count-nouns. TD children in the low vocabulary group demonstrated stratified performance across all object conditions. TD children in the high vocabulary group performed equally well on abstract objects and objects from the middle condition. For children with autism relative performance across each object condition did not differ between vocabulary groups. Further, children with autism performed at a high level compared to TD children across all conditions.

Conclusions: The current study makes several assumptions. The first assumption is that vocabulary size can be seen as a contextual factor. The second assumption is that categorization of shape abstraction objects translates to the ability to process Gestalt information. The third assumption is that Gestalt processing is an adaptive function that arises when contexts make tasks difficult. Under these assumptions, the fact that children with autism did not demonstrate stratified performance seen in TD children may suggest that they do not adapt to contextual changes in the same manner.

141.153 153 Toddlers with Autism Do Not Show Evidence of Categorization in a Novel Word Learning Task. S. Tek*[1] and R. J. Landa[2], (1)*Kennedy Krieger Institute for Autism and Related Disorders*, (2)*Kennedy Krieger Institute*

Background: It has been shown in literature that individuals with autism spectrum disorders (ASD) can categorize rule-based information, but have difficulty abstracting prototypes or relationships among object features for natural objects, artifacts, and faces (Gastgeb et al., 2006). Because infants can abstract prototypes around 3 months of age (Mareschal & Quinn, 2001), a difficulty with generalization or prototype formation can be an early sign of autism in young children.

Objectives: To investigate whether children with ASD would generalize from simple geometric shapes to real-life objects in a novel word learning task.

Methods: We tested 16 children with ASD (mean age = 28.33 months) and 18 TD children (mean age = 28.66 months) in a novel word learning task (Son et al., 2008). Children were first presented with a simple geometrical novel object paired with a novel name: a "*dax*." In the following trial, children were presented with the same object with a distractor, and were asked to identify the *dax*. This was the memory trial, because the test object was the same as the one in the previous trial. In the next trial, children were presented with real-life versions of objects that were presented in the memorization trial, and were asked to identify the *dax*. This was the generalization trial, since the children were expected to generalize the novel name that they learned during the memory trial with the simple objects to the real-life objects. Children in both groups were also administered the Mullen Scales of Early Learning (MSEL; Mullen, 1995).

Results: We compared children's performance on the memory trials to their performance on the generalization trials, and then their performance on both trials to the 50% chance.

The performance of TD group on the memory trials was similar to their performance on the generalization trials, which were both above 50% chance. The ASD group performed significantly better on the memory trials compared to the generalization trials, and their performance on the memory trials was above chance, whereas their performance on the generalization trials was not.

Since it has been shown that children who have larger vocabulary perform better in a novel word learning task than children with limited vocabulary (Son et al., 2008), we conducted the analyses with the ASD group with and without expressive language delay. Eight children were classified as "average-language group" (ASD-AL) whose standard sores on the MSEL Expressive Language were within the average range, and eight children were classified as language-delayed group (ASD-LD) whose scores were at least one standard deviation below the mean. ASD-AL group did significantly better on the memory trials as compared to the generalization trials, and their performance on the memory trials was above chance, whereas their performance on the generalization trials was not. ASD-LD group performed at the chance level on both memory and the generalization trials.

Conclusions: Children with ASD, both those with average expressive language and those who have delayed language, do not seem to generalize from simple to complex objects in a novel word learning task.

141.154 154 Cognitive Processing of Global and Local Visual Stimuli in High-Functioning Individuals with Autism. O. Olu-Lafe*, J. Liederman and H. Tager-Flusberg, *Boston University*

Background: Three decades ago researchers noticed that despite marked social and behavioral impairments, individuals with autism spectrum disorders (ASD) excelled on tasks requiring a focus on small parts or elements. Established deficit accounts of autism failed to explain these strengths. The weak central coherence (WCC) theory was developed to explain both impairments and superior skills observed in autism. This theory asserts that people with autism possess a weakness in the neural systems involved in pulling information together to establish meaning; this results in over focus on fine detail and disregard of context, or the global picture. The WCC theory has been supported by many studies, several groups, however, failed to find any marked deficits in global processing in people with autism. Consequently, a competing theory, enhanced perceptual functioning (EPF), was proposed. The EPF hypothesis asserts that people with autism have enhanced perceptual systems; this enhanced perception biases people with autism toward focusing on local details and parts. This bias, however, does not come at the expense of global processing. An ongoing debate is whether people with autism have an excessively detail-focused processing (local processing) style accompanied with impaired contextual processing (global processing).

Objectives: The present study assesses both global and local processing, and shifts between global and local processing in an effort to reconcile ongoing controversy. To clarify cognitive processing style and perceptual ability in people with autism, this paradigm (1) tests several dimensions of the effects of local and global variables on processing, (2) employs both high- and low-level perceptual tasks, and (3) collects eye movement data.

Methods: Individuals with autism and age- (15-30 years) and IQ- (85+) matched normal controls were given an embedded figures task, two silhouette tasks, a local-global switching task, and a local and a global motion detection task. In the embedded figures task, participants located a target shape hidden in a larger complex figure (local processing advantageous). In the silhouette tasks, participants selected the correct silhouette of target images (global processing advantageous). In the local-global switching task participants identified rapidly presented local or global letters (both local and global processing required). In the motion detection tasks participants detected the motion of dot displays (global motion detection task) and vertical gratings (local motion detection task). Eye-tracking data was collected during the embedded figures task and silhouette tasks as an index of underlying strategy.

Results: Overall the autism group exhibited superior performance on local processing, but abnormal performance on global processing. Eye-movement data (fixation duration and frequency) also suggests atypical perception underlies ASD performance.

Conclusions: Our findings provide a more comprehensive understanding of perception in people with autism. The behavioral data helps clarify processing style in autism. The eye-movement data provides additional information about the perceptual and attentional strategies employed by individuals with autism. These findings combined help refine cognitive and neuroanatomical accounts of autism.

141.155 155 Preserved Sensitivity to Higher-Order Conceptual Versus Lower-Level Perceptual Information During Explicit Verbal Memory Encoding In ASD: Limits to EPF and WCC?. D. M. Bowler*, S. B. Gaigg and J. Cooper, *City University London*

Background: It is well established that individuals with Autism Spectrum Disorder (ASD) experience difficulties in utilising conceptual relations among stimuli to facilitate memory (Tager-Flusberg, 1991; *Brit J Dev Psych, 9,* 417-413). The reasons for this difficulty, however, remain unclear. According to the Enhanced Perceptual Functioning theory (EPF; Mottron et al., 2006; *JADD, 36,* 27-43), encoding of conceptual information in ASD is sometimes compromised by interference from enhanced processing of lower-level perceptual information. This view is supported by studies employing levels of processing manipulations showing that cued recall following deep, conceptual encoding (e.g. '*Is this a Fruit?*) is preserved in ASD whilst cued recall following shallow, perceptual encoding (e.g. *'Is this a 2-syllable word'?*) is superior. The question remains, however, of whether individuals with ASD also spontaneously demonstrate an encoding superiority for low-level perceptual information.

Objectives: To assess the degree to which individuals with ASD spontaneously encode perceptual and conceptual aspects of word stimuli (i.e. when no specific encoding instructions are provided).

Methods: 20 adolescents and adults with a confirmed diagnosis of ASD and 20 age and IQ matched typically developed participants studied a list of 42 words presented at 4 sec intervals. Unbeknownst to the participant, word lists were constructed to comprise 4 exemplars of six semantic categories, 2 exemplars of another six and 1 exemplar of another six categories. In words were chosen so that they could also be grouped on orthographic/phonological grounds (e.g. words starting with a silent 'k' etc.). Again, either 4, 2 or 1 exemplars of each of these orthographic/phonological categories was presented. The size of these groupings was independent of the size of the semantic categories.

After study, participants were presented with a list of semantic and orthographic/phonological category labels (e.g. Fruits, Words containing an x, etc.) and asked to estimate how many (if any) of the study words were part of that category. Responses between 0 and 9 (inclusive) were allowed. Following this estimation task the same category labels were re-presented with instructions to try to recall relevant words from the list.

Results: Both groups were significantly quicker ($F(1,38) = 4.85$; $p < .05$) and more accurate ($F(3,114) = 3.73$, $p < .05$) at estimating the number of exemplars from semantic categories in the study list as compared to the number of orthographic/phonological category exemplars. Both groups also demonstrated superior cued recall for the semantic as compared to the orthographic/phonological category exemplars ($F(1,38) = 38.30$; $p < .001$). There were no group differences or interactions between group and any of our experimental factors.

Conclusions: Our results suggest that during unguided encoding of verbal material individuals with ASD are no more likely than typically developing comparison individuals to encode low-level perceptual features of stimuli – or at least those features manipulated here. Nor were they any less likely to encode high-level, categorical information. It may therefore be the case that although individuals with ASD process perceptual information more effectively when instructed to do so, the are not spontaneously biased to processing perceptual over conceptual information.

141.156 156 The Effect of Feedback on Perceptual Learning in Autistic Adults. A. Bertone*[1], V. Courchesne[2], L. Filiatrault[3], K. Dugas[1] and L. Mottron, M.D.[2], (1)*McGill University*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (3)*Department of Psychology, Université de Montréal*

Background: Understanding how autistic individuals learn is very important for developing and implementing efficient educational and behavioural interventions. Given their relatively stronger perceptually-based cognitive abilities (relative to those in the verbal domain), it cannot be assumed that autistics learn using the same rules and strategies as non-autistics. Of particular interest, perceptual learning (PL) is a class of learning that is based upon changes induced by the repeated exposition and response to specific types of perceptual information. Such learning often includes feedback, indicating whether or not a response was correct during a trial within a PL task. A previous study assessing PL using feedback-based training in autism suggested that feedback did not benefit autistics, who nevertheless outperformed typical controls when asked to discriminate novel highly-similar stimuli (Plaisted et al., 1998).

Objectives: To investigate PL in autism using a low-level perceptual task, in the presence and absence of trial-by-trial feedback.

Methods: Ten autistic and ten non-autistic adults, matched for full-scale IQ and age (18-31 years), performed a low-level PL task. They were asked to indicate whether a grating was tilted to the left (i.e., counter-clockwise) or to the right (i.e., clockwise) relative to an oblique 45-degree reference orientation. Thresholds, defined by the minimal deviation in degrees needed to discriminate tilt orientation, were measured for each participant every 25 minutes, with each session consisting of 420 trials. To assess baseline performance, all participants completed one baseline session with no feedback. During six subsequent testing sessions, half (n=5) the participants in each group were then provided feedback and half were not.

Results: PL was defined as the percent change in tilt discrimination threshold in the six testing sessions compared to the baseline session. For the autistic group, there was no evidence for PL. Thresholds remained equal to baseline across testing sessions, whether or not trial-by-trial feedback was present. In contrast, in the non-autistic control group, thresholds decreased with training sessions and thus there was evidence for PL, but only when feedback was present.

Conclusions: Within the context of the experimental conditions and paradigm, evidence for PL was found only in the non-autistic group when feedback was present during testing sessions. Importantly, trial-by-trial feedback did not result in PL in the autistic group, suggesting that the neuromodulatory effects of feedback are different in autism. This preliminary finding raises questions regarding the value of feedback during interventions, and at a more basic level, during studies defining perceptual and cognitive processes in autism.

141.157 157 The Relationship Between Iconicity and Referential Understanding of Pictures in Low-Functioning Children with Autism. C. Hartley* and M. L. Allen, *Lancaster University*

Background:

Low-functioning children with autism (CWA) tend to form associative, rather than referential, relations between words, pictures and objects (Preissler, 2008). This results in poor generalization of labels to pictured objects and may prevent CWA from understanding that words and pictures can represent categories. This has implications for the effectiveness of interventions such as the Picture Exchange Communication System (PECS). However, it is possible that referential understanding of pictures in CWA is facilitated by high levels of iconicity (the perceptual similarity between picture and referent), as is the case for young neurotypical children (NTC).

Objectives:

We investigated the relationship between iconicity and referential understanding of pictures in CWA. We also examined whether iconicity influenced the ability of CWA to generalise labels from pictures to novel category members (i.e. differently-coloured versions of depicted entities).

Methods:

Seventeen CWA (*M* age = 9.6 years) were matched to 14 NTC (*M* age = 3.9 years) on receptive language (CWA *M* = 3.9 years; NTC children *M* = 3.7 years). In each trial, participants were taught a novel word (e.g. “Zepper”) repeatedly paired with a target picture of an unfamiliar object. They were then asked to

identify the referent of the newly-learned word from arrays consisting of the target picture paired with the depicted object and then a novel category member. Target pictures were black-and-white line drawings (BWLD), colour line drawings (CLD), greyscale photographs (GP) and colour photographs (CP). Participants received four trials over 2 test sessions, with the iconicity of the target picture varying between trials. In another session, participants completed a preference task to rule out picture/object selection biases.

Results:

CWA most frequently selected the target picture as the referent of the learned label at all levels of iconicity (BWLD = 88%; GP = 76%; CLD = 65%; CP = 50%), while NTC selected the depicted object most often. Chi-square tests revealed significant relations between group and associative responding for BWLD ($\chi^2 = 14.07$, $p < .001$) and GP ($\chi^2 = 5.24$, $p < .05$), but there was no difference in response types for colour trials (CLD and CP). Regardless of iconicity, CWA were unlikely to generalise a label from a picture to a novel category member (BWLD = 24%; GP = 12%; CLD = 35%; CP = 25%). In contrast, NTC most frequently identified the differently-coloured object as the label's referent at all levels of iconicity. Both CWA and neurotypical children responded correctly on 98% of preference task trials, eliminating picture/object biases as explanations for between-group differences.

Conclusions:

CWA are significantly more likely to recognise referential relations between pictures and objects that are colour-matched. Although they may extend a label from a highly-iconic colour picture to its specific referent, they will not generalise the label to a novel category member, unlike NTC. These findings suggest that interventionists should use colour pictures when implementing PECS, but it is important that recipients are exposed to pictures of differently-coloured category members in order to promote category formation and facilitate generalisation of labels.

141.158 158 Magnitude of Perceptual Peaks in Autism Is Partially Dependent on the Matching Variable: The Example of Pitch Discrimination. L. Mottron, M.D.*[1], A. A. Simard-Meilleur[1], A. Bertone[2] and I. Soulières[1],

(1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Perceptual Neuroscience Laboratory for Autism and Development (PNLab)*

Background: When comparing cognitive performance between autistic and comparison populations, groups are matched for intellectual functioning, assuming that the effect of the matching variable on performance is the same for both groups. The most frequent matching variable in autism studies is Wechsler Full Scale IQ (FSIQ; Mottron, 2004). However, it has been shown that this measure underestimates autistics' cognitive level when compared to another major test of general intelligence, Raven's Progressive Matrices (RPM; Dawson et al., 2007), which minimizes the need for typical speech comprehension and production. It is therefore possible that autistics' perceptual peaks are, at least partially, an artifact of the matching variable.

Objectives: To investigate this possibility, the current study tested the influence of RPM, as a more representative measure of autistic intelligence, on the magnitude of perceptual peaks in autism.

Methods: 34 autistic and 34 typically developing adolescents and adults, aged between 14 and 35 years, were tested on Wechsler FSIQ, RPM, and pitch discrimination, using an adaptive psychophysical task.

Results: Regression analyses revealed a Group X IQ interaction (p=.01): Wechsler FSIQ predicted pitch discrimination performance in control participants (p=.004 R^2=.176), but not in autistic participants (p>.20). RPM predicted discrimination performance similarly in both groups (p=.001; no Group X RPM interaction p=.23). Group comparisons entering either Wechsler FSIQ or RPM as a control variable consistently revealed significantly better performance in autistics compared to controls. However, the effect size was smaller when using RPM, rather than Wechsler FSIQ, thereby reducing the magnitude of the peak of ability.

Conclusions: RPM but not Wechsler FSIQ predicted perceptual ability in autistics, suggesting that RPM is a more consistent measure of autistic intelligence than Wechsler scales. Matching on RPM diminished but did not eliminate an

auditory perceptual peak, indicating that enhanced perceptual functioning cannot be explained by an incorrect matching strategy. This finding, in addition to the very low level of perceptual architecture where superiorities are evident, and the very young age at which these superiorities can be demonstrated (Kaldy et al., 2011), argues in favour of a primary role of early perceptual alteration in the cascade of effects resulting in the autistic cognitive and behavioural phenotype.

141.159 159 Using a Change Detection Paradigm to Assess the Allocation of Visual Attention in Autism At Different Developmental Periods. F. Laine*[1], J. A. Burack[2], V. Doobay[1], L. Caruso[1], L. Mottron, M.D.[1] and A. Bertone[3], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*McGill University*, (3)*Perceptual Neuroscience Laboratory for Autism and Development (PNLab)*

Background: Change detection, the ability to detect changes in the environment, can be affected by the type of information that is prioritized. Among adults with typical development (TD), change detection is more efficient when change occurs in foreground (*i.e.* the front plane) compared to background elements (*i.e.* the ground) of geometric visual displays. As this foreground bias has been studied among adults only, this finding raises the question of when this phenomenon appears during development. Another question concerns how this foreground bias is affected by the presence of other competing perceptual factors, such as configurality (generally not prioritized among individuals with autism) and dynamicity (used as an external attentional cue) at different periods of development.

Objectives: The objectives of this study were to assess (1) whether the typically-manifested attention bias for foreground information is displayed by children, adolescents, and adults with autism at different periods of development, and (2) to what extent, if any, manipulating the configurality or dynamicity of foreground information differentially influences visual attention allocation among adults with autism as compared to individuals with TD across development.

Methods: Seven school-aged children with autism (8-12 yrs), 13 adolescents with autism (12-17 yrs), and 13 adults with autism (18-35 yrs) were matched for mean age and full-scale IQ with the same number of school-aged children, adolescents and adults with TD. In an adapted version of a change blindness paradigm (Mazza et al., 2005), the background consisted of 20 columns (alternating between purple/green and blue/red) comprising ten vertically-oriented rectangles (1.81 ^{o} x 1.24 ^{o}), and the foreground consisted of 6 horizontally-oriented rectangles (3 purple/green and 3 blue/red) arranged in either a circular (configural) or random (non-configural) manner. On a given trial, either a foreground change (horizontal rectangles changed color), a background change (vertical rectangles changed color), or no change occurred between two successively presented displays (500 ms in duration). In the static condition, no motion occurred within the rectangles. In the dynamic condition, either the foreground or background rectangles contained dynamic noise. The participants indicated whether or not they perceived a change between the two successively presented displays.

Results: Across age groups, both the participants with autism and typical-development were more efficient at detecting foreground relative to background change in the static condition and better at detecting non-configural foreground information relative to configural foreground information. Moreover, all participants were better able to use dynamic information as a cue to detect changes in the foreground, across periods of development.

Conclusions: Similar patterns of prioritization of visual attention were found between participants with autism and participants with TD across childhood, adolescence, and adulthood on a change detection paradigm in which perceptual attributes such as the configurality of the foreground elements were manipulated.

141.160 160 Assessing the Building Blocks of Spatial Perception in Autism Using a Tilt Discrimination Task. S. Censi*[1], A. Perreault[2], J. A. Burack[3], L. Mottron[4] and A. Bertone[3], (1)*Université de Montréal*, (2)*Perceptual Neuroscience Laboratory for Autism and Development (PNLab)*, (3)*McGill University*, (4)*Centre d'excellence*

en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)

Background: As perceptual processing in autism is often described as detail-oriented, much can be learned about the spatial resolution of the visual system using stimuli and paradigms that directly assess the extraction of local orientation and spatial frequency. These early visual attributes, considered as the building blocks of spatial perception, are first encoded by orientation-specific mechanisms (spatial filters) operating within primary visual cortices. The tuning of these mechanisms - reflecting their spatial resolution - can be assessed by measuring the minimal amount of tilt that can be perceived relative to a reference orientation, across a variety of physical stimulus attributes (luminance- vs texture-defined) and spatial frequencies. This approach provides information about the extent to which "detailed" perception in autism stems from the increased tuning of mechanisms mediating early spatial perception.

Objectives: To use a tilt discrimination task to assess whether the extraction of low-level spatial information is atypical among high-functioning individuals with autism.

Methods: Fourteen participants with autism and 15 typically developing participants, matched for full-scale IQ and age (14-35 years), performed a tilt discrimination task. The participants were asked to indicate whether a grating was tilted to the left (counter-clockwise) or to the right (clockwise) relative to either a vertical or horizontal reference orientation. An adaptive staircase procedure was used to measure thresholds, defined by the minimal deviation (in degrees) needed to discriminate tilt orientation. Thresholds were obtained using gratings defined by luminance (with / without noise) and texture attributes of varying spatial frequencies (0.5, 1.0 and 2.0 cycles per degree (cpd)). The visibility of the gratings were equalized and kept constant throughout experimentation. Staircases ended after a 90 % confidence level, representing the threshold estimate falling within +/- 0.1 log units of the true measure, was obtained.

Results: A 2 (group) x 2 (reference orientation) x 3 (spatial frequency) mixed factorial ANOVA was conducted for each of the three attribute conditions (luminance with noise, luminance without noise, and texture) to evaluate whether groups differed with respect to tilt discrimination ability. For the luminance-defined, no-noise condition, the participants with autism had significantly lower ($p < 0.05$) tilt discrimination thresholds for horizontal gratings with a spatial frequency of 2 cpd. A significant group by orientation interaction ($p < 0.05$) revealed that the participants with autism were better at discriminating tilt relative to the horizontal axis for luminance-defined gratings with noise. No significant between-group differences and no significant interactions were found for texture-defined gratings.

Conclusions: The main finding of the present study was that participants with autism performed better than typically developing participants when discriminating tilt relative to a horizontal reference orientation for luminance-defined gratings with and without noise. This finding is evidence that the extraction of elementary, low-level spatial information is different among adolescents and young adults with autism, and consistent with increased tuning of early neural mechanisms mediating the extraction of elementary spatial information in autism. Such early alterations in autistic information processing may have effects on subsequent processing of higher-order stimuli, regardless of whether these stimuli are socially relevant.

141.161 161 The Emergence of Distinct Patterns of Nonverbal Cognitive Abilities in Preschoolers with Autism. K. K. Powell*, L. G. Anthony and E. S. Kuschner, *Children's National Medical Center*

Background:

Uneven patterns of cognitive abilities have been documented among individuals with autism suggesting enhanced nonverbal abilities over verbal abilities. However, among superior performance on tests of nonverbal abilities, there exists variability in performance in individuals with autism. Research has suggested that individuals with autism show enhanced perceptual or visuospatial abilities and weaker conceptual or abstraction abilities within the non-verbal domain. This study aimed to prospectively examine the development of these patterns of nonverbal cognitive processing over time in younger children with ASD. This is an

important step in further uncovering the development of unique cognitive profiles in young children with autism.

Objectives:

To examine a proposed pattern of relative strengths in perceptual nonverbal cognitive abilities and relative weaknesses in conceptual nonverbal abilities over time within the cognitive profiles of children with autism.

Methods:

Participants consisted of a clinically referred sample of 27 children (n= 21 [75%] male) with an ASD diagnosis based on the Autism Diagnostic Observation Schedule and clinical impression (Autism n= 13; PDD-NOS n= 14). All data were collected during a comprehensive clinical diagnostic evaluation at a special education preschool. Nonverbal cognitive abilities were estimated using the Leiter International Performance Scale–Revised (Leiter-R) Brief IQ Screener [Figure Ground (FG), Form Completion (FC), Repeated Patterns (RP), and Sequential Order (SO)] at two time points (mean age=41.7 months and mean age=59.7 months). A relative strength on subtests that depend on perceptual processes (i.e., FG and FC) compared to relative weaknesses in the subtests that require abstract reasoning or concept formulation (i.e., RP and SO) would represent the proposed pattern of strengths and weaknesses in non-verbal cognitive processing consistent with finding from Kuschner and colleagues (2007). This study aims to replicate these previous findings as well as examine when this pattern emerges over time.

Results:

Paired samples t-tests at Time 1 indicate no differences (all *ps*> .50) among the Brief IQ subtests. Paired samples t-tests at Time 2 indicate differences between FC>FG=RP>SO (*ps*< .05); however, differences between FG-RP were not found (*p*>.76). Ipsative subtest profiles were also constructed relative to each child's overall performance. Four paired sample t tests were performed comparing Time 1 deviation scores to Time 2 deviation scores for each Brief IQ subtest. Findings suggest differences between FC1<FC2 and SO1>SO2 (*ps*<.05); however differences between FG1-FG2 and RP1-RP2 were not found (*ps*>.72).

Conclusions:

At Time 1, we find that young preschoolers with autism are not showing specific strengths and weaknesses within their cognitive profile, suggesting flat profiles of comparable nonverbal abilities. In contrast, at Time 2 (18 months later), children with autism are showing relative strengths on FC and relative weaknesses on SO. Findings suggest that an uneven pattern of relative strengths and weaknesses in cognition found in previous research on individuals with autism, namely strengths in nonverbal perceptual versus nonverbal conceptual skills are evident for older preschoolers (on specific Leiter-R subtests), but not present for younger preschoolers with autism. This unique profile may have implications for intervention.

141.162 162 Intellectual Ability and Autism. S. Neves*, J. Shenouda, H. Patel, A. M. Fongang-Fossa and W. Zahorodny, *UMDNJ-New Jersey Medical School*

Background: While many children with Autism Spectrum Disorders (ASD) undergo intelligence testing, little is known about the distribution of intellectual ability of this population. Previous studies estimated the rate of intellectual disability (ID) in children with ASD to be between 30% and 70%. It is important to reassess the expression of intellectual ability in ASD children.

Objectives: The purpose of this study was to investigate the distribution of intelligence among ASD children. Case-specific data were analyzed to determine differences between ASD children on different intellectual levels.

Methods: Data were collected as part of an ASD surveillance investigation carried out in four New Jersey counties. Using an active case-finding method established by the Centers for Disease Control and Prevention (CDC), ASD surveillance data were collected for 8-year-old children living in the region in 2006. Data were based on review and analysis of information contained in health and education records. Demographic information referencing SES, ASD diagnosis, case-specific data and intelligence quotient (IQ) results were analyzed. ASD

diagnosis included Autistic Disorder and ASD-NOS (representing all other ASD diagnoses). Statistical analysis was performed using t-tests and Chi-square tests.

Results: We identified 232 ASD children having both an IQ test and an ASD diagnosis from a community provider. Of these children, 37.1% met the ID criteria, scoring 70 or below on an IQ test. There were no significant differences between IQ and sex. Associations between race and IQ as well as SES and IQ were highly significant ($p<0.001$). However, when both factors were combined and analyzed in relation to IQ, no statistical difference was observed. The rate of ID differed by race, where 22.7% of white children, 57.8% of black children and 41.3% of Hispanic children met the criteria for ID ($p<0.001$). Compared to children with AD, children with ASD-NOS were more likely to have an average IQ score of 85 or above (44.9% v. 17.0%, $p<0.001$). The rate of ID in children with AD was significantly higher than those with ASD-NOS (63.8% v. 25.4%, $p<0.001$).

Conclusions: Consistent with other recent studies, 37% of ASD children in our sample have ID. However, children with AD were more likely to present with ID. However, one out of four children with ASD-NOS still met the criteria for ID. Contrary to other studies, we did not identify higher rates of ID among girls with ASD. It is important to note that almost 40% of all children in our sample had an IQ of 85 or above, demonstrating the strong intellectual ability of children with ASD. The high prevalence of ID in children with Autistic Disorder could allow clinicians to more accurately diagnose cases of autism. While socio-economic and race factors showed significant differences with regards to IQ and rate of ID, further research must be done to determine what factors contribute to these variations. There may be race and/or SES-based differences in the intellectual ability of children with ASD. If these differences are confirmed, we would expect there to be parallel differences in educational placement and functional outcomes.

141.163 163 Intelligence Testing in Autistic Children Regarded As Very "Low-Functioning": The Good Surprise. V. Courchesne*, A. A. Simard-Meilleur and I. Soulières, *Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: Different intelligence tests can portray autistic children's abilities in very different ways. For some individuals, there can be a considerable mismatch between scores on different tests. For example, many non-speaking autistic children simply cannot be evaluated with the Wechsler scales and are therefore considered to be intellectually disabled. Could these autistic children, often described as very "low-functioning," show unexpected reasoning capacities within the normal range when assessed with tests better suited to accurately measuring autistic abilities? A wide variety of autistics perform better than non-autistics on several visual perceptual tasks, and their performance on some of these tasks correlates with their reasoning abilities. In a group of so-called very "low-functioning" autistic children, can perceptual abilities predict reasoning abilities as well?

Objectives: To evaluate the intellectual potential of these "un-testable" autistic children and to investigate associations between their perceptual and reasoning abilities.

Methods: All children aged six to 12 years from a specialized school for intellectually disabled autistics were solicited for the study. Nineteen children participated, among whom 11 had no spoken words, five used fewer than five single words, and three used a few simple two-word phrases. The study involved evaluation with WISC-IV, Raven's Coloured Progressive Matrices board form (RCPM), and two perceptual tasks on which autistics are known to perform well, the Children's Embedded Figures Test (CEFT) and visual search (VS). A control group of 14 typically developing children was recruited and matched to the autistic group on chronological age.

Results: None of the autistic children could reliably complete any of the WISC-IV subtests. However, 16 of 19 autistic children could reliably complete other tasks. Autistic children spontaneously understood the CEFT and VS with no or minimal demonstration, and were similar to the control group in pattern of results despite generally slower response times. For RCPM, 15 autistic children could reliably complete the test following brief training on simple puzzles with a visual display similar to RCPM. Interestingly, eight of the 15 autistic children who completed the RCPM scored in the normal intelligence range, one child scoring well above average (90th percentile). These eight autistic children were generally faster

in CEFT and VS than the seven who scored in the intellectual disability range on RCPM.

Conclusions: These results show that non-speaking "un-testable" autistic children who are regarded as very "low-functioning" can be evaluated with certain tests that require few or no verbal indications. More importantly, some non-speaking autistic children considered to have an intellectual disability were shown to have intellectual potential in the normal range, which bears implications for educational interventions. Furthermore, a possible association between performance in simple-to-administer perceptual tasks and performance in more complex reasoning abilities could be of particular importance when facing difficulties in the evaluation of non-speaking and/or very young autistic children. Indeed, even if no evaluation seems possible with an autistic child, obtaining a good performance on one of these tasks could suggest hidden potential that should be encouraged.

141.164 164 Cognitive Flexibility Among Individuals with Autism: The Influences of Chronological Age Vs. Mental Age. C. A. Campbell*[1], O. Landry[2], N. N. Russo[3], H. Flores[1], S. Jacques[2] and J. A. Burack[1], (1)*McGill University*, (2)*Dalhousie University*, (3)*Syracuse University*

Background: Cognitive flexibility, the ability to switch sets in thinking, is a component of executive function that appears to be impaired among children with autism (Corbett et al., 2009; Russo et al., 2007; Sanders et al., 2008). Although the ability to complete tasks of cognitive flexibility is generally linked to higher verbal abilities (Ardila, Pineda & Rosselli, 2000; Jacques & Zelazo, 2005), the relative non-verbal strengths among persons with autism (Lincoln et al., 1995; Mayes & Calhoun, 2003) allows for a unique opportunity to study the relative contributions of verbal and non-verbal abilities on the Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001), a widely used test of cognitive flexibility.

Objectives: The objective of the current study was to examine the relative influences of chronological age (CA), performance mental age (PMA), and verbal mental age (VMA) on performance on the FIST among a group of children and adolescents with autism.

Methods: Fourteen individuals with autism, ranging in CA from 53 months to 206 months (*M*=133.1 mos, *SD*=47.1 mos), participated in this study. The participants were administered the PPVT-III (Dunn & Dunn, 1997) to determine VMA and the Leiter-R (Roid & Miller, 1997) to determine PMA. They had a mean VMA of 51.5 (*SD*=20.86) based on scores from the PPVT-III and a mean PMA of 76.1 (*SD*=22.72) based on scores from the Leiter-R. The FIST, a picture based task that required matching three objects on two different dimensions, was used as a measure of cognitive flexibility.

Results: Pearson correlations for PMA and both first $r(14) = .62$, $p < .05$ and second pair match $r(14) = .69$, $p < .01$ on the FIST were significant, while VMA was only significantly correlated with FIST second pair match $r(14) = .59$, $p < .05$. First pair matching assesses abstraction abilities, whereas second pair matching assesses cognitive flexibility. Chronological age was not significantly correlated with FIST performance. A stepwise regression analysis on second pair selections revealed that PMA was the best predictor of cognitive flexibility ($F(1,12) = 10.99$, $p < .01$, adjusted $R^2 = .44$).

Conclusions: Chronological age was not found to have any discernible relationship with cognitive flexibility, supporting the premise that MA is a better indicator of cognitive development than CA (Burack et al., 2001, 2004; Iarocci et al., 1997). Despite previous evidence that verbal intelligence predicts performance on tasks of cognitive flexibility, including the FIST, we found that non-verbal intelligence (PMA) was the better predictor among children with autism. As individuals with autism typically display patterns of strength in non-verbal cognitive abilities and weaknesses in verbal areas (Lincoln et al., 1995), the findings may indicate a tendency for people with autism to rely on non-verbal abilities to complete tasks that require cognitive flexibility, unlike typically developing children who appear to rely more on verbal abilities.

141.165 165 The Use of the Differential Ability Scales, Second Edition in Individuals with Autism Spectrum Disorders: Clinical Utility and Profile Variability. K. P. Nowell*[1], G. T. Schanding[1], S. M. Kanne[2] and R. P. Goin-Kochel[2], (1)*University of Houston*, (2)*Baylor College of Medicine*

Background:

Reliable and valid intellectual assessment is of particular importance when evaluating for an autism spectrum disorder (ASD) because of the need to interpret symptoms within the context of the individual's developmental level. In addition, cognitive evaluation is important when selecting teaching strategies, developing teaching objectives, and may be the most important prognostic indicator in this population. However, ASD's impact on cognition is highly variable and, when combined with the interfering behaviors associated with ASD, standardized assessment in this population can be challenging.

The majority of children with ASD exhibit significant scatter of scores on cognitive profiles, rendering the obtained composite scores non-unitary and potentially invalid. Research suggests that that over 50% of children/adolescents with ASD have significant discrepancies between their verbal intelligence quotient (VIQ) and their non-verbal intelligence quotient (NVIQ); a substantially higher rate than in the normative samples on which intellectual measures are standardized. General recommendations regarding test selection include choosing an instrument with reduced verbal loading, opportunities for teaching, decreased demands for social engagement, few timed tasks, and hands-on activities. The *Differential Ability Scale--Second Edition* (DAS-II; Elliott, 2007) is one instrument specifically recommended for use with this population; however, given its relatively recent publication, there is minimal published research on its use in general and special populations. In particular, there are no extant data describing the performance of children/adolescents with ASD on the DAS-II.

Objectives:

The objective of the proposed study is to examine the clinical utility and profile variability of the DAS-II in a large, well characterized sample of children/adolescents with ASD.

Methods:

Data will be analyzed for children with ASD who participated in the Simons Simplex Collection (SSC). The SSC is a repository of clinical and genetic data from families with only one child (between the ages of 4 and 18) with an ASD (i.e., simplex families). All probands included in the SSC met diagnostic criteria for ASD based on research-reliable administrations of the ADI-R and ADOS and in clinical opinion. Only probands who obtained standard scores on all subtests on either the DAS-II Early Years (EY; N=887) or the DAS-II School Age (SA; N=870) will be included in the sample.

Results:

Mean scores at the subtest, cluster, and composite levels for both the DAS-II EY and the DAS-II SA groups will be presented and compared to the normative sample using multivariate or univariate analysis. Proportion of the sample with VIQ/NVIQ discrepancies will be calculated and compared to the normative sample. Within-group comparison will also be made at the subtest level to determine the proportion of the sample with non-unitary VIQ and NVIQ cluster scores.

Conclusions:

In addition to demonstrating the clinical utility of the DAS-II in a population of children with ASD, it is hypothesized that findings from this study will add to the existing literature regarding cognitive profile variability among children with ASD and further emphasize the importance of considering profile variability both at the individual level (i.e., selecting appropriate interventions) and group level (i.e., when defining samples for research).

141.166 166 Cognitive Profile in Higher Functioning Children with An Autism Spectrum Disorder. E. M. Butter*[1] and R. Arendt[2], (1)*Nationwide Children's Hospital*, (2)*The Ohio State University*

Background: Although Autism Spectrum Disorders (ASD) often co-occurs with Intellectual Disability, presentation varies from more subtle to significant impairment in cognitive functioning. Level of intellectual functioning has been associated with severity of autistic symptoms, ability to acquire skills, and level of adaptive functioning. The Stanford-Binet Intelligence Scales, Fifth Edition (SB-5) is a commonly used measure of cognitive abilities. Although the normative sample for the SB-5 included children with autism, the number was small (N=83) and no particular pattern of scores was identified.

Objectives: To determine whether a subset of higher functioning children with ASD present with a specific cognitive profile on the SB-5, specifically a relatively low Knowledge Factor compared other indices of intellectual fucntioning.

Methods: Individuals between the ages of 2 to 18 years old with a confirmed diagnosis of ASD, including Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified, participating in the Autism Treatment Network (ATN) Registry and a Full Scale IQ score of 85 or greater on the SB-5 were included in this analysis.

Results: A total of 557 ATN Registry participants had a Full Scale SB5 IQ available. Of these, 209 (37.5%) had a score of 85 or greater

Label	N	Mean (SD)	Minimum	Maximum
Fluid Reasoning	209	104.02	73.00	135.00
Knowledge	209	(13.76)	66.00	140.00
NVIQ	209	97.93 (13.27)	79.000	135.00
FSIQ	209	103.62	85.00	131.00
VIQ	209	(11.60)	72.00	132.00
		101.84		
		(11.33)		
		100.22		
		(13.30)		

As predicted, children with ASD had a Knowledge Factor Standard Score (SS) on the SB-5 that was significantly lower than their Fluid Reasoning Factor SS (t Value=-6.14, p<.0001). Children with an ASD also had a Knowledge Factor SS that was significantly lower than their Non-Verbal IQ SS (t Value=-6.16 p<.0001), significantly lower than their Verbal IQ SS (t Value=-3.26 p<.0013) and significantly lower than their Full Scale IQ standard score on the Stanford-Binet 5 (t Value=-5.56, p<.0001).

Conclusions: Based on preliminary findings, as predicted a subset of children with ASD and average IQ had Knowledge scores signifcantly below other scores within the cognitive profile. Knowledge is a person's accumulated fund of general information acquired at home, school, or work. The current results suggest that the relatively low Knowledge Factor standard score in this subset of children with ASD could be associated with attention problems and socialization delays. Uneven cognitive development in children with ASD similar to what we have identified here using the SB-5 also suggests that cognitive assessment measures may be particularly useful in delineating differential patterns of cognitive strengths and weaknesses in children with ASD, as well as indexing an etiologically significant subtype of autism. If further investigation supports these findings, a distinct cognitive pattern in some higher functioning children with ASD may also lead to more targeted intervention strategies.

We acknowledge the members of the Autism Treatment Network (ATN) for use and analysis of the data and the families who participated in the Registry. The ATN is funded by Autism Speaks and a cooperative agreement (UA3 MC 11054) from HRSA to the Massachusetts General Hospital.

141.167 167 Impaired Classical Conditioning in Persons with Autism Spectrum Disorders. P. S. Powell*[1], M. E. Crisler[1], L. G. Klinger[2], B. G. Travers[3] and M. R. Klinger[1], (1)*University of Alabama*, (2)*TEACCH, University of North Carolina School of Medicine*, (3)*University of Wisconsin-Madison*

Background:

Research has indicated that individuals with autism spectrum disorder (ASD) have difficulty with implicit or automatic learning. The present study utilized a classical fear conditioning paradigm to examine implicit associative learning (i.e., classical conditioning) in individuals with ASD. Previous studies examining associative learning in ASD have found both intact (Bernier et al., 2004) and impaired learning (Gaigg & Bowler, 2007). However, both studies examined associative learning across modalities; pairing a visual conditioned stimulus (CS) with an auditory unconditioned stimulus (UCS). To date, no study has examined associative learning both across modalities (visual CS with auditory UCS) and within a modality (auditory CS with auditory UCS).

Objectives:

The primary objective of this study was to assess individuals with ASD associative learning across and within modalities. We predicted that if individuals demonstrated impaired

learning across modalities, but intact learning within a modality, this would be consistent with functional connectivity theories of ASD. However, if individuals with ASD demonstrated impaired learning both across and within modalities, this would suggest more general associative learning impairments

Methods:

Fifteen high-functioning young adults diagnosed with ASD and 16 age- and IQ-matched individuals with typical development were presented with both a visual color (CS visual) and an instrument sound (CS auditory) paired with an aversive sound (UCS). Three neutral visual stimuli and three neutral auditory stimuli were also presented. Participants' skin conductance responses (SCRs) were recorded. After 40 trials in which the CS and UCS were paired, we examined whether participants showed elevated SCRs when the UCS (aversive sound) did not follow he CS. This elevation in SCRs provided evidence of learning. Following the conditioning task, an explicit memory test examined awareness of the learning contingences.

Results:

Individuals with typical development displayed greater learning than individuals with ASD across both the visual and auditory conditions, $F(1,29)=7.90$, $p < .01$. Participants with typical development demonstrated a large learning effect, $F(1,15)=32.13$, $p < .01$, $\eta_p^2=.682$, whereas participants with ASD did not show significant learning, $F(1,14)=2.31$, $p =.15$, $\eta_p^2=.142$. These results suggest individuals with ASD have a general impairment in associative learning. Additionally, a significant interaction between pairing and explicit memory, $F(1,13)=8.13$, $p=.01$,was found for individuals with ASD, but not individuals with typical development suggesting that only those individuals with ASD who explicitly learned the contingencies showed reliable associative learning.

Conclusions:

Results demonstrated impaired learning across both visual and auditory modalities, suggesting that individuals with ASD may have a general impairment in associative learning. Additionally, we found that greater explicit awareness was related to greater associative learning among individuals with ASD. These findings are consistent with the claim that individuals with ASD have impairments in implicit, associative learning and may compensate for these impairments by employing explicit learning strategies. Given the importance of learning by automatic associations and its ubiquitous role in early learning, our findings provide important evidence for basic learning impairments in autism and the importance for targeting associative learning in early intervention strategies.

141.168 168 Behavioral and Somatic Responses to Decision Making in Autism Spectrum Disorders: Evidence From the Iowa Gambling Test. P. D. Chamberlain*, T. Newton, W. Ernst, S. E. White, K. Nelson, D. Schmuck and M. South, *Brigham Young University*

Background: There are ongoing questions regarding the relative contributions of cognition and emotion to decision-making in the autism spectrum disorders. In the context of previous work regarding possible disconnects between behavior and physiological response in autism--such as increased anxiety associated with increased risk-taking (South et al., 2011) or social anxiety atypically mediating emotional perception (Kleinhans et al., 2010)—we aimed to investigate autonomic arousal in ASD and matched controls during performance on the Iowa Gambling Task.

Objectives: To characterize potential differences in the cognitive and somatic strategies used in ASD versus typical samples. Such characterization may provide insight into the developmental course of autism as well as improve the specificity of intervention techniques.

Methods: Participants included 36 older children and adolescents diagnosed with an ASD and 30 typical controls. Groups were matched on both age (ages 11-16, mean =14.6) and IQ (mean=108.3). The *Iowa Gambling Task* is a behavioral task that models real-life decision-making in response to uncertainty, rewards, and punishments (Bechara et al., 1994). During each trial participants chose from one of four simulated card decks on a computer screen: each card comes with a reward, while some cards in each are also followed by a loss. Two "advantageous" decks come with small rewards but also small losses and lead to an overall profit, while the two "disadvantageous" decks have large rewards but larger losses, leading to an overall net loss.

Disposable electrodes were used to collect SCR for the duration of the experiment.

Results: We first analyzed the number of choices from the advantageous deck in each block of 20 cards. A 2 (diagnostic group) x 5 (trial block) repeated measures ANOVA showed an expected significant main effect for trial block, with an increase over time in the number of cards chosen from the advantageous decks. There was no main effect for diagnostic group; however, the ASD group learned more quickly and reliably to choose from the advantageous decks, leading to a significant group x trial block interaction. Consistent with the existing literature for this age range neither the ASD nor CON groups showed significant differences in SCR for anticipation of good vs. bad decks, or response to loss vs. no-loss trials.

Conclusions: The ASD group performed the task very similar to healthy adults, while the worse performance by the CON group looked like studies of typical adolescents who make riskier choices on the IGT. We speculate that the ASD group showed a stronger reliance on cognitive rather than emotional components during decision-making. While sometimes advantageous, this dissociation of cognition and emotion may not helpful in some situations, especially during social interactions that are the hallmark difficulty of autism.

141.169 169 Age-Related Differences in Visual Interference Control in Adolescents with Autism Spectrum Disorder. K. E. Bodner*, J. P. Stichter, D. Q. Beversdorf, J. H. Miles and S. E. Christ, *University of Missouri*

Background: Given the countless sources of interference that one encounters on a moment-by-moment basis, the ability to filter and resist interference from visual distractors (RIVD) is essential for efficient functioning in everyday life. Recent research in our laboratory (Christ et al., 2007, 2011) and others (e.g., Geurts et al., 2008) have documented impaired RIVD in individuals with autism spectrum disorder (ASD). Within this context, results from a recent cross-sectional study (Christ et al., 2011) suggest that RIVD impairment may be more pronounced in young as compared to older adolescents with ASD.

Objectives: The objective of the present study was to replicate and extend previous findings of age-related differences in the magnitude of RIVD impairment experienced by children and adolescents with ASD.

Methods: A new sample of 36 participants with ASD (mean age: 14.5 years; range: 12.3 – 20 years) and a comparison group of 48 neurologically uncompromised participants without ASD (mean age: 15.6 yrs; range: 12.1-19.4 yrs) participated. Similar to previous studies, we utilized a flanker visual filtering task to assess RIVD. In this task, participants were shown a stimulus comprising a horizontal row of five fish-shaped stimuli (Rueda et al., 2004). They were asked to respond as quickly as possible to the direction (left or right) that the center fish was facing. The flanking stimuli (i.e., the two fish stimuli on each side of the target) could be either compatible (i.e., facing the same direction) or incompatible (i.e., facing the opposite direction) with the target. RIVD ability was assessed by comparing performance between trials with incompatible flankers and trials with compatible flankers.

Results: Regression analyses were conducted to determine if a potential ASD-related impairment in RIVD emerged, remained static, or resolved across development. By utilizing this approach, we were able to control for the general contribution of age to RIVD, and evaluate whether any group differences in RIVD varied as a function of age. The analysis revealed a significant interaction between age and group, pr^2=.06, $t(79)$=2.19, p=.03. Post hoc t-test comparisons confirmed that younger adolescents with ASD demonstrated a significantly larger RIVD effect (i.e., mean RT in the incompatible condition minus mean RT in the compatible condition) than their age-matched control counterparts (RIVD effect for participants age 16 years and younger: ASD=56 ms, non-ASD=38 ms), $t(57)$=2.27, p=.03, d=.60. No such difference, however, was observed for the older participants in the sample (RIVD effect for participants older than 16 years: ASD=37 ms, non-ASD=41 ms), $t(23)$<1, p=.69, d=.17.

Conclusions: Taken together with other recent research (Christ et al., 2011), the present results support the hypothesis that children with ASD experience impairments in RIVD and this impairment is more evident in younger (as compared to older) children and adolescents with ASD. Given the potential clinical/academic implications associated with an age-related change in RIVD impairment (e.g., children may be at a major

disadvantage if their early learning occurs with impaired RIVD), there is a clear need for additional longitudinal study to validate this finding.

141.170 170 New Parent Report Measure of Cognitive Inflexibility and Related Symptoms in High Functioning ASD. L. Kenworthy*[1], B. Yerys[1], M. A. Rosenthal[2], J. L. Sokoloff[1], M. C. Wills[1], G. L. Wallace[3] and L. G. Anthony[1], (1)*Children's National Medical Center*, (2)*Center for Autism Spectrum Disorders, Children's National Medical Center*, (3)*National Institute of Mental Health*

Background: Restricted, repetitive, behaviors and interest (RRBI) symptoms are core to autism spectrum disorders (ASD), particularly higher-order RRBIs which discriminate ASD from other neurodevelopmental disorders. Furthermore, lab based and ecologically valid measures show a relationship between RRBIs and cognitive and behavioral inflexibility. Accurate phenotyping of these symptoms on continuous scales is useful for measuring the effect of treatments and identifying gene-behavior relationships. The Autism Diagnostic Interview (ADI) provides a gold standard diagnostic evaluation of RRBI symptoms and has been relied on heavily to characterize the RRBI phenotype, but it is intended as a diagnostic, not a quantitative measure. The Behavior Rating Inventory of Executive Function (BRIEF) is a standardized instrument that provides quantitative measurement of cognitive and behavioral flexibility, and has consistently identified flexibility deficits in ASD, but it does not measure RRBI symptoms. A measure tapping both these aspects of flexibility with a larger set of items could increase power and specificity when describing the inflexibility phenotype in ASD.

Objectives: To investigate the internal consistency, and discriminant and construct validity of a new 50 item parent report measure of flexibility, the Flexibility Questionnaire (FQ), in children with high functioning ASD.

Methods: Total raw FQ scores were compared in children with ASD (n= 95; 81% male; mean age =10.1 years, SD=1.8; mean full scale IQ=107.0, SD=19.8) and typically developing children (n= 29; 66% male; mean age=10.6 years, SD=1.9; mean full scale IQ=119.2, SD=11.9). Diagnosis in the ASD group was confirmed with the ADI-R and ADOS (ADI Social interaction mean=19.6, SD=5.7; ADI RRBI mean=5.7, SD=2.5; ADOS Communication and social interaction total mean=12.2, SD=5.3). Children with ASD were also assessed using the BRIEF Shift domain (mean T-score=68.0, SD=13.8), the Repetitive Behavior Scale-R (RBSR) compulsive subscale severity raw score (mean=2.8, SD=3.0), and the Social Responsiveness Scale (SRS) Mannerisms subscale (mean T-score=79.8, SD=17.1).

Results: Chronbach's alpha statistics indicate good internal consistency for the FQ in both the ASD (0.88) and TD (0.75) groups. The FQ clearly distinguishes individuals with ASD from the TD group (ASD mean=63.7, SD=20.5; TD mean=17.5, SD=10.1; F=121.9, p<.0001) after controlling for full scale IQ. The FQ shows convergent validity with the ADI RRBI domain (spearman rho=0.31, p<.005); BRIEF Shift domain (pearson r=.71, p<.0001), SRS Mannerisms Scale (0.59 p<.0001), and RBS-R compulsive subscale (.544, p<.001). This distinguishes it from the BRIEF Shift scale which is not significantly related to the ADI RRBI domain (spearman rho=.11).

Conclusions: Preliminary data are promising for the FQ as a continuous parent report measure of cognition, behaviors and symptoms that are related to inflexibility in high functioning ASD. It has the potential to provide a fine grained and integrated measure of inflexibility in autism. Future investigations are required to investigate discriminant validity of the FQ with other populations of developmentally disabled children that exhibit RRBIs, assess the relationship of FQ ratings to age and cognitive ability, and investigate the factor structure of the measure.

Cognition and Behavior Program
142 Cognition and Behavior V

142.171 171 BASC-II Profiles for Puerto Rican Children with Autism Spectrum Disorders. M. Vega*[1], E. Pabon[2], J. Ruiz[2] and R. E. Oliveras-Rentas[2], (1)*Ponce Center for Autism*, (2)*Ponce School of Medicine and Health Sciences*

Background: The Behavior Assessment System for Children Second Edition, Parent Rating Scales (BASC-2 PRS; Reynolds & Kamphaus, 2004) has been designed to obtain descriptive

information from parents about children's behavior and functioning across several domains. This instrument is also used to aid in the diagnosis and treatment planning process for children and adolescents. Many of these scales can measure deficits commonly associated to a wide range of diagnoses, such as Autism Spectrum Disorders (ASD). According to the authors, a common profile seen in this population includes lower scores on the Adaptive Skills Composite scale and elevations on the Withdrawal scale, the Atypicality scale and the Developmental Social Disorder content scale (Reynolds & Kamphaus, 2004). Studies on Spanish versions of other screening instruments for ASD have yielded questionable results on their specificity for diverse populations. The purpose of this pilot study is to determine if the Spanish version of the BASC-2 PRS provides a reliable profile to discriminate between children with ASD and children with other disorders, such as Attention Deficit- Hyperactivity Disorder (ADHD) for the Puerto Rican population.

Objectives: To explore and determine if the Spanish version of the BASC-2 PRS can be used to discriminate between children with Autism Spectrum Disorders and peers without the diagnosis in the Puerto Rican population.

Methods: Archival data of BASC-2 PRS ratings were reviewed for 30 children, ages 2 through 9 years, who underwent clinical evaluations at a local outpatient center for Autism in Puerto Rico. Data was collected only for children with diagnoses of Autism Spectrum Disorders (ASD) or Attention Deficit-Hyperactivity Disorder (ADHD). Scores on shared scales available in the BASC-2 Parent Rating Scale for Preschoolers and Children were analyzed for both groups.

Results: Preliminary data indicated statistically significant elevations ($p < .01$) for the ASD group on the Withdrawal scale and the Developmental Social Disorders scale, as well as lower scores on the Adaptive Composite. Other scales also showed significant differences, including the Behavioral Symptoms Index and the Emotional Self-Control, Executive Functioning and Resiliency content scales. However, the Atypicality scale did not differ significantly for both groups.

Conclusions: These findings are generally consistent with the BASC-2 profile associated with ASD, as described by the authors. Surprisingly, this is not true for the Atypicality scale. Using this preliminary data we can conclude that the BASC-2 can be used as a good screening instrument for children with ASD in Puerto Rico. However, sample size characteristics and cultural diversity issues should be closely examined.

142.172 172 Brain and Mind: The Relationship Between Head Circumference Trajectories and Intelligence in Typically Developing Infants. J. C. Sullivan*, S. Baron-Cohen and A. Humphrey, *Autism Research Centre, University of Cambridge*

Background: Abnormal brain growth trajectories are increasingly recognised as a key developmental feature of autism spectrum disorders (i.e. Courchesne, Campbell, & Solso, 2011), although little is understood about the cognitive implications of these growth patterns. In typically developing individuals, it is recognised that individual differences in brain size and growth trajectories during infancy may predict later IQ performance (i.e. Gale et al., 2004;2006), but no studies have investigated the *concurrent* covariance between brain growth and cognitive growth despite the implications of such a potential coupling for both clinical and typical populations.

Objectives: This study therefore aimed to explore the relationship between brain growth, as indexed by head circumference (HC), and IQ performance in a longitudinal sample of typically developing infants 7-29 months old. HC is a very strong predictor of brain volume in young children (Hazlett et al., 2005).

Methods: A total of 25 infants were seen on 3 occasions where IQ was assessed using the Mullen Scales of Early Learning (Mullen, 1995) and HC was measured by a trained researcher using a non-stretchable fibreglass measuring tape. Mixed linear growth models with random intercepts and slopes, were conducted to investigate the relationship between IQ change and HC growth.

Results: Between-child IQ performance and within-child changes in IQ performance showed distinct relationships with HC size and growth. Higher IQ scores at the first session (between-child IQ) were associated with larger HC as well as slower and less decelerative HC growth rates, lower IQ with faster and more decelerative HC growth and a smaller HC.

Within-child changes in IQ performance at the second or third visit, on the other hand, were associated with a contemporaneous change in HC growth rates, IQ increases associated with faster growth rates.

Conclusions: This is the first study to report that individual differences in IQ performance are associated with different HC growth rates in infancy at both the population and the individual level, and furthermore that between-child IQ scores (how they compared to other children in the sample) showed a different relationship with HC than did within-child IQ score changes (how much each child varied in IQ performance across time). Implications are discussed in terms of possible biological mechanisms, the effects of abnormal brain growth in autism on cognitive development, and the use of IQ or HC measurements in infant research studies.

142.173 173 Characteristics of Speech-Language Pathology Evaluations Abstracted During An Autism Prevalence Study. J. P. Zimmerman*, A. V. Bakian and S. Shumway, *University of Utah*

Background: The American Speech-Language-Hearing Association guidelines suggest speech-language pathologists (SLPs) can diagnosis an autism spectrum disorder (ASD) if trained in DSM-IV criteria, use ASD diagnostic tools, and are experienced in the diagnosis of developmental disorders. The degree to which SLPs actively identify and assess ASD and associated behaviors is unknown. In this study, we examine the ASD diagnostic patterns and characteristics of SLP evaluations abstracted during an ASD population-based prevalence study and compare to other provider types.

Objectives: 1) Among children with a previous ASD diagnosis, compare differences in evaluation patterns by provider type including average age at evaluation, average number of evaluations, and percent of total evaluations; and 2) Compare DSM-IV behaviors and autism discriminators as defined by the Centers for Disease Control Autism and Developmental Disabilities Monitoring (ADDM) Network on individual provider evaluations by provider type.

Methods: Children aged eight in 2008 were identified with an ASD (*n*=51) from a surveillance region in Northern Utah using the ADDM Network retrospective record review methodology. Speech language pathologists were one of 37 provider types documented. An ASD was identified based on information obtained from a cumulative set of evaluations scored by a qualified clinician reviewer using DSM-IV criteria for ASD. Individual evaluations by provider type for children with a final case definition of ASD were used for the analyses. Descriptive statistics and goodness-of-fit tests were used to analyze patterns.

Results: Among ASD cases (N=51), 616 evaluations were abstracted. A total of 103 evaluations (16.7%) were conducted by SLPs for an average of 2.2 evaluations per case. In comparison, 513 evaluations were conducted by non-SLP providers for an average of 10.1 evaluations per case. Doctoral level psychologists conducted the second largest number of evaluations (13.02%) after SLPs. Thirty-two unique SLPs were identified among all abstracted evaluations compared to 23 unique non-SLP providers. The average age at which a SLP evaluated a child with ASD was 5.12 years compared to 4.61 for all other provider types. Statistically significant differences were found in the presence of DSM-IV criteria and ASD discriminators as a function of provider type. Speech language pathologists were significantly more likely to document a DSM-IV qualitative impairment in communication (item 2b) and significantly less likely to document the DSM-IV social behavior 1d and restricted, repetitive, and stereotyped patterns of behavior, interests or activities (3a-3d). No differences were found on other social impairments as a function of provider type (1a-1c). Speech language pathologists were significantly less likely to mention an autism discriminator in evaluations (19%) compared to other provider types (35%). In cases, SLPs did not suggest or diagnose an ASD 79% of the time.

Conclusions: As was expected, Utah SLPs identify DSM-IV communication behavior 2b more frequently than other provider types in children with ASD. Further training may be beneficial for SLPs to recognize and document other ASD related behaviors.

142.174 174 Congruence Between Parental Report and Standardized Assessment of Cognitive and Developmental Functioning Among Children with ASD.

L. N. Clionsky*[1], K. P. Nowell[2], C. M. Brewton[2] and R. P. Goin-Kochel[3], (1)*University of Florida*, (2)*University of Houston*, (3)*Baylor College of Medicine*

Background: Parental perception of child functioning undoubtedly influences whether children with autism spectrum disorders (ASD) receive appropriate diagnoses. Parental report is an extremely valuable, important data source when evaluating symptoms of ASD. Yet formal assessment of a child's *cognitive* functioning is also important in the ASD-diagnostic process, as it provides context for a child's abilities; however, it is not clear how often standardized IQ testing is performed as part of the ASD evaluation. Many professionals may rely on caregiver report as their primary data source for this information, but parents may not always accurately perceive or estimate their children's level of functioning, particularly functioning in cognitive domains. For example, Geiger et al. (2002) noted that parents of children with ASD increasingly *over*estimated intelligence as their children's intelligence decreased. A better understanding of (a) how parents of children with ASD perceive their children's cognitive/developmental functioning and (b) what is being communicated to parents about their children's cognitive levels is warranted.

Objectives: To (a) explore parents' perceptions of cognitive and developmental functioning among their children with ASD; (b) assess the congruence between parental report and standardized assessment of children's functioning; and (c) determine whether evidence of ID, per cognitive-test results, was associated with families ever being told that their children met criteria for ID, mental retardation (MR), and/or global developmental delay (GDD).

Methods: Data were collected from families who simultaneously participated in the Simons Simplex Collection (SSC) at the Houston, TX, site. There were 181 probands with ASD (*M* age = 8.5 years, *SD* = 3.2; 85.6% male; 72.9% white; 59.2% of mothers had a bachelor's degree or completed graduate school); all received current cognitive testing with either the *Mullen Scales of Early Learning* (Mullen) or the *Differential Ability Scales-II*l (DAS-II). All families completed the authors' *Cognitive and Developmental Functioning Questionnaire* (CDFQ).

Results: Parental age-equivalent estimates of their children's social, language, and overall developmental functioning per the CDFQ were 5.3 years, 6.6 years, and 6 years, respectively. Compared to children's full-scale mental ages per cognitive assessment, 22.8% of parents overestimated and 62.9% underestimated their child's overall developmental functioning; 71.3% of these estimates were outside a 6-month window of accuracy, while 57.5% were outside a 12-month window of accuracy. Fifty-five children (30.4%) met criteria for ID, defined as verbal and nonverbal IQ scores ≤70, and 37% were previously told their children met criteria for MR/ID and/or GDD. In 28.3% of cases, the child did not currently meet criteria for ID but the family had been told that he/she had ID/MR/GDD; for 38.9%, the child did meet criteria for ID but the family had never been told, $\chi^2 = 16.898$, $p < .0001$.

Conclusions: Parents' ratings of their children's developmental functioning were generally discrepant with objective, standardized measures; more than half of parents over- or underestimated their child's functioning by ≥ one year. Many parents further reported that professionals either are *not* communicating ID diagnoses when they are warranted or *do* communicate them when they are not. Implications and additional findings will be discussed.

142.175 175 Developmental Changes in Gaze Behaviour During Face Processing in Autism. N. Hernandez*[1], L. Roche[2], M. Guimard-Brunault[2], C. Barthelemy[1], F. Bonnet-Brilhault[1] and J. Martineau[1], (1)*INSERM U930*, (2)*Inserm U930*

Background: Autism is a neurodevelopmental disorder characterized by alterations in social interaction and emotional reciprocity which can be related to difficulties in understanding the mental states of others ("theory of mind") and in processing efficiently facial information. Face perception depends on the integrity of several mechanisms, including an effective initial oculomotor exploration. Previous behavioral studies suggested an atypical visual scanning of faces in autism; subjects with autism disorder seem to explore the mouth area more than the eye area compared to control subjects. Most of these studies were based on an indirect evaluation of ocular behaviors, raising the problem of subjectivity. Since the last few years, the development of eye

tracking systems provides access to an objective quantification of gaze behaviors grace to the precise measures of various ocular parameters (exploration and fixations time, pupil diameter).

Objectives: Using an eye tracking system, the current study aimed to provide a better understanding of the ocular behavior involved in face perception during typical and autistic development.

Methods: We quantified ocular behaviors of typical and autistic participants (children and adults), measuring the time of exploration and the time spent on the different areas of interest (eyes, nose and mouth) while exploring faces. A large population consisting of 52 healthy children (4-15 years), 44 healthy adults (18-35 years), 27 children with autism (4- 15 years) and 7 adults with autism (18-35 years) was included in this study.

Results: Our results showed that all subjects (controls and patients) spent significantly more time on the eye region than on the other areas of interest. However, subjects with autism spent significantly less time on the eye region than healthy subjects. Moreover, control subjects used a strategy based on their own eye dominance when exploring faces, beginning their exploration of a face by looking at the eye in the contra-lateral visual field to their own dominant eye. This strategy could not be found in patients with autism. Our developmental study also showed that the time spent on the area of the eyes increases significantly with age during typical development as well as in autistic development.

Conclusions: The preferred exploration of the eye region in control subjects suggests a focus of visual attention on this area, particularly rich in social information. The increase of the time spent on the eyes with increasing age could be related to the development of an exploration strategy linked to the face-expertise. Our data also showed that subjects with autism spent less time exploring the eyes compared to typical subjects. However, subjects with autism looked at the eyes significantly more than other facial areas of interest, this data contrasts with earlier reports of a lack of interest in the eye region in patients with autism. Moreover, this time spent on the eye region increases throughout autistic development, revealing an increasing interest for the eyes.

142.176 176 Screening for Autism Spectrum Disorder in Developmentally At-Risk Toddlers. F. Nawaz*[1], C. Roncadin[2], J. Brian[3], S. E. Bryson[4], A. Niccols[5], W. Roberts[3], I. M. Smith[4], P. Szatmari[6] and L. Zwaigenbaum[7], (1)*University of Toronto Mississauga*, (2)*Peel Children's Centre*, (3)*Holland Bloorview Kids Rehabilitation Hospital*, (4)*Dalhousie University/IWK Health Centre*, (5)*Hamilton Health Sciences Centre*, (6)*Offord Centre for Child Studies, McMaster University*, (7)*University of Alberta*

Background: Children who are at-risk developmentally due to circumstances such as prematurity or genetic syndromes are diagnosed with autism spectrum disorders (ASD) at higher rates than those in the general population, making effective ASD screening techniques important for this group. The Modified Checklist for Autism in Toddlers (M-CHAT) is the most common ASD screening tool, yet little is known about its effectiveness in developmentally at-risk children.

Objectives: To evaluate the relation between the M-CHAT and Autism Diagnostic Observation Schedule (ADOS) in developmentally at-risk toddlers recruited from early intervention programs in southern Ontario by (a) examining whether M-CHAT classification was associated with ADOS classification or severity score in the whole sample, or in subgroups based upon extent of developmental delay; and (b) examining the profiles of the subset of participants who received a diagnostic outcome assessment.

Methods: Participants were 71 children recruited prior to their first birthdays for an ongoing longitudinal study. At 24 months, children were administered Module 1 of the ADOS and caregivers completed the M-CHAT (questionnaire and follow-up). The Mullen Scales of Early Learning (AGS Edition) and Vineland Adaptive Behavior Scales (Second Edition) also were administered to identify developmental delay, i.e., scores > 1 SD below the mean. ASD outcome was available for 21 participants (assessed at 3 years by experienced clinicians blind to prior study data using the ADI-R, ADOS, and clinical judgment using DSM-IV criteria).

Results: Twenty-six children had no delays, 19 had a delay in one domain, and 26 had delays in two or more domains. Twenty-four percent of the sample scored above the M-CHAT clinical cut-off. As expected, M-CHAT classification (Pass vs. Fail) was associated with ADOS classification (ASD/Autism vs. Non-ASD) based on the original algorithm ($X^2 = 9.54$, $p = .002$). However, when the sample was divided by extent of developmental delay (No Delay, Single Delay, or Multiple Delays), only the Chi-square test for the No Delay subgroup was significant ($X^2 = 5.46$, $p = .019$). Similarly, Mann-Whitney U tests using M-CHAT classification and ADOS severity score were significant for the whole sample ($U = 307.50$, $p = .031$) and the No Delay subgroup ($U = 6.50$, $p = .031$), but not the Single Delay or Multiple Delay subgroups. In the subsample with 3-year outcome data, 29% (6/21) received an ASD diagnosis and 33% (2/6) of those with an ASD diagnosis also had M-CHAT scores above the clinical cut-off at 24 months. Of the five children with 3-year outcome data who had M-CHAT scores above the clinical cut-off, 60% (3/5) did not receive an ASD diagnosis. All three of these children had Multiple Delays.

Conclusions: The M-CHAT has been shown to be a reliable screening tool for ASD in toddlers. The current findings suggest that it is useful with developmentally at-risk toddlers, but may not be specific enough in those with multiple developmental delays, which has implications for referral to diagnostic services. It will be important to assess ASD outcome for the remainder of the sample to determine the reliability of these findings.

142.177 177 Validation of a Japanese Version of the Vineland Adaptive Behavior Scales, Second Edition: Clinical Utility for the Assessment of Autism Spectrum Disorders. M. Tsujii*[1], H. Ito[2], S. Ohtake[2], N. Takayanagi[2] and W. Noda[2], (1)*Chukyo University*, (2)*Hamamatsu University School of Medicine*

Background: At present, a comprehensive adaptive behavior scale that helps deciding the necessary level of support required for individuals with disabilities is still not available in Japan. This unavailability has led to the underestimation of the adaptive functioning needs of individuals with disabilities, particularly those who exhibit a significant disparity between their cognitive ability and adaptive functioning (i.e., those who exhibit a higher IQ but have deficits in adaptive functioning). The Vineland Adaptive Behavior Scales, Second Edition (VABS-II; Sparrow, Cicchetti, & Balla, 2005) is one of the most widely used adaptive behavior scales in the US and other countries; this scale is not only utilized for identifying individuals with cognitive disabilities, but also for assessing the needs of individuals with autism spectrum disorders (ASD) and other developmental disabilities. We have initiated a standardizing process for a Japanese version of the VABS-II.

Objectives: As part of the validation analysis, this study aimed to compare the scale scores of the Japanese version of the VABS-II among 3 groups; normal controls, individuals with ASD and intellectual disability (ID), and individuals with ASD and normal intellectual ability.

Methods: Normal controls (n = 412) were enrolled from 28 prefectures throughout Japan. The ASD with ID group (n = 81) and ASD without ID group (n = 132) were enrolled from several prefectures in central Japan. We administered the Japanese version of the VABS-II to parents, caregivers, or adult family members of individuals of the 3 groups.

Results: With regard to the adaptive behavior subscales, the ASD groups showed lower scores than the normal control group regardless of the presence of ID, especially in the Communication and Socialization domains. These differences grew more prominent with an increase in the participants' age. With regard to the maladaptive scales, the ASD groups showed higher scores than the normal control group; however, the age of the participants was not as influential on these differences as that for the adaptive behavior scales.

Conclusions: Therefore, we observed that the Japanese version of the VABS-II is quite sensitive to the behavioral symptoms of ASD, even if the individuals have normal intellectual ability.

142.178 178 Assessment of Pragmatic Language in High-Functioning Autism. R. L. Loomis*[1], E. S. Simmons[1] and R. Paul[2], (1)*Yale University*, (2)*Yale Child Study Center*

Background:

Although individuals with high-functioning autism (HFA) often have average syntactic and lexical skills, deficits in pragmatic language are a hallmark of the disorder (Tager-Flusberg et al., 1990). Difficulties with pragmatic language, including reduced turn-taking, reduced range of speech acts, and inadequate management of turns and topics in conversation have long been reported in the literature. Although such pragmatic difficulties are well documented, there are few assessment instruments designed to characterize these pragmatic language acts. One such instrument developed to quantify pragmatic language deficits is the *Yale in vivo Pragmatic Protocol* (YiPP; Schoen, Paul & Volkmar, in prep). This semi-structured conversational tool was designed to elicit pragmatic behaviors in children with HFA.

Objectives:

To examine YiPP performance by children who have HFA and compare their performance to a typically developing (TD) control group.

Methods:

Children and adolescents age 9 - 17 years were divided into four groups based on diagnosis (HFA vs. typically developing; TD) and age (younger (Y) = children 9-12, and older (O) = children 13-17). Groups (HFA-Y vs. TD-Y and HFA-O vs. TD-O) were matched on chronological age and IQ. Each participant completed a 20-minute YiPP conversation that was video recorded. Each YiPP item was given an error code based on the appropriateness of the child's response. Error codes for each behavior were divided into five domains of pragmatic language (discourse management, DM; communicative function, CF; conversational repair, CR; presupposition, P; register variation, RV). The number of utterances produced by each participant (#child) during the YiPP was tallied to capture amount of language each participant used.

Results:

ANOVA with LSD post hoc testing was used to examine differences in error scores among the four groups. Differences between groups were observed within the DM, CR, P and RV pragmatic domains. No differences were noted on the CF domain.

An independent samples t-test yielded a significant difference between the HFA and TD groups on overall number of participant utterances ($t(136)= -2.403$, $p < 0.02$). Pearson correlation coefficients were calculated for the relationship between number of utterances and pragmatic error scores for participants with HFA. A negative correlation was found between # utterances and DM ($r= -.420$, $p < 0.01$); #child and CF ($r= -.349$, $p < 0.01$); and #child and P ($r= -.342$; $p < 0.01$).

Conclusions:

Children with HFA produced responses during the YiPP that were less pragmatically correct relative to age-matched TD peers. Differences were primarily observed in discourse management, conversational repair and presupposition domains. Additionally, children with HFA produced fewer utterances than did their TD peers. Among HFA participants, a greater number of child utterances was associated with lower error scores in DM, CF, and P domains. These results confirm pragmatic language difficulties and lower speaking rates among children with HFA relative to TD peers. This pattern of results illustrates the difficulties that children with HFA have in maintaining conversation and responding to a partner's conversational bids and has implications for the development of social-communicative interventions.

142.180 180 An Evaluation of the Measurement Properties of An Activities of Daily Living Scale for Adults with Autism, Down Syndrome, Fragile X, and Other Intellectual Disabilities. M. M. Seltzer*, M. J. Maenner, L. E. Smith, J. Hong, R. Makuch and J. S. Greenberg, *Waisman Center, University of Wisconsin-Madison*

Background:

Adults with autism experience a wide range of difficulties in performing daily activities; some might encounter severe limitations in self-care and basic tasks necessary for independent living, while others have few limitations in these areas. Activities of Daily Living (ADLs) are considered durable indicators of "activity limitations"—consistent with the World

Health Organization's dimensional framework for disability. ADL instruments have been used extensively in clinical applications, research, and public health practice. However, there is a paucity of freely-available and high quality tools for measuring activity limitations among adults with autism or other developmental disabilities.

Objectives:

To describe the development of the Waisman Activities of Daily Living (W-ADL) Scale, and to thoroughly evaluate its measurement properties for adults with developmental disabilities.

Methods:

This analysis utilized four well-characterized and longitudinally-studied groups of adults with developmental disabilities: 406 adults with autism; 147 adolescents and adults with fragile-X syndrome; 169 adults with Down syndrome, and 292 adults with intellectual disability (but not Down syndrome). The W-ADL Scale consists of 17 items that pertain to the target adult's current performance in daily activities such as grooming, bathing, running errands, and preparing meals. The target adult's performance of each activity is rated on a 3-point scale (0="does not do at all", 1="does with help", 2="independent"), and item scores are summed to produce an overall score. W-ADL items were administered at the beginning of each study. Items were readministered at three additional time points for adults with autism and seven additional time points for adults with Down syndrome or intellectual disability. We evaluated the W-ADL according to an established set of quality criteria for the measurement properties of health status questionnaires (Terwee et al, 2007).

Results:

Cronbach's alphas for the W-ADL ranged from 0.88 to 0.94 in the four disability groups, and a single-factor structure was most parsimonious. Comparisons of consecutive time points resulted in weighted kappas between 0.92 and 0.93, suggesting high reliability. Construct validity was supported through substantial associations between the W-ADL and the level of employment or participation in educational programs, maternally-reported need for respite services, maternal caregiving burden, and target adult IQ. Criterion validity was demonstrated with a correlation of 0.78 between the W-ADL and Vineland Screener standard score among adults with autism. The W-ADL demonstrated no floor or ceiling effects in any of the four groups. Among adults with Down syndrome and intellectual disability, there were significant group differences in W-ADL scores by subjective maternal ratings of "mild", "moderate", "severe", and "profound" intellectual disability. We estimate that a 1-point change in W-ADL scores is detectable in samples of at least 35 people.

Conclusions:

The W-ADL exceeded the recommended threshold for each quality criterion we evaluated, and appears to have desirable measurement properties as a research instrument. Additional work is needed to evaluate its utility and applicability in different cultures and contexts. This freely-available tool has practical applications as an efficient measure of activities of daily living for research concerning adults with autism and developmental disabilities.

142.181 181 Using Eye-Tracking to Evaluate Visual Attention During the Encoding Stage of Social Information Processing of Dynamic Social Scenes in Children and Adolescents with ASD. J. H. Schroeder* and J. M. Bebko, *York University*

Background: Individuals with ASDs have difficulties in perceiving and understanding social interactions. The Social Information Processing model, as developed by Crick and Dodge (1994) consists of five steps that operate in a circular manner, from the encoding of social cues, to the selection of an appropriate response. The model is the most widely accepted model to explain aggression in children, and the model has more recently been supported by research that indicates that it can be applied to social competence and difficulties more broadly. The first stage of the model involves the encoding of the sensory components of a social situation. There have only been two studies that have examined the Social Information Processing model in individuals with an ASD and both of these studies have found differences at this stage of social information processing. Meyers and colleagues (2006) found that individuals with Asperger

syndrome made more encoding errors than the typically developing comparison group. Embregts and colleagues (2009) found that relative to typically developing peers, individuals with PDD-NOS + mild ID encode more negative cues.

Objectives: The purpose of this study was to develop a better understanding of the encoding stage of social information processing in individuals with ASD compared with typically developing peers.

Methods: Participants range in age from 6 to 18 year and are divided into an ASD group (Asperger Syndrome/high-functioning autism) (n=20) and a typically developing comparison group (n=20). Social information processing was assessed using the Social Information Processing Application (SIP-AP, innovation Research & Training, 2011), which required the participants to watch a series of 8 brief videos depicting social situations involving either hostile or ambiguous provocations. To assess encoding, participants were asked to describe what happened in the video. The Tobii Eyetracker was used to enhance the measurement of encoding of the social situation by recording where the participants were looking during each of the videos.

Results: Initial participants were consistent with the hypotheses that the ASD group will have more errors in encoding than the typically developing group. More specifically, the ASD group will be more likely to report negative social cues, and less likely to report non-hostile cues. The second hypothesis was that the ASD group will spend less time attending to the faces and more time attending to irrelevant aspects of the surrounding environment than will their typically developing counterparts. Data collection and analysis is continuing.

Conclusions: This is the second study to incorporate eye-tracking technology with a social information processing paradigm and it is the first to use this methodology with individuals with an ASD. The results from this study will contribute greatly to the understanding of social difficulties in ASD and may help guide treatment planning. The eye-tracking results will provide clarity about where children with ASDs are looking in potentially provoking social situations, with an eye to perhaps teaching them where to attend in order to better understand social cues and social situations.

Funding: Canadian Institutes for Health Research

142.182 182 Action Understanding and Imitation of Actions with An Inferable Functional Outcome Level (IFOL) in Young Children with Autism Spectrum Disorders. M. Vanvuchelen*, *Katholieke Universiteit Leuven - PHL-University College, Belgium*

Background:

Converging evidence from EEG and fMRI studies in adults and school-aged children with autism spectrum disorders (ASD) has led some to propose that autism results from a failure of the mirror neuron system (MNS). However, only studies of young children with ASD can determine whether this dysfunction is a primary or a secondary deficit. The understanding and imitation of actions with an inferable functional outcome level (IFOL) are critical in social interaction and praxis learning To the best of our knowledge this kind of actions are not yet investigated in young children with ASD.

Objectives:

To examine action understanding and imitation of actions with IFOL in children with ASD compared to typically developing (TD) peers.

Methods:

Participants: 20 children with ASD (full IQ above 85) and 20 age and gender matched TD between 2 and 2.5 years of age. Pre-and post-tests: Observation of the child's grip (bimanual versus unimanual) while drinking a glass of juice to determine the child's predominantly grip and to investigate the correlation between action understanding and implicit imitative learning. The ability to perceive and predict action goals based on the unimanual grip selection of the demonstrator will be investigated by videos shown on a computer screen. Gaze position will be measured with a corneal reflection technique (Seeing Machine FaceLab). The target video will show the

demonstrator who performs two different goal-directed actions with IFOL: grasping a glass to drink versus grasping a glass to place. We shall compare the gaze position of ASD and TD. We shall also compare children who selected predominantly a bimanual grip to grasp a glass (without motor familiarity with the observed unimanual grips) with children who selected predominantly an unimanual grip (with motor familiarity) to investigate the effect of congruency between the observed action and the child's motor repertoire on the ability to predict goals.
If the child's gaze reaches the goal (mouth or second glass) at the same time or after the demonstrator's hand reaches the goal then the gaze shift is labelled reactive. In contrast, if the child's gaze reaches the goal before the demonstrator's hand reaches the goal then the gaze shift is labelled predictive.
We assume that if the predictive gaze shift appears in the reaching stage (i.e. before the demonstrator grasps the glass) the child has tracked the grip type to understand the action goal, which may be an indication of activity of the MNS. In contrast, if the predictive gaze shifting appears in the placing stage the child has tracked the direction of the moving hand.
We expect that regardless of diagnosis and level of motor familiarity, all children initially will use direction of motion as stimulus to predict the demonstrator's goal. Moreover, we expect that ASD children, in contrast to TD children, will not use grip type as stimulus after some trials.
A control video with geometric figures will be used to rule out that logical reasoning construes goal prediction.

Results:

Data-acquisition is on-going.

Conclusions: will be presented on the congress.

142.183 183 The Interplay of Language on Executive Functions for Children with ASD. M. Akbar*[1], R. Loomis[2] and R. Paul[1], (1) *Yale Child Study Center*, (2) *Yale School of Medicine*

Background: Impairment in use and development of language is a defining feature of autism spectrum disorders (ASD). Difficulties in executive functioning (EF) have also been consistently observed in individuals with ASD. A strong relationship exists between these two skill sets; in many cases, language operates as a self-regulatory function during problem solving and is thought to play a mediating role in EF. Use of inner or self-directed speech in particular may be a key component of EF. Findings on the association between language and EF, however, have been inconsistent. These inconsistencies merit additional examination of the link between language and EF.

Objectives: The purpose of this study is to elucidate the specific EF profile of children with ASD by exploring the relationship between verbal and nonverbal skills on EF, using direct assessments and indirect parent and teacher reports.

Methods: 87 participants with ASD aged 8-12 years were administered assessments assessing EF (NEPSY-2, DKEFS), cognition (DAS, WISC), and language (CELF). Parents and teachers completed the BRIEF questionnaire (EF), the Vineland (adaptive functioning), and the CCC-2 (language).

Results: Significant correlations were found between measures of EF and both verbal and nonverbal measures, meriting further investigation into these relationships. As such, simple linear regressions were calculated between language and cognitive ability and measures of EF in four domains: working memory (WM), organization (O), shift (S), and inhibition (I). Direct assessment measures used were WISC Letter-Number Sequencing (WM), NEPSY Animal Sort task (O), DKEFS Number-Letter Switching (S), and DKEFS Color-Word Interference (I). Language skill, represented by DAS VIQ, was a significant predictor of WM ($F(2,55)= 20.27$, $p < .05$; $R^2= .424$) and O ($F(2,41)= 11.008$, $p < .01$; $R^2= .349$). Non-verbal cognitive ability, represented by WISC PRI, was a significant predictor of WM ($F(2,55)= 20.27$, $p < .02$; $R^2= .424$) and S ($F(2,50)= 3.881$, $p < .01$; $R^2= .134$).

Indirect reports of EF were likewise examined. Teacher report of adaptive language was a significant predictor of teacher report of WM ($F(3,40)= 4.749$, $p < .05$; $R^2= .263$). No significant parent predictors were found. Further, a stepwise regression revealed that a significant predictor of direct WM assessment was language skill ($F(1,29)= 20.027$, $p < .05$; $R^2= .408$) and parent report of language development ($F(2,28)= 14.096$, $p < .05$; $R^2= .502$).

Conclusions: Language and nonverbal cognitive skills in individuals with ASD predicted different domains of EF. Verbal assessment predicted WM and O, whereas nonverbal assessment predicted WM and S. Indirect assessment of language skill substantiated the relationship between language skill and WM. The association of language and WM found in this study comports with the importance of self-talk in maintaining information in the phonological loop. Organization requires consolidating different parts into a whole, and language would intuitively be helpful in defining and categorizing a number of stimuli as part of this process. The present results indicate a profile of EF in individuals with autism that is mediated by language ability. This association has important implications for both the diagnosis of ASD and for the development of treatment interventions.

142.184 184 Does Being Japanese-English Bilingual Affect Language Development in Children with Autism?. K. Gondo[1], T. Matsui[2], R. Yanagisawa[1], H. Li[3] and M. Oi*[4], (1)*Kyoritsu Women's University*, (2)*Tokyo Gakugei University*, (3)*Kanazawa University*, (4)*United Graduate School of Child Development, Osaka University, Kanazawa University, and Hamamatsu University School of Medicine*

Background: Many educators and clinicians believe that bilingualism has negative influences on language development of children with Autism Spectrum Disorders (ASD). However, there have been few studies conducted to examine whether or not, or how bilingualism affects the language development of children with ASD. There is not sufficient evidence to prove that the aforementioned claim is true. On the other hand, past studies on typically developing bilingual children have indicated that bilingualism can lead to linguistic and cognitive benefits. It is therefore important to research further on this topic. In this preliminary study, we focused on Japanese-English bilingual children, both typically developing and with ASD. With the advancement in globalization, the number of children with ASD growing up in bilingual environments is gradually increasing in Japan, and this population has not been revealed in research.

Objectives: To explore vocabulary and grammatical abilities of high functioning Japanese-English bilingual children with ASD (BLASD) in both languages and to compare results with those of typically developing Japanese-English bilingual children (BLTD).

Methods: Participants were six high functioning BLASD children (MA=104.5 months, 1 female) and 6 BLTD children (MA=105.8 months, 2 females). All were born and raised in a Japanese-English bilingual environment since birth. All children in the BLTD were living in US. Of the BLASD, 5 children were raised in Japan and one was raised in US. The following standardized tests were used to assess the language abilities among participants: PPVT-4 for English vocabulary comprehension, EVT-2 for English vocabulary production, Trog-2 for English grammatical comprehension, PVT-R (Picture Vocabulary Test-Revised) for Japanese vocabulary comprehension, and J-COSS3 (Japanese test for Comprehension of Syntax and Semantics) for Japanese grammatical comprehension.

Results: PPVT-4: Mean Standard Score (SS) of BLTD was about average while SS of BLASD was 2SD below average (SS=106.2, SS=70.8; respectively). EVT-2: SS of BLTD was about average, while SS of BLASD was 1SD below average (SS=103.5, SS=83.7; respectively). PVT-R: Mean age equivalent of BLTD was 73.8 months, while it was 96.7 months in BLASD.Trog-2: SS of BLTD was 89.4 and SS of BLASD was 84.0. J-COSS3: Of the BLTD, three children were at level 3 (5-6 year old level), two were at level 2 (3-4 year old level), and one child was at level 4 (6-7 year old level). Compared to the BLTD, BLASD showed relatively high levels. Three children reached level 6 (above 8 year old level), and one child at levels 3, 4, and 7, respectively. However, spondaic developmental pattern was found among all BLASD children.

Conclusions: BLASD demonstrated higher abilities in Japanese vocabulary comprehension than BLTD, while BLTD showed higher abilities in English vocabulary comprehension and expression than BLASD. These results indicate the possibility that vocabulary development more affected by the language spoken in their community. Regarding English grammatical comprehension, no difference was found between groups. It was also noteworthy that BLASD demonstrated an atypical pattern in Japanese grammatical comprehension, in contrast to BLTD. ASD and linguistic

environment might have different influences on vocabulary and grammatical development.

142.186 186 Do Children with Specific Language Impairment Have a Cognitive Profile Reminiscent of Autism? A Review of the Literature. L. J. Taylor*[1], M. T. Maybery[2] and A. Whitehouse[2], (1)*Telethon Institute for Child Health Research*, (2)*University of Western Australia*

Background: There is debate regarding the relationship between autism spectrum disorder (ASD) and specific language impairment (SLI), with some researchers proposing etiological overlap between the conditions and others maintaining their etiological distinction. The language phenotype of SLI is characterised by structural language difficulties, which contrast with the pragmatic language and broader developmental difficulties observed in children with ASD. On the basis of these differences, SLI and autism have traditionally been considered separate disorders, with distinct aetiologies. However, in recent years, evidence has emerged that the diagnostic boundary between autism and SLI may not be clear cut.

Objectives: Although there is an accumulating body of literature comparing the language phenotypes of ASD and SLI, no study has undertaken a systematic investigation of potential cognitive overlap between the two conditions. The overarching aim of the current review was to compare the cognitive phenotypes of ASD and SLI described in the published literature. The current review focused on the empirical literature that has investigated cognitive characteristics of ASD (namely impaired theory of mind and emotion recognition, executive dysfunction and weak central coherence) in children with SLI.

Methods: Published literature was examined for empirical articles that met the following criteria: (1) examined cognitive characteristics of ASD (Theory of Mind [ToM], emotion recognition, executive function and central coherence) in children with SLI, or (2) compared the cognitive phenotype of ASD and SLI with regard to the aforementioned cognitive characteristics of ASD. Findings were reviewed and synthesized.

Results: Overall, findings were inconsistent and there is a lack of substantive evidence supporting overlapping cognitive phenotypes in autism and SLI. While several studies have found that children with SLI have intact ToM, other studies suggest that children with SLI have difficulty with ToM tasks. The mixed findings may relate to methodological limitations commonly observed across these studies. Observed ToM impairments in children with SLI may relate to the language difficulties of this population, rather than an underlying cognitive deficit. With regard to emotion recognition, while children with SLI are able to identify facial expressions, they have difficulty understanding and expressing auditory affective information. Results relating to executive function in children with SLI were also mixed. While some authors have reported planning and set-shifting deficits in children with SLI, there are a number of notable failures to replicate. There is also considerable debate as to whether language impairment is causal in the executive function deficits observed in children with SLI. Only one study has examined central coherence in children with SLI, finding that children with SLI did not manifest specific deficits in visuospatial processing (i.e., in either global or local processing).

Conclusions: There is little consistent evidence supporting the hypothesis that autism and SLI have overlapping cognitive phenotypes. Better powered and more rigorous experimental designs, as well as studies directly comparing the cognitive phenotypes for SLI and ASD will further elucidate the etiological relationship between these two conditions.

142.187 187 Palm Reversals Are the Pronoun Reversals of Sign Language. A. Shield*, *Boston University*

Background:

Originally noted by Kanner (1943), pronoun reversals are more common in children with autism than in any other group (Lee, et al., 1994), have been reported in many studies (e.g., Bartak & Rutter, 1974; Charney, 1980), and may reflect the autistic child's difficulty "in conceptualizing the notion of self and other as it is embedded in shifting discourse roles between speaker and listener" (Tager-Flusberg, 1993, 1994, 2000). In American Sign Language (ASL), the pronouns 'me' and 'you' consist of indexical points to the speaker and the interlocutor, respectively. Little is known about the acquisition of ASL

pronouns by deaf children on the autism spectrum, though pronoun reversals have been documented in the early signing of typically-developing (TD) deaf children (Petitto, 1987) and in the speech of TD hearing-impaired children (Oshima-Takane, et al., 1993).

Objectives:

We aimed to investigate whether there is any evidence of pronoun reversal in the sign language of native-signing children (of deaf parents) diagnosed with an ASD. We furthermore hypothesized that the cognitive deficit underlying pronoun reversal in speech would lead to a different effect in sign: namely, reversals in the palm orientation of lexical signs and fingerspelling. A deficit in the understanding of the relation between self and other might lead the signing child to reproduce signs as observed from his perspective, rather than the perspective of the signer being modeled; this could result in palm reversals, such that a sign normally produced with palm(s) outward would be reproduced by the child with palm(s) inward, and vice versa. By contrast, a child with such a deficit would not be predicted to reverse pronouns, since the reproduction of an indexical point as observed from the child's perspective would result in the correct pronoun (i.e., the sign 'you' would be reproduced 'me'). A true pronoun reversal in ASL would consist of the child producing the sign 'you' (pointing away from himself) in reference to himself (Petitto, 1987).

Methods:

Four deaf ASD children (ages 4;6-7;5) were each observed for 30 minutes in naturalistic interaction with teachers or parents. Four age-matched TD deaf children were observed in structured tasks. Signs were transcribed and coded for the parameters of palm orientation, handshape, location, and movement.

Results:

All four of the ASD children, but none of the TD children, produced palm reversal substitutions in the sign language samples transcribed. However, none of the children reversed pronominal points. The ASD children were inconsistent in their reversing of palm orientation, just as hearing ASD children are inconsistent in their reversal of pronouns (Chiat, 1982). Children were also relatively accurate in their production of handshapes, indicating that fine motor control was not at issue.

Conclusions:

This study lends strong evidence to the hypothesis that the social and cognitive deficits found in ASD will lead to different linguistic effects in a visual-gestural language such as ASL. Furthermore, we claim that palm reversals are the sign language correlate of spoken language pronoun reversals.

142.188 188 Maternal and Paternal Speech to Children with Autism Spectrum Disorder. P. Venuti*[1], A. Bentenuto[1], S. De Falco[1], G. Esposito[1] and M. H. Bornstein[2], (1)*University of Trento*, (2)*NIHCD*

Background: Parental speech directed to young children is crucial for many developmental reasons. For example, language is among the most immediate and relevant means parents have to convey both affect and information to children. Speech directed to children has been thoroughly investigated in typical development, and associations between parent speech and child language, social, and emotional development are prominent in the literature (Blount, 1990; Garton, 1992; Hampson & Nelson, 1993; Longobardi, 1992; Stern, 1985; Thiessen, Hill, & Saffran, 2005). However, the characteristics of parental speech to children with intellectual disabilities are far less well documented (cf. Longobardi, Caselli, & Colombini, 1998; Spiker, Boyce, & Boyce, 2002; de Falco et al. 2010). Generally, parents of children with intellectual disabilities are believed to adapt to their children's mental and language level in a way believed to promote their children's communication and attention skills (Legerstee & Fisher, 2008; Legerstee, Van Beek, & Varghese, 2002). In the area of developmental disabilities, father–child interaction has been much less investigated when compared to mother–child interaction (Girolametto, 1994; McConachie, 1989), and no recent studies have been conducted that involve children with ASD.

Objectives: The aim of the present study is to investigate and compare maternal and paternal speech directed to young children with ASD. The study involves 15 mother-child dyads

and 15 father-child dyads with children (age 3 to 5 years) with ASD.

Methods: The diagnosis of participants with ASD was confirmed through clinical judgment by an independent clinician based on DSM-IV criteria as well as through the Autism Diagnostic Observation Schedule (ADOS - Lord, Rutter, DiLavore, & Risi, 2003). Mothers' child-directed speech and father' child-directed speech were recorded during a 10-min observation session of joint play interaction. Parents' speech was coded from verbatim transcripts of parental use of language from the videos of parent–child interactions. Parental speech was categorized in terms of the primary function of each speech unit, using a coding scheme validated in previous studies of maternal speech that confirm its appropriateness across cultures (Bornstein et al., 1992; Rossi, 1998; Venuti et al., 1997). Three main categories are: (a) affect-salient speech—expressive, generally non-propositional, idiomatic, or meaningless statements language (encouragement, discouragement, nonsense, greetings, mimic, onomatopoeia and conventions) and (b) information-salient speech—normally fully propositional statements that give or ask information about the child, the parent him/herself, or the environment. Subcategories of information-salient speech are also considered (direct statements, questions, or descriptions). A third class (c) of other parental speech included vocatives, speaking on behalf the dyad, the child or a toy, and a fourth included unintelligible utterances. These four classes are mutually exclusive and exhaustive.

Results: This functional analysis was applied by two independent coders. Data analyses showed that there are no quantitative differences between mothers and fathers of children with ASD regarding the three main categories and the subcategories of information-salient speech.

Conclusions: However, qualitative differences between mothers' and fathers' speech emerged.

142.189 189 Focus On the Positive: Adolescents with ASD and Their Impact On the Family. L. Berkovits*[1], S. Zeedyk[2], S. Cohen[2] and J. Blacher[2], (1)*University of California, Los Angeles*, (2)*University of California, Riverside*

Background: Raising a child with any disability significantly affects families. Parents of children with autism spectrum disorders (ASD), in particular, can experience negative effects, including more stress and depressive symptoms (Abbeduto et al., 2004; Blacher & McIntyre 2006; Eisenhower et al., 2005). Less attention has been paid to examining positive family experiences (e.g., family closeness). Blacher and Baker (2007) found that parents reported the same level of positive impact, regardless of whether their child was typically developing or had developmental delay. A focus on the positive during the transition period of adolescence will help to better understand family processes.

Objectives: This study will examine both the positive and negative impact of adolescents on their families, comparing families of adolescents with ASD, intellectual disability (ID), and typical development (TD). Family impact will be considered in the context of the adolescent's social skills and behavior problems.

Methods: Participants in this study were assessed as part of a longitudinal study of child and adolescent development; all youth in the three groups were age 13: TD (n=81; Mean IQ=110), ID (n=23; MIQ=59), ASD (n=24; MIQ=98). Groups did not differ on race/ethnicity or socioeconomic variables. The projected final sample size for ASD is 40. Positive and negative impacts were measured using mother report on the Family Impact Questionnaire (FIQ; Donenberg & Baker, 1993). Social skills were measured using mother report on the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) and behavior problems on the Child Behavior Checklist 6-18 (CBCL; Achenbach, 2000).

Results: Preliminary results indicate group differences in both positive (p = .015) and negative (p < .001) impact of the adolescent on the family. Tukey post-hoc analyses revealed that the adolescents with TD had a more positive impact on their families (M=15.8, SD=5.2) than adolescents with ASD (M=12.2, SD=5.8). Positive impact in the ID group (M=13.9, SD=5.7) was not significantly different from either group. Adolescents with ASD (M=23.5, SD=15.7) and ID (M=22.3, SD=13.8) had a more negative impact on their families than the adolescents with TD (M=9.6, SD=8.2). Results also revealed group differences in social skills (p <.001) and

behavior problems (p <.001); adolescents in the ID and ASD groups exhibited poorer social skills and more internalizing and externalizing behavior problems than the TD group. Based on these findings, additional analyses will determine if these variables can account for the group differences in positive and negative family impact.

Conclusions: These results show that while families of adolescents with ASD and ID both exhibit increased negative impact, only families of adolescents with ASD exhibit reduced positive impact. Given previous research suggesting that perceived positive impact can buffer the relationship between child behavior problems and parenting stress (Blacher & Baker, 2007), this finding can help explain the increased difficulties experienced by families raising children with ASD, and pointedly suggests areas for intervening with parent expectations.

142.190 190 Remembering Delayed Intentions in Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorders: A Comparison. M. Altgassen* and A. Kretschmer, *Technische Universitaet Dresden*

Background:

Individuals with Autism Spectrum Disorders (ASD) and individuals with Attention Deficit Hyperactivity Disorders often show deficits in the organization and coordination of everyday activities. They have difficulties with time management, preparation and sequencing of actions. These impairments in planning ahead have been found in standard laboratory-based prospective memory tasks (Altgassen et al., 2009; 2010; Mackinlay et al., 2006; Zinke et al., 2010). However, all studies on prospective memory in ASD and ADHD have used rather abstract tasks that do only allow a limited transfer of these laboratory-based results to participants' everyday performance.

Objectives:

The purposes of the present study were (1) to directly compare prospective memory performance between individuals with ASD and those with ADHD and (2) for the first time, to apply an everyday-like, ecologically valid task.

Methods:

Twenty-five adults with high-functioning ASD, 25 individuals with ADHD and 25 age- and ability-matched neurotypical controls were asked to work on standard prospective memory tasks as well as on the Dresden Breakfast task. The latter required participants to prepare breakfast comprising certain drinks (orange juice, tea) and foods (eggs, bread, etc.) following a set of rules and time restrictions that constituted several prospective memory tasks (such as remembering to take the tea bag out of the teapot after 4 minutes).

Results:

Controls outperformed both clinical groups in the standard, laboratory-based prospective memory tasks. Regarding the Dresden Breakfast task analyses of variance (ANOVAs) revealed group differences in planning measures as well as general task performance and time- and event-based prospective memory performance. Overall, individuals with ASD and ADHD completed less tasks than controls and showed poorer planning performance. With the exception of time-based prospective memory performance, individuals with ASD performed poorer than those with ADHD.

Conclusions:

Difficulties with planning and execution of complex tasks not only evidenced in standard, laboratory-based tasks as previously found, but also when using an ecologically valid, everyday-like task. Participants with ASD and ADHD were impaired in the intention formation and initiation phases of prospective remembering. These deficits were related to difficulties in planning, execution and coordination of the tasks (rule adherence, time, efficiency). Overall, individuals with ASD seem to show more deficits in planning and prospective memory than individuals with ADHD which is reflected in more severe everyday difficulties.

142.191 191 Do Planning Aids Help to Remember? An Investigation of Prospective Memory and Implementation Intentions in Autism Spectrum Disorders. A. Kretschmer*[1], M. Altgassen[2], P. Rendell[3] and S. Bölte[4], (1)*Technische Universitaet Dresden, Dresden, Germany*, (2)*Technische Universitaet Dresden*, (3)*Australian Catholic University, Melbourne, Australia*, (4)*Karolinska Institute*

Background: The ability to remember future intentions like taking medication on time is an important ability in everyday life. It is referred to as term prospective memory. Deficits in the organization of daily activities in individuals with autism spectrum disorders (ASD) have been related to impaired prospective memory performance (Mackinlay et al., 2006). Until now, only few studies addressed prospective memory in ASD, but empirical evidence indicates that individuals with ASD show impairments in prospective memory tasks (Altgassen et al., 2009; Brandimonte et al., 2011). To date, none of the studies targeted the question of how to improve prospective memory performance in ASD. Implementation intentions are planning aids that may work as strategies to enhance prospective memory by supporting encoding of the intention that has to be remembered at a later point in the future.

Objectives: The aim of the present study was to investigate, for the first time, the influence of implementation intentions on prospective memory performance in individuals with ASD.

Methods: Twenty-seven adults with high-functioning ASD and 27 neurotypical controls parallel for age, verbal and non-verbal mental abilities were included in this study. Virtual Week, a computer-based game imitating a week with everyday life tasks, was used to test prospective memory performance. Half of the control and half of the ASD group were requested to use implementation intentions, while the other participants received standard prospective memory instructions.

Results: Analyses of variance (ANOVAs) revealed significant group differences in prospective memory performance. Individuals with ASD completed less prospective memory tasks correctly than neurotypical controls. No significant main effect emerged for instruction (implementation intention vs. control). Further analyses indicated that significant group differences in prospective memory task performance can be eliminated by introducing implementation intentions.

Conclusions: Results provide further evidence for reduced prospective memory performance in ASD. Importantly however, deficits in prospective remembering were eliminated when participants were prompted to form implementation intentions.

142.192 192 Semantic Integration in Adults with Asperger Syndrome and Nonverbal LD. M. E. Stothers* and J. Oram Cardy, *The University of Western Ontario*

Background:

The striking combination of verbal strengths and adaptational weaknesses characteristic of Asperger Syndrome (AS) has also been described as typical of Nonverbal Learning Disability (NLD), a learning disability subtype. Only recently has research begun to explore similarities between AS and NLD, and none of this research has investigated language. The present study addressed this gap.

Empirically, adults with AS and with NLD have demonstrated average or better vocabulary on standardized testing. Some studies, however, have reported semantic weaknesses, the sources of which are unknown. *The present study examined the possibility that semantic difficulties arise during the integration of unique semantic representations.* Semantic integration involves the detection and elaboration of overlap between discrete representations to form a novel, higher-order relationship. As such, it is a form of gestalt perception – a relational process in which meaningful wholes are constructed from stimulus fragments that differ qualitatively from the larger whole. Low scores on nonverbal tests of gestalt perception have been reported in AS and NLD, as has difficulty understanding verbal gestalts such as metaphors.

Objectives:

We tested the hypotheses that: a) adults with AS and NLD have at least average scores on standardized vocabulary tests, b) adults with AS and NLD share a deficit in integrative processing, and c) the processing deficit affects the apprehension of both verbal and nonverbal gestalts.

Methods:

Typical adults were compared to adults with a community diagnosis of AS or NLD on measures of vocabulary, semantic integration, and nonverbal gestalt perception. The measures of semantic integration included remote associate problems (Swiss, cottage, cake = cheese), similarities (how are two objects or concepts alike?), and metaphor identification. The

nonverbal tasks included puzzle assembly and two tests of gestalt closure.

Results:

1) The groups did not significantly differ on vocabulary measures. 2) The clinical groups had significantly lower scores on verbal and nonverbal integration measures than controls. 3) Verbal tests of semantic integration and nonverbal measures of gestalt perception were significantly positively correlated across the sample. The same pattern was not true for vocabulary and semantic integration tests, or vocabulary and nonverbal gestalt perception.

Conclusions:

Adults with AS and NLD demonstrated similar vocabulary levels to typical adults, yet had low scores for verbal tests that required integration of unique semantic representations. Results could not be explained by differences in single word knowledge, and supported the hypothesis that adults with AS and NLD experience difficulty with integrating discrete word meanings into novel semantic representations. Results also supported the hypothesis that verbal semantic integration and nonverbal gestalt perception rely on the same underlying cognitive function; low scores for the latter corresponded with low scores for the former. Gestalt cognitive functioning appears to distinguish adults with AS and with NLD from their typical peers at both verbal and nonverbal levels of inquiry.

142.193 193 Dense Recordings of Naturalistic Interactions Reveal Both Typical and Atypical Speech in One Child with ASD. I. Chin*[1], D. Rubin[1], A. Tovar[1], S. Vosoughi[2], M. Cheng[1], E. Potrzeba[1], M. S. Goodwin[3], D. Roy[2] and L. Naigles[1], (1)*University of Connecticut*, (2)*Massachusetts Institute of Technology*, (3)*Northeastern University*

Background: Children with autism spectrum disorders (ASDs) usually demonstrate impairments in language. In particular, children with ASD seem to have difficulty using linguistic rules in speech production (Minshew et al., 2002); for example, they may frequently repeat frozen, unanalyzed phrases rather than produce new utterances (Tager-Flusberg & Calkins, 1990). However, comprehension data do implicate grammatical rule use in this population (Naigles et al., in press). We suggest that dense and daily recordings of speech will provide data that might indicate creative language use in speech production. The Speechome Recorder (Roy, 2011), which was developed to enable continuous audio and video recording in family homes over a period of months, allows us to test this hypothesis.

Objectives: We analyzed the verb usage, particularly present and past tense, of one child with ASD whose speech was recorded daily for about 4 months.

Methods: The Speechome recorded family activities in one room of Audrey's home for four months. Audrey (age= 33 months, MLU = 2.80) was diagnosed with ASD prior to beginning the study. Recordings ranged from 20 to 160 minutes. For the first 3 months, sessions occurred an average of 3.45 times/week. Transcripts of the sessions were coded for present and past tense verbs, including a) marked and unmarked present tense b) unmarked, correct, and over-generalized irregular past tense, and c) marked and unmarked regular past tense. Preliminary findings involve the first month, with 13 total sessions **(**11.63 hours**);** four involved one-on-one therapy and 9 included free play.

Results: Of the 1,260 verb tokens produced, about 90% referred to present events. Of unmarked present tense verbs, 94% were used correctly as the imperative. Errors of omission included 3rd person singular agreement (*She go*), auxiliaries (*Where __ he go*), progressive (*I'm stay_*), and "to" (*I want __ play*). Of the 128 references to past events, 64% involved correctly marked irregular verbs (*broke*), 14.8% were correctly marked regular past (*played*) and 12.5% were unmarked. Audrey also produced one over-generalized past tense verb (*I throwed*). Like typically developing children, then, Audrey talked more about the here and now, made more errors of omission than commission, and produced more irregular than regular past tense verbs (Hoff, 2008). Unlike typical children, Audrey produced an atypical "I am a verb" frame (*I am a get*). Uses with multiple verbs (12 verbs, 21 tokens) across the 13 sessions suggest that this frame was productive.

Conclusions: With dense, daily recordings of Audrey's speech, a better comparison of the development of verb use of a child

with ASD to a typical child can be made. Audrey seems to be developing tense and agreement similarly to typical children in many ways; moreover, her use of an overgeneralization and the "I am a verb" frame shows that she can both use and create grammatical rules. Further analyses will search for additional overgeneralizations, as well as when/if her novel frame use decreases. The Speechome Recorder allows us to track how children with ASD might both follow and diverge from the typical language development trajectory.

142.194 194 Semantic Priming in Children with High-Functioning Autism: An Eye-Tracking Study. G. Gergis* and E. L. Bavin, *La Trobe University*

Background: Children with high functioning Autism (HFA) have problems processing language (e.g., Goldstein, Minshew, & Siegel, 1994). Some of their problems may arise from abnormalities in semantic categorisation (e.g., Dunn & Bates, 2005; Gaigg, Gardiner, & Bowler, 2008; Kamio, Robins, Kelley, Swainson, & Fein, 2007). Priming aids language processing; it relies on implicit memory and results in increased sensitivity to stimuli due to prior experience. Priming effects have been previously studied in children with typical development (TD) using eye-tracking technology (e.g., Heuttig & Altmann, 2005); a prime may facilitate a faster response to a target item. Children with autism have also been found to benefit from priming, with support found for 'global processing' (e.g., Ozonoff, Strayer, McMahon, & Filloux, 1994). However, eye tracking research with young children with HFA using semantic categories for priming has not previously been reported. In order to better understand language processing problems in autism, an on-line method (eye tracking) is advantageous in identifying to what extent young children with autism respond similarly to children with TD as they listen to and integrate verbal input.

Objectives: The main objective of the study was to use eye tracking to investigate if priming of semantic categories equally benefited 5-7 year old children with TD and children with HFA.

Methods: The semantic task comprised two conditions, priming and non-priming. Participants heard a total of 24 items (16 test items: eight primed and eight non-primed) and eight fillers whilst they viewed pictures displayed on the eye-tracker. For each test sentence, one of four pictures was the target; the target was named in the test sentence. Four versions of the stimuli were prepared in order to counterbalance which items were primed or not primed and the order of presentation. Children's eye movements were recorded by the Tobii V2.2.8. Eye-gaze was coded from the critical points, including (1) the onset of the prime (e.g., 'fruit') to determine if the prime influenced which items children looked at, and; (2) the onset of the target noun (e.g., 'apple') to determine if the prime facilitated a faster response to the target in comparison to targets presented in the non-priming condition. Proportion of looking time to each of the four displayed items was calculated for 2 second time periods (per 100ms time frames) following the critical point. Children's language and attention were assessed using standardised tests.

Results: Preliminary results for 20 of the children tested (10 TD and 10 HFA) showed large variability but a significant main effect of priming, as predicted, with a greater proportion of looking time to the target items in the priming condition. The paper will present the results by group for the total sample and in relation to the attention and language abilities of the participants.

Conclusions: Preliminary findings indicate that semantically related words are processed and accessed faster following a prime than a neutral word. We discuss the group differences in relation to the Weak Central Coherence Theory.

142.195 195 "What Just Happened?"- Individuals' Abilities to Infer Events From Behavioural Responses. D. Pillai*[1], E. Sheppard[2] and P. Mitchell[2], (1)*University of Nottingham*, (2)*University of Nottingham Malaysia Campus*

Background:

Distinctive characteristics of Autism Spectrum Disorder (ASD) include difficulties in social cognition and interaction. Past research suggests that social difficulties in ASD may be explained by impaired mentalising ability- that is, processes utilised to understand emotions, mental states, and inferring of behaviours (e.g. Baron-Cohen et al., 1997). The majority of research on mentalising in those with and without ASD requires participants to make a prediction about what a person

will do based on knowledge of the current situation. However, mentalising also plays a role in understanding a person's current behaviour, by predicting what kind of circumstances could have caused it (retrodiction, e.g. Goldman & Sripada, 2005).

Objectives:

The current study focused on this neglected aspect of mentalising by investigating how individuals with and without ASD interpret people's natural reactions (facial expressions) by deducing the event that had previously occurred; and what visual information they used in order to do so. Whereas most previous studies have used artificially posed stimuli, the current study used stimuli filmed in a naturalistic social context to capture people's genuine and somewhat subtle responses. Furthermore, dynamic as opposed to static stimuli were utilised as they provide a more realistic representation of day-to-day experiences (e.g. Klin et. al. 2002). A further strength of this method is that, rather than asking participants explicitly to deduce a mental state or emotion (where the real mental state or emotion may not be known), participants were required to deduce an event, for which we knew the objectively correct answer.

Methods:

Stimulus Development: Four scenarios (ie., Joke, Waiting, Compliments, Story) were created that were deemed to elicit a range of complex reactions, and performed by the researcher whilst neurotypical participants' reactions were covertly filmed. Participants were told a joke in the Joke scenario whereas in the Story scenario the researcher related a series of unfortunate mishaps that she experienced earlier in the day. In the Compliments scenario, participants were bombarded with compliments while in the Waiting scenario the researcher performed irrelevant tasks during an experiment whilst the participant was kept waiting.

Main Study: 20 adolescents with ASD and 20 neurotypical comparison participants matched for age/IQ viewed a video of the experimenter acting out all four scenarios. They were then asked to judge which of the four scenarios each of the people in 40 videoclips (10 for each scenario) were responding to, whilst being eye-tracked. Participants were also asked to indicate how they would have responded should they have experienced the above mentioned scenarios themselves.

Results:

Data analyses are currently underway but early indications suggest that those with ASD were impaired at identifying some of the scenarios only.

Conclusions:

The implications of the findings for theories of autism that postulate a deficit in mentalising will be discussed.

142.196 196 Longitudinal Changes in Pronoun Reversal in Children with ASD and TD Children. M. Cheng*[1], N. Khetrapal[2], K. Demuth[2], D. A. Fein[1] and L. Naigles[1], (1)*University of Connecticut*, (2)*Macquarie University*

Background: Pronoun reversal (e.g., using "you" for "I") is a striking characteristic of ASD language (Fay, 1979). However, the actual incidence of reversals is still unknown. Previous research has reported 15% reversals in 5-7-year-old children with ASD (Tager-Flusberg, 1994), and around 85% reversals in a two-year-old child with Asperger's syndrome (Evans & Demuth, in press). It is also unclear what proportion of ASD and TD children reverse.

Objectives: To assess these issues we examined spontaneous pronoun use in children with ASD and TD controls in a longitudinal study of language development.

Methods: Children (*n*=10 ASD, 18 TD) were visited every four months for two years. At visit 1, ASD children had a mean age of 33 months, had begun intensive ABA therapy, had mean Mullen Visual Reception T-scores of 45.6, and produced 159.7 words on the CDI-1. TD controls had a mean age of 20 months, mean Mullen VR T-scores of 53, and produced 118.8 words on the CDI-1.

At each visit, children engaged in 30-minute semi-structured play sessions with their parents. The children's spontaneous speech was coded for the occurrence of 1st and 2nd person pronouns, and for whether each pronoun was correct or reversed. Data from visits 1, 3, and 5 are reported here.

Results: Pronoun use increased with age for both groups, the ASD group producing an average of 12.8 (SD=14.15) at visit 1, 36.5 (SD=36.12) at visit 3, and 46.55 (SD=37.97), and the TD group producing an average of 3.22 (SD=6.84) at visit 1, 37.61 (SD=32.02) at visit 3, and 55.88 (SD=24.31) at visit 5 (group differences ns). Both groups produced many more pronouns referring to self than other (ranges 63%-77%) at all visits (group differences ns). Percent of pronoun uses that were reversals also varied across visits; the ASD group produced 14.12% reversals at visit 1, 3.14% reversals at visit 3, and 8.56% reversals at visit 5, and the TD group produced 2.5% reversals at visit 1, 2.25% reversals at visit 3, and 1.2% reversals at visit 5. The ASD group produced a marginally higher percentage of pronoun reversals only at visit 5 ($t(9) = 2.17$, $p = .057$). Developmental changes were seen in both groups concerning which pronouns were reversed more: Children with ASD used "I" for "you" more at visit 1, but "you" for "I" more at visits 3 and 5 ($X^2 = 5.47$, $p = .065$); TD children' used "you" for "I" more at visit 1, but "I" for "you" more at visits 3 and 5 ($X^2 = 6.83$, $p = .033$). The groups differed in their patterns of reversals at visits 1 ($X^2 = 5.6$, $p = .018$) and 3 ($X^2 = 5.61$, $p = .018$).

Conclusions: Both TD and ASD children increased pronoun use with age, and both groups produced pronoun reversals. Although the incidence of reversals was lower than previously reported, the ASD children produced a higher proportion of pronouns as reversed, and more frequently used "you" to refer to themselves. Pronoun reversals may be both contextually- and developmentally-sensitive.

142.197 197 Multisensory Speech Perception in High-Functioning Children with Autism Spectrum Disorders.

T. G. Woynaroski*[1], L. E. Dowell[1], J. H. Foss-Feig[1], R. A. Stevenson[2], J. K. Siemann[1], S. M. Camarata[2] and M. T. Wallace[2], (1)*Vanderbilt University*, (2)*Vanderbilt University Medical Center*

Background: Accounts of unusual responses to sensory stimuli abound in the ASD literature (Iarocci and McDonald, 2006). Reports of sensory disturbance have motivated modern theories proposing children with ASD have difficulty integrating information to derive meaning from their experiences, potentially due to atypical temporal binding (Frith and Happé, 1994; Brock et al., 2002). Recent research has demonstrated atypical integration of simple multisensory (i.e., visual-auditory) stimuli over time in ASD (Foss-Feig et al., 2010; Kwakye et al., 2011). It remains unclear how aberrant responses to environmental stimuli and irregular integration of low-level sensory stimuli in ASD impact higher-level multisensory processes linked to language learning and social skills, such as speech perception.

Objectives: This study examined multisensory speech perception in high-functioning children with ASD. Specific research questions included:

a) Do children with ASD show reduced multisensory integration in response to incongruent "McGurk" stimuli?

b) Compared to controls, do children with ASD integrate incongruent speech stimuli differently over time?

c) Do children with ASD display deficits in unimodal or congruent audiovisual speech perception?

d) Does multisensory speech perception vary according to ASD symptom severity as measured by Autism Diagnostic Observation Schedule (ADOS)?

e) Is performance on speech perception tasks correlated with everyday responses to sensory stimuli as indexed by the Sensory Profile Questionnaire (SPCQ)?

Methods: Groups included 8-17 y.o. children with ASD (n=18) and TD (n=18) matched for mean age, sex, and IQ. Audiovisual incongruent "McGurk" syllables (visual /ga/ + auditory /ba/) were presented at seven stimulus onset asynchronies from 0-300ms to examine integration of audiovisual speech information over time. CV syllables associated with the McGurk task (auditory /ba/, visual /ga/, and percepts consistent with fusion - /da/ and /tha/) were presented in audiovisual congruent, unimodal-visual, and unimodal-auditory conditions to clarify multisensory and unisensory capabilities in this population. Correlational analyses were conducted to examine associations between performance on multisensory tasks, symptom severity as measured by ADOS scores, and atypical responses to sensory stimuli as indexed by SPCQ scores. Instructions were unbiased (e.g. report what

the speaker said), and the response mode was non-verbal (button-press).

Results: Children with ASD displayed deficits relative to TD in bimodal congruent speech perception. While unimodal auditory accuracy was similar, unimodal visual accuracy was significantly reduced for children with ASD relative to TD. Multisensory speech perception was strongly associated with unimodal-auditory performance, but less so with unimodal-visual performance in ASD. Additionally, perception of bimodal congruent stimuli correlated with ADOS Communication scores. No significant differences were seen in the frequency of illusory McGurk percepts between ASD and TD over time; however, post-hoc analyses revealed that perception of incongruent stimuli correlated with Auditory Processing Scores on the SPCQ for ASD.

Conclusions: Results suggest atypical patterns of multisensory speech perception in children with ASD. Associations with symptom severity and sensory profiles support larger links between speech perception, communication skills, and broader behavioral characteristics in ASD. Findings are discussed in relation to previous work, prevalent theory, and future directions. These outcomes may have important implications for academics and clinicians.

142.198 198 General and Specific Predictors of Understanding Tense/Aspect in Young Children with ASD. A. T. Tovar*, D. A. Fein and L. Naigles, *University of Connecticut*

Background: Children with ASDs vary considerably in their usage of grammatical morphemes, with some showing consistent omissions in production while others omit only sporadically. Their *comprehension* of grammar (wh-questions, sentence frames) also demonstrates variability in performance. Consistency in production has correlated with concurrent vocabulary and/or general cognitive abilities (Eigsti et al., 2007; Fein et al., 1996; Roberts et al., 2004), while consistency in comprehension has correlated with earlier vocabulary, speed of sentence processing, and/or diagnosis/adaptive functioning (Goodwin et al., 2011; Naigles et al., 2009, in press). The current study investigates the extent to which earlier predictors of tense/aspect comprehension are general (i.e., vocabulary, IQ) or specific (e.g., prior use of verb suffixes) in ASD.

Objectives: We compare children with ASD's early language and cognition with their later understanding of tense/aspect markers.

Methods: Children (n=14) were tested every four months for two years. At visit 1, children had a mean age of 33 months, had begun intensive ABA therapy, had language scores comparable to 20-month-old typical children, and a mean Mullen Visual Reception T-score of 38.3. At Visit 5, the children first viewed the tense/aspect video; they averaged 49.6 months of age and produced on average 40% of the words on the CDI checklist. Their mean age-equivalents on the Vineland scales were 32 months (Communication) and 37 months (Motor). At visits 2 and 3, CDI scores were obtained for total words produced and usage of noun and verb grammatical inflections; moreover, 30-minute spontaneous speech samples yielded measures of MLU, noun and verb tokens, and verb suffixes. The tense/aspect video contrasted two familiar events, one presented as ongoing (a girl washing a dolly) and the other presented as completed (the girl finished washing the dolly). During the baseline trial, both events were presented simultaneously with a non-directing audio ("She is on both screens!"). During the test trials, the audio presented the verb with the '-ed' suffix (first block; e.g., "She washed the dolly") and '-ing' suffix (2nd block; "She's washing the dolly"). Children's eye movements were coded off-line. Measures included (a) amount of looking (attention) to both screens, (b) preferential looking to the matching screen, and (c) latency of looking to the matching screen.

Results: Children with larger overall vocabularies at Visits 2 and 3 demonstrated overall longer attention to both screens during the Aspect task at Visit 5 (rs>.600, ps<.05). Children who were faster to look at the *matching* screen, though, were those reported to produce more verb suffixes at visits 2 and 3 (rs <-.535, ps<.05). And children who actually *preferred* the matching screen in the Aspect task were those who produced more verbs, more verb suffixes, and longer MLUs in spontaneous speech at visits 2 and 3 (rs>.565, ps<.044). MullenVR scores at visit 1 did not predict performance on the Aspect task at visit 5.

Conclusions: Overall language predicts later overall attention during this comprehension task. However, children's speed and accuracy of comprehension were only significantly predicted by their prior use of the specifically relevant verbs and verb suffixes.

142.199 199 Decoding Abstract Picture-Referent Relations: Are Low-Functioning Children with Autism Naïve Realists?. M. L. Allen* and C. Hartley, *Lancaster University*

Background:

Low-functioning children with autism (CWA) typically have an impaired understanding of intentionality and a strong tendency to focus on localised perceptual elements when processing visual stimuli. These deficits may impact on their ability to decode non-iconic pictures that do not clearly resemble their intended referents (e.g. abstract art, children's drawings etc). Neurotypical 3-year-olds spontaneously use intentional cues (e.g. artist's eye gaze) to determine the referent of an ambiguous pictorial representation, however CWA may instead decode such pictures exclusively in terms of their appearance and thus demonstrate a unique route to picture processing.

Objectives:

Using a modified version of Bloom and Markson's (1998) "Size Task", we investigated whether picture processing in CWA conforms to the theory of "naïve realism", which contends that pictures represent whatever they look most like to the viewer, irrespective of the artist's intentions.

Methods:

Participants were 14 CWA (*M* age = 9.8 years) and 14 neurotypical children (*M* age = 3.9 years) matched on receptive language ability (CWA *M* = 3.9 years; neurotypical children *M* = 3.7 years). In the first session, they were presented with pairs of differently-sized 'abstract' pictures (e.g. a small and a large circle) supposedly drawn by a child with a broken arm, and were asked to identify the picture that represented either a small or a large named referent (e.g. elephant or mouse). They were then asked to select the 3-dimensional object that the artist had attempted to depict from an array consisting of the intended referent (e.g. a model elephant), an object that resembled the abstract picture (e.g. a ball) and a distracter. A second test session confirmed whether children could simply match iconic pictures to their referents, to rule out potential task demands. Participants completed 4 trials in each session.

Results:

In the first session CWA used relative size to infer correct picture-referent relations in 75% of trials, a rate significantly greater than chance ($t = 3.02$, $p < .01$). Neurotypical children selected the correct picture in 94.6% of trials. When asked to identify an abstract picture's 3-D referent, CWA selected the object that resembled the picture in 61% of trials and the intended referent in just 30% of trials. Conversely, neurotypical children selected the intended referent and the perceptual referent in 79% and 14% of trials respectively (a significant Group x Response Type interaction, ($F = 23.33$, $p < .001$). In the second test session, when the pictures resembled their intended referents, both groups performed at ceiling when asked to identify a target picture and select the intended 3-D referent.

Conclusions:

CWA displayed a surprising ability to infer correct picture-referent relations in the absence of perceptual resemblance. Whilst this could be evidence for intentional reasoning in CWA, we suggest that their success is more likely to be driven by non-intentional problem solving. This conclusion is corroborated by their 3-D referent selections, which indicate that CWA form relations between pictures and objects based on perceptual resemblance rather than referential intent, thus supporting the claim that CWA are naïve realists.

142.200 200 Verbal Problem-Solving in Deafness and Autism Spectrum Disorders. B. Alderson-Day*, *The University of Edinburgh*

Background:

People with autism spectrum disorders (ASDs) use less efficient strategies than typically-developing participants on measures of verbal problem-solving such as the Twenty Questions Task (TQT; Minshew et al., 1994). While this can

be explained with reference to autism-specific cognitive deficits, the problem-solving of deaf participants suggests a contributory role of atypical language development.

Like participants with ASD, deaf participants have been reported to ask over-specific questions in their problem-solving on the TQT, even when they possess good language skills (Marschark & Everhart, 1999). It is thought that this reflects atypical organization of semantic networks (Marschark et al., 2004). However, previous research on this profile has not controlled for verbal and non-verbal IQ differences between deaf and hearing participants, so it is unclear how similar deaf problem-solving is to ASD. Moreover, the link between problem-solving and semantic organization has not been demonstrated empirically.

Objectives:

i) To replicate the TQT profile in a sample of deaf individuals and compare this with verbal problem-solving performance in a) ASD and b) hearing, typically-developing (TD) participants, controlling for verbal and non-verbal cognitive abilities.

ii) To explore the relationship between semantic organization and use of semantic strategies in the TQT, via performance on a semantic decision task.

Methods:

Primary data were acquired from a sample of deaf adults (n = 9, Age_{Range} = 22-29) and children (n = 11, Age_{Range} = 9-16) recruited from local schools and community settings. All participants attempted an adapted TQT and subgroups completed tasks assessing language use and semantic decision skills. These data were then compared with existing data from a sample of children with ASD (n = 22, Age_{Range} = 9-16) and a larger group of hearing TD participants (n = 48, Age_{Range} = 9-36). Verbal and non-verbal abilities were examined using the Similarities and Matrix Reasoning subtests of the WASI. Analyses will examine the contribution of group membership, age, verbal and non-verbal cognitive ability to question quality (QQ), an efficiency metric that reflects the mean information eliminated per question on the TQT.

Results:

Preliminary results suggest that adult participants who are deaf show significantly lower QQ scores than hearing counterparts on the TQT (F (1,33) = 4.278, p <.05) even when verbal and non-verbal cognitive abilities are accounted for. In contrast, QQ scores in deaf and ASD groups do not differ (F (1,28) = 0.946, p = .339, n.s.). Further analysis of performance in the group of deaf children will examine relations to semantic decision skills (and by extension) semantic organization.

Conclusions:

Initial conclusions suggest that the problem-solving profile of deaf participants on the TQT is a) less efficient than hearing counterparts and b) very similar to ASD performance. Examination of semantic decision performance will provide insight into lexical organization and its relation to accessibility of verbal strategies for problem-solving in people who are deaf and people with ASD. Overlaps in deaf and ASD problem-solving are important in understanding the long-term effects of atypical language development on cognitive skills.

142.201 201 WISC-IV Vs. WISC-III: Cognitive Profile in Autistic, Asperger and Typically Developing Children. A. M. Nader*[1], P. Jelenic[2] and I. Soulières[2], (1)*University of Quebec in Montreal*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: The 3rd edition of the Wechsler Intelligence Scale for Children (WISC-III) has revealed consistent differences in the cognitive profile of autistic versus Asperger children. These two subtypes of the autistic spectrum mainly differ on the presence or absence of speech delay and visuospatial strengths. Does the 4th edition of WISC yield the same cognitive profiles in autism spectrum children as the previous one, despite many changes in the structure of the test?

Objectives: To compare WISC-III and WISC-IV cognitive profiles in Asperger, autistic, and typically developing children.

Methods: 22 autistic, 15 Asperger and 16 typically developing children (6-15 years; IQ 80-120) completed the WISC-IV. They were individually matched on age and Full-Scale IQ to 22

autistic, 15 Asperger and 16 typical children who completed the WISC-III. Full-Scale IQ differed between the typical group (*M* 106.6, *SD* 9.4) and the autistic (*M* 97.1, *SD* 9.8) and Asperger (*M* 98.2, *SD* 10.1) groups. Two sets of analyses of variance assessed (1) discrepancies across Wechsler indexes; (2) strengths and weaknesses, by comparing a participant's performance on a given subtest with his mean performance on all subtests.

Results: Profiles obtained on WISC-IV were consistent with those obtained on WISC-III. First, on WISC-IV Asperger children obtained a significantly higher Verbal Comprehension Index (VCI 110) than Perceptual Reasoning Index score (PRI 101), whereas the autistic group presented the opposite profile (PRI 111 vs. VCI 90). For the autistic group, the gap between VCI and PRI has nearly tripled relative to WISC-III results. No difference between VCI and PRI was found in the typical group. The new indexes of Working Memory and Processing Speed were the lowest in the three groups, but the largest gap between Processing Speed and Full-Scale IQ was found in Asperger children.

At the subtest level, autistic children displayed a significant strength on Block Design in both WISC versions, with an additional strength on the new WISC-IV motor-free visual reasoning subtest, Matrix Reasoning. A significant weakness was revealed on the Comprehension subtest in both WISC editions. As for Asperger children, significant strength on the Vocabulary subtest was present in both WISC versions, while strength in Similarities reached significance only in WISC-IV. For both WISC editions, the main weakness of Asperger children was on the Code subtest.

Conclusions: WISC-IV cognitive profiles are consistent with those obtained with the WISC-III. Discrepancies between VCI and PRI are more representative of the autistic spectrum than of typical children. Also, cognitive profiles of autistic versus Asperger children might be more differentiated with the WISC-IV than they were with WISC-III, due to their respective Matrix Reasoning and Similarities additional strengths. The greater difference between VCI and PRI obtained on WISC-IV (compared to WISC-III) for autistic children could also reflect a diminution of motor demands for non-verbal tasks, thus better revealing their visuospatial strengths. With the upcoming DSM-V and associated changes in nomenclature, using the WISC-IV can help highlight different cognitive profiles within the autistic spectrum and target educative methods accordingly.

142.202 202 Narrative Ability in Children with Asperger's Syndrome. S. W. Cho*[1], K. S. Lee[2], Y. J. Shin[3] and K. J. Joo[4], (1)*Sogang University*, (2)*Hanshin University*, (3)*Yonsei University*, (4)*University of Hawaii at Manoa*

Background: Studies of English-speaking children with autistic spectrum disorder (ASD) have reported that narrative assessment is sensitive to the communication impairments. With respect to typical cognitive development, narrative cognition represents one of the most fundamental means by which we come to understand the world (Bruner, 1990). It would be important to examine whether and how children with ASD are sensitive to the macro-structural story grammar components of an event (introduction, relationship, initiating events, internal response, attempts/actions, and ending) (Strong, 1998) in telling a story. Narrative development of Korean children with ASD has rarely been examined, and it is unclear how qualitatively different their deficits may be from typically developing Korean children's narrative ability. Objectives: The purpose of this study was to provide an analysis of narratives in 10 children with Asperger's Syndrome (AS) and 10 typically developing (TD) children matched on age, gender, language abilities, and cognitive abilities. Methods: Participants in this study were 10 children with AS (nine boys and 1 girl) aged with a range of 5;10-7;5 and 10 TD children (4 boys and 6 girls) aged with a range of 4;6-7;11). Both groups completed stories based on the MacArthur Story Stem Battery. Each of their stories was assessed in terms of story organization components developed in Strong Narrative Assessment Procedure (Strong, 1998). Results: Narratives were scored quantitatively and analyzed qualitatively for mentions of macro-structural story grammar elements. We found that the AS group had significantly poorer performance than the TD group on the overall story grammar score, and that the AS groups had lower attempts/actions and ending scores than the TD group. It was also found that the AS group had significantly more difficulties than the TD group in developing a story in cases involving a complicated relationship shared by more than two characters in an event. Conclusions: We conclude that the presence of ASD has a

significantly detrimental effect on narrative skills to integrate utterances coherently into the macro-structure of a story. It is speculated that lack of sensitivity to the macro-structural elements is likely to be associated with a deficiency in employing theory of mind and perspective-switch as needed in narration.

142.203 203 Development of Interactional Synchrony in High- and Low-Risk Infants During Mother Infant Face-to-Face Interactions. S. Glazer*[1], P. Lewis[1], J. B. Northrup[2], A. Klin[1] and W. Jones[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*University of Pittsburgh*

Background: Typically-developing infants, from the first days of life, engage preferentially with social aspects of their surrounding environment. Examples include both their ability to distinguish whether or not an adult is looking at them, as well as their preferential fixation, from at least 3 months of age, to the eyes of others. Many of these engagements are directed by the dynamic face-to-face interactions between infant and caregiver. In previous research, by 3 months of age, mothers are more easily able to elicit infant responses during face-to-face interactions. By 6-9 months of age, unsolicited infant responses become more frequent. These milestones indicate the development of the infant's ability to initiate face-to-face interactions, social bidding, the first step in eliciting and maintaining a contingent social interaction.

Objectives: This experiment is intended to test the hypothesis that changes in visual scanning by caregiver and infant during face-to-face interaction coincide with the development of infant social bidding. In addition, we aim to investigate how the visual scanning patterns of both participants indicate when infant social bidding is mastered and the steps leading to its development.

Methods: Using eye-tracking technology, we compared the visual scanning of caregivers and infants enrolled in a longitudinal prospective study of infant siblings of children with autism spectrum disorder (ASD). Infants at high-risk for ASD had a full sibling with a confirmed diagnosis of ASD, whereas infants at low-risk had no siblings with, or family history of, ASD. Between ages 2 to 6 months, visual scanning was compared between the two groups during three conditions: watching a videotaped actress (condition 1), participating in face-to-face interaction with their caregiver (condition 2), and a pre-recorded, thus non-contingent, video of the infant's caregiver recorded during a previous session (condition 3). Fixation data were used to divide each condition into periods of mutual and non-mutual gaze. In addition, these data were used to determine which participant initiated and broke each mutual gaze period. Propensity of each participant to look at the eyes, mouth, body, or object areas during periods of non-mutual gaze, as well as facial affect during mutual and non-mutual gaze were quantified.

Results: Results indicate that low-risk infants show increased mutual gaze duration and decreased mouth fixation during contingent interaction with caregivers (condition 2) as compared with pre-recorded videos of actresses (condition 1). Preliminary results also indicate that as low-risk infants get older, duration of mutual gaze decreases, while number of mutual/non-mutual cycles increases. However, our high-risk ASD sample indicates increased variability in looking patterns.

Conclusions: Preliminary results suggest that changes in the visual scanning patterns of infants can be attributed to infant social learning. This experimental paradigm is likely to potentiate between-group differences relative to infants at-risk for autism, thus increasing the utility in detection of early deviations from the course of normal social development.

142.204 204 Parental Perceptions and Concerns Over Their Child's ASD-Related Behaviors: A Cultural Perspective. P. Yang*[1], L. C. Lee[2], I. T. Li[3], R. A. Harrington[2], C. L. Chang[4], P. C. Tsai[2] and F. W. Lung[5], (1)*Kaohsiung Medical University*, (2)*Johns Hopkins Bloomberg School of Public Health*, (3)*Calo Hospital*, (4)*Kaohsiung Armed Forces General Hospital*, (5)*Taipei City Hospital*

Background: Cultural influence on the perception of autism-related behaviors has drawn much attention, yet data are scant on this subject. Because the determination of Autism Spectrum Disorders (ASDs) is solely based on observed behaviors, caregivers' perception of these behaviors plays a crucial role on whether clinical evaluation or services are sought. Taking advantage of a population-based autism

epidemiologic study recently conducted in Taiwan, we addressed the issue of parental perception and concern from a cultural perspective. From a scientific perspective, the finding will provide information on the extent parental cultural background may influence prevalence of ASDs, and will help to address the need for public awareness in diverse populations.

Objectives: To analyze and summarize parental perceptions and concerns over their child's ASD-related behaviors in a Taiwanese population.

Methods: The Social Communication Questionnaire (SCQ) and Social Responsiveness Scale (SRS) were used as screening tools to ascertain possible cases of ASD. The SCQ assesses the core behavioral domains of ASDs with a suggested cutoff score of 15 used in Western countries to differentiate children with and without ASDs. The SRS is designed to assess autistic symptomatology as a quantitative trait. When used as a screening tool in the general population a raw score of >=70 in males and >=65 in females is recommended as a cut-point that provides evidence for the presence of an ASD. Additionally, caregivers completed a survey of ten open-ended questions regarding concerns over their child's behaviors, in general. We compiled these answers in the group with either an SCQ or SRS score above the suggested clinical cutoffs in order to inspect caregivers' views, perceptions, and concerns over their child at high risk of ASDs.

Results: Participants were 213 caregivers whose child's SCQ score was >=15 (99 boys, 105 girls, 9 unknown sex). Of the 213, 202 completed the survey about their concerns. Of the 202, 74 (36.6%) stated they do not have any concern, 93 (46.0%) had little concern, and 35 (17.3%) had some or more concerns. Of those who stated they had concerns, most commonly mentioned was the child not being able to pay attention in class and poor academic performance, followed by communication issues, then bad temper. Of the 368 who had met SRS cutoffs (172 boys, 185 girls, 11 unknown sex), 343 completed the survey about their concerns. Of the 343, 51 (14.9%) said do not have any concern, 175 (51.0%) had little concern, and 117 (34.1%) had some or more concerns. The top three concerns reported were: not paying attention in class and learning difficulties, communication problems, and social awkwardness.

Conclusions: The majority of caregivers reported either no or only little concerns over behaviors of their child at high risk of ASD, according to the SCQ or SRS. Possible interpretations of the finding include lack of autism awareness in the local community, family dynamics in child-caring, lower family SES, different views on child's problem behaviors in this culture, and the fact that no autism intervention or education programs are available.

142.205 205 Analysis of Handwriting Fluency in Children with Autism. B. Dirlikov*, M. B. Nebel, M. M. Talley, A. J. Bastian and S. H. Mostofsky, *Kennedy Krieger Institute*

Background: Children with autism spectrum disorders (ASD) experience difficulty performing a host of skilled motor behaviors, including handwriting (Fuentes et al., 2009; Fuentes et al., 2010). In learning to write, children develop fluidity in handwriting which minimizes the interference of motor demands with higher-order cognitive processes related to composition, and thus, the dynamics of writing account for a large portion of variance in composition fluency (Graham et al, 1997). Despite the recognition of handwriting impairment in ASD and the known importance of handwriting to academic as well as social and communicative growth, there has been little systematic examination of the dynamics of handwriting in children with ASD.

Objectives: The aim of this study was to investigate the dynamic mechanisms underlying writing impairment in children with ASD compared to typically developing (TD) children, which will help to inform the development of effective methods for handwriting remediation.

Methods: Writing performance was assessed using a digitizing tablet (Wacom Intuos4) in sixteen children, 8 with ASD and 8 TD, ages 8-12. Groups were balanced for gender, age, and perceptual reasoning. Each participant completed the Minnesota Handwriting Assessment (MHA) on the digitizing table under three conditions: normal copy, trace, and fast trace. Position and pressure of the pen tip were recorded at a sampling rate of 100 Hz. Using Matlab, handwriting data were segmented using pen pressure to demarcate time spent

on and off of the tablet. For each segment, duration, pressure, and total distance traveled were extracted to calculate three dependent variables: speed, fluidity (number of inflection points in speed or decelerations/accelerations), and pen pressure variability. Significance of group differences in handwriting kinematics was assessed using Mann-Whitney U Tests and the relationship between handwriting kinematics and Movement Assessment Battery for Children, version 2 (mABC-2) score was investigated using Pearson's correlations.

Results: Regardless of writing condition, children with ASD showed significantly more speed inflections per segment compared to TDs ($p < .001$ for all three conditions). There were no significant group differences in mean segment speed or pen pressure variability on any of the conditions. Within the ASD group, higher mABC-2 Manual Dexterity scores were correlated with fewer speed inflections per segment for ASD subjects across conditions ($R = -.8$, $p = .017$ for all conditions).

Conclusions: Children with ASD show decreased fluidity of movements during handwriting, regardless of whether copying or tracing letters. This increased tendency to change speed while writing letter segments may indicate that handwriting is less automated in children with ASD (Mai and Marquardt 1992). Alternatively, it may indicate less stable pen control, particularly given that decreased fluidity was correlated with manual dexterity in children with ASD. Further investigation using additional metrics (e.g., letter form) and using novel letter forms will help to clarify the basis of these findings.

142.206 206 Parent-Child Interaction and Child Behavior: Children with and without Autism. H. N. Liming*, B. J. Wilson, E. L. Haven, M. N. Will, U. Hussein and E. Choe, *Seattle Pacific University*

Background:

Parent-child interactions are an essential feature of early childhood development. For typically developing children, positive parenting behaviors such as scaffolding are linked to the emergence of child emotion and behavioral regulation (Hoffman, Crnic, & Baker, 2006). In the current study, we examined parental attention cues during a parent-child reading task with children with autism spectrum disorders (ASD) and typically developing (TD) children. We first hypothesized that parents of children with ASD would provide more attention cues compared to parents of typically developing children. Our second hypothesis predicted that children with ASD would have higher parent-rated behavioral problems, and lower parent-rated adaptive skills. We also investigated links between supportive parenting behaviors such as scaffolding and children's current adaptive skills and behavior problems in both children with ASD and TD.

Objectives:

The primary goal of this study is to determine how parental attention cues, both verbal and non-verbal, relate to child behavior for children with and without ASD.

Methods:

Using preliminary data from a larger study investigating self-regulation skills in children with ASD, we examined parental attention cues directed towards children during a reading task. Participants included 36 children, 3:0 to 6:11 years old. Eighteen participants had an ASD diagnosis, and the remaining 18 were typically developing children. Participants were matched on mental age based on verbal scores from the Differential Ability Scale – Version II (DAS-II; Elliott, 2007). Parents and children completed a 5-minute wordless picture book-reading task in a laboratory setting, which was videotaped for future coding. Parental responses were coded for verbal, nonverbal, and simultaneous (verbal and nonverbal combined) attention cues. Parents also completed The Behavioral Assessment System for Children – Second Edition (BASC-2; Reynolds & Kamphaus, 2004), a rating scale for child adaptive and problem behaviors.

Results:

Parents of children with ASD used significantly more simultaneous attention cues than those of typically developing children $F(1, 34) = 4.11$, $p = .05$, $n^2 = .11$. Children with ASD had significantly higher parent ratings of behavioral problems than their typically developing peers, $F(1, 34) = 35.07$, $p < .001$, $n^2 = .51$, and significantly lower parent ratings of adaptive skills $F(1, 34) = 56.07$, $p, < .001$, $n^2 = .62$. Also, simultaneous parent attention cues predicted higher levels of inattention problems

(B = 0.38, p = .22, R^2 = .14) and lower levels of adaptive skills (B = -0.41, p = .012, R^2 = .17).

Conclusions:

Our first hypothesis that parents of children with ASD would provide more attention cues compared to parents of typically developing children was supported. Our second hypothesis was also supported as we found that children with ASD had higher ratings of behavior problem and lower ratings of adaptive behavior. We also found that higher amounts of parental attention cues during the book-reading task predicted lower parent-rated adaptive skills and higher parent rated behavioral problems. More specific group differences as well as implications and limitations will be further discussed.

142.207 207 Self Regulatory Strategies During Delay of Gratification Paradigm in Children with Autism Spectrum Disorders. K. E. McKee*, J. Schoenfield-McNeil, B. J. Wilson, J. L. Berg, J. Sparrow, M. Zurawski and K. M. Kloes, *Seattle Pacific University*

Background:

The delay of gratification paradigm has shown to be a good context for assessing self-regulatory strategies in the face of temptation (Metcalfe & Mischel, 1999). Previous research suggests that flexible attention deployment is critical for performance on delay of gratification tasks (Ayduk et al., 2000; Mischel et al., 1988). Distraction as a coping strategy is associated with longer wait time, where as attention to a reward is associated with decreased ability to wait (Rodriguez, Mischel, & Shoda, 1989). Research with typical populations demonstrates that children utilize a number of distraction and self-regulatory strategies during the delay of gratification paradigm including gaze aversion, kinetic movement, and verbal mediation. While research has shown that children with ASD tend to choose smaller rewards sooner than their typically developing peers (Dixon & Cummings, 2001), little research examines the coping strategies that children with ASD employ to help them delay gratification. There is also a paucity of research examining how the ability to delay gratification in children with ASD may be related to other developmental processes such as attention.

Objectives:

The purpose of our study was to assess the independent contribution of three modalities of self-regulatory behavior (gaze aversion, kinetic movement, and verbal mediation) and whether they predict the ability to delay gratification and/or attention problems in children with ASD.

Methods:

The current study utilizes the delay of gratification task originally pioneered by Walter Mischel. Participants included 30 children who were typically developing or diagnosed with autism between the ages 3:0 to 6:11 who were matched on verbal mental age. Participants were given the option to receive a smaller or greater reward depending on the amount of time they were able to wait. To receive the greater reward participants were required to wait 7 minutes. Total wait time was used as an index of participants' ability to delay gratification. Videotapes of the task were coded for total wait time and self-regulatory behaviors including gaze aversion, kinetic movement, and verbal mediation. Problems with attention were measured using the Conners parent rating questionnaire (Conners, Rothbart, Ahadi, & Hershey, 1994).

Results:

Our previous findings suggest that developmental status and proportion of time in self-regulatory behaviors predict ability to delay gratification. In addition, delay of gratification moderated the relation between developmental status and attention problems. Our current study seeks to extend our previous findings and examine the independent contribution of three modalities of self-regulatory behavior to the ability to delay gratification, and how this relates to problems with attention. Our hypothesis is that modalities of self-regulatory behavior will differentially influence delay of gratification and will negatively predict attention problems. Thus, we will test a moderation model whereby self-regulatory modality moderates the relation between developmental status and attention problems.

Conclusions:

The current study will provide information about the strategies that children use to delay gratification. Our findings will ideally

identify a profile of self-regulatory strategies that are successful for children with ASD. These conclusions will be valuable for intervention programs that focus on teaching children self regulation skills.

142.208 208 A Fifteen-Year Longitudinal Case Study of the Development of An Asperger Syndrome Obsession. L. Vuletic*,

Background:

Intense and all-absorbing interests are among the defining features of Asperger syndrome (APA, 2000); however, the literature in this area is limited and inconclusive. While some clinicians and parents feel that these interests have a negative impact on the lives of individuals with autism because they interfere with socialization (Tantam, 1991), others emphasize their positive aspects, such as importance for enjoyment, self-esteem, and occupation (Asperger, 1944/1991; Atwood, 1998; Grandin & Scariano, 1986). Moreover, while some studies that specifically explored this issue found that special interests increased in severity over time (South et al., 2005), others found the opposite (Mercier et al., 2000).

Objectives:

The objective of this study was to systematically document the evolution of an unusual interest of a young adult with Asperger syndrome from the time he was eight until he was twenty-two years old.

Methods:

This study employed observations and interviews with the subject and the people who know him best—his parents, grandparents, teaching assistant, and best friend.

Results:

The subject's highly intense special interest began as a fascination with bus routes when he was around four years old. Since then, it developed through three phases. *The first phase* lasted approximately nine years and included memorization of bus and train routes and schedules; collecting items related to public transits such as tickets, transfers, schedules, and maps; taking long and frequent trips to obtain these items from specific places; using telephone and Internet to gather information about public transit systems from around the world; playing with the collected items; creating transit-related artifacts and playing with them; playing by pretending to be a bus or a train, or their driver; and writing stories involving public transits. During this phase, the subject actively avoided interactions with other children. *The second phase*, which started at age thirteen, lasted only about a year, and was characterized by the development of two other interests, photography and web design, both of which, in his use of them, still related to public transit—and both of moderate intensity. During this phase, the subject started to show some interest in his peers. In *the third phase*, the subject lost all interest in public transit and replaced it with interests in travel and tourism—both again of moderate intensity. During this phase he acquired several friends and used his new interests to develop relationships; he found employment, as well as an education path, in the areas of these interests: he currently works as a travel agent and is in his third year of a university degree in hospitality and tourism management.

Conclusions:

This study documents the development of an intense and restricted interest in an unusual area that did not facilitate social interaction and its gradual transformation into socially recognized interests that helped develop relationships and led to employment and education paths. This development is consistent with Tantam's (1991) suggestion of interference of intense interests with socialization and with Mercier and colleagues' (2000) report about diversification of interests with maturation and intervention of parents and professionals.

142.209 209 Gesture and Language Development in Infant Siblings of Children with ASD. E. S. LeBarton* and J. M. Iverson, *University of Pittsburgh*

Background:

Deficits in gestural communication are often observed in children with autism spectrum disorders (ASD) and are a central component in the ASD diagnostic criteria. Early communication delays have also been observed in the infant siblings of children with autism who are at heightened biological risk for ASD (High-risk, HR). Research with

expressive language finds increased risk for delays in HR infants both with and without a subsequent ASD diagnosis. However, there is also within-group and between-group variability such that HR children with ASD exhibit more pronounced delays than those with no diagnosis. What remains unclear is whether similar patterns of variability are observed in another aspect of communication—gesture production. We focus on gesture because it is tightly linked to lexical development in typically developing (TD) and atypically developing children, with early gesture predicting concurrent as well as subsequent lexical skill.

Objectives:

Objectives are to: (1) Characterize gesture use in pre-school age HR infants (both with and without a subsequent ASD diagnosis) and (2) investigate concurrent and predictive relations between gesture use and expressive vocabulary.

Methods:

We investigated communication longitudinally in 23 HR infants at 2- and 3-years-of-age. Three HR infants were given an ASD diagnosis at a 3-year evaluation. At 2-years, we coded spontaneous communicative gesture production during semi-structured 15-minute parent-child free-play. We coded both amount and kind of gesture, resulting in two measures: (a) total number of gestures produced and (b) proportion of gestures that are pointing gestures. At 2- and 3-years parents completed a standardized language measure (MacArthur-Bates Communicative Development Inventory; CDI). We used the CDI vocabulary production checklist as our measure of expressive vocabulary.

Results:

Objective 1: Regarding total number of gestures, HR infants produced an average of 10 gestures (range=1-27, SD=7.6). When restricting analyses to HR infants without a known ASD diagnosis (HR-noASD), results were similar (range=1-27, mean=11, SD=8.1). Regarding pointing gestures, a small proportion of gestures were points for both the full HR group and the HR-noASD subgroup (HR mean=.31, SD=.21; HR-noASD mean=.31, SD=.20) with an average of 4 (SD=3.7) and 3.9 (SD=3.9) pointing gestures produced by HR and HR-noASD groups, respectively. Objective 2: Consistent with previous research, HR infants fell at the low end of the typical range at both 2- and 3-years-of-age (Binomial tests: percent below 15th percentile, $p<.01$). Further, Spearman correlations revealed that 2-year gesture positively related to 2-year CDI expressive vocabulary (total number of gestures: rho=.47, $p<.05$; proportion of gestures that are points: rho= $p<.52$, $p<.05$). Total number of gestures at 2-years positively (though not significantly) related to 3-year CDI (rho=.38, $p<.10$), proportion of gestures that were points did not (rho=.14, $p<.56$).

Conclusions:

We observed large individual differences in HR infants' total communicative gesture production and relative frequency of pointing gestures. However, on average, both are smaller than what is often reported for TD 2-year-olds. Further, 2-year gesturing related to concurrent expressive vocabulary. Communicative gesture use at pre-school-age is variable among HR infants, and these individual differences relate to variability in expressive vocabulary.

142.210 210 Learning Words by Watching: A Comparison of Eye-Tracking and In-Person Measures. J. Lee[1], K. Gillespie-Lynch*[2], R. Elias[3], P. Escudero[4], T. Hutman[5] and S. P. Johnson[1], (1)*University of California, Los Angeles*, (2)*UCLA*, (3)*University of California, Berkeley*, (4)*University of Western Sydney*, (5)*UCLA Center for Autism Research and Treatment*

Background:

Reduced responsiveness to joint attention (RJA) is often observed among autistic children below a certain developmental level (e.g. Mundy, Sigman, & Kasari, 1994) and is predictive of language development (Sigman & Ruskin, 1999). Difficulty using a speaker's attention to learn words has been documented primarily among cognitively delayed children with autism (Baron-Cohen, Baldwin, & Crowson, 1997; Preissler & Carey, 2005). Some autistic children are unimpaired at using another's attention to learn words (Luyster & Lord, 2009). Even autistic children who have attained a fairly advanced cognitive level (one that would typically be associated with few RJA impairments) exhibited reduced RJA when assessed with an eye-tracker during an RJA word

learning opportunity (Akechi et al., 2011). Does eye-tracking enhance detection of RJA difficulties that are not apparent with in-person measures?

Objectives:

1. Determine if autistic children exhibit different levels of RJA in an eye-tracker versus in-person.

2. Assess relations between developmental level, RJA and word learning in autism.

Methods:

Fifteen 3 to 7 year old autistic children participated in this study. Control participants are currently being recruited. Participants viewed three measures of RJA: an in-person RJA word learning paradigm, an eye-tracking RJA word learning measure, and the RJA component of the ESCS. Two novel words and objects were introduced during each RJA word learning measure in a counterbalanced manner. Both word learning paradigms consisted of a female model turning toward one of 2 objects 4 times each and labeling them. Intelligence was assessed with the Mullen Scales of Early Learning or the Differential Ability Scales. Children with an IQ less than 70 were classified as intellectually disabled (ID).

Results:

Similar levels of RJA (a difference score consisting of first looks toward the same object as the model minus first looks toward the other object) and word learning (assessed by object selection) were observed in the eye-tracker and in person (p>.05). Intellectual disability was unrelated to ESCS RJA and to the in-person RJA word learning paradigm (p>.05). However, ID children (M=1.20, SD = 2.77) displayed less RJA in the eye-tracker than non-ID children (M= 4.86, SD= 2.61, p =.042). Both ID and non-ID children exhibited similar levels of word learning in response to the eye-tracking paradigm (p >.05). However, ID children (M=1.00, SD = 2.00) showed less word learning following the in-person RJA word learning paradigm than non-ID children (M=5.22, SD = 1.39, p <.001). Interestingly, word learning following the in-person paradigm was associated with whether or not a child was intellectually disabled (p= .044) but was not associated with RJA during the word learning task (p=.271).

Conclusions:

Autistic children exhibited similar levels of RJA in-person and in the eye-tracker. However, eye-tracking revealed associations between RJA and developmental level that were not apparent using in-person measures. Developmental level was associated with the ability to learn words in response to social cues while RJA during the task was not. Thus, frequency of RJA may be less important for word learning than the ability to recognize the referential nature of social cues.

142.211 211 Cross-Situational Word Learning In Children with ASD. H. Akechi*[1], Y. Kikuchi[2], Y. Tojo[3], H. Osanai[4] and T. Hasegawa[1], (1)*The University of Tokyo*, (2)*Japan Society for the Promotion of Science*, (3)*Ibaraki University*, (4)*Musashino Higashi Gakuen*

Background: It was reported that children with autism spectrum disorder (ASD) have difficulty in learning words via social cues (e.g., speaker's eye gaze; Baron-Cohen et al., 1997). However, some children with ASD acquire vocabularies as rich as typically developing (TD) children. One of potential efficient strategies is a cross-situational learning, which is a mechanism for learning the words across multiple trials even when there is no definite cue for the word-object correspondence in one trial.

Objectives: To investigate whether children with ASD learn words effectively using cross-situational learning as well as TD children.

Methods: Participants consisted of 20 children with ASD (mean age 9.1; range 6-12) and 20 TD children (mean age 8.4; range 6-12), who were matched on verbal mental age (VMA). There were 6 novel words and 6 novel objects. In the training phase, two novel objects were presented on the monitor and two corresponding novel words were presented via the loudspeaker in each trial. There is no definite cue for the word-object correspondence in one trial. Each word-object pairs was presented 10 times. In the test trials, two objects and one word were presented and the participant was asked which object is the referent. Each object was presented

twice as a target and twice as a non-target. Thus, there were 12 test trials in total.

Results: There was no significant difference between groups in the performance in the test trials ($p > .10$). In addition, the performance in both the ASD ($p < .001$) and the TD group ($p < .001$) were above chance level (6/12 = 50%). Moreover, the performance in the TD group positively correlated with their VMA ($r = .47$, $p < .05$), but not in the ASD group ($r = -.16$, $p > .10$).

Conclusions: Results suggest that children with ASD can learn novel words effectively using cross-situational learning regardless of VMA.

142.212 212 High-Functioning Children with Autism Flexibly Use Prosody to Parse Syntactic Ambiguity. N. Hahn* and J. Snedeker, *Harvard University*

Background: While impairments in producing prosody have been long studied in autism spectrum disorder (ASD), we know less about impairments in using prosody during comprehension. Research on the use of prosody to infer syntactic structure is particularly sparse. Most existing research has used tasks that rely on overt judgments (Paul et al, 2005) rather than examining spontaneous differences in interpretation and the moment-to-moment processes that give rise to them. The exception to this is a recent study by Diehl and colleagues (in prep) demonstrated that 8-12 year-old high-functioning children with autism (HFA) can use prosody to parse globally-ambiguous sentences. But this ability is fragile. Performance is strong in the first block of trials, but drops sharply in the second block when the prosody shifts, a pattern seen in typically-developing preschoolers. Thus children with ASD show a delay in inhibiting the incorrect analysis, perhaps due to executive function (EF) impairments (Hill, 2004).

Objectives: The current study uses temporary syntactic *closure ambiguities* (1-4). Temporary ambiguities may place fewer demands on EF than global ambiguities because the time period in which two syntactic analyses compete is substantially reduced. Temporary-ambiguities are also more common in natural speech and thus provide a more ecologically valid measure of prosodic processing. If HFA children can flexibly use prosodic cues to guide syntactic interpretation, they will succeed in this task, which places minimal demands on EF. However, if HFA children lack the flexibility to shift among syntactic analyses, then we expect to see no effects of prosody on the interpretation of these local ambiguities.

Methods: 6- to 9-year-olds with HFA (Mean age=91months, CELF=110) and typically-developing controls (Mean age=87months, CELF=114) were tested using the visual-world paradigm. Children were presented with utterances with closure ambiguities (1-4). In the early-closure conditions (EC) the second noun was the subject of the main clause. In the late-closure conditions (LC) this noun was the object of the subordinate clause.

1. When the robot baked the big **postman** delivered the mail (EC/neutral)

2. When the robot baked….the big **postman** delivered the mail (EC/cooperative)

3. When the robot baked the big **muffin** the postman delivered the mail (LC/neutral)

4. When the robot baked the big **muffin**…the postman delivered the mail (LC/cooperative)

Looks to the probable subject (postman) and the probable object (muffin) were measured in the ambiguous time window (underlined) and the noun time window (bold).

Results: In the ambiguous window controls looked at the probable object less often in the EC/cooperative condition than in the other three conditions resulting in a ProsodyXClosure interaction ($p<0.01$). This interaction disappeared in the noun window. In contrast the HFA children showed no effects in the ambiguous window, but during the noun window, they displayed the same pattern as TD controls had in the ambiguous window ($p<0.05$).

Conclusions: We conclude that 6-9-year-old HFA and controls are capable of using prosody to sentence-parsing flexibly, unlike 5-year-old typically-developing children (Hahn&Snedeker, 2011) suggesting no developmental delay.

However, they are slower at integrating prosodic information with the semantic information during real time processing.

142.213 213 Parent-Adolescent Relationships in the Context of Autism Spectrum Disorders. M. M. Abdullah* and W. A. Goldberg, *University of California, Irvine*

Background: Individuals with autism spectrum disorders (ASD) demonstrate early socio-communicative impairments by diagnostic definition (American Psychiatric Association, 2000); these impairments have a substantial bearing on their ability to develop social relationships, even within the family. Relationships between adolescents with ASD and their parents are fundamental social relationships that are inadequately understood. Although parent-adolescent relationships have been a mainstream topic among adolescent development researchers for nearly thirty years (Steinberg, 2001), there exists only a handful of studies examining this crucial relationship in the ASD literature. This is the first study, to our knowledge, that examines parent-adolescent relationship quality from the perspectives of mothers, fathers, and adolescents with ASD.

Objectives: (1) Compare self-reported parent-adolescent relationship quality in families of adolescents with and without ASD; (2) Assess the concordance of relationship quality reports between parents and adolescents with ASD.

Methods: Thirty-one families have participated in this study thus far; 22 with adolescents with ASD and no comorbid intellectual disability (M_{age} = 14.78 years, *SD* = 0.39) and 9 with typically developing (TD) adolescents (M_{age} = 15.32 years, *SD* = 0.63). Mothers (M_{age} = 46.84 years, *SD* = 6.40) and fathers (M_{age} = 48.62 years, *SD* = 6.68) were predominantly Caucasian, well-educated, and middle-class. Parent-adolescent relationship quality was assessed with the Network of Relationships Questionnaire-Relationships Qualities Version (NRI-RQV; Furman & Buhrmester, 2008). Mothers, fathers, and adolescents completed this 30-item questionnaire, which measured closeness (i.e., companionship, disclosure, emotional support, approval, and satisfaction) and discord (i.e., conflict, criticism, pressure, exclusion, and dominance).

Results: Diagnostic groups did not differ on demographic variables. Mann-Whitney tests were used to compare ASD and TD groups on parent-adolescent closeness and discord. There were no significant differences between groups in parent-adolescent closeness. However, mothers of adolescents with ASD reported marginally higher parent-adolescent discord compared to mothers of TD adolescents (z = -1.86, p = .063). Fathers of adolescents with ASD reported significantly higher parent-adolescent discord (z = -2.12, p = .034) compared to fathers of TD adolescents. Adolescents with ASD reported significantly higher mother-adolescent discord (z = -2.14, p = .033) and father-adolescent discord (z = -2.31, p = .021) compared to TD adolescents.

To assess for level of agreement in reports of closeness and discord between mothers and adolescents and fathers and adolescents in the ASD group, Spearman correlations were calculated. Mothers and adolescents demonstrated moderate to strong agreement in their reports of closeness (*rho* = .44, p = .046) and strong agreement in their reports of discord (*rho* = .64, p = .002). Fathers and adolescents showed strong agreement in their reports of discord (*rho* = .72, $p < .001$); however, their reports of closeness were not significantly related.

Conclusions: Relationships between parents and adolescents with ASD were close in companionate and emotional ways, but significantly more discordant compared to parents and TD adolescents. In terms of shared perspectives on relationship quality, fathers and adolescents with ASD did not concur on their reports of closeness. Findings have implications for targets of intervention for families of adolescents with ASD.

142.214 214 Picture Exchange Communication System: Moderators of Collateral Speech Gains. S. Petersen-Brown* and X. Qian, *University of Minnesota*

Background:

For some with autism spectrum disorder (ASD) the Picture Exchange Communication System (PECS) results in collateral speech gains (e.g.Yoder & Stone, 2006). However, speech gains associated with PECS are not universally observed (e.g., Carr & Felce, 2007). Consequently, it is important to identify child variables that may influence the likelihood of collateral

speech gains that occur concurrent with or subsequent to the implementation of PECS. Previous research has demonstrated that several variables appear to be associated with collateral speech production including levels of speech prior to intervention (Carr & Felce, 2007); vocal imitation, joint attention, and play (e.g., Toth, Munson, Meltzoff, & Dawson, 2006); and treatment intensity (Warren, Fey, & Yoder, 2007).

Objectives:

The purpose of this paper was to examine whether factors (listed above) associated with collateral speech gains were addressed in experimental investigations involving PECS and whether these factors may have contributed to collateral speech outcomes.

Methods:

Studies were identified by searching PyscINFO, ERIC, and Academic Search Premier using the terms *autism* and *Picture Exchange Communication System* or *PECS* between 1994 and 2011. To expand on previous reviews (e.g., Flippin et al., 2010), we included adults and children with disabilities (e.g., autism, Down syndrome) and coded participant variables (e.g., level of speech) and treatment intensity.

Additionally, the efficacy of PECS was examined by scrutinizing dependent measures reported in studies reviewed, including independent requests and speech outcomes. We computed effect size as the percent of all non-overlapping data (PAND; Parker, Hagan-Burke, & Vannest, 2007) for studies using a single case design (SCD) and Hedge's *g* for group design studies.

Results:

Twenty-five studies were reviewed in this study, including 21 SCD studies and 4 group design studies. Many of the potential moderators described above were rarely reported, and participants were described to varying levels of detail. To date, it appears that the focus of this literature thus far has been to examine the effectiveness of PECS rather than identify potential moderators of collateral speech gains.

Of the 64 participants in the 21 SCD studies, speech-related outcomes were reported for 17. Results showed that participants who had some speech prior to the PECS intervention had greater collateral speech gains (n = 9, average PAND effect size of .80) than participants who were preverbal (n = 7, average PAND effect size .63). Very few studies reported information about participant imitation, play, joint attention, or included comprehensive information about treatment intensity, so these potential moderators were not examined further.

Conclusions:

Based on this meta-analysis, it appears that children who have some speech prior to intervention may show better speech outcomes than children at a preverbal stage. However, other child characteristics were not investigated as potential moderators because they are rarely reported (e.g., initiating and response to joint attention, verbal and motor imitation). Future studies should adopt a unified assessment procedure to assess and report these variables so that studies can be synthesized and compared.

143 CNVs in ASD – Molecular Findings, Clinical Outcomes and Ethical Implications.

Organizer: L. Gallagher *Trinity College Dublin*

The panel will present an integrated 'State of the Art' discussion of autism genetics illustrated by past and recent findings from the Autism Genome Project (AGP). Our emerging data highlights the complexity of ASD genetics and relative contributions of rare and common genetic variation to ASD aetiology. We will present evidence supporting the role of rare Copy Number Variants (CNV) in ASD in a proportion of cases. Importantly our data demonstrates convergence on functionally related pathways helping to piece together the neurobiological underpinnings of the condition. We will explore the phenotypic heterogeneity that exists within ASD, possible overlaps with other neurodevelopmental disorders and describe our analyses of the complex relationship between genetics and clinical outcomes. Our discussion will consider the challenges to overcome to interpret these relationships and their clinical translation in the form of improved diagnostics and treatments for ASD. This emerging knowledge carries a set of ethical considerations and

challenges to be worked through in the best interests of individuals with ASD and their families. We will illustrate this through the outcomes of recent investigations of parental understanding and desire for genetic testing in ASD.

143.001 The Impact of Rare Genomic Variants in Autism Spectrum Disorders – Evidence for Converging Pathways. D. Pinto*, S. W. Scherer and ,. the Autism Genome Project Consortium, *The Centre for Applied Genomics, The Hospital for Sick Children*

Background: The autism spectrum disorders (ASDs) are a group of early-onset conditions that affect 1% of the general population. ASDs are characterized by impairments in reciprocal social interaction and communication, and the presence of restricted and repetitive behaviours. Individuals with an ASD vary greatly in cognitive development, which can range from above average to intellectual disability. ASDs have a substantial genetic aetiology, but the underlying genetic determinants are still largely unknown. Recent association studies provide only weak evidence for common allele risk effects. In contrast, the role of rare variants in ASDs is being increasingly recognized with recent surveys for copy number variation (CNVs) and emerging sequencing efforts.

Objectives: Evaluation of the genome-wide characteristics of rare variants in ~2,000 ASD trios.

Methods: In Phase II of the Autism Genome Project (AGP), we recently reported on the genome-wide characteristics of rare (<1% frequency) CNV in ~1,000 ASD trios using the Illumina 1M SNP platform (Pinto et al. 2010). Here we report on an additional independent collection of ~1,000 ASD trios screened using a similar analysis pipeline.

Results: The integration of the two CNV sets from up to 2,000 ASD trios highlights several aspects: i) an extremely heterogeneous genomic architecture of ASD; ii) rare *de novo* CNVs are present in at least 4-5% of subjects with idiopathic ASD, iii) rare inherited CNVs are seen to disrupt loci previously implicated by *de novo* CNVs; iv) incomplete penetrance, failure to segregate and significant phenotypic heterogeneity associated with specific CNVs; v) while separate ascertainment delivers different representations of rare CNVs, they can be grouped in a few common functional pathways.

Conclusions: Our study further expands on the extremely heterogeneous nature of ASDs, and reveals additional new genetic and functional targets in ASD that point towards connected pathways in brain function and development. We expect that integration of the two CNV sets, coupled with deeper phenotyping and additional genomic analysis such as sequencing, will further aid in establishing genotype-phenotype correlations.

143.002 Common Variants for Schizophrenia Do Not Predict Autism. J. Vorstman*, *University Medical Center Utrecht*

Background: The results of recent studies suggest that an increasing number of *rare* genetic variants can lead to both schizophrenia and autism. These findings provide new insights to the question as to whether autism ought to be considered as related to, or rather, distinct from schizophrenia.

In a recent paper published by the International Schizophrenia Consortium (ISC) evidence in support of a polygenic contribution to schizophrenia was presented. Focusing on the effect of common variants with small individual effects, they demonstrated a significant “en masse” effect of this class of genetic variation for schizophrenia (the polygene score). Interestingly, they showed that the same schizophrenia-derived polygene score also contributes to the risk of bipolar disorder.

Objectives: Given the clinical overlap between schizophrenia and ASD, as well as the molecular evidence of shared genetic risk between these disorders due to rare genomic CNVs, we hypothesized that common risk alleles may also be shared between schizophrenia and autism.

Methods: To test this hypothesis, we utilized the polygenic score which was derived from a schizophrenia case-control dataset, (previously reported by the ISC). We examined whether this schizophrenia-derived polygenic score was able to differentiate autism cases from controls (based on trio data available through the Autism Genome Project, AGP).

Results: For the current analysis 2,737 proband-parent trios from the AGP were included. In previous publications methods of phenotyping of these samples have been extensively described. Of all samples high resolution SNP data (Illumina 1M) were available. Given the absence of unrelated controls

in the AGP dataset, the non-transmitted alleles to the proband were used as controls (or pseudocontrols). We used the schizophrenia score allele set that was previously described in the ISC paper, consisting of ~74k SNPs with nominal association (at different significance thresholds) in a discovery GWAS schizophrenia case control sample.

Our results show that the schizophrenia-derived polygenic score was not significantly different between ASD-cases and controls.

Conclusions:

While there may be a number of *rare* causative genetic variants that are shared between schizophrenia and autism, this study suggests that such sharing is non existent (or very limited) when *common* genetic variants are considered. These findings, in the context of other recent findings provide important novel insights into shared and distinct elements of the genetic architecture of autism and schizophrenia.

143.003 Relating Copy Number Variation to Phenotype – Bridging Phenotype Gaps. L. Gallagher* and A. K. Merikangas, *Trinity College Dublin*

Background: Copy-number variation (CNV) is the most prevalent type of structural variation in the human genome. In a proportion of cases which might be considered 'syndromal autism', data from the Autism Genome Project (AGP) supports the role of rare de novo CNV in causing Autistic Spectrum Disorders (ASD). We also find evidence for recurrent CNV impacting neurodevelopmental genes that may increase the susceptibility to ASD. It is not entirely clear how CNV influence the development of the clinical features of ASD. Similar CNV studies in intellectual disability are helping to describe syndromal forms of intellectual disability. In that context it is recognized that CNV also influence broader phenotypic manifestations in addition to intellectual ability, including physical and broader developmental characteristics, and medical comorbidities. Furthermore there is also some evidence in the literature that advanced parental age may carry increased risk for carrying a CNV and in turn could confer risk for ASD.

Objectives: We hypothesized that developmental abnormalities would be more likely to occur in association with rare CNV in ASD and investigated the association between symptoms of atypical development and medical comorbidities in our data with the presence of CNV. We also investigated the relationship with parental age. Symptom profiles were also investigated by CNV type using clustering methods.

Methods: Data was derived from the Autism Genome Project Illumina Infinium 1M and 1M Duo SNP microarray data and clinical phenotypes (ADI-R, ADOS-G, measures of adaptive and cognitive functioning, brief physical measures) (Stage 1 and Stage 2). >2000 individuals with rare CNV were included in the analyses. Associations were carried out in SAS version 9.2 (SAS Institute Inc., Cary, NC, USA), Chi Square and Fisher's exact tests via proc freq – Logistic regression via proc logistic. Clustering approaches are also being conducted.

Results: Analyses of relationships between rare CNV and selected phenotypes did not suggest the presence of statistically significant associations. Despite suggestions elsewhere, increased maternal and paternal age were not associated with the presence of rare CNVs impacting ASD- or ID- implicated genes. On a case by case basis we found further evidence supporting the role of known CNV, e.g. duplications of 15q11-q13 and also identified known syndromes within our AGP cohort, e.g. Smith Magenis Syndrome.

Conclusions: Even within a large sample such as the AGP, understanding the role of rare CNV in autism and the relationship with ASD is undermined by low power and missing phenotypic information.. Additional phenotypic information and medical histories will be required on a large scale to better describe ASD syndromes which will require better interdisciplinary integration of clinical genetics, psychiatry, neurology and paediatrics.

144 Social Perception in Toddlers with ASD: Methodological and Conceptual Considerations
Chair: K. Chawarska *Yale University School of Medicine*

Organizer: S. Macari *Yale University School of Medicine*

Deficits in social attention constitute one of the core symptoms of autism in toddlers. While a number of hypotheses have been advanced, the mechanisms underlying poor attention to people in naturalistic settings are poorly understood. In recent years, this area of research has been actively investigated using eye-tracking technology. Studies presented in this panel examine factors responsible for toddlers' atypical attention to people (Talks#1,2,&4), investigate individual variability in social attention and their links to phenotypic features (Talk#3&4), and illustrate the utility of fine-grained and less assumption-laden analytical methods to further our understanding of the factors driving visual behavior of toddlers with ASD (Talks#2&4) based on a series of conceptually-linked tasks. This panel will address several methodological considerations inherent in eye- tracking methodology: importance of accounting for both top-down and bottom-up influences on visual attention, approaches to parsing variability within ASD samples, as well as methodological aspects of analyzing eye-tracking on dynamic scenes. Taken together, this panel will 1) present a comprehensive account on abnormalities of visual scanning in response to complex social scenes, 2) address the issue of heterogeneity of attentional responses; and 3) offer insights into fine-grained analytic approaches to analysis of dynamic eye-tracking data.

144.001 Suppressed Attentional Response to Dyadic Social Cues in Infants with Autism. K. Chawarska*, S. Macari, D. Campbell and F. Shic, *Yale University School of Medicine*

Background: In typical development, the unfolding of social and communicative skills hinges upon the ability to allocate and sustain attention towards people. Deficits in social attention have been documented in autism, though the underlying mechanisms are poorly understood.

Objectives: To examine effects of context on attention to people and faces in toddlers with ASD using a free-viewing eye-tracking paradigm.

Methods: Participants were 13- to 25-month-old toddlers with autism (AUT; n=54), developmental delay (DD; n=22) and typical development (TD; n=48). To identify the factors responsible for limited attention to faces we manipulated the presence of salient social (child-directed speech (CDS) and eye contact (EC)) and nonsocial (distractor toys) cues. Four conditions were tested: actress making a sandwich (Sandwich, no CDS or EC), actress attempting to engage viewer through CDS and EC (DyadicCue), actress initiating joint attention (JointAttention, CDS and EC limited), and actress looking at moving toys in background (MovingToys, no CDS or EC). A generalized deficit in social attention would result in limited attention to person and enhanced attention to toys across conditions; elementary sensitivity to the context in which people appear in their visual field would produce condition-specific deficits. The results were analyzed using linear mixed models.

Results: In conditions devoid of EC and CDS, the distribution of attention between key features of the scene in all groups was comparable (Sandwich, MovingToys). However, when explicit dyadic cues were introduced (DyadicCue), AUT group showed suppressed attention to the entire scene ($p<.01$) and, when they looked at the scene, spent less time looking at the speaker's face ($p<.01$) and monitoring her mouth ($p<.05$) compared to the control groups. In the JointAttention, they tended to spend more time looking away from the entire scene ($p<.01$)..

Conclusions: The mere *presence* of a person within the visual field does not appear to disturb the general looking patterns in toddlers with autism. Neither did the *presence* of toys and objects. It was only when child-directed speech and eye contact were introduced that differences between autism and control groups became pronounced. Thus, as a group, toddlers with autism show abnormal visual responses to social scenes, which appear context-specific and do not reflect a generalized social attention deficit or prepotent preference for objects. A combination of EC and CDS represent the prototypical bid for dyadic attention, the most elementary and perhaps most salient social behavior, to which a keen sensitivity is already present in newborns. An attenuated attentional bias for this class of social stimuli early in life is likely to have a profound and debilitating effect on the development of social-cognitive skills and language in autism. Considering marked inter-individual variability observed in response to Dyadic Cue condition in the autism sample, further investigation into potential presence of subtypes

amongst toddlers with ASD is warranted. Similarly, the relative contribution of dyadic cues and perceptual characteristics of potential distractors to atypical scanning patterns in autism needs to be further clarified.

144.002 Diminished Salience of Social Stimuli, Not Enhanced Salience of Nonsocial Stimuli in Young Children with ASD. S. Macari*, F. Shic, D. Campbell and K. Chawarska, *Yale University School of Medicine*

Background: Whether in vivo or during eye-tracking, toddlers with ASD show an attentional bias toward objects in scenes containing both people and objects. Recent studies have suggested that contrast and motion may be processed atypically in young children with ASD (McCleery et al., 2009; Shic et al., 2009) and thus might play a role in attentional differences.

Objectives: To assess attentional preferences for basic perceptual features in young children with ASD. Are they biased toward high-contrast stimuli or certain kinds of motion? Does the presence of perceptually salient distractors impede their attention to social stimuli?

Methods: Visual attention was examined in young children with ASD (n=36), DD (n=12) and TD (n=42), (M=25mo). (1) Contrast Salience Task: A preferential looking paradigm using identical images that differed only in levels of contrast or color (high and low) assessed preferences for high/low contrast and high/low color. (2) Motion Salience Task: A preferential looking paradigm assessed preferences for three kinds of motion: rotational, translational, and scaling. (3) Dynamic Distractibility Task: Patterns of visual attention during a two-minute video were compared in young children with ASD (n=22) and TD (n=24), (M=25mo). The video consisted of a woman reading nursery rhymes with two monitors in the background that were blank or that contained still images (high contrast, high color) or video (rotating, scaling, or translating objects; Dynamic Distractors). Looking time for the Regions of Interest (ROI): face, book, body, distractors, and background were recorded with an eye tracker.

Results: (1) Contrast Salience: Children in all three groups preferred to look at images containing high color vs. low color and high contrast vs. low contrast at above-chance levels ($p<$ .001), with no group differences in the magnitude of the preference. (2) Motion Salience: Children in all groups overwhelmingly preferred to watch rotational motion over other kinds of motion ($p<.001$), with no main effect of diagnosis. (3) Dynamic Distractibility: Although children in both groups allocated most of their attention to the face, children with ASD attended longer to Dynamic Distractors than TD children, especially the rotating distractors, $p<.01$, $d=1.21$. The increase in looking time to the distractors came at the expense of looking at the face.

Conclusions: When tested in a preferential looking paradigm outside of the social context (experiments 1 & 2) toddlers with ASD have similar attentional preferences as non-ASD controls. When the same preferred stimuli (e.g., rotating objects) were presented in competition with highly salient social stimuli (experiment 3), non-ASD toddlers were capable of suppressing their attention to moving objects. Toddlers with ASD had difficulty doing so and ended up spending a significant amount of time looking away from the person. Consistent with other studies (Chawarska et al., 2003; 2010; Shic et al., 2011), these results indicate a diminished capacity to maintain attention to dynamic faces in young children with ASD which is not explained by increased salience of perceptual features of nonsocial distractors. Rather, the difficulties attending to social partners exhibited by children with ASD appear to result from diminished salience of social stimuli

144.003 Subtyping Toddlers with ASD Based on Their Scanning Patterns in Response to Dyadic Bids for Attention. D. Campbell*[1], F. Shic[1], S. Macari[1], J. Chang[2] and K. Chawarska[1], (1) *Yale University School of Medicine*, (2) *Yale University*

Background: Heterogeneity of syndrome expression is a well-known but poorly understood phenomenon in ASD. Our previous study (Chawarska et al., in revisions), revealed impaired visual responses to scenes containing child-directed speech and eye-contact (dyadic cues). The analysis also revealed marked variability in performance amongst toddlers with ASD. The mechanisms supporting responsiveness to dyadic cues are present shortly after birth and are highly consequential for development of social cognition and

communication. Hence, examining variability in performance in toddlers with ASD in this domain may have important implications for identifying meaningful subtypes within the spectrum, as well as for design of non-invasive early screening methods and identification of novel targets for treatment.

Objectives: To examine for presence of subgroups amongst toddlers with ASD based on their scanning patterns.

Methods: Fixation patterns were recorded in 57 18-24-month-old toddlers with ASD in response to a video of an actress emulating bids for dyadic attention. Their diagnoses were ascertained at 3 years. Hierarchical clustering using Euclidean distance and Ward's method was applied to four eye-tracking variables: the percentage of looking time at the scene, and percentages of looking time at the Person, Toys, and Background. Bootstrapping methods, in which subjects are randomly resampled to estimate the accuracy of statistical measures, were performed to assess cluster stability.

Results: Clustering analysis identified three subgroups amongst toddlers with ASD. Subsequent analysis evaluated symptom severity and levels of verbal and nonverbal functioning in each of the three clusters. The clusters were: (1) toddlers who displayed limited attention to the entire scene in general and to the speaker, who had low cognitive skills and severe symptoms of autism (32% of toddlers); (2) toddlers who had no difficulties in attending to the scene, but who spent very little time monitoring the speaker, and who were higher functioning and had less severe autism symptoms than Cluster 1 (28%); (3) toddlers with scanning patterns comparable to those of DD and TD controls, who had similar clinical profiles to Cluster 2, but less abnormal language profiles (40%). 77% of subjects were assigned to the same cluster in at least 80% of bootstrapped samples, demonstrating that the identified clusters are remarkably consistent.

Conclusions: The cluster analysis captured complex dependencies between visual scanning and severity of cognitive deficits, language impairment, and social disability in a sample of toddlers with ASD. Almost 2/3 of the sample exhibited limited attention to the speaker, approximately half of whom had major difficulties in attending to complex scenes in general. However, 40% of the sample performed similarly to their TD and DD peers, at least when global indices of performance were considered. It is not clear if the scanning pattern observed in this group is equivalent to the typical pattern observed in control groups with regard to underlying mechanisms. As work in our lab and by others have demonstrated, what appears to be a typical pattern of responses might sometimes be driven by atypical or compensatory mechanisms, thus further investigation into this phenomenon is necessary.

144.004 Scan Pattern Deviations in Toddlers with ASD: A Framework Based on Cohesion. F. Shic*, D. Campbell, S. Macari and K. Chawarska, *Yale University School of Medicine*

Background: Standard region-of-interest (ROI) analysis assumes a specific spatial context in which interpretation is made. Yet, these assumptions are often challenged by atypical attentional selections made by individuals with ASD. Autism researchers who employ eye-tracking in their work are also increasingly relying on the delivery of complex, naturalistic, dynamic scenes; ROI analysis of such stimuli can be ambiguous and time-consuming.

Objectives: To employ a region-free analysis method that leverages the spatiotemporal cohesion of typically developing (TD) toddlers in order to examine the atypical visual scanning of complex, social scenes by toddlers with ASD.

Methods: Two analyses were conducted on previous datasets from our lab (Chawarska et al., 2011; Campbell et al., 2011). In the first analysis participants were 20 month-old-toddlers with ASD (N=57), DD (N=31), and TD (N=74). In the second analysis, the ASD group was broken down via hierarchical clustering into three groups based on their response to an eye-tracking dyadic social probe: a group with typical scanning trajectories (ATYP, N=23), a group that did not monitor the speaker (ASPK, N=16), and a group that did not monitor the scene (ASCE, N=18). These groups were compared against TD controls. A dynamic 3-minute scene consisting of multiple probes was shown to the toddlers, and for analysis was broken down into successive 500 ms segments. A third of the segments where TD individuals exhibited the greatest cohesion were isolated by taking

successive medians on the distances between TD individuals. Median distances from TD participants in these segments were computed for each participant. Scan pattern velocities were also calculated, in order to provide further region-free measures. Analyses were conducted both on the collection of isolated segments as well as the segments broken down into episodes including Sandwich-making and DyadicCues.

Results: Toddlers with ASD scanning patterns deviated from both DD and ASD groups overall ($p<.05$,$p<.001$), but most prominently in the DyadicCue condition ($p<.001$,$p<.001$). Atypical scanning patterns were, overall, associated with greater difficulties with eye-contact and social affect; in the DyadicCue condition it was also associated with lower receptive language. Velocities in the DyadicCue condition were also higher for the ASD group than other groups. Subgroup analysis indicated that ASCE showed the most atypical scanning patterns in all conditions ($p<.001$); the ASPK group showed atypical attention only in the DyadicCue condition ($p<.001$). Interestingly, the ATYP group only viewed the Sandwich condition atypically ($p<.05$), though prior ROI analysis had shown them to be equivalent in this condition. In this group, greater scene exploration (higher velocities) was associated with better receptive language.

Conclusions: This study presents uses region-free methods of eye-tracking analysis that also arrives at results similar to standard ROI analysis. Discrepancies between findings of atypical scan patterns in ATYP and findings of typical region scanning suggest more subtle spatiotemporal synchronization issues in the ATYP group given equivalence in overall region looking times. Increased velocities combined with greater atypicalities in scanpaths in ASD in the DyadicCue condition suggests depressed synchrony with socially salient cues not evidence in individuals without ASD.

145 Lullaby and Good Night or Tomorrow Is Gonna Be A Tough Day: Research Predictions for the Influence of Disturbed Sleep and What We Can Do

Chair: K. A. Schreck *Penn State University - Harrisburg*

Organizer: K. A. Schreck *Penn State Universtiy - Harrisburg*

The treatment of day-time behavior for people with autism has challenged clinicians for many years. Most researchers and clinicians have solely concentrated on the treatment of what happens during the day – overlooking the possible influence of sleep on these behaviors. This panel provides evidence to support the relationship of day-time problems and symptoms to disrupted sleep for people with autism. Specifically, the panel will review the relationships of sleep disruption with a) cognitive and adaptive behavior, b) mental health (e.g., anxiety and depression), and c) behavior excesses (e.g., aggression). The panel will also address the research-based efficacy for a parent training protocol for treating sleep problems in children with autism.

145.001 Bad Nights and Biting Bed Bugs: The Effect of a Bad Night's Sleep on Children with Autism's Day-Time Behavior. K. A. Schreck*[1], M. Taylor[2], P. Kumar[3], L. Knapp[1] and J. A. Mulick[4], (1)*Penn State University-Harrisburg*, (2)*Penn State University - Harrisburg*, (3)*Penn State University* , (4)*Nationwide Children's Hospital & The Ohio State University*

Background: Preliminary research indicates that a variety of day-time behaviors (e.g., intensified symptoms of autism, stereotypic body movements, self-injurious behavior, communication problems, and social difficulties) significantly relate to sleep problems for people with an autism spectrum disorder. In most of these studies, day-time behavior or sleep problems are defined generally. Sufficiently more research needs to be done to clarify the specific relationships of these day-time problems and sleep disorders in this population.

Objectives: This paper identifies the specific relationships among day-time behavior (e.g., anxiety/depression and aggression) and sleep disorders.

Methods: Archival assessment data (i.e., sleep problem scores or diagnoses and day-time behavior) from an autism assessment clinic were recorded for N = 255 children diagnosed with an autism spectrum disorder by clinical psychologists. Parental report of sleep problems on the Behavioral Evaluation of Disorders of Sleep was correlated with Child Behavior Check List domain scores.

Results: Fewer total hours of sleep per night significantly related to increased rates of day-time aggression. Children more sensitive to night-time environmental stimuli who awoke

confused during the night were more likely to experience higher levels of day-time anxiety and depression. However, night waking significantly impacted aggression and attention difficulties more than the environmental stimuli and confusion.

Conclusions: Disturbed sleep at night significantly relates to day-time behavior difficulties for children with autism spectrum disorders. Until research specifies the relationships between sleep and day-time behavior for these children, day-time treatments may be significantly hindered by disregarding the night-time influences on behavior.

145.002 No Sweet Dreams for Children with Autism: The Day After A Bad Night's Sleep May Not Be So Sweet Either.
M. Taylor*[1], K. A. Schreck[2] and J. A. Mulick[3], (1)*Penn State University - Harrisburg*, (2)*Penn State University-Harrisburg*, (3)*Nationwide Children's Hospital & The Ohio State University*

Background: For typically developing children, research supports significant impacts of disturbed sleep on cognitive and day-time functioning. Significantly fewer studies have specified the relationship of disturbed sleep to these factors for children with autism.

Objectives: This paper identifies the specific relationships among cognitive ability, adaptive behavior and sleep problems for children with autism.

Methods: Archival assessment data (i.e., IQ scores, adaptive behavior scores, and sleep problem scores) from an autism assessment clinic were recorded for N = 335 children diagnosed with an autism spectrum disorder by clinical psychologists. Parental report of sleep problems on the Behavioral Evaluation of Disorders of Sleep were correlated with domain scores for each of the cognitive and adaptive measures.

Results: Results suggested that children who slept more hours per night had higher overall intelligence, verbal skills, overall adaptive functioning, daily living skills, socialization skills, and motor development. Children who slept more at night without waking during the night had fewer communication problems. Breathing related sleep problems and fewer hours of sleep related most often to problems with perceptual tasks.

Conclusions: This paper supports relationships between quality sleep and day-time functioning for children with autism. Identifying relationships between specific cognitive and adaptive skills influenced by disturbed sleep allows clinicians and researchers to more accurately develop treatment and remediation.

145.003 Sleep, Anxiety and Depression in High-Functioning Adolescents with Autism Spectrum Disorder (HFASD).
A. L. Richdale*[1], E. Baker[1], M. Short[2] and M. Gradisar[2], (1)*La Trobe University*, (2)*Flinders University*

Background: Anxiety is commonly related to insomnia in typically developing (TD) populations. At puberty sleep patterns change in TD adolescents with a rise in sleeping difficulties compared with middle childhood. Poor sleep, particularly insomnia, is common and often chronic in children with ASD and can be associated with behavioural difficulties, ADHD, anxiety and depression. However, little is known about sleep problems and their associations in adolescents with ASD and whether they differ from TD adolescents.

Objectives: Our aim was to explore the relationships between sleep patterns, psychopathology and satisfaction with life in high-functioning adolescents with autism spectrum disorder and age- and gender-matched TD adolescents

Methods: HFASD adolescents completed 7-day sleep diaries, actigraphy and questionnaires including sleep-related anxiety (Sleep Anticipatory Anxiety Questionnaire); severity of core symptoms of anxiety (Anxiety subscale of the DASS-21); depressive symptoms (Centre for Epidemiological Depression Scale); perception of quality and satisfaction with life (Satisfaction with Life Scale; SLS); and the Chronic Sleep Reduction Questionnaire (CSRQ). TD adolescents were drawn from an existing data base and matched with HFASD adolescents on both age and sex.

Results: 27 adolescents with HFASD (22 male, 5 female), age 15.50 years (*SD* = 1.27) and 27 TD adolescents, age 15.54 years (*SD* = 1.14) were included in the study. Sleep problems

were reported by 46.2% (n = 26) of HFASD adolescents and 14.1% (n = 27) of TD adolescents (p = .01) and these were primarily symptoms of insomnia. HFASD adolescents had longer sleep latency (p = .01), poorer sleep efficiency (p < .05), and more symptoms of insomnia (p < .05) than TD adolescents. The groups did not differ on the SLS or the CSRQ, but HFASD adolescents had significantly higher levels of sleep-related anxiety and general anxiety (both p < .05), and depression (p < .05) than TD adolescents. Sleep-related anxiety was significantly associated with several sleep parameters in the HFASD group, but there were no significant correlations in the TD group. Many problematic aspects of sleep were significantly associated with both general anxiety and depression in the HFASD group, but few significant associations were found for the TD group. Additionally, sleep-related anxiety, general anxiety, and depression were significantly associated with the CSRQ (all p < .001) for the HFASD group but only general anxiety was associated with this measure (p < .01) for TD adolescents.

Conclusions: Similar to reports for children, adolescents with HFASD self-report more sleep problems, primarily insomnia, and higher levels of anxiety and depression than TD adolescents. A range of insomnia symptoms are associated with sleep-related anxiety, general anxiety and depression in HFASD adolescents, with few such associations found for TD adolescents. Symptoms of chronic sleep reduction are also strongly associated with psychopathology in HFASD adolescents. These relationships have implications for the assessment and treatment of both sleep problems and psychopathology in HFASD.

145.004 Parent-Based Sleep Education Program for Children with Autism—Positive Impact on the Child and Family.

B. A. Malow*[1], A. M. Reynolds[2], S. Weiss[3], K. Adkins[1], K. A. Artibee[1], T. Clemons[4], D. B. Fawkes[1], K. Frank[1], S. E. Goldman[1], R. Hundley[5], T. Katz[6], A. Loh[7], N. Madduri[8] and D. Wofford[1], (1)*Vanderbilt Medical Center*, (2)*University of Colorado Denver*, (3)*Hospital for Sick Children*, (4)*EMMES Corp*, (5)*Vanderbilt University, Pediatrics*, (6)*University of Colorado*, (7)*Surrey Place*, (8)*Vanderbilt University*

Background: Parent training has been effective in a variety of interventions for children with autism spectrum disorders (ASD). Training parents to improve sleep habits in their children with ASD has shown promise on sleep and child/family functioning, although findings have been limited to small studies.

Objectives: To test the efficacy of parent-based sleep education for children with ASD on child sleep, child behavior, and family functioning. The aim of our larger study is to compare individualized and group sessions.

Methods: We carried out a multisite protocol at three sites within our Autism Treatment Network (ATN). Children ranged in age from 2-10 years, and were enrolled in the ATN, with their clinical diagnosis of ASD (by DSM-IV criteria) confirmed by the Autism Diagnostic Observation Schedule. All had sleep onset delay, defined by a sleep latency of 30 minutes or greater. Children were evaluated for medical co-occurring conditions that affect sleep, and children with these conditions were either excluded or treated prior to enrollment in the protocol. Parents met with an educator in either individualized and group sessions to: (1) Learn techniques related to appropriate timing of sleep and sleep hygiene (e.g., daytime habits, evening habits, sleep environment); (2) Develop and implement an individualized bedtime routine; and (3) Discuss strategies to interact with their child to minimize bedtime resistance and night wakings. The Children's Sleep Habits Questionnaire (CSHQ), Family Inventory of Sleep Habits (FISH), Repetitive Behavior Scale (RBS), Parenting Sense of Competence (PSOC), and Pediatric Quality of Life Scale (Peds-QL), and two weeks of actigraphy, were completed before and one-month after parent education. Parents received training in actigraphy collection procedures and educators at each site followed a manualized curriculum, with fidelity checks performed to ensure completeness and consistency in the education provided.

Results: Data from 33 children [24 boys, 9 girls; ages 6.2 ± 2.4 years (mean ± standard deviation)] completing the protocol have been analyzed to date. As our results are preliminary, we combined group (n = 13) and individual (n = 20) education. Paired t-tests were used to analyze results. Actigraphy showed an improvement in sleep latency from 58.3 ± 24.7 minutes to

40 ± 24.7 minutes (p =0.002); sleep duration and night wakings were not significantly improved. Parents also reported improvements in CSHQ sleep-onset delay (p < 0.001), RBS compulsive behavior (p = 0.01); PSOC parenting satisfaction (p = 0.05) and parenting efficacy (p = 0.05) and total peds-QL (p = 0.007) with treatment.

Conclusions: Based on our preliminary findings, parent-based sleep education improves sleep latency and aspects of child and family functioning in children with ASD.

We acknowledge the members of the Autism Treatment Network (ATN) for use of the data and the families who participated in the Registry. The ATN is funded by Autism Speaks and a cooperative agreement (UA3 MC 11054) from HRSA to the Massachusetts General Hospital.

146 Disrupted Neural Circuitry in Autism

Chair: S. E. Schipul *Center for Cognitive Brain Imaging, Carnegie Mellon University*

Organizer: S. E. Schipul *Center for Cognitive Brain Imaging, Carnegie Mellon University*

Just as autism affects many seemingly unrelated areas of behavior, brain imaging studies have revealed that atypical patterns of activation occur in many distinct regions of the brain. Such findings suggest that atypical neural functioning in autism is not restricted to one region, but rather occurs throughout the brain. Furthermore, numerous brain imaging studies have revealed converging evidence of disrupted connectivity between brain regions in autism. Such evidence includes lower frontal-posterior functional connectivity during task performance, lower structural integrity of white matter pathways, and behavioral impairments on cognitive tasks requiring the integration of distinct brain regions. This scientific panel will present recent work refining this issue through a variety of methods, including resting state functional connectivity, classification algorithms, relations between high definition fiber tracking and behavior, and the effects of disrupted brain circuitry on neural learning processes.

146.001 Effects of Disrupted Neural Circuitry on Learning Processes in Autism. S. E. Schipul* and M. A. Just, *Center for Cognitive Brain Imaging, Carnegie Mellon University*

Background: Learning is a network process that requires the integration of several distinct brain regions. Therefore, it is unsurprising that studies have reported impaired behavior and atypical brain activation patterns during learning in autism, which has been characterized as a disorder of brain connectivity. For example, a recent fMRI study revealed that participants with autism did not show the same changes in brain activation with learning as did neurotypical participants (Schipul et al., in press). Furthermore, the participants with autism had lower functional connectivity than neurotypical participants throughout the learning process. These results suggest that neural processing during learning in autism may be affected by disrupted brain circuitry. To clarify the extent to which neural circuitry affects the learning process in autism, we sought to compare learning during two tasks that vary in their reliance on a distributed network of regions. Dot pattern prototype learning is a complex task requiring the integration of a distributed network of brain regions and has shown behavioral impairments in autism. Paired associate learning of words requires a limited network of areas and has shown intact performance in autism.

Objectives: This fMRI study examined the brain activation patterns after learning to determine whether neural learning processes are only atypical in autism in tasks recruiting a distributed network, thereby implicating disrupted neural circuitry.

Methods: Participants include adults with autism spectrum disorders and neurotypical participants matched on age and IQ. The study includes two learning paradigms: (1) Implicit learning of dot pattern prototypes and (2) Explicit paired associate learning of words. Participants were trained outside the scanner on one set of stimuli for each task. After training, brain activation was measured during task performance on the trained items they had practiced earlier, as well as on untrained items. Brain activation was compared between task performance on the trained and untrained items to determine if the neural learning process could extend to novel stimuli. This contrast was compared between the Implicit task and the Explicit task, and between the autism participants and the neurotypical participants.

Results: Preliminary results with 10 participants in each group suggest that the autism group showed increased activation for the untrained items relative to the trained items in the Implicit task, reflecting the recruitment of increased resources for the novel stimuli. The neurotypical participants did not show this effect. These findings suggest that the learning process was specific to the trained stimuli in the autism participants, while it extended to novel stimuli in the neurotypical participants. This effect occurred in the Implicit task, which required the integration of many distinct brain regions. However, in the Explicit task, both groups showed a similar neural response for the trained and untrained items, reflecting intact neural processing in autism during learning of a less distributed task.

Conclusions: These preliminary findings suggest that individuals with autism show restricted neural adaptations during learning of an Implicit task requiring the integration of several distinct brain regions, but not during an Explicit task relying on a limited network.

146.002 Relating Alterations in White Matter Circuitry to Cognitive Performance. M. A. Just* and T. A. Keller, *Center for Cognitive Brain Imaging, Carnegie Mellon University*

Background: Diffusion tensor imaging (DTI) has consistently demonstrated widespread reductions in fractional anisotropy (FA) in adults with autism (e.g. Keller et al., 2007), however DTI-based quantitative tractography studies have been less consistent (e.g., Catani et al., 2008; Contouro et al., 2008; Pugilese et al., 2009; Thomas et al., 2011). DTI-based tractography suffers from a well-known limitation in its ability to track connectivity where tracts cross. Within the last year, we have made transformative technological advances in High Definition Fiber Tracking (HDFT) that permit noninvasive tracing of individual fiber tracts at previously inaccessible levels of precision and accuracy (Verstynen et al., 2011; Yeh et al., 2010; 2011), allowing us to map the connectivity of individual micro-fiber bundles arising from the cortex, follow them as they turn and cross other tracts, and identify their cortical/subcortical destinations. The present study is one of the first comprehensive investigations of brain structure and function in autism between the ages of 40 and 65. The sample includes a significant number of older adults with autism, addressing an egregious lack of information about the aging brain and mind in this disorder.

Objectives: To relate anatomic connectivity alterations in specific tracts to cognitive performance drawing on brain areas connected by those tracts.

Methods: The methods include combining high-angular diffusion weighted imaging (HARDI) acquisition methods (128-directions, high b-values, 32-channel head coil) with advanced computational methods for reconstructing the diffusion orientation density function (generalized q-space imaging and fiber tractography) to map the detailed white matter connectivity in individual participants.

Results: We have successfully collected preliminary HDFT data from a sample of 8 individuals with autism and 9 controls aged 40-65 years, and found important group differences, even in this small sample. The fractional anisotropy of the left superior longitudinal fasciculus is reduced in autism ($F(1, 14) = 6.02$, $p < .05$) and it reliably predicts a *lower-level* language ability (word reading speed) ($r = .69$, $p < .05$) (measured with the WRAT). In addition, the number of fibers in the *right* uncinate fasciculus was reduced ($F(1, 14) = 9.58$, $p < .01$). Importantly, the number of fibers in this tract reliably predicts *higher level* language abilities in autism, namely inference-making ($r = .71$, $p < .05$) and oral expression ($r = .77$, $p < .05$) (measured by the Test of Language Competence). In both cases, the tract properties show a strong correlation with the type of language performance that relies on the specific interregional connectivity provided by the tract. This extremely encouraging preliminary finding exemplifies the ability to relate cognitive performance to connectivity on an individual basis. Moreover, these tract measures do not predict performance in controls, where connectivity is apparently not a limiting factor.

Conclusions: These findings constitute some of the first evidence that white matter properties are disrupted in older adults with autism and that these measures are related to cognitive performance. These preliminary results demonstrate the feasibility of the approach, its applicability to older participants, and its potential fruitfulness.

146.003 Large-Scale Cortical Functional Connectivity in Children with Autism Spectrum Disorders. B. Deen*[1] and K. A. Pelphrey[2], (1)*MIT*, (2)*Yale University School of Medicine*

Background: Prior research has found reduced functional connectivity of cortical regions in adults with Autism Spectrum Disorders (ASD), leading to a theory of generalized underconnectivity. However, prior studies may have been confounded by effects of task activation, and haven't directly compared predictions of general underconnectivity as opposed to network-specific alterations. This study provides evidence against the hypothesis of broadly decreased functional connectivity in ASD. Instead, the evidence suggests a pattern of network-specific alterations, including increased integration of sensorimotor networks and decreased integration of the DMN.

Objectives: In the present study, we assessed cortical functional connectivity using resting-state fMRI, in large samples of young children with and without ASD, and in a number of different networks.

Methods: Twenty-eight TD children (20 male, mean age 12.7±2.8) and twenty-eight children with an ASD (20 male, mean age 12.7±3.0) participated in the study. Furthermore, we acquired resting-state data from 48 TD adults (23 male, mean age 23.4±3.0), for the purposes of defining seed regions for correlation analysis. Diagnoses of ASD were determined using the Autism Diagnostic Observation Schedule, the Autism Diagnostic Interview – Revised, and the judgment of experienced clinicians at the Yale Child Study Center. TD children and adults had no psychiatric or neurological conditions. All children received the Differential Ability Scales – Second Edition to assess general intelligence, and a subset of 26 subjects per group received the Social Responsiveness Scale to assess autistic traits. The TD and ASD groups did not differ significantly in age, verbal/nonverbal intelligence, gender, or mean translational head motion between volumes ($P > .05$, unpaired, two-tailed two-sample *t*-test); however, they did differ significantly in SRS score ($t = 11.13$, $P < 5x10^{-15}$), as expected. Structural and functional images were acquired on a 3 Tesla Siemens Magnetom Trio scanner, with a 32-channel head coil. Functional data were acquired in the resting state: participants viewed a gray screen with a black crosshair, and were asked to keep their eyes open, remain awake, and stay as still as possible. Resting-state scans lasted 6:40 minutes, or 200 volumes; a single run was acquired per participant.

Results: Patterns of functional connectivity were largely similar in children with and without ASDs. A number of network-specific group differences were found in both directions. In particular, we found reduced functional connectivity in ASD in the default mode network (DMN), most strongly in the ventral DMN subnetwork. Increased functional connectivity was found within the somatomotor and visual networks. In addition, we found reduced functional connectivity between primary visual cortex and the fusiform gyrus and posterior superior temporal sulcus, regions involved in social perception.

Conclusions: This study provides evidence against the hypothesis of broadly decreased functional connectivity in ASD. Instead, they suggest a pattern of network-specific alterations, including increased integration of sensorimotor networks and decreased integration of the DMN.

146.004 Autism Classification Using Local, Global, and Connectome-Wide Measures of Functional Connectivity. J. D. Rudie*[1], J. B. Colby[1], Z. Shehzad[2], P. M. Douglas[1], J. A. Brown[1], D. Beck-Pancer[1], L. M. Hernandez[3], D. H. Geschwind[1], P. M. Thompson[1], M. S. Cohen[1], S. Y. Bookheimer[1] and M. Dapretto[1], (1)*University of California, Los Angeles*, (2)*Yale University*, (3)*Brain Mapping Center, University of California, Los Angeles*

Background: A major goal of neuroimaging research is to develop individualized measures that aid in the diagnosis and treatment of neuropsychiatric disorders. Although converging evidence suggests that autism spectrum disorders (ASD) are related to disrupted functional connectivity across distributed brain networks (Schipul et al. 2011), the nature and distribution of these alterations are not entirely known. Additionally, the robustness of differences at the individual subject level is not well established since studies typically report group level differences and do not use independent replication samples.

Objectives: We sought to characterize alterations in local, regional, and global connectivity in ASD using resting-state fMRI, as well as develop a reliable method for classifying whether an individual had a diagnosis of ASD or was typically developing (TD) based on these measures.

Methods: Our sample consisted of 6-minute resting-state fMRI scans of eighty children and adolescents (43 ASD, 37 TD), matched for age (13.2+/-2.2), Full Scale IQ (104+/-12.3), gender (86% male), and head motion. Data were first corrected for motion, skull stripped, spatially smoothed, and temporally filtered. This was followed by regression of motion parameters, CSF, WM and whole-brain timeseries, and standard space registration. Residual gray matter timeseries were then used in voxelwise regional homogeneity (similarity of a voxel with those of its nearest neighbors using Kendall's W), global connectivity (average connectivity between a voxel and all other positively correlated voxels) and connectome-wide association (comparing a voxel's whole-brain connectivity map between participants) analyses. A multiple support vector machine recursive feature elimination algorithm (mSVM-RFE) was used to obtain a ranked list of voxelwise features for each of these methods. This process was wrapped in an external layer of 10-fold cross validation. Estimates of generalization error were obtained by averaging the performance of a tuned and trained radial basis function SVM classifier on the respective hold-out samples across these 10 folds. Top features from each method were then tested separately and jointly in an independent replication sample consisting of thirty subjects (15 ASD, 15 TD).

Results: Autism was associated with reductions in both local and global connectivity across multiple brain regions including the precuneus/posterior cingulate and medial prefrontal cortex of the default mode network, frontal and parietal regions of the attention network, as well as the striatum, anterior insula and fusiform gyrus. Within the training set, features derived from global connectivity, regional homogeneity, and the connectome-wide similarity matrix reached average accuracies of 70%, 74%, and 75% respectively. In the independent replication sample a classifier trained from these measures reached accuracies of 70%, 66%, and 66% respectively and 73% jointly (p=0.003; 11/15 ASD and 11/15 TD).

Conclusions: These findings support the notion that autism is characterized by reductions in both long and short-range functional connectivity across multiple brain networks. Furthermore, this work suggests that a 6-minute resting fMRI scan can distinguish individuals with autism above chance and may be useful as a diagnostic measure. Larger sample sizes, better data quality and analytical methods, as well as a better understanding of genetic factors influencing these circuits should improve accuracy.

147 Challenges for Children with ASD in School: Teaching Strategies and Learning Outcomes

Chair: A. S. Carter *University of Massachusetts Boston*

Organizer: J. Blacher *University of California*

Making school days happy days for children with autism spectrum disorders has become more of a reality, but these children still face academic challenges and fragile student-teacher-relationships. These three talks look at aspects of academic engagement--including relationships with teachers, task engagement, academic performance, and in-class attention--across the early childhood, middle childhood, and secondary school years for children with ASD. In the first paper, the author will present a model of successful transition to the early school years that hypothesizes school and teacher relationships as moderators of child outcome of success in literacy. In the second paper, the author addresses school engagement in minimally verbal children participating in a literacy task. The author of the third paper will address challenges of communication in the natural classroom setting, also with minimally verbal children, using PECS. In the fourth paper, the author will present data on the classroom engagement of secondary school students via public speaking and a virtual reality paradigm. The four research teams represented in this scientific panel utilize a variety of methodological approaches including single case design, within group parametric analyses and multi-level modeling. Discussion in each case will focus on implications for current or future interventions.

147.001 Smooth Sailing: Charting Successful Transition in the Early School Years for Children with ASD. J. Blacher*[1] and A. Eisenhower[2], (1)*University of California*, (2)*University of Massachusetts*

Background: The transition to kindergarten is a crucial milestone for all children. The proposed study builds on research findings that student-teacher relationships (STRs) during the early school years can be pivotal in children's subsequent academic, behavioral, and social adjustment in school (e.g. Alexander & Entwistle, 1988; Hamre et al., 2008; Pianta & Stuhlman, 2004). We are studying the early school experience of children with ASD, toward the development of early interventions to ease this transition. Ultimately, we are interested in the relationship between STRs and child progress in literacy skills, behavior problems, social skills, and peer relationships.

Objectives: The overall objective is to understand the relationships among child characteristics, the student-teacher relationship, and child progress in academic, behavioral, and social realms. We present a model that proposes how these domains could be related, as well as possible moderators and mediators of the relationship among them. In this paper, we will focus on children's literacy, which is one of our child outcomes.

Methods: This is a two-cohort (2011, 2012), cross-sectional (year of school), longitudinal (three assessments), and two-site (California, Massachusetts) design. Although the study has just begun, we will have completed eligibility assessments and full Time 1 visit protocols for at least 40 children with autism as a basis for this presentation. The sample (n=13) completed to date was recruited through local and regional schools, agencies, and hospitals. 85% of the enrolled children were male. All children were enrolled in public schools, with 54% in 1st grade, 31% in kindergarten, and 15% in pre-K. Overall 92% were receiving special education services. Among parents, 92% reported attaining a degree of B.A. or higher, while 8% had a high school diploma as their terminal degree. Seventy-five percent of parents reported their race as White, while 8% reported black and 17% reported other, including Hispanic/Latino and Asian; we expect greater ethnic/racial diversity as the sample increases.

At an initial screening visit, children were administered a short form of the WPPSI and the ADOS. The estimated full scale IQ (FSIQ) mean was 93.4, SD = 17.2. According to the ADOS, 73% of children met the criteria for autism, and the other 27% met the criteria for Autism Spectrum Disorder. At the Time 1 visit, children participate in a complete literacy battery designed to asses the "Big 5" aspects of early reading: phonemic awareness, alphabetic principle, fluency, vocabulary, comprehension. There is also a videotaped, parent-child shared-literacy task.

Results: We will report data from the Time 1 visit on literacy functions and their relationship to child characteristics (e.g., age, autism symptomatology), family demographics (e.g., parent education), and parent perceptions of school involvement (e.g. child engagement in school). We will also track the relationship of behavior problems and social skills to literacy.

Conclusions: We anticipate that this intensive, multi-method study of children with ASD will yield unique information about adjustment to early schooling. These findings will serve as the evidence base for developing a school-based early intervention program for teachers and parents of children with ASD.

147.002 Academic Engagement of Minimally Verbal Children with ASD At School. K. Krueger*[1], K. Goods[2], C. Mucchetti[2] and C. Kasari[3], (1)*UCLA*, (2)*Semel Institute* , (3)*University of California, Los Angeles*

Background: Approximately 30-40% of children with autism remain minimally verbal (fewer than 20 functional words) despite receiving years of interventions and a range of opportunities. Very little is known about these individuals as they are often excluded from research studies due to limited language or cognitive ability. Thus, we are limited in our knowledge of the academic engagement, communication and literacy development of these children in school settings where they presumably spend the most time.

Objectives: The current studies examined the task engagement and communication of minimally verbal children (between 5 and 8 years) while at school.

Methods: Study 1: Eighteen participants screened for a larger intervention study for minimally verbal children with autism were observed in their classroom for two hours during their morning routines. The majority of children were observed in self-contained special education classrooms on general education campuses; 2 were observed in a general education classroom, and 1 in a special education school. Within subjects repeated measures with simple contrasts were conducted to compare differences within child engagement states, communicative partners and type of classroom instruction. Study 2: Four participants were included in an alternating treatment, multiple baseline design of an adapted shared reading paradigm in which task engagement was tracked.

Results: *Study 1*: Children were unengaged from classroom activities for a majority of observations (*M*= 41.2%). This time was significantly different from time jointly engaged (*M*= 18.2%), object engaged (*M*= 12.5%), onlooking (*M*= 10.8%), or person engaged (*M*= 0.6%). Children's primary communicative partner was a classroom aide (*M*= 43.7%), whom they communicated with a significantly greater percentage of the observation than no communicative partner (*M*= 20.3%), teacher (*M*= 11.9%) or peers (*M*= 1.0%). In terms of academic instruction, children spent significantly more class time on break (*M*= 34.2%) than whole group instruction (*M*= 19.8%) one-on-one instruction (*M*= 17.6%), small groups (*M*= 8.2%), and independent work (*M*= 3.4%). During the 2-hour observation, children initiated an average of 69 bids for communication, while classroom staff initiated an average of 339 bids. Children and classroom staff responded to a similar number of bids (46.2% and 46.4%, respectively). *Study 2:* In a multiple baseline, alternating treatment design, four participants showed increased task engagement during teacher –led adapted shared reading activities compared with standard shared reading (see figure). Adapted activities included visual supports as well as embedded objects and teachers employed strategies to increase student engagement.

Conclusions: Minimally verbal children with autism in school spend little time engaged in meaningful academic or social activities. However, when engaged in a shared reading paradigm, they show increased story comprehension and joint engagement. Thus, these types of interventions should find their way into the classroom practice for this underserved population of children.

147.003 Academic Engagement of Minimally Verbal Children with ASD At School: Virtual Reality Paradigm with Secondary Students. M. V. Gwaltney*[1], N. MacIntyre[1], W. Jarrold[2] and P. C. Mundy[2], (1)*UC Davis School of Education*, (2)*UC Davis*

Background: Social attention theory has contributed to clinical advances for preschool children with autism, but has had less impact on school-aged children. In school-aged children social attention become more complex, such as in public speaking tasks where children must coordinate attention with *multiple* social partners while also attending too and referring to their internal thoughts and representations. Recent data suggests that more secondary school-aged children with ASD in inclusive setting rarely engage in this type of public speaking in frontal of a class (51% to 71%) compared to peers (32%, IES, 2007). We have developed a virtual reality classroom public speaking paradigm to better understand the impediments to development of this type of complex social attention in secondary students with ASD.

Objectives: The proposed study compares the development of complex social attention to avatar peers versus complex attention to non-social stimuli in a virtual classroom paradigm in order to understand differences in age effects and associations with measures of behavior, learning and cognition specific to social attention in students with ASD.

Methods: Forty students with ASD, IQ = 40, and age-matched typical 8- to 16-year-old control children participated in this study. Participants were presented with a battery that included measures of behavior and learning problems (Connors Parent Report and Multidimensional Scale for Anxiety in Children), IQ (WISC-IV), working memory (WRAML), Academic Achievement (WIAT-II) and two virtual reality paradigms assessing complex social and non-social attention. These required children to answer self-referenced questions while directing their attention to each of nine avatar peers (Social

Condition), or nine inanimate obelisques (Non-Social Condition) positioned around the virtual classroom.

Results: Preliminary data are currently available on 15 children in each diagnostic group. Analyses of these data revealed evidence that children with typical development display greater age related advances in social attention than children in the ASD sample. In addition social attention measures were related to cognition and behavior to a greater degree than were non-social measures; however the pattern of these differences varied across diagnostic groups. In the ASD sample, frequency of social orienting was negatively related to parents ratings of executive function problems (-.51, $p < .075$) and an overall problems score on the Conners (-.71 $p < .05$). Conversely, in the typical sample social attention was positively related to visual working memory on the WRAML (.72, $p < .05$) but negatively related to self reports of social anxiety (-.71, $p < .05$). Additional data on the full sample, including data on the relations between social-attention for both groups will be presented.

Conclusions: This study provides additional support for the validity of virtual classroom measures for examining developmental differences in attention that may impact classroom performance in school aged children with autism. The intervention potential of VR classroom paradigms will also be discussed.

147.004 Communication Intervention in Real-Life Settings: Outcomes and Challenges. P. Howlin*[1], K. Gordon[2], G. Pasco[3] and T. Charman[3], (1)*Institute of Psychiatry, King's College London*, (2)*Great Ormond Street Hospital*, (3)*Institute of Education*

Background : The Picture Exchange Communication system (PECS) is a widely used programme to enhance communication skills in non-verbal children with autism. However, despite being used in over half of all specialist autism schools in the UK (National Autistic Society statistics, 2005), the majority of teachers using this system are neither specially trained, or monitored in their use of PECS. Thus, the quality of intervention offered to pupils is often poor. Moreover, although children who remain non-verbal through elementary school tend to have the lowest levels of intellectual and language ability, little is known about the specific characteristics of those children who do or do not respond to PECS teaching in the classroom.

Objectives : (1) To investigate, in a pragmatic, group RCT the impact of providing PECS training and on-going monitoring to teachers on children's communication skills. (2) To determine the characteristics of children who respond best to such training and the aspects of communication that are most likely to improve. (3) To consider the limitations and challenges of conducting treatment trials in the classroom - i.e. when therapy is administered directly by teachers rather than specifically trained therapists

Methods : 84 children from 17 specialist elementary schools participated in the study. Mean age was 6.8 years (range 4-10 years); median non-verbal IQ was 29.9 (interquartile range 21.2-40.5). Over 80% had no spoken language or used single words only. All met criteria for autism or ASD on the ADOS, Class groups were randomly assigned to Treatment groups (immediate or delayed) or No Treatment. In the Treatment groups classroom staff attended 2-day workshops held by PECS consultants and were then regularly monitored and provided with feedback by expert PECS consultants over the following 5 months (6 sessions per month) Multi-level Poisson regression was used to take account of initial group differences, treatment conditions, change across time points, and variations in length of observations and time between observations.

Results: Naturalistic observations of children in the classroom indicated that PECS training for teachers resulted in significantly improved spontaneous communication using pictures, speech or both, in the children ($p<.001$). Spontaneous requesting for objects increased significantly ($p<.001$) but spontaneous requesting for social purposes did not. Only the effect on spontaneous speech persisted by 9 month follow-up. Improvement in the spontaneous use of pictures to communicate was not associated with any specific child characteristics (e.g. DQ, initial language, ADOS score) , but the children who showed improvements in speech tended to show less severe autism symptoms and to have at least some expressive language when intervention began.

Conclusions : Multi-level modelling allowed for exploration of specific intervention effects and outcome predictors. However, although it was possible to collect detailed information on child factors related to outcome, assessment of other variables, such as teacher competence, treatment fidelity, differences between classrooms or other factors related to school or home background was not possible within the design of the programme. Why treatment effects diminished over time is also unclear. The practical difficulties of conducting RCTs within real-life classroom settings will be further discussed.

148 Implications of DSM-5 Criteria for the Recognition of Autism Spectrum Disorders: Clinical and Epidemiological Considerations.

Chair: D. H. Skuse *Institute of Child Health, University College London*

Organizer: D. H. Skuse *Institute of Child Health, University College London*

DSM-5 draft criteria, revised and posted January 2011, aim to simplify the diagnostic criteria used to define the range of autistic disorders subsumed under the heading Pervasive Developmental Disorders in DSM-IV-TR. The proposal to combine Asperger disorder, pervasive developmental disorder–not otherwise specified (PDD-NOS), and autistic disorder into one new category of ASD has major implications for recognition and service provision. One critical assumption underlying the revision is that autism is a heterogeneous condition, with a considerable range of clinical severity. The range of associated intellectual disability does not wholly account for that variance in severity. Evidence for the validity of conventional subtypes, defined by DSM-IV-TR is inconsistent. A second assumption is that diagnoses within the autism spectrum may be best served by combining categorical with dimensional approaches to summarizing symptom profiles. A third assumption is that diagnostic exclusion rules should be relaxed, insofar as it makes clinical sense separately to record comorbidities. In this Panel we aim to challenge the evidence both for and against these assumptions, bringing together recent research based upon epidemiological data on autism traits in the general population and from clinically identified populations in the USA and Europe.

148.001 The Construct Validity of Proposed Criteria for DSM-5 Autism Spectrum Disorder. W. P. Mandy*[1], T. Charman[2] and D. H. Skuse[3], (1)*University College London*, (2)*Institute of Education*, (3)*Institute of Child Health, University College London*

Background: Imminent revisions of diagnostic criteria for ASD beg a number of questions concerning construct validity. For example, should stereotyped language be regarded as a repetitive behaviour (RRB) or as social communication impairment? Is it appropriate that play and imagination deficits be dropped as a symptom of autistic social communication impairment? What is the role being played by sensory sensitivities in the autism phenotype: are they congruent with other aspects of symptom severity?

Objectives: We used confirmatory factor analysis to test the construct validity of the proposed DSM-5 symptom model of autism spectrum disorder (ASD), in comparison to alternative models, including that described in DSM-IV-TR.

Methods: Participants were 708 verbal children and young people (mean age=9.5 years) with mild to severe autistic difficulties. Autistic symptoms were measured using the Developmental, Dimensional and Diagnostic interview (3Di). The fit of the two-factor DSM-5 model, which has a social communication and a restricted, repetitive behaviour (RRB) factor, was compared to that of alternative models. In one half of the sample, properties of the DSM-5 model were examined to investigate the validity of specific diagnostic criteria, informing the development of a better fitting DSM-5 model. This was then cross-validated in the remaining 'hold out' half of the sample; and its stability was tested across groups defined by age, sex and symptom severity.

Results: The DSM-5 model was superior to the three-factor DSM-IV-TR model. It was improved by the removal of items measuring 'play and imagination' and 'stereotyped and repetitive use of language'. A scale measuring sensory abnormalities was added to the model, and loaded onto its RRB factor. This DSM-5 model fit well in the hold out sample; was stable across age and sex; and fit adequately in those with clinical and sub-threshold autistic presentations.

Conclusions: Our findings suggest that the autism phenotype is inadequately described by DSM-IV-TR criteria, and that the proposed autism dyad of DSM-5 has greater validity. We conclude that the core impairments of ASD are manifestations of separable social communication and RRB dimensions. We have also found support for the hypothesis that sensory abnormalities are best conceptualised as an aspect of RRB. Evidence is emerging that it is 'time to give up on a single explanation for autism', and that distinct aetiologies may underpin different dimensions of autistic impairment. We conclude that the time has come to investigate whether the social communication and RRB dimensions we describe are associated with distinct endophenotypes and genotypes.

148.002 Links Between Autism Spectrum Disorders and ADHD Symptoms Trajectories: Recent Evidence and Implications for Exclusion Rules in DSM-5. B. St. Pourcain*[1], W. P. Mandy[2], J. Heron[1], J. Golding[3], G. Davey-Smith[1] and D. H. Skuse[4], (1)*School of Social and Community Medicine, University of Bristol*, (2)*University College London*, (3)*University of Bristol*, (4)*Institute of Child Health, University College London*

Background: There is co-occurrence between autistic and hyperactive-inattentive symptomatology when the traits associated with ASD and ADHD are studied cross-sectionally. Currently, ADHD is not diagnosable if the clinical presentation is of an ASD. On the other hand, if the co-diagnosis of ADHD were to be permitted, as is proposed within DSM-5, there will be immediate implications for both clinical practice and for the design and interpretation of research into both of these neurodevelopmental traits.

Objectives: We have conducted the first study to examine the longitudinal pattern of association between social-communication deficits and hyperactive-inattentive symptoms in the general population, from childhood through adolescence. We explored the interrelationship between trajectories of co-occurring symptoms, and sought evidence for shared prenatal/perinatal risk factors.

Methods: Study participants were 5,383 singletons of white ethnicity from the Avon Longitudinal Study of Parents and Children (ALSPAC). Multiple measurements of hyperactive-inattentive traits (Strengths and Difficulties Questionnaire) and autistic social-communication impairment (Social Communication Disorder Checklist) were obtained between 4 and 17 years. Both traits and their trajectories were modeled in parallel using latent class growth analysis (LCGA). Trajectory membership was subsequently investigated with respect to prenatal/perinatal risk factors.

Results: Our longitudinal approach to data analysis over a 14 year period of follow-up identified two social-communication domain related autistic trait trajectories (persistently impaired versus low-risk) and four hyperactive-inattentive trait trajectories (persistently impaired, intermediate, childhood-limited, and low-risk). Our findings are consistent with earlier reports of high stability of autistic symptoms, and with evidence for a greater variability of ADHD-like behaviour, during the course of child development from 4 to 17 years. Among the hyperactive-inattentive trajectories, the observation that there are both persistently-impaired and childhood-limited patterns matched previous reports indicating subgroups with stable ADHD symptoms and others showing a decline of ADHD symptoms with progressing age, respectively. We found that the observed trait interrelationship between the most persistently impaired individuals is not reciprocal. Although the majority of children with persistently impaired social communication skills were either part of the persistently impaired hyperactive-inattentive or the intermediate hyperactive-inattentive group, children with persistent hyperactive-inattentive symptoms were almost entirely subsumed within the persistently impaired social-communication group.

Conclusions: The strong trajectory links observed in our study, especially between the most persistently affected individuals, directly support the proposed revisions for DSM-5. These include changes with respect to separate recording of ADHD criteria and of ASD symptoms, which will allow ASD and ADHD to be diagnosed in the same individual. We propose the possible existence of a novel autistic/hyperactive-inattentive syndrome. Our hypothesis finds general support through recently published genetic analyses, including both general population traits and genetic studies of individuals with severe symptoms. Recent research suggests common genetic

variants, identified from ADHD and ASD genome-wide association analysis, may increase predisposition to both conditions.

148.003 Phenotypic and Cognitive Overlap Between Autism Spectrum Disorder and Attention Deficit Hyperactivity Disorder. J. K. Buitelaar*[1], A. Oerlemans[2], D. van Steijn[2] and N. N. J. Rommelse[3], (1)*Radboud University*, (2)*Donders Institute, Radboud University*, (3)*Karakter Child and Adolescent Psychiatry University Centre*

Background: Autism Spectrum Disorder (ASD) and (ADHD) are genetically related neuropsychiatric disorders that co-occur frequently. Given the substantial overlap in cognitive functions and functional and structural brain abnormalities, in a proportion of cases ASD and ADHD may be different manifestations of the same overarching disorder.

Objectives: Few studies have seized the opportunity to study the cognitive and neural base of ASD and ADHD in conjunction. Such an investigation, of a carefully selected clinically comorbid sample, could provide an excellent basis to identify pleiotropic genes for ASD and ADHD. The study could also serve as a basis for the investigation of evidence supporting a novel and distinct syndrome that manifests both phenotypes.We aimed to conduct such an investigation.

Methods: We established a large database of ASD probands (with and without co-occurring ADHD) (N=180). Evaluations were also made of affected and unaffected siblings, and parents. In addition we established a database of ADHD probands (N=400), also containing assessments of affected and unaffected siblings, and parents. A third database comprised control subjects and their siblings and parents. Probands, siblings and parents have been phenotyped for ASD and ADHD symptoms, and have been evaluated on a set of cognitive tests including face recognition, emotion recognition and prosody, working memory, inhibition and planning.

Results: We have started to analyse the data in terms of 3 questions: 1) which cognitive impairments are common to both ASD and ADHD and which are specific to ASD or ADHD ?; 2) do the cognitive impairments in ASD map onto one common underlying cognitive construct, or alternatively, do these impairments better fit into a 2- or 3-factor model; and 3) to which extent are these cognitive impairments familial in ASD, in ADHD, and in ASD and ADHD families ?

Conclusions: Results of these forthcoming analyses will provide further insight into the cognitive endophenotypes of ASD and ADHD. They will also provide insights into the nosological issue of whether, as least in a subset of cases, ASD and ADHD are different manifestations of one overarching disorder. These findings could provide evidence of a biological basis for recent observations that children from the general population with persistent hyperactive-inattentive symptoms are almost entirely subsumed within a subgroup of children with persistently impaired social-communication (St Pourcain et al, 2011). The implications of that observation are that children with persistent social communication impairments may comprise a heterogeneous clinical population, with distinct biological substrates underlying their superficially similar symptomatology. Our potential findings will have implications for the revision of rules in DSM-5 regarding the separate recording of ADHD-traits in the presence of an autistic spectrum disorder.

148.004 The Concept of Dimensionality, Applied to Proposed DSM-5 Criteria for Autism Spectrum Disorder. T. W. Frazier*[1], E. A. Youngstrom[2], L. Speer[1], R. A. Embacher[3], P. A. Law[4], J. N. Constantino[5], R. Findling[6], A. Y. Hardan[7] and C. Eng[1], (1)*Cleveland Clinic*, (2)*University of North Carolina at Chapel Hill*, (3)*Cleveland Clinic Center for Autism*, (4)*Kennedy Krieger Institute*, (5)*Washington University School of Medicine*, (6)*University Hospitals Case Medical Center*, (7)*Stanford University School of Medicine*

Background: A question that is pertinent to the conceptual background underlying revisions to the definition of autistic disorders in DSM-5 concerns the extent to which we should regard this heterogeneous set of conditions as representing multidimensional traits that vary in severity relatively independent of one another. DSM-5 goes some way to reflecting a widespread view that dimensional descriptors are a more appropriate way of reflecting individual differences in symptom severity and general impairment. The implications of employing a dimensional framework for diagnosis, compared to a categorical one, are profound and could impact upon

both the provision of clinical care and strategies for neurocognitive and genomic research.

Objectives: We aimed to evaluate the validity of proposed DSM-5 criteria for autism spectrum disorder (ASD).

Methods: We analyzed symptoms from 14,744 siblings (8,911 ASD and 5,863 non-ASD) included in a national registry, the Interactive Autism Network. Youth 2 to 18 years of age were included if at least one child in the family was diagnosed with ASD. Caregivers reported symptoms using the Social Responsiveness Scale and the Social Communication Questionnaire. The structure of autism symptoms was examined using taxometric procedures and latent variable models that included categories, dimensions, or hybrid models specifying categories and subdimensions. Diagnostic efficiency statistics evaluated DSM-IV-TR, the proposed DSM-5 algorithm, alterations of the DSM-5 algorithm in identifying ASD.

Results: We found a hybrid model that included both a category (ASD versus non-ASD) and two symptom dimensions (social communication/interaction and restricted/repetitive behaviors) was more parsimonious than all other models, and replicated across measures, subsamples, and taxometric procedures. Empirical classifications implied a broad ASD category distinct from non-ASD. DSM-5 criteria had superior specificity relative to DSM-IV-TR criteria (0.97 versus 0.86); however sensitivity was lower (0.81 versus 0.95). Relaxing DSM-5 criteria by requiring one less symptom criterion increased sensitivity (0.93 versus 0.81), with minimal reduction in specificity (0.95 versus 0.97). Including hypo- and hyper-sensory sensitivities and unusual sensory interests increased sensitivity to ASD without altering specificity.

Conclusions: Our results supported the validity of proposed DSM-5 criteria for ASD as provided in Phase I Field Trials criteria. Increased specificity of DSM-5 relative to DSM-IV-TR may reduce false positive diagnoses, a particularly relevant consideration for low base rate clinical settings. We recommend that Phase II testing of DSM-5 should consider a relaxed algorithm, without which as many as 12% of ASD-affected individuals, particularly high functioning cases and females, will be missed. Relaxed DSM-5 criteria may improve identification of ASD, decreasing societal costs through appropriate early diagnosis and maximizing intervention resources.

Keynote Address Program
149 Structural Connectivity In Neurodevelopment
Speaker: A. C. Evans *Montreal Neurological Institute*

The NIH MRI Study of Normal Brain Development is a multi-centre, mixed cross-sectional and longitudinal study of anatomical and behavioural maturation in 500 typically-developing children ages 0-18 years. The database has been made publicly available since 2007 and has gone through 5 releases by 2011. This talk will review recent work on: (i) age-appropriate structural atlasing. (ii) Cortical correlates of behavioral metrics, e.g. IQ, testosterone level, aggressivity/anxiety. (iii) age-related changes in structural network topology derived from cortical thickness analysis.

149.001 Structural Connectivity in Neurodevelopment. A. C. Evans*, *Montreal Neurological Institute*

The NIH MRI Study of Normal Brain Development is a multi-centre, mixed cross-sectional and longitudinal study of anatomical and behavioural maturation in 500 typically-developing children ages 0-18 years. The database has been made publicly available since 2007 and has gone through 5 releases by 2011. This talk will review recent work on:

(i) age-appropriate structural atlasing.

(ii) Cortical correlates of behavioral metrics, e.g. IQ, testosterone level, aggressivity/anxiety.

(iii) age-related changes in structural network topology derived from cortical thickness analysis.

Invited Educational Symposium Program
150 Challenges and Opportunities In Conducting Global ASD Research
Chair: M. Yeargin-Allsopp *National Center on Birth Defects & Developmental Disabilities*

Moderator: R. R. Grinker *George Washington University*

Researchers have long agreed that autism occurs in families across races and socioeconomic backgrounds and, based on the presence of autism organizations in more than 100 countries, there is clear evidence that a constellation of behaviors has been recognized as "autism" on every continent. In order to both advance our understanding of ASD and develop interventions that meet this global need, there is a need for more research in diverse areas of the world. The conduct of such studies is not without challenges, however. The purpose of this Educational Symposium is to raise audience understanding of the complex theoretical, methodological, and ethical issues in conducting research on ASD in other countries, particularly those which are non-Western and/or low and middle income. Featured speakers include three individuals with extensive experience in both a clinical and research setting, representing Uganda, Argentina and India. The researchers will discuss three challenges to autism research common in nearly all low and middle income countries.

150.001 Cross Cultural Issues in Tool Adaptation, Screening and Assessment of ASD Research Globally. A. Kakooza*[1], J. Grether[2], L. A. Croen[3], R. L. Hansen[4], C. Karamagi[5], S. Kiguli[5], E. Trevathan[6], K. S. Smith[7] and K. Ssebyala[8], (1)*Makerere University, School of Medicine*, (2)*Sequoia Foundation*, (3)*Kaiser Permanente Division of Research*, (4)*University of California, Davis, MIND Institute*, (5)*Makerere College of Health Sciences*, (6)*St. Louis University*, (7)*California Department of Public Health*, (8)*Makerere University College of Health Sciences*

Background: Culture is broadly used to refer to a complex of learned behaviour patterns that characterizes a particular group, community, or population. This process is continuously evolving and determines their perceptions, way of communication and interaction with one another. Challenges exist in establishing Autistic Spectrum Disorders (ASD) diagnoses based on behavioral criteria due to the prevailing cross cultural differences. These disparities, present an inherent dilemma in attempting to adapt screening and diagnostic tools. The value of these tools for application in developing countries is limited by scarce resources and cultural factors affecting clinical manifestations and/or interpretation of behaviours. These factors impact on community recognition and integration of ASD-affected individuals.

Methods: We initiated an ASD screening and assessment project in the sub-Saharan country of Uganda, nested in the context of a broader neuro-developmental three stage screening and assessment project. In the first stage, the Ten Questions Screen (TQ) was adapted for screening to include 10 questions specific for ASD, five each for those above and below five years of age respectively. The second stage for assessment picked out those children with possible ASD for referral to the final confirmatory stage by a psychiatrist using the DSM IV-R criteria.

Results: Issues encountered included selecting the choice of questions, ensuring their local language translation was clear to illicit the valid responses and providing appropriate examples to clarify culturally specific questions like the "*mama* and *tata*" games played during childhood. During assessment and confirmation, several children with varying disabilities and other medical conditions were examined including: delayed speech development, mental retardation and severe malnutrition.

Conclusion: Standardization of screening tools for ASD is fraught with many challenges. This should not deter the process of tool adaptation and validation to be culturally relevant and sensitive for accurate diagnosis and facilitation of early detection of ASD.

150.002 Developing Model Collaborations Between U.S. and Non-U.S. Researchers In Conducting ASD Research Globally. A. Rattazzi*[1], M. L. Massolo[2], K. A. Gutson[1], C. Plebst[1], V. M. Ensenat[1] and L. A. Croen[2], (1)*PANAACEA*, (2)*Kaiser Permanente Division of Research*

Collaborative relationships in working in low and middle income (LAMI) countries present both opportunities and challenges. This talk will address the importance of establishing international partnerships between U.S. and non-U.S. researchers in the ASD research field, how this potentially benefits scientific research in LAMI countries, what are the opportunities and how they can be exploited, and lastly, what are the challenges and how they can be mitigated. An ongoing

collaboration between U.S. and argentine researchers will be used to exemplify these issues.

150.003 Ethical Considerations in Conducting ASD Research in Low and Middle Income Countries. N. Singhal*[1], T. C. Daley[2] and I. Singh[3], (1)*Action for Autism, National Centre for Autism*, (2)*Westat*, (3)*London School of Economics and Political Science*

The gaps about what is known about Autism Spectrum Disorder in low and middle income countries present clear opportunities for a variety of different types of research, including epidemiological, treatment, genetic, and psychometric studies. However, such research also requires careful attention to specific ethical issues beyond what is typically followed in conducting studies on ASD. This is particularly true in situations where the researcher is not from the country in which the study is being conducted. In the broader field of multinational clinical research, a number of ethical principles have been articulated (e.g. Emanuel, Wendler, Killen & Grady, 2004) that are relevant when conducting ASD research in low and middle income countries. These principles include the importance of establishing collaborative partnerships, setting research priorities, respect for participants and the study community, fair selection of study population, favorable risk-benefit ratio, independent review, and informed consent. This presentation draws from a number of studies that have been conducted in India to describe areas of ASD research that may require particular attention when examined in a low or middle income country, or in a country where research on ASD is not yet well established. Through consideration of these areas, we suggest that research on ASD in low and middle income countries will more effectively examine and promote the issues of greatest significance for families, individuals with ASD, and local researchers.

150.004 Introduction. R. R. Grinker*, *George Washington University*

Invited Educational Symposium Program
151 Anxiety In Autism Spectrum Disorders: From Biology to Treatment
Chair: J. D. Herrington *Children's Hospital of Philadelphia*

It is increasingly clear that anxiety is a common and important co-occurring condition in ASD. The learning goals for this symposium range from the neurobiological underpinnings of anxiety and their relation to ASD, to comparisons of the clinical phenotype and treatment (behavioral and pharmacological) of anxiety disorders in children with and without ASD. This integration of basic and applied sciences, medical and psychological perspectives, will help to bridge gaps in our understanding of anxiety in ASD and facilitate novel directions for research.

151.001 Enhanced Cognitive Behavioral Treatment for Anxiety In Youth with ASD. J. J. Wood*, *University of California, Los Angeles*

Clinical anxiety is a common challenge for youth with ASD that appears to exacerbate social maladjustment and related autism symptoms. Cognitive-behavioral therapy (CBT), an empirically supported treatment for anxiety in typically developing youth, has been modified for use with youth with ASD with considerable success. Among the most intriguing findings is that treatment-mediated anxiety reduction is associated with improvements in social responsiveness and peer relationships in youth with ASD. The treatment methods, which include explicit focus on social anxiety and social initiation, will be reviewed, and the potential mechanisms through which CBT may mediate improvements in social functioning in youth with ASD will be discussed. Important areas for further treatment refinement and evaluation will also be reviewed.

151.002 Anxiety In Youth with and without ASD: Commonalities and Variations. C. M. Puleo*[1], L. Berry[2] and P. C. Kendall[1], (1)*Temple University*, (2)*Children's Hospital of Philadelphia*

Much is known regarding the presentation and treatment of anxiety disorders in typically developing youth. How this knowledge applies to the anxiety experienced by youth with ASD or ASD-related symptoms is unclear. The evidence-based diagnosis and psychosocial treatment (e.g. cognitive-behavioral therapy: CBT) of anxiety disorders in typically developing youth will be reviewed and compared to emerging data regarding varying clinical presentations of anxiety in ASD.

Implications for assessment, differential diagnosis and treatment will also be discussed.

151.003 Toward Better Psychopharmacological Management of Anxiety In ASD. L. Scahill*, *Yale University*

Anxiety is an overdue target for drug intervention in ASD. The presence of language and cognitive delays make it difficult to measure internal anxiety symptoms in children with ASDs. Moreover, the manifestations of anxiety in children with ASDs may differ from typically developing children, potentially limiting the utility of cognitive-behavioral interventions for some children. To date, few medication studies have targeted anxiety in children with ASDs, though selective serotonin reuptake inhibitors (SSRIs) have demonstrated positive effects in typically developing children. This presentation will examine the evidence for SSRIs in typically developing children with moderate or greater anxiety symptoms and consider their use in children with ASDs. The presentation will also include a method of measuring anxiety in clinical trials for children with ASDs.

151.004 Common Endophenotypes: The Role of Anxiety Disorders In Understanding the Neurobiology of ASD. J. D. Herrington*, *Children's Hospital of Philadelphia*

Amygdala deficits figure prominently in research on anxiety disorders, as well as research on ASD. It is therefore surprising that there are so few studies examining the role of anxiety in mediating amygdala findings in ASD. This presentation will review the literature on the neurobiology of anxiety disorders, with an emphasis on amygdala and the regulation of amygdala by prefrontal cortex. Literature on amygdala dysfunction in ASD will also be reviewed, including emerging data on the relationship between anxiety symptoms and this dysfunction. The integration of findings from anxiety disorders point to a model of "socio-emotional" function in ASD that subsumes negative affect as well as abnormal social information processing.

Brain Imaging: fMRI-Social Cognition and Emotion Perception Program
152 Brain Imaging: Development, Structure, and Genetics

Chair: S. Y. Bookheimer *University of California, Los Angeles*

This session is for structural, developmental, or imaging genetics studies

152.001 Blunted Trajectories of White Matter Development Associated with Autism in High-Risk Infants. J. J. Wolff*[1], G. Gerig[2], H. Gu[3], J. T. Elison[4], K. Botteron[5], S. R. Dager[6], G. Dawson[7], H. C. Hazlett[1], S. Paterson[8], R. T. Schultz[8], M. Styner[9], L. Zwaigenbaum[10], J. Piven[11] and I. B. I. S. Network[12], (1)*University of North Carolina at Chapel Hill*, (2)*University of Utah*, (3)*University of North Carolina*, (4)*California Institute of Technology*, (5)*Washington University School of Medicine*, (6)*University of Washington*, (7)*Autism Speaks, UNC Chapel Hill*, (8)*Children's Hospital of Philadelphia*, (9)*UNC*, (10)*University of Alberta*, (11)*University of North Carolina, Chapel Hill (UNC-CH)*, (12)*Autism Center of Excellence*

Background: Findings from prospective studies of infant siblings of individuals with autism suggest that defining symptoms of the disorder typically emerge late in the first- or early in the second-year of life. Neuroimaging research and studies of head size likewise point to infancy as a time of divergence from typical development. Converging evidence from functional and structural connectivity studies of older children and adults with autism suggest that altered neurocircuitry may underlay the neurobehavioral phenotype of autism.

Objectives: To compare trajectories of white matter fiber tract development over the 6 to 24 month interval between high-risk infants with and without evidence of an ASD at 24 months.

Methods: As part of the IBIS protocol, infants were scanned using a 25 direction DTI sequence on identical 3T scanners. Participants in the present study included 92 high-risk infant siblings with diffusion tensor imaging (DTI) at 6 months and behavioral assessments at 24 months. The majority of these participants contributed additional imaging data at either or both 12 and 24 month time points. At 24 months, 28 infants met ADOS criteria for an ASD, while 64 infants were classified as non-spectrum. Microstructural properties of 6 bilateral fiber

pathways and 3 divisions of the corpus callosum were characterized by fractional anisotropy (FA) and radial and axial diffusivity. Longitudinal trajectories of diffusion measures were compared between high-risk ASD+ and ASD- groups using random coefficient linear growth curve models.

Results: FA trajectories differed significantly between infants who did versus did not develop ASDs for 12 of 15 fiber tracts. Development for most fiber tracts in ASD+ infants was characterized by elevated FA at 6 months followed by slower change over-time relative to infants without ASDs. Thus, by 24 months of age, lower FA values were evident for those with ASDs. At the six month time point, FA values for 5 fiber tracts were significantly higher for infants who went on to develop autism. With the exception of the internal capsule, trajectories of axial and radial diffusivity did not differ between groups.

Conclusions: These preliminary data suggest that the onset of core autistic symptoms may be preceded by the aberrant development of structural connectivity very early in life. During a time typically characterized by robust, experience-dependent change in neurocircuitry, infants with autism show evidence of blunted axonal organization. These results are consistent with DTI findings from older children and adults with autism as well as recent histological findings, and add to a body of evidence suggesting that autism is a disorder of atypical neural connectivity.

152.002 Enlarged Cortical Surface Area In Autistic Infants. K. Campbell*, W. Thompson, S. Solso, K. Pierce, M. Javier, J. Young, M. Mayo, S. Spendlove, C. Carter, M. Weinfeld and E. Courchesne, *University of California, San Diego*

Background: Although overall brain enlargement has been reported in infants and toddlers with autism, studies directly measuring cortical surface area and comparing it to volumetric enlargement have yet to be undertaken. This comparison is of particular interest because recent evidence points to increased number of neurons as a possible mechanism underlying brain enlargement (Courchesne 2011). However, increased neuron number does not translate to proportionate overall brain weight increase (and thus overall brain volume enlargement) in autistic children, as it does in typically developing controls. The expected consequence of increased cell number is expanded cortical surface area (Chenn 2002). Therefore, a comparison of relative expansion of surface and other volumetric measures could prove useful in understanding the neural basis of brain enlargement in autism.

Objectives: This study aims to investigate brain enlargement in multiple measurement dimensions from a general population sample of simplex and multiplex autistic infants and toddlers and typically developing controls. We also sought to study the relationship between measures of brain enlargement and differential symptom severity within the autism group.

Methods: We measured gray and white matter volume and cortical surface area on 51 ASD and 45 control subjects between 12 and 48 months. Brain images were measured with algorithms from the software packages FSL and BrainVisa that were customized to more accurately segment and reconstruct the small size and tight sulci of the developing infant brain. A combination of longitudinal and cross-sectional data was analyzed to determine degree of enlargement and relative enlargement of volume and cortical surface area. We also evaluated the relationship between brain enlargement and impairment in reciprocal social interaction and developmental quotient as measured on the ADOS and Mullen Scales of Early Learning.

Results: We found increased gray matter and white matter volume as well as surface area in infants and toddlers with autism ($p=0.05$). We also found that female autistic subjects with greatest impairments in reciprocal social interaction and lowest developmental quotients had significantly larger surface area in the right hemisphere when compared to both controls ($p=0.05$) and autistic females with less impairment ($p=0.0005$). In males, there was a trend towards greater brain enlargement in subjects with greatest impairments in reciprocal social interaction and lowest developmental quotients. For a large cluster of autistic subjects, enlarged cortical surface area was also accompanied by deviant small white matter volume for age relative to gray matter volume for age.

Conclusions: In autistic infants, cortical surface area in combination with volumetric measures was shown to better identify and characterize brain enlargement in autistic subjects than volumetric measures alone. Increased surface area in the first few years of life supports the theory that increased neuron number drives brain enlargement in children with autism, and further investigation into expansion of the cortical surface in autism may be a more powerful way to detect early clinical and biological indicators of the disorder.

152.003 Microglial Activation in Adults with Autism Spectrum Disorders. K. Nakamura*[1], K. Suzuki[1], Y. Ouchi[1], M. Tsujii[2], G. Sugihara[1], Y. Iwata[1], K. Matsumoto[1], K. Takebayashi[1], T. Wakuda[1], T. Sugiyama[1], Y. Yoshihara[1] and N. Mori[1], (1)*Hamamatsu University School of Medicine*, (2)*Chukyo University*

Background: A growing body of evidence suggests that aberrant immunological systems underlie the pathophysiology of autism spectrum disorders (ASD). However, it is unclear whether immunological alterations, such as excessive microglial activation, are embryonic origin and ongoing mechanism of subjects with ASD.

Objectives: To examine whether microglial activation is increased in individuals with ASD, and whether characteristics of anatomical distribution of the increased, if any, activation of microglia in the brain are different between ASD and controls.

Methods: Twenty adult males with ASD (age range, 18-31 years; mean [SD] IQ, 93.7 [19.0]) and 20 age- and IQ-matched healthy males as control. Diagnosis of ASD was made by the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised. Positron emission tomography using a radiotracer [^{11}C](*R*)-PK11195 was undertaken in each participants. Regional brain [^{11}C](*R*)-PK11195 binding potential (BP) was estimated by simplified reference tissue model and regarded as a representative measure of microglial activation.

Results: [^{11}C](*R*)-PK11195 BP was significantly higher in multiple brain regions in adults with ASD as compared to controls ($P < .05$, corrected). The brain regions with increased binding potentials included the cerebellum, midbrain, pons, superior temporal and fusiform gyri, and anterior cingulate and orbitofrontal cortices. The most prominent increase was observed in the cerebellum and brainstem. The regional patterns of activated microglia in the different brain areas are regarded to be essentially similar between ASD and control groups.

Conclusions: Excessive microglial activation was present in multiple brain regions in ASD, especially in the cerebellum and brainstem. The similar parallelism of the pattern of distribution of activated microglia in both ASD and control groups suggest that activated microglia in ASD, as those in controls, are embryonic or fatal origin.

152.004 Sex and Diagnosis Effects on Microstructural White Matter Properties in Individuals with Autism Spectrum Conditions. A. N. Ruigrok*[1], M. V. Lombardo[2], M. C. Lai[2], F. dell'Acqua[3], M. Catani[3], J. Suckling[4], B. Chakrabarti[1], M. Craig[5], D. G. Murphy[5], U. K. MRC AIMS Consortium[6] and S. Baron-Cohen[2], (1)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (2)*Autism Research Centre, University of Cambridge*, (3)*King's College London*, (4)*Brain Mapping Unit, University of Cambridge*, (5)*Institute of Psychiatry, King's College London*, (6)*Institute of Psychiatry, King's College London; University of Cambridge; University of Oxford*

Background: Autism spectrum conditions (ASC) affect more males than females. Many studies are either exclusively male or reflect the skewed population sex ratio. Such studies neglect females and overlook the possibility that different etiological or compensatory mechanisms may be at work in males and females with ASC. While some studies have explicitly looked at this question at the behavioral level, sex differences in ASC have not been extensively investigated at the neural level.

Objectives: To examine the microstructure of four major white matter tracts: the cingulum, inferior fronto-occipital fasciculus (IFOF), inferior longitudinal fasciculus (ILF), and the uncinate fasciculus (UF), to test for similarities and differences between males and females with and without ASC.

Methods: 30 adult males and 31 adult females with an ADI-R confirmed diagnosis of ASC (aged 18-45) and age- and IQ-

matched typically developing controls (31 males and 31 females) were scanned on a cardiac-gated 32-direction diffusion tensor imaging sequence at 3T. Data preprocessing was implemented in ExploreDTI (Leemans, et al., 2009). Deterministic tractography was performed on the cingulum, IFOF, ILF and UF according to guidelines given by Catani & Thiebaut de Schotten (2008) using TrackVis software (http://trackvis.org). Repeated-measures analysis of covariance (ANCOVA) was performed on fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD), axial diffusivity (AD) and tract volume respectively, with 'hemisphere' and 'tract' as within-subjects factors, 'diagnosis' and 'sex' as between-subject factors, and 'age' as a covariate. Any significant interaction effects were followed up by post-hoc repeated-measures ANCOVAs and multivariate ANCOVAs.

Results: Within the UF there were significant three-way sex*diagnosis*hemisphere interactions for MD and RD. This reflected a trend towards significance for a sex*diagnosis interaction for RD. A significant diagnosis*hemisphere interaction was found for IFOF volume. This interaction was driven by a significant effect main of diagnosis in the right IFOF ($F(1,118)=4$, $p=0.048$) with a larger observed volume in typically developing individuals (21.08ml) than in individuals with ASC (19.52ml). Trends towards significant three-way sex*diagnosis*hemisphere interactions were observed for FA, RD and tract volume in the cingulum, UF and IFOF.

Conclusions: Adults with ASC have smaller right IFOF volumes than typical controls. As the IFOF is a tract that connects the orbito-frontal cortices (OFC) to the occipital cortices, this likely affects connectivity between these areas. OFC has a role in reward-based decision-making and has been implicated in impaired theory of mind in autism. The finding of trends towards significance in other tracts may reflect the method used, which tests an average along each entire tract. Further analysis using voxel-based whole-brain approach may uncover localized differences in microstructural properties of these tracts.

152.005 Atypical Regional Brain Volume in Women but Not Men with Autism Overlaps with Sexually Dimorphic Regions: Neuroanatomical Evidence for Females As a Sub-Group on the Autism Spectrum. M. C. Lai*[1], M. V. Lombardo[2], J. Suckling[3], A. N. Ruigrok[1], B. Chakrabarti[1], E. T. Bullmore[3], M. R. C. AIMS Consortium[4] and S. Baron-Cohen[2], (1)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (2)*University of Cambridge*, (3)*Brain Mapping Unit, University of Cambridge*, (4)*University of Oxford, University of Cambridge, Institute of Psychiatry*

Background: Females with autism spectrum conditions (ASC) have been relatively ignored in research, or implicitly assumed as similar to their male counterparts. This leaves two questions unanswered: In what ways are females and males with ASC similar or different? What mechanisms account for such similarities and differences? Recent studies suggest females with ASC are distinct from males with ASC in terms of cognitive, serum biomarker and early brain overgrowth profiles. This suggests that sex-linked factors may contribute substantially to the observed heterogeneity and potentially obscure the scope of inferences that can be drawn from etiological studies of ASC.

Objectives: We aimed (1) to characterize brain morphometric features for women with autism; (2) to investigate how women and men with ASC are similar or different in brain morphometry; (3) to test if typical sexual dimorphism is linked to autism; and (4) to investigate the extent to which a proxy marker of early androgen exposure (the 2D:4D ratio) is associated with the link between brain sexual dimorphism and autism.

Methods: High-resolution structural MRI (3T) images were obtained and preprocessed with a standard voxel-based morphometry (VBM) pipeline (DARTEL) in SPM8. Thirty women with ASC (aged 18-49 years) were compared with 30 age and IQ-matched typical control women to characterize the brain morphometry in women with autism. They were then compared with age and IQ-matched men with and without ASC (N = 30 per group) in a 4-group design, using two statistical strategies: (1) a *factorial ANOVA* (to test if women and men with autism have different brain morphometry) and (2) *spatial overlap (conjunction) analyses on planned pair-wise comparisons* (to test if brain feature of autism is linked to typical sexual dimorphism, in males and females, respectively).

Results: Compared to typical women, women with ASC have smaller relative gray matter (GM) volume in the anterior cingulate cortex, smaller relative white matter (WM) volume of ponto-cerebellar fibers and larger WM volume bilaterally in temporo-parieto-occipital regions. In particular, women with ASC showed substantial 'masculinization', evidenced by the finding that up to 25.14% of GM voxels and 55.34% of WM voxels showing a diagnostic effect were also sexually dimorphic voxels. In contrast, virtually no overlap was observed between diagnostic effect and sexual dimorphism in men. Finally in women, for GM regions involved in both features of autism and sexual dimorphism, a proxy measure of prenatal androgen stimulation effect (2D:4D ratio) correlated with regional volume in typical women but not women with ASC.

Conclusions: Brain structural characteristics are strikingly distinct between men and women with ASC, and the effect of autism overlaps substantially with the effect of sexual dimorphism in women with ASC. Future research should thus avoid combining males and females with ASC in studies as this increases heterogeneity. The underlying mechanisms that contribute to variation in brain structure are likely not the same in males and females with ASC. Predictions from the 'extreme male brain' theory may be more evident in females with ASC.

152.006 The Intrinsic Geometry of the Cerebral Cortex In AUTISM – the Relationship BETWEEN Cortical Folding and White MATTER Wiring. C. Ecker*[1], E. Daly[2], C. M. Murphy[3], S. C. Williams[1], M. MRC AIMS Consortium[4] and D. G. Murphy[5], (1)*Institute of Psychiatry*, (2)*King's College London, Institute of Psychiatry*, (3)*King's College London, Institute of Psychiatry*, (4)*Institute of Psychiatry, London; University of Oxford; University of Cambridge, United Kingdom*, (5)*Institute of Psychiatry, King's College London*

Background: Evidence suggests that the brain in Autism Spectrum Disorder (ASD) undergoes a period of precocious accelerated growth during early postnatal life, followed by an atypically slow or arrested growth during childhood. The early overgrowth is idiosyncratic for different lobes of the brain with frontal and temporal lobes being more affected than occipital and parietal lobes. Such differential growth will not only affect the overall size of the brain in ASD but also influence the way the brain is shaped and 'wired'. Despite growing evidence for atypical structural and functional connectivity coming from DTI and fMRI studies, it is currently unknown how the intrinsic cerebral organization of the cortex affects local and global wiring in ASD.

Objectives: Our objective was therefore to examine how the intrinsic geometry of the cortex affects local and global wiring of the brain in ASD. Furthermore, we aimed to demonstrate that regional patterns of cerebral connectivity affect autistic symptoms.

Methods: Structural MRI data was collected on 34 well-characterized male adults with an ADI-R confirmed diagnosis of ASD (mean age=26yrs, mean FSIQ=112), and 34 age/FSIQ matched neurotypicals. Surface reconstructions for all participants were performed using FreeSurfer software on the basis of high-resolution structural T_1-weighted inversion recovery images. The intrinsic geometry of the grey matter surface was examined using geodesic distances (i.e. shortest paths linking to points on a surface) and geodesic circles. This allowed us to estimate intra- and inter-regional wiring costs for different brain regions.

Results: Overall, the intrinsic geometry of the cortex in ASD differed significantly from neurotypicals in terms of local and global wiring costs predominantly in anterior temporal, prefrontal and central regions (pre-/post-central gyrus). In ASD, we observed significant increases in local connectivity around the temporal pole, the pre-central gyrus, and the dorsolateral prefrontal cortex. At the same time, these regions displayed significantly reduced inter-areal connectivity (i.e. enhanced wiring costs) in ASD relative to controls. Significant differences in regional cortical geometry were accompanied by differences in white matter connectivity, and were correlated with autistic symptoms in the social domain.

Conclusions: Our results confirm the hypothesis that the brain in adults with ASD is abnormally shaped and wired, which most likely results from an altered trajectory of brain development during early childhood. Atypical patterns of connectivity predominantly affect phylogenetically younger brain regions maturing later during development, and are associated with white matter deficits. Taking together these

findings suggest that regional differences in cortical folding in addition to differences in brain volume might underlie the social deficits observed in ASD.

152.007 Longitudinal Cortical Development During Adolescence and Young Adulthood in Autism Spectrum Disorders: Increased Cortical Thinning but Comparable Surface Area. G. L. Wallace*[1], B. L. Robustelli[1], N. A. Dankner[1], L. Kenworthy[2], J. Giedd[1] and A. Martin[1], (1)*National Institute of Mental Health*, (2)*Children's National Medical Center*

Background: Autism spectrum disorders (ASD) are associated with atypical early brain development, with many reports of excessive brain growth during the preschool years. Recent cross-sectional studies suggest that later cortical development during adolescence and young adulthood may also be aberrant (Hadjikhani et al., 2006; Wallace et al., 2010), though longitudinal designs are required to evaluate atypical growth trajectories. In order to address this question, we provide the first longitudinal study investigating highly localized differences in cortical development, examining both cortical thickness and surface area, among adolescents and young adults with high functioning ASD.

Objectives: The purpose of the current study is to compare longitudinal changes in cortical thickness and surface area among adolescents and young adults with ASD versus typically developing (TD) youth.

Methods: 17 youth with ASD (diagnosed using DSM-IV criteria and the ADI/ADOS) and 18 TD youth provided two high-resolution 3 Tesla anatomic magnetic resonance imaging scans which were obtained, on average, approximately two years apart. Groups were matched on age (ASD scan 1 mean=17.37+/- 2.41, scan 2 mean=19.12 +/- 2.51; TD scan 1=17.46 +/- 1.45, scan 2=19.60 +/- 1.61), IQ (ASD mean=116.59 +/- 13.05; TD mean=116.17 +/- 9.54), sex ratio (male:female – ASD=15:2; TD=17:1), and duration between scans (ASD mean=1.72 +/- 0.83; TD mean=2.10 +/- 0.95). The FreeSurfer image analysis suite (version 5.1) was used to derive vertex-level cortical thickness and surface area values and to complete longitudinal analyses.

Results: There was widespread accelerated cortical thinning for the ASD group as compared to the TD group. Most prominently, two areas in the left hemisphere, the posterior region of the fusiform gyrus and superior parietal cortex demonstrated greater thinning in the ASD group (cluster corrected $p<.01$). Group comparisons at time point one indicated comparable cortical thickness, while time point two (~19 years) was characterized by thinner cortex in the ASD group, particularly in the aforementioned left hemisphere regions. In contrast, longitudinal changes in surface area did not differ between groups after cluster correction for multiple comparisons.

Conclusions: The present longitudinal study complements and builds upon prior cross-sectional research by demonstrating extended cortical thinning in ASD during adolescence and into young adulthood. Specifically, in portions of the temporal and parietal lobes, the cortex appears to have ceased thinning by 19 years of age (i.e., time two of this study) among TD individuals, while thinning continues to occur in these regions in ASD individuals. On the other hand, surface area, another component of brain volume, appears to exhibit comparable growth rates for TD and ASD individuals during this developmental window. These findings provide further evidence for a second period of atypical cortical development in ASD marked by increased cortical thinning in late adolescence/young adulthood.

152.008 The Presence of Specific Maternal IgG Antibodies Is Associated with Abnormal Brain Enlargement in ASD and in Nonhuman Primate Model of ASD. C. W. Nordahl*[1], M. Bauman[1], D. Braunschweig[1], A. M. Iosif[2], P. Ashwood[1], J. Van de Water[1] and D. G. Amaral[1], (1)*UC Davis MIND Institute*, (2)*University of California*

Background: The immune system has been implicated in the pathogenesis of some forms of autism. Braunschweig et al. (2007) have demonstrated that 12% of mothers of children with autism have autoantibodies directed against fetal brain tissue. Nonhuman primate models are currently underway to further determine the pathologic significance of these antibodies.

Objectives: We evaluated children born to mothers with these autism-specific IgG autoantibodies to determine whether they exhibit a distinct neural phenotype. In a parallel line of research utilizing nonhuman primates, we evaluated brain and behavioral development of rhesus monkeys prenatally exposed to these autism-specific antibodies.

Methods: We examined total cerebral volume (TCV) in 152 male children (12 autism spectrum disorder [ASD] and 40 typically developing [TD] controls), at 3 years of age. Participants were enrolled in the MIND Institute Autism Phenome Project (APP). Mothers from both groups were screened for maternal IgG autoantibodies that are reactive to fetal brain proteins. We focused our efforts on antibodies that demonstrate the highest autism specificity, with reactivity to two fetal brain protein bands (37 and 73 kDa). In the nonhuman primate model, we prenatally exposed rhesus monkeys to a pool of 37/73 kDa IgG antibodies collected from a subset of the human mother participants and evaluated total brain volume (TBV) when the monkey offspring reached 2 years of age.

Results: Of the 112 children in the ASD group, 10 (9%) were born to mothers with the autism-specific 37/73kDa IgG antibodies (ASD-POS). The remaining 102 ASD children were negative for the 37/73KDa IgG antibodies (ASD-NEG). As expected, none of the mothers in the TD group exhibited these autoantibodies. Clinically, there were no differences in age, autism severity, or DQ in the two ASD groups. However, TCV in ASD-POS group is significantly larger than both ASD-NEG and TD groups ($p = 0.0003$). The magnitude of abnormal brain enlargement in ASD-NEG group relative to TD controls is 5%, consistent with previous reports of brain enlargement in ASD. However, the magnitude of enlargement in the ASD-POS group is much larger, at 12%. Parallel results obtained from the nonhuman primate model indicate that TBV in juvenile male monkeys prenatally exposed to autism-specific maternal antibodies is significantly larger than control groups ($p = 0.04$).

Conclusions: These results suggest that there may be an underlying immunological etiology for megalencephaly/macrocephaly in autism. With the nonhuman primate model, we will be able to evaluate the cellular/molecular pathology associated with this pattern of abnormal brain growth. The translational nature of this multidisciplinary research can be used to further determine the pathological significance of the autism-specific antibodies, and may ultimately contribute to novel preventative and/or therapeutic measures.

Neurophysiology Program

153 Electrophysiological Correlates of Autism Spectrum Disorder

Chair: E. Anagnostou *Bloorview Research Institute, University of Toronto*

153.001 Physiological and Behavioral Characterization of Sensory Dysfunction in Autism. T. W. Benevides and R. Schaaf*, *Thomas Jefferson University*

Background: Unusual responses to sensation or sensory dysfunction (SD) are extremely prevalent (80-90%) in individuals with Autistic Spectrum Disorder (ASD) and present some of the most challenging obstacles by limiting adaptive behaviors and participation in life activities. Nevertheless, SD in autism is poorly characterized, its mechanisms are not well understood, and current practices to address SD lack an adequate theoretical basis and empirical data to support their utility.

Objectives: This paper presents data describing the physiological and behavioral responses to sensation in 60 well characterized subjects with ASD between 6-9 years of age in comparison to 20 controls. Relationships between physiological and behavioral variables are reported. Aims include: 1) Compare physiological activity at baseline and during 7 sensory challenges; 2) Compare behavioral responses to sensation; 3) Evaluate whether physiological reactions predict behavioral responses to sensation and adaptive behavior.

Methods: Sixty well characterized children with ASD were tested during the Sensory Challenge Protocol, a unique laboratory procedure designed to assess autonomic nervous system activity in response to sensory challenges in the auditory, tactile, olfactory, visual and vestibular systems. MindWare BioLab was used to collect physiological data at baseline and during the sensory challenges. Behavioral

responses to sensation were measured by the Short Sensory Profile and the Sensory Processing Measure, and the Vineland Adaptive Behavior Scales-II was used to collect data about adaptive behaviors. Multiple linear regression will be performed to predict behavioral response to sensation from physiological reactivity after controlling for gender and mental age.

Results: Data collection and analysis will be completed in March 2012. Pilot findings suggest that children with ASD have different physiological profiles at rest and in response to sensation than typically developing controls. In addition, there are specific patterns of ANS activity that are related to behavioral responses to sensation. For example, decreased heart rate variability (a measure of parasympathetic nervous system activity) is expected to be associated with poor adaptive behavior and greater observed sensory dysfunction.

Conclusions: Objective characterization of SD in ASD may yield important information regarding the type, patterns and severity of sensory features in autism, including their impact on adaptive behaviors. In addition, this knowledge provides insight into intervention targets for sensory features in ASD.

153.002 Sensory Assessments Reveal Phenotypic Heterogeneity in Autism. E. Francisco, J. Holden, O. Favorov and M. Tommerdahl*, *University of North Carolina*

Background: Adults with autism exhibit inhibitory deficits that are often manifested in behavioral excesses, such as repetitive behaviors, and/or sensory hyper-responsiveness. If such behaviors are the result of a generalized deficiency in inhibitory neurotransmission, then it stands to reason that deficits involving localized cortical-cortical interactions – such as in sensory discrimination tasks – could be detected and quantified. Quantification of systemic alterations in information processing strategies could reveal differences within the autism spectrum.

Objectives: This study describes several methods for quantifiable biologically based sensory perceptual metrics. These sensory discrimination tests may provide (a) an effective means for biobehavioral assessment of deficits specific to autism and (b) an efficient and sensitive measure of change following treatment.

Methods: The sensory discriminative capacity of individuals with autism (n=56, age range 16-40) and age matched controls (n=150) were obtained by delivering several different protocols that utilized vibrotactile stimuli applied to the finger tips. Specific information processing mechanisms were targeted by each of several sets of protocols. Mechanistically, the protocols were designed to be sensitive to (1) feed-forward inhibition, (2) lateral inhibition, (3) adaptation, and (4) functional connectivity by delivering combinations of stimuli that were either “static” (did not change in amplitude) or “dynamic” (amplitudes of stimuli were dynamically modulated during a trial). Multi-parametric approaches (e.g., PCA) were used to combine the data from several tests.

Results: Although protocols that utilized dynamic modulation of the testing stimuli demonstrated a pronounced but consistent impact on the discriminative capacity of the typically developing subjects in a wide array of protocols, there was a pronounced difference on the observations obtained from within the cohort of autism subjects. Moreover, there appears to be a distinct heterogeneity within the autism spectrum in terms of sensory information processing strategies, particularly for the protocols that utilized amplitude modulated stimuli in a rate dependent fashion. Additionally, although sorting the autism cohort into two groups could be best accomplished with protocols utilizing dynamic stimuli, the group differences remained intact and were significant across all protocols, both static and dynamic. Multi-parametric analysis of the sensory based data revealed two distinct groups within the autism spectrum independent of IQ.

Conclusions: The changes observed with different parameters of stimulation, and in particular the increased impact of the rate of change of amplitude modulated vibrotactile stimuli on the responses of subjects within the autism spectrum, was interpreted to be consistent with the reduced GABAergic mediated inhibition described in previous reports and could be interpreted as a more sensitive means of assessing information processing strategies. One significant aspect of this study is that the methods could prove to be a useful and efficient way to detect specific neural deficits within the autism

spectrum and perhaps monitor the efficacy of pharmacological or behavioral treatments.

<

153.003 Gamma-Band Activity and Coherence in Response to Familiar and Unfamiliar Faces in Infants At-Risk for Autism Spectrum Disorder. B. Keehn*[1], R. Luyster[1], V. Vogel-Farley[1], H. Tager-Flusberg[2] and C. A. Nelson[1], (1)*Children's Hospital Boston/Harvard Medical School*, (2)*Boston University*

Background: Behavioral and neurofunctional assays of face processing in autism spectrum disorder (ASD) have revealed atypical processing and recognition of faces across the lifespan. Furthermore, electrophysiological studies of infants at high risk for autism (HRA) have demonstrated aberrant face and gaze processing within the first year of life. Although a majority of these studies have investigated event-related potentials, examining event-related oscillatory dynamics provides a complementary source of information regarding neurophsyiological correlates of face processing. Of particular interest is the gamma band frequency; variations in gamma power, revealed via time-frequency analysis, are thought to represent synchronized activity of smaller neural networks whereas phase coherence between discrete regions may be necessary for large-scale integration of functionally-specialized cortical regions.

Objectives: To examine event-related gamma band activity and coherence to familiar and unfamiliar faces in HRA and low risk comparison (LRC) infants across the first year of life (6-, 9-, and 12-months).

Methods: HRA and LRC infants completed visits at 6 (HRA = 21; LRC = 23), 9 (HRA = 26; LRC = 31) and 12 (HRA = 27; LRC = 18) months of age. EEG was recorded using high density electrode arrays (Geodesic Sensor Net), sampled at 250 Hz, and referenced to single vertex electrode. Data were segmented into 1200ms epochs (200ms pre- 1000ms post-stimulus onset), trial/artifact rejected, and re-referenced to average reference. Infants with fewer than 12 good trials per condition were excluded. Stimuli included images of the infant's mother and an unfamiliar stranger presented for 500ms. Time-frequency analysis was conducted to examine gamma-band activity (30-50 Hz) in three regions of interest (ROI): frontal, central, and posterior electrode locations; coherence analysis examined phase coherence for gamma band for left and right hemisphere frontal-posterior electrode pairs.

Results: Preliminary time-frequency analysis showed significant main effect of hemisphere for the posterior ROI by 9 months (p<.05) with greater gamma activity in the right compared to left hemisphere, but no main effect of group nor interaction between group and any other factor. Coherence analysis revealed marginally significant group by hemisphere interactions at 6- and 12-months (ps<.1). At 6 months HRA infants showed increased right hemisphere gamma coherence compared to LRC infants; however, by 12 months LRC infants showed a significant shift in rightward asymmetry resulting in greater right compared to left hemisphere coherence (p<.1), whereas HRA infants showed no asymmetry of coherence values for left versus right hemisphere at one year.

Conclusions: For both groups right-lateralized gamma activity in response to faces was apparent by 9 months; however, only LRC infants showed a trajectory of increasing rightward lateralization of intrahemispheric coherence during the first year of life. In contrast, infants at risk for ASD showed an atypical pattern of increasing leftward lateralization of frontoposterior gamma coherence. These results are in accord with prior findings of aberrant neural synchrony in autism, rather than of region-specific neural dysfunction. Finally, the current study provides further evidence that emergence of atypical face processing for individuals with a family history of ASD may occur within the first year of life.

153.004 Auditory Evoked Potentials: Candidate Endophenotypic Indices of ASD Susceptibility. O. V. Sysoeva*, A. Z. Snyder, J. N. Constantino and A. P. Anokhin, *Washington University School of Medicine*

Background: Autism spectrum disorders (ASD) are characterized by early-emerging social and communication impairments. Abnormal auditory sensory processing as well as atypical preferences to computerized non-speech sounds over human speech has been reported in ASD children. The

latter deficit might be rooted in atypically persistent sensitivity to non-native speech or non-human sounds, which normally declines between 6 and 12 months in typically developing infants (TD).

Objectives: The purpose of the current study was to examine the time-course of brain activity at preattentive stages for both native (English) and non-native (Hindi) speech sounds in a design that allowed exploration of familial aggregation of electrophysiologic traits.

Methods: Fourteen males with ASD, 17 unaffected siblings (US) and 12 TD controls (age 15-22, mean 18 for all groups) participated in an electrophysiological (EEG) study and performed a speech-sound version of a Mismatch Negativity (MMN) paradigm incorporating native (English) and non-native (Hindi) speech sounds.

Results: Contrary to our expectation, there were no differences between the groups in the MMN component of the ERP, indicating intact automatic change detection in ASD subjects. However, earlier sensory components (P1 and N1), were abnormal in ASD subjects, and these abnormalities were correlated with severity of ASD, as assessed by the Social Responsiveness Scale. Crucially, these enhanced P1 and delayed N1 responses in ASD subjects were specific to non-native speech sounds and not observed in response to native speech. The enhanced P1 amplitude in the non-native condition was also observed in unaffected siblings (US), suggesting a familial risk effect for ASD. Noteworthy, the P1 amplitude was significantly smaller for non-native compared to native sounds in TD and US, but not in ASD group, suggesting the lack of difference between conditions as a disease-state effect.

Conclusions: Our study provided evidence for abnormal early stage processing of non-native sounds in ASD and US groups. Enhanced amplitude of the early sensory component P1 warrants further exploration as an intermediate phenotype (endophenotype) for ASD.

153.005 Intact Interhemispheric Transmission in Children and Adolescents Diagnosed with An ASD. M. South*[1], M. J. Larson[1], P. E. Clayson[2] and S. E. White[1], (1)*Brigham Young University*, (2)*UCLA*

Background:

There is converging evidence for what Kana et al. (in press) refer to as “disrupted cortical connectivity” in autism spectrum disorders (ASD). To date, only a few studies have examined the functional role of the corpus callosum for information transfer in autism, including structural (e.g., DTI; Shukla et al., 2010) and behavioral (Nyden et al., 2004) studies. EEG-based event-related potential (ERP) techniques have high temporal resolution and are ideally suited for research regarding interhemispheric transfer of information across the corpus callosum, including studies of psychiatric samples (Endrass et al., 2002).

Objectives:

We utilized ERP for an interhemispheric transmission time (IHTT) task to examine whether our ASD group would show relatively longer transfer times across the corpus callosum.

Methods:

Older children and adolescents (ages 10-18) diagnosed with an ASD (*n*=28; mean ADOS score = 12.8) and healthy controls (*n*=22) matched on age (*M*=13.6) and IQ (*M*=107.3) completed the IHTT task while wearing a 128-electrode geodesic sensor net with an EGI amplifier system. The task involved pairs of letters (either “A” or “B,” which could be either uppercase or lowercase) appearing to either side of a central fixation cross for 60milliseconds. Participants pushed one key with their right hand if the two letters were the same letter (e.g., both “A”) and a separate key with the left hand if they did not match. The IHTT is defined as the difference in latency of the early-occurring evoked potential components between the contralateral and the ipsilateral hemispheres (Endrass et al., 2002). We examined the latency of the N1 deflection using electrodes at parietal sites.

Results:

A 2 (visual field) x 2 (hemisphere) x 2 (diagnostic group) ANOVA demonstrated a significant interaction of visual field x

hemisphere, $F(1,48)=6.9$, $p<.05$, as both groups showed similar, robust differences in contralateral (slower) than ipsilateral trials. There were no significant effects of diagnostic group with hemisphere, visual field, nor importantly for the three-way interaction with diagnostic group, $F(1,48)=.22$ $p=.64$.

Conclusions:

We show evidence of interhemispheric transmission rates similar in ASD and our typical controls, with both groups showing similar slower rates of early ERP deflections for contralateral vs. ipsilateral trials. Our study differs from the early existing IHTT-like study by Nyden et al. (2004), which did not use ERP, especially in the simplicity of our task vs. their complex auditory and visual tasks. Kana (in press; see also Gaigg and Bowler, 2007; South et al., in press) notes that impaired neural connectivity is most notable in tasks with higher levels of complexity and that simpler tasks may be processed in normal fashion. This may in part explain the particular trouble in ASD with social interactions, which are by nature high in complexity and required speed of processing. Further research regarding task complexity in autism, including tasks measuring speed of neural transmission, will help to refine this hypothesis.

153.006 Level of Autistic Traits Modulates Activity in Face and Action Perception Systems. J. McPartland*[1], M. Coffman[1], S. Faja[2], A. Kresse[2], C. E. Mukerji[1], A. Naples[1] and R. Bernier[2], (1)*Yale Child Study Center*, (2)*University of Washington*

Background: The social motivation hypothesis posits that reduced social drive leads to inattention to people and consequent failure of developmental specialization in experience-driven brain systems for processing faces. Abnormalities in face perception and recognition and in the action perception system are evident early in life in individuals with ASD and have been documented throughout the lifespan. The current work focuses on these two facets of social brain circuitry and their relationship to social perception and autistic traits.

Objectives: To apply an innovative experimental paradigm to (a) examine electrophysiological markers of both face processing and action perception and to (b) test models of effective connectivity between these systems and real-world social behavior to (c) understand connectivity in social brain systems and (d) its relation to autistic traits.

Methods: The paradigm employed a novel stimulus set of 210 unique 3D photorealistic face stimuli capable of producing movements consistent with human musculoskeletal structure. Typically developing adult participants viewed a 500ms static initial pose which segued into 500ms facial movement of three types: (1) affective movement (fearful expression); (2) neutral movement (puffed cheeks); and (3) biologically impossible movement (upward dislocation of eyes and mouth). ERPs (reflecting stages of face processing) were time locked to onset of static face stimuli, and oscillatory EEG power in the mu range (reflecting activation in the action-perception system) was extracted during periods of facial movement. Autistic traits and social perception were assessed via self-report on the Autism Quotient (AQ) and Reading the Mind in the Eyes Task (RMET), respectively.

Results: An ERP index of emotion decoding (N250) differentiated conditions, such that fear (-0.43μv) elicited enhanced amplitude relative to neutral (-0.01μv), impossible (0.162μv), or puffed (-0.05μv) poses. N250 amplitude correlated with RMET score across conditions (*r*s range from -.55 to -.62), such that larger amplitude was associated with stronger social perception and lower levels of autistic traits. For an ERP index of face structural encoding (N170), amplitude correlated with AQ score across conditions (*r*s range from .24 to .31), such that attenuated amplitude was associated with higher levels of autistic traits. For mu attenuation, fearful movement elicited greater attenuation than neutral or impossible movements ($p<.05$). Bayesian structural equation models were applied to examine shared versus distinct latent sources of variability for ERPs and EEGs to faces, as well as an integrative model incorporating brain activity and behavior, as a function of level of autistic traits.

Conclusions: Neural responses differentiated emotional facial expressions in terms of both ERPs to static poses and mu attenuation to dynamic movement. Furthermore, ERP markers of face perception correlated with behavioral measures of social function; stronger response at an emotion

decoding component associated with better emotion perception, and attenuated response at an early face perceptual component associated with higher levels of autistic traits. The integration of EEG and ERP in a latent variable framework with standardized measures of subclinical traits holds promise to empirically derive models of effective connectivity in brain systems subserving social behavior.

153.007 Sex Differences in Social Information Processing in ASD. M. Coffman*, A. Naples, D. Perszyk, C. E. Mukerji and J. McPartland, *Yale Child Study Center*

Background: Autism Spectrum disorders (ASDs) differentially affect males and females at a rate of 4:1. This disparity has led to an underrepresentation of females in the ASD literature and a consequently limited understanding of differences in social function across the sexes. Face perception is a well-studied facet of social behavior that is affected in ASD. Individuals with ASD are noted to exhibit both behavioral and neural anomalies in face processing, which has been theorized to reflect a lack of specialization from reduced motivation to attend to people throughout development. Investigations of face perception represent a promising target for understanding differences in social functioning between genders.

Objectives: This analysis aimed to investigate sex differences in the historically understudied population of females with ASD. Specifically, we used electrophysiological brain recordings to examine the neural correlates of face perception, which have been linked to social functioning in ASD. Differential results at early stages of face perception were expected to relate to differential expression of social disability across sexes.

Methods: 10 females and 10 males with ASD matched on age (mean = 11.6) and Full Scale IQ (mean = 101) participated in the study. Event related potentials were recorded with a 256 electrode Geodesic Sensor Net while participants viewed human faces, inverted human faces, and houses. Peak amplitude and latency were extracted for an ERP component reflecting structural face encoding (N170) from electrodes over lateral posterior scalp.

Results: Males with ASD displayed a characteristic pattern of shorter N170 latency to upright faces relative to inverted faces ($p = .001$) and houses ($p < .05$). In females, however, N170 latency did not differentiate conditions, with equivalent latencies for faces relative to inverted faces and houses (*p*s > .1). Significant differences were not detected for N170 amplitude.

Conclusions: Results reveal distinct patterns of brain response to social information in females versus males with ASD. A tightly controlled and sex-balanced sample indicated that females showed relatively reduced sensitivity at an ERP marker of the early stages of face processing. Compared to males, females differentiated neither social from non-social information (faces versus house) nor social information in prototypic versus atypical configurations (faces versus inverted faces). These findings suggest distinct neural phenotypes for males and females with ASD, with females exhibiting more significant impairment in basic social perception. These results offer clarification of heterogeneous results in prior studies with mixed samples and hold promise for development of sex-specific screening measures for early detection of atypical social development.

153.008 Functional Neuroanatomical Changes Induced by Mu-Based Neurofeedback Training in Children on the Autism Spectrum. M. C. Datko*[1], J. A. Pineda[2] and R. A. Müller[3], (1)*University of California San Diego*, (2)*University of California, San Diego*, (3)*Brain Development Imaging Laboratory, San Diego State University*

Background: Autism Spectrum Disorders (ASD) may arise from atypical anatomical and functional connections and therefore have been characterized as a 'disconnection syndrome'. Impaired connectivity may lead to desynchronization and ineffective intra- and interhemispheric communication in neural circuits affecting higher order cognitive processes. While no single explanation can account for the ASD profile, converging evidence implicates the human mirror neuron system (MNS). Studies from our laboratory have shown that ASD individuals exhibit normal EEG mu rhythm suppression for self-generated movement but fail to suppress during observation of movement compared to typically developing (TD) controls. On the other hand, suppression is normal if the actors being observed are familiar, suggesting

that the MNS is not entirely broken. We have shown that significant improvement occurs in social engagement and related behaviors, as well as in the electrophysiology of ASD children following neurofeedback training focused on the mu-rhythm.

Objectives: The present study tested whether functional and structural neuroanatomical changes occur after 20 weeks of mu-based neurofeedback training.

Methods: Neurofeedback training is an operant conditioning task in which trainees learn to control mu rhythm (8-13 Hz) power at electrode site C4, over the sensorimotor cortex in the right hemisphere. Games and movies on a computer reward increased mu-power and decreased muscle activity. All participants complete 30 hours of this training (45 min/session x 2 sessions/week x 20 weeks). Prior to and again immediately following training, participants (7 ASD and 8 TD, ages 8-17) underwent fMRI scans that included the following protocols: resting state fMRI (6 min), 3 fMRI runs of a task that involved imitation and observation of object-oriented finger movements (total of 15 min), anatomical (5 min), and diffusion tensor imaging (10 min). Contrary to imitation tasks previously used by Iacoboni (1999) and Williams (2006), the imitation task in our study was object-oriented (pressing buttons on a button-box). Diffusion tensor imaging data were collected to assess white matter changes associated with neurofeedback training in pathways connecting areas of the MNS.

Results: Before training, greater activation occurred in regions of interest related to MNS in TD compared to ASD during object-oriented imitation and observation. These areas of differential activation included left inferior frontal gyrus (IFG) and bilateral inferior parietal lobules. Abnormal resting state functional connectivity (both under- and over-connectivity) between MNS regions of interest was also seen in ASD compared to TD groups. Following mu neurofeedback training, ASD children showed increased activations in IFG and other relevant MNS areas, as well as normalization of functional connectivity in MNS circuits.

Conclusions: These preliminary data indicate plasticity within the mirror neuron system occurs in response to mu-based neurofeedback training in ASD. Both activation and connectivity measures were found to normalize with training.

Psychiatric/Behavioral Comorbidities Program
154 Medical, Psychiatric and Behavioral Co-Morbidities In ASD
Chair: S. J. Spence *Childrens Hospital Boston*

These papers present data on medical, psychiatric and behavioral co-morbid conditions in ASD.

154.001 The Effect of Autism on Bone Metabolism in Peripubertal Boys. A. M. Neumeyer*[1], A. Gates[2], C. Ferrone[2] and M. Misra[3], (1) *Massachusetts General Hospital/ Harvard Medical School*, (2)*Massachusetts General Hospital*, (3)*Massachusetts General Hospital/ Harvard Medical School*

Background:

Little is known about bone metabolism in children with autism spectrum disorders (ASD). There are many factors that may impact bone mineral density (BMD) in children with ASD including impaired calcium and vitamin D intake subsequent to unusual diets, alterations in hormones such as cortisol, gonadal steroids, growth hormone (GH) and insulin like growth factor-1 (IGF-1), and use of medications such as anticonvulsants. Cortisol levels increase in conditions of stress with possible deleterious effects on bone. GH peaks during puberty and leads to increase IGF-1 secretion; both GH and IGF-1 increase pubertal bone formation. Additionally, the gonadal steroids increase with increasing pubertal stage and reduce bone loss. Changes in these hormones could potentially impact bone.

Objectives:

Our objective was to determine whether BMD is lower in peripubertal boys with autism compared to controls and assess determinants of BMD in this population.

Methods:

In 18 peripubertal boys (mean age 10.5±0.4 years) with ASD and 19 age matched controls (11.2±0.3 years) (p=0.23) 8-14 years old we measured BMD at the spine and hip using dual

energy x-ray absorptiometry (DEXA). We also assessed caloric, vitamin D and calcium intake using food records, fasting serum levels of calcium, phosphorus, 25(OH) vitamin D [25(OH)D], testosterone, IGF-1 and salivary cortisol (AM and PM).

Results:

Boys with autism had lower BMD Z-scores compared with healthy boys at the spine (-1.13±0.28 vs. -0.21±0.25, p=0.02), total hip (-0.71±0.03 vs. 0.14±0.29, p=0.04) and femoral neck (-1.64±0.21 vs. -0.52±0.24, p=0.001). Total caloric intake did not differ between groups. However, dietary vitamin D intake was lower in boys with autism compared with controls (5.0±0.6 vs. 8.5±1.4 mcg/d, p=0.03) while calcium intake trended lower (878±92 vs. 1184±121 mg/d, p=0.05). These differences may reflect lower intake of milk and dairy products in ASD. Total calcium (878±92 vs. 1184±121 mg/d, p=0.05) and vitamin D (7.9±1.6, vs. 12.2±2.1 mcg/d, p=0.07) intake from diet and supplements also trended lower in boys with autism. 25(OH)D levels were lower in boys with autism (26.7±1.9 vs. 31.7±1.6 ng/ml, p=0.05), and a larger proportion of boys with autism (76.5%) than controls (36.8%) had levels <32 ng/ml. IGF-1 and testosterone levels did not differ. PM cortisol was higher in autistic boys (1.44±0.37 vs. 0.47±0.16 nmol/L, p=0.004), but did not correlate with BMD. Importantly, lower dietary vitamin D intake was a very strong predictor of lower BMD measures at all sites. Differences between the groups at the femoral neck (p=0.02) persisted even after controlling for dietary vitamin D.

Conclusions:

This is the first study to describe low BMD in peripubertal boys with ASD compared to controls, associated with lower dietary vitamin D intake. Further studies are necessary to investigate both the rate of bone accrual in children with ASD as well as the effect of optimizing vitamin D intake through dietary intervention.

154.002 Head Growth in Autism: A Population-Based Cohort Study. P. Suren*[1], M. Hornig[2], M. Bresnahan[2], D. Hirtz[3], K. Kveim Lie[1], W. I. Lipkin[2], P. Magnus[1], T. Reichborn-Kjennerud[1], S. Schjolberg[1], E. Susser[2], A. S. Oyen[1], L. Li[4] and C. Stoltenberg[1], (1)*The Norwegian Institute of Public Health*, (2)*The Mailman School of Public Health, Columbia University*, (3)*National Institute of Neurological Disorders and Stroke*, (4)*Centre for Paediatric Epidemiology and Biostatistics, UCL Institute of Child Health*

Background: Case-control studies have found accelerated head growth in children with autism spectrum disorder (ASD), most commonly during the first year of life. However, findings are not consistent and have not been replicated in population-based study samples.

Objectives: To study head circumference (HC) growth in children with ASD using longitudinal data from a prospective population-based child cohort in Norway.

Methods: HC measures were obtained prospectively from birth until 12 months of age. Cases of ASD in the cohort were identified through questionnaire-based screening, referrals of suspected ASD cases, and record linkages to Norwegian specialist health services. Head growth trajectories in ASD cases and non-cases were compared through parametric modeling of growth curves.

Results: The study sample included 90,159 children, of whom 249 (0.28%) had been diagnosed with ASD, 203 boys and 46 girls. An average of 4.1 HC measures per child was available. For ASD boys, mean head size was similar to that of other boys at birth, and the trajectory for mean head growth overlapped with the overall mean trajectory for boys at all ages from birth until 12 months. There was an increase in the prevalence of macrocephaly (HC > 97th population percentile) by age, to 11.8% at age one year (95% CI, 6.2-19.6%, p<0.001). Macrocephaly was accompanied by a similar relative increase in mean length; when head size was adjusted for length, the proportion above the 97th population percentile at age one year was 2.0% (95% CI, 0.2-6.9%, p=0.77). Correspondingly, the prevalence of microcephaly (HC < 3rd population percentile) was 2.9% at one year (95% CI, 0.2-8.4%, p=1.00), but after adjustment for length, the proportion below the 3rd population percentile was 6.9% (95% CI, 3.2-6.4%, p=0.03). When mean head size was adjusted for length, ASD boys fell below the population mean from age six months

onwards, and the downward deviance was significant by one year of age (p=0.02). In girls with ASD, mean HC was 0.44 cm lower compared to non-cases at birth (p=0.05), and the difference increased gradually to 0.7 cm at one year of age (p=0.001). ASD girls also had an increased prevalence of microcephaly. For all HC measures in this group combined, 7.3% were below the 3rd population percentile (95% CI, 3.8-12.4%, p=0.004), but after adjustment for length, the proportion below the 3rd percentile was reduced to 4.4% (95% CI, 1.8-8.9%, p=0.34), i.e., not significantly different from the population mean of 3%. Like in ASD boys, mean head size adjusted for length fell below the population mean from age six months onwards. Macrocephaly in ASD girls only occurred at one instance, for a girl at age one year.

Conclusions: Head growth patterns in ASD children diverge from those of the general population, and the differences are sex-specific. Previous findings of accelerated mean head growth in ASD were not replicated.

154.003 Age of Diagnosis of Autism Spectrum Disorders in Children with Hearing Loss. J. Meinzen-Derr*, S. Wiley, S. L. Bishop, P. Manning and D. Murray, *Cincinnati Children's Hospital Medical Center*

Background: Upwards 4% of children who are deaf/hard of hearing have co-existing autism spectrum disorder (ASD). Children with the hearing loss (HL) tend to receive diagnoses of ASD at older ages than hearing children.[1] This disparity likely relates to the complexities of determining whether speech/language and social delays can be accounted for by their HL, or whether they might be indicative of a comorbid ASD diagnosis. With universal newborn hearing screening, the age of identification of HL has decreased, making early language acquisition for deaf/hard of hearing children approaching hearing children's developmental trajectory.[2] This advance has relevance to potentially decreasing the age of ASD diagnosis in these children.

Objectives: Investigate age of ASD diagnosis among children with HL; Explore factors associated with later diagnosis.

Methods: Children with dual diagnosis of hearing loss and ASD were identified from a clinical developmental pediatric database of >600 children with any degree of permanent HL. Children completed a comprehensive evaluation for an ASD using standardized autism evaluations (Autism Diagnostic Observation Schedule, language and psychological testing). As evaluation tools have not been validated on children with HL, a team of professionals representing expertise in ASD and expertise in HL arrived at a consensus opinion for the diagnosis of ASD. Descriptive statistics included medians with ranges and frequencies with percentages. This study was approved by the Institutional Review Board at Cincinnati Children's Hospital Medical Center.

Results: Among 23 children with ASD and HL, 74% were male. Most (65%) had profound HL, 14 (61%) children had a cochlear implant, and 3 children had no amplification for HL. The etiology of HL was syndrome or CMV for 30% of children and unknown for 30%. The median non-verbal IQ was 77 (range 27-97). The ADOS was administered to 19 of the 23 children. Most children who required Module 1 had profound HL (12/16). The median age of diagnosis of HL was 14 months (range 1-71) while the median age of ASD diagnosis was 57.5 months (range 33-106). Only 23% (n=6) children were diagnosed with ASD <48 months of age and 55% <6 years. Cognitive levels were not correlated with age of ASD diagnosis (Spearman rho=-0.004). The median time between identification of HL and ASD diagnosis was 40 months (range 6-101) with the diagnosis of ASD occurring after the identification of HL in every child. Children with cochlear implants appeared to be identified with ASD at earlier ages than those with hearing aids (54 vs. 78 months, p=0.17), though not statistically significant.

Conclusions: Children with HL and a co-existing ASD are challenging to evaluate and tend to receive a diagnosis of ASD at older ages. This late diagnosis may impact access to early and appropriate interventions for the ASD. In addition, children who received cochlear implants completed a multidisciplinary evaluation including a developmental pediatrician, which may have provided closer monitoring of speech and language progression and subsequently led to an earlier ASD diagnosis. Future studies on the validity of autism-specific screening and assessments for children with hearing loss are warranted.

154.004 Food Preferences in Autism Spectrum Disorders and Their Relationship to Sensory and Behavioral

Symptoms. L. Bennetto*[1], C. J. Zampella[1], E. S. Kuschner[2], R. G. Bender[1] and S. L. Hyman[3], (1)*University of Rochester*, (2)*Children's National Medical Center*, (3)*University of Rochester School of Medicine*

Background: Difficulties related to eating behavior and food selectivity are a common and significant clinical and family concern when working with individuals with autism spectrum disorders (ASD). Compared to their typically developing peers, children with ASD have been found to be more likely to exhibit food refusal, picky eating, and mealtime behavioral problems. Food preferences have been investigated in relation to sensory functioning, restrictive and/or repetitive patterns of behavior, and nutrition and health; however, the current data remain inconclusive with regard to the causes and nutritional consequences of eating differences in ASD, particularly in older children and adolescents.

Objectives: To examine food preferences and eating behavior in children and adolescents with ASD and their typically developing peers, as well as potential relationships between food selectivity and sensory functioning, behavioral symptoms, and health.

Methods: Children and adolescents with high-functioning ASD (n=57) and typically developing controls (n=73), ages 7 through 19, participated in this study. Groups were well-characterized and matched on age and gender. Exclusion criteria included diagnoses of neurological, genetic, and/or other psychiatric disorders, as well as injuries or medications that could affect taste, smell, or eating behavior. Participants and/or a parent completed written measures assessing medical and feeding-related history, food preferences, food neophobia (anxiety around trying new foods), general sensory functioning, restrictive and repetitive behaviors, and autism symptomatology. They were also given laboratory-based measures of chemosensory functioning (taste and smell abilities). Finally, data on height and weight were collected for each participant.

Results: Children and adolescents with ASD were found to be more selective than their typically developing peers with regard to certain food groups, tastes, textures, and temperatures (p's ranged from .04 to .001, with distinct patterns of selectivity within each category). Participants with ASD were also found to exhibit higher levels of food refusal (p=.001). Preliminary analyses suggested that selective food preferences in the ASD group were related to patterns of restrictive and repetitive behavior (p<.01) and food neophobia (p<.05), as well as to poorer olfactory functioning (p<.05). Finally, participants in the ASD group were significantly more likely than controls to have a body mass index (BMI) within the obesity or overweight range for their ages (p=.01).

Conclusions: Individuals with ASD display clear differences relative to controls related to eating and food preferences, even as they age beyond childhood. Sensory and behavioral factors both appear to play a role in food selectivity. In our sample, children and adolescents with ASD were also found to be at higher risk for obesity as compared to their typically developing peers, underscoring the importance of investigating food selectivity and eating behavior in this population.

154.005 Shared and Distinct Presentations of ADHD and ASD: An Examination of the Autism Spectrum Continuum. R. L. Grzadzinski*[1], R. Lange[2], J. Rodman[1], E. V. Roberts[3], M. O'Neale[2], E. Petkova[3], C. E. Lord[4], F. X. Castellanos[5] and A. Di Martino[1], (1)*Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience*, (2)*Phyllis Green and Randolph Cōwen Institute for Pediatric Neuroscience*, (3)*NYU Child Study Center*, (4)*Weill Cornell Medical College*, (5)*Nathan Kline Institute for Psychiatric Research*

Background: Current DSM-IV-TR diagnostic criteria do not allow for a comorbid diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD). While it is widely accepted that children with ASD often present with ADHD symptoms, only recently have reports of elevated rates of autistic traits in a subgroup of children with ADHD ($ADHD^+$) emerged. Initial evidence suggests that increased ratings of autistic traits in ADHD do not solely result from ADHD symptoms and may be qualitatively similar to ASD. However, direct comparisons between $ADHD^+$ and children with ASD (with or without ADHD traits) are limited.

Objectives: We aimed to characterize children identified as ADHD$^+$ with respect to ASD and ADHD symptom profiles, communicative skills, and general psychopathology relative to children with ASD with and without ADHD traits (ASD$^+$ and ASD$^-$, respectively).

Methods: We included 264 children (164 with ADHD and 100 with ASD) aged 7.0 to 17.8 years. The Social Responsiveness Scale (SRS) was used to identify ASD traits in children with ADHD (ADHD$^+$; T-Score≥65). The Conners' Parent Rating Scale (CPRS-R:L) was used to identify children with ASD and ADHD traits (ASD+; DSM-IV Total T score≥65). In accordance with prior work (Grzadzinski et al. 2010), SRS consensus coding was used to examine the contribution of specific symptom domains identified by the consensus of 8 ASD experts. The Children's Communication Checklist (CCC-2) was used to measure communication profiles consistent with ASD; the Child Behavior Checklist (CBCL) to examine general psychopathology including behavioral and emotional difficulties. We used the likelihood ratio test to examine the contribution of each SRS category to the total SRS score. ANOVAs were conducted comparing the three groups with respect to CPRS-R:L, CCC-2 and CBCL scales.

Results: Consistent with prior evidence, 21% of the ADHD group was identified as ADHD$^+$ and 61% of the ASD sample as ASD$^+$. The contribution of the SRS consensus categories was similar for the ADHD$^+$ and both ASD groups, except for significantly higher contribution from the Restricted/Repetitive Behaviors category to the ASD$^+$ ($p<0.001$). Results of the CCC-2 revealed three patterns of impairments: an increasing gradient of severity in social relatedness going from ADHD to ASD (i.e., ADHD$^+$ < ASD$^-$ < ASD$^+$); shared impairment between ADHD$^+$ and ASD$^{+ \text{ or } -}$ (e.g., stereotyped language); and shared impairments between ADHD$^+$ and ASD$^+$ (e.g., inappropriate initiation). ADHD$^+$ and ASD$^+$ did not differ on ADHD symptoms severity. In terms of other psychopathology, compared to ASD$^-$, ADHD$^+$ and ASD$^+$ showed similarly elevated scores for CBCL-Externalizing problems as well as for CPRS Oppositional, Anxious/Shy, and Emotional Lability.

Conclusions: We found that children with ADHD$^+$ present with social-communicative impairments qualitatively similar to ASD, albeit less severe. The ADHD$^+$ and ASD$^+$ subgroups show more severe patterns of behavioral and emotional difficulties than the ASD$^-$ subgroup. These results illustrate the complexity of the overlap between ADHD and ASD and confirm the need for objective examinations of the distinct and shared characteristics of ADHD and ASD through neuroimaging and genetics studies.

154.006 The Stability and Specificity of Psychopathology in Autism Spectrum Disorders. E. Simonoff*[1], A. Pickles[2], G. Baird[3], C. Jones[4] and T. Charman[5], (1), (2)*Institute of Psychiatry, King's College London*, (3)*Guy's Hospital*, (4)*University of Essex*, (5)*Institute of Education*

Background: Numerous recent studies have highlighted the presence of co-occurring psychiatric disorders in people with ASD but there is less evidence on the persistence of these problems.

Objectives: Psychiatric problems are common in autism spectrum disorders (ASDs) but the reasons for this are poorly understood. We use a longitudinal population-representative cohort s to examine the four-year persistence of psychiatric problems and to identify risk factors for their occurrence and stability.

Methods: Eighty-one 16 year old adolescents, initially seen at 12 years, were re-assessed using the parent-report Strengths and Difficulties Questionnaire (SDQ). Child, family and contextual characteristics from age 12 were tested as risk factors for psychopathology.

Results: Prevalence rates varied depending on whether general population or ASD-specific SDQ cut-offs were used; while the former suggested a decrease in psychiatric problems over time, the ASD-specific cut-offs showed no significant rate differences between 12 and 16 years. There was strong longitudinal domain-specificity, with parent correlations ranging from 0.44-0.58 and teacher SDQ reports at age 12 showing correlations of 0.31-0.58 with parent reports at 16. Among the few significant risk factors, lower IQ and adaptive functioning predicted hyperactivity problems and total difficulties. Emotional problems at 16 were predicted by poorer maternal mental health, family-based deprivation and lower social class. Improvement from 12 to 16 in conduct problems

was predicted by greater neighborhood deprivation and special school attendance.

Conclusions: Additional psychiatric problems in ASD are persistent and domain-specific from childhood to adolescence. Using norms generated for general population samples may be inappropriate and give misleading results. There was a striking lack of effect for risk factors associated with psychopathology in the general child population, although a few expected associations were found.

154.007 Dimensions of Oppositionality in Autism Spectrum Disorder. L. Roughan*[1], D. H. Skuse[2] and W. P. Mandy[3], (1)*Great Ormond Street Hospital*, (2)*Institute of Child Health*, (3)*University College London*

Background:

Oppositional Defiant Disorder (ODD) is amongst the most common comorbid conditions amongst children with autism spectrum disorder (ASD) and is a strong predictor of both internalizing and externalizing psychopathology. Recent attempts to understand the multifinality (i.e. range of developmental outcomes) of ODD in the general population of children has suggested that it should be parsed into three distinct 'irritable', 'headstrong' and 'hurtful' dimensions. These dimensions appear to have distinct cross-sectional and longitudinal correlates, such that irritability is associated with internalizing difficulties; whilst headstrong and spiteful behaviors predict conduct disorder. The value of parsing ODD when assessing and formulating comorbid difficulties in ASD has not previously been examined.

Objectives:

To test whether irritable, headstrong and hurtful symptom domains have distinct patterns of associated psychopathology in a sample of children with ASD. We predicted that the irritable dimension would be most strongly associated with internalizing problems and that headstrong and hurtful dimensions would be most strongly associated with conduct disorder symptoms.

Methods:

Cross-sectional data were examined for 217 (82% males) young people (mean age = 9 years) with a high-functioning ASD. A well-standardised parent-report interview (the 3Di) was used to measure ASD, ODD and conduct disorder symptoms. The strengths and difficulties questionnaire was used to measure internalising difficulties by parent and teacher report.

Results:

Irritable, headstrong and hurtful behavior were not correlated with 3Di measures of autism triadic symptoms (all ps>.29). In a regression model with the three ODD domains as predictors, irritiability (β=.20) and headstrong (β=.24) behavior were significant predictors of conduct disorder symptoms. By contrast, of the three ODD domains, only irritability (β=.27) predicted internalizing problems by parent report. Similarly only irritability (β=.26) predicted teacher report internalizing problems.

Conclusions:

The three domains of oppositionality we investigated are relevant to understanding comorbidity in ASD, and are independent to autistic symptom severity. Irritability appears to be an important construct in this population, and is associated with both internalizing and externalizing psychopathology. By contrast, headstrong behaviours are a specific risk factor for more serious conduct problems in ASD. Clinical assessment of irritable and headstrong behaviours in ASD populations may help identify children most at risk of developing further psychiatric disorders and inform the development of appropriate treatment packages for children with ASD.

154.008 Prevalence of Co-Morbid Psychiatric Conditions In An Adult Population Assessed for Autism Spectrum Disorder. E. Wilson*[1], D. M. Robertson[2], N. Gillan[3], G. Roberts[4], S. Coghlan[5], M. A. Mendez[3], D. Spain[1], C. Ohlsen[4], N. Hammond[4], D. G. Murphy[3] and C. M. Murphy[6], (1)*King's College London*, (2)*South London and Maudsley NHS Trust*, (3)*Institute of Psychiatry, King's College London*, (4)*South London and Maudsley*

NHS Foundation Trust, (5)*King's College, London*, (6)*King's College London, Institute of Psychiatry*

Background:

Individuals with an autism spectrum disorder (ASD) are vulnerable to co-morbid mental health problems. However, research in this area typically involves children and there is limited research investigating co-morbid difficulties in adults with ASD.

Furthermore, to date, no studies have investigated the relationship between ASD subtypes (Asperger, Childhood Autism, atypical autism and PDD-NOS) and the risk of developing co-morbid conditions in adulthood.

Objectives:

To determine prevalence and type of co-morbid mental health conditions in adults diagnosed with ASD.

Methods:

A retrospective review was completed of 518 adult patients (78% male; mean age: 31 years, SD: 11 years) consecutively diagnosed with ASD at the Behavioural Genetics Clinic, a specialist clinic providing gold-standard assessment of ASD in adults at the Maudsley Hospital, London. Diagnostic assessment included a detailed neuropsychiatric interview, the Autism Diagnostic Interview-Revised (ADI-R) and / or Autism Diagnostic Observation Schedule (ADOS), pending consent to contact parents/parental availability, and a physical examination. Co-morbid mental health diagnoses were made in accordance with ICD10 criteria (with the exception of adult Attention Deficit Hyperactivity Disorder (ADHD) which, in keeping with UK guidelines, was assessed using DSM IV).

Results:

394 (76%) patients that were diagnosed with ASD also met diagnostic criteria for at least one other co-morbid mental health condition. The most common of these were depression (19%), Obsessive Compulsive Disorder (OCD; 18%), Generalised Anxiety Disorder (GAD; 13%), social phobia (11%) and ADHD (9%).

Rates of different co-morbid conditions (depression, OCD, GAD, social phobia and ADHD) were contrasted between ASD subtypes using Pearson chi-square. Those meeting diagnostic criteria for Asperger or Childhood Autism (N = 351) had a significantly *lower* prevalence of co-morbid ADHD (p = .05) and a significantly *higher* prevalence of co-morbid OCD (p = .02) than people diagnosed with PDD-NOS or atypical autism (N = 173). Furthermore, individuals with Asperger (N = 218) exhibited significantly higher rates of social phobia (p = .02) and depression (p = .05) than those with Childhood Autism (N = 133). There were no significant differences in rates of any other co-morbid conditions between ASD subtypes.

Conclusions:

Results from this large retrospective naturalistic sample indicate that adults with ASD have a significantly increased risk for developing co-morbid mental health conditions, highlighting the need for improved recognition and treatment of co-morbid mental health difficulties in this population. Our results also have implications for the diagnostic formulation of ASD and other psychiatric conditions. For example, the notion that diagnoses of co-morbid psychiatric conditions such as ADHD should not be made if an individual is on the autistic spectrum is challenged. Also, subtypes of ASD differed with respect to likelihood of developing specific psychiatric conditions.

Clinical Phenotype Program

155 Clinical Phenotype : Measurement

155.001 1 DISCO: A Decade of Epidemiological Research.

C. Gillberg*[1] and T. Brugha[2], (1)*The Gillberg Neuropsychiatry Centre, Sahlgrenska Academy, Gothenburg University*, (2)*University of Leicester*

Background: The scientific study of autism spectrum disorder (ASD) has recently been slowed up because of widespread and uncritical acceptance of a set of time-consuming prescribed diagnostic instruments with very limited scope, focusing on a narrow phenotype of autism. A belief system has been put in place that autism can only be properly diagnosed and studied if these instruments are used. In the meantime, the DISCO, with a broad view of the autism spectrum,

corresponding to what is currently known about the very broad phenotype of ASD has been developed and employed in large-scale epidemiological and clinical studies in the UK, the Netherlands, and, particularly, in Scandinavia.

Objectives: To carry out epidemiological studies of (a) children in the Faroe Islands and (b) adults in the UK using the DISCO interview.

Methods: In both studies, the DISCO was used at the third phase of the studies, following first stage screening and subsequent assessment of suspected cases. In the Scandinavian sample, all 8-17 year old children in the Faroe Islands, born 1985-1994 were screened through schools and the DISCO used in 41 cases after second phase clinical assessment. The UK study was an epidemiological study of adults. A stratified multi-phase random sample was used in the third national survey of psychiatric morbidity in adults in England in 2007. Second phase clinical assessment was carried out using the Autism Diagnostic Observation Schedule Module 4 (ADOS-4).

Results: The Scandinavian study reported a prevalence level in the Faroe Island similar to that of other western countries. Results showed that .56 of the population had diagnoses of Childhood Autism, Asperger syndrome or Atypical Autism. Male-female ratio was 6:1. The UK study of adults reported ASD prevalence to be 9.8 per 1000. Prevalence was not related to the respondents' age but was related to male gender, lack of educational qualifications and to living in social housing. None of the cases identified in the survey had taken part in an autism diagnostic assessment or were known to have an ASD.

Conclusions: The DISCO is a very useful diagnostic interview for the whole range of ASD and its many associated developmental and neuropsychiatric problems. It is suitable for epidemiological studies of both children and adults.

155.003 3 Challenges in Diagnosis of Autism Spectrum Disorder in Vietnam. H. S. Vu*[1], A. Whittaker[2], S. Rodger[2] and M. Whittaker[2], (1)*Center for Creative Initiatives in Health and Population*, (2)*University of Queensland*

Background:

For individuals with ASD, diagnosis enables early intervention, which leads to improved life of these individuals. Nevertheless the diagnostic process for ASD is a confusing process and socially and culturally constructed. The diagnostic label of ASD has recently recognised in Vietnam since 2000 and the number of children who have been given the diagnosis has increased dramatically. However, there is limited understanding on the condition and diagnostic process of ASD in Vietnam. This paper is a part of a larger qualitative study being undertaken in Hanoi, Vietnam from June 2011 to May 2012 that seeks to understand the social construction of ASD in Vietnam.

Objectives:

To describe practices of providing a diagnosis on ASD and the negotiation between parents and professionals on the diagnostic label in Hanoi, Vietnam.

Methods:

Data for this paper came from in-depth interviews and case studies with parents and service providers, as well as observations at health clinics and centers that provide diagnosis and intervention services for children with ASD. Approximately 25 parents of children with ASD, and 15 key informants have participated in this study with written consent.

Results:

There has been some improvement in diagnosis for *Tu ky (a Vietnamese word for Autism)* in Vietnam; however, parents and professionals still struggle with a number of concerns on the diagnosis of this condition. First, there is no governmental standard guideline on diagnosis of ASD as well as no organization responsible for monitoring the quality of diagnosis. Second, while clinics use different procedures and Western-developed tools for assessment, social and cultural influences may lead to misinterpretation of child's behavior and capacity, and misdiagnosis. For example, Vietnamese children are expected to obey adult's instruction and if they do not they may be "culturally" labeled as a problem behavior. This study also reveals that the limited communication

between parents and professionals, the judgment attitude and the unclear on diagnostic process contribute to the parents' confusion and unsatisfaction on diagnosis. In addition, although ASD has became hot topic in media recently, lack of understanding of the normal development of children and limited knowledge on this condition, amongst both parents and professionals result in panic among parents and the pressure to give this diagnostic label.

Conclusions:

It is very important to recognize influences of social structure and cultural norms to the diagnosis of autism in Vietnam and other cross-cultural settings. In addition to public education on ASD, attention needs to be paid to capacity building for professionals and monitoring the quality of diagnosis.

155.004 4 Diagnostic Stability of Autism Spectrum Disorders and Predictors of Crossover in Toddlers Prospectively Identified in a Community-Based Setting. J. Barbaro* and C. Dissanayake, *Olga Tennison Autism Research Centre, La Trobe University*

Background: Diagnoses of Autism Spectrum Disorders (ASD) at 2-years-of-age has been established as relatively stable across time in studies using high-risk sibling or clinic referred samples. The stability of ASD diagnoses in children who have been prospectively identified from low-risk, community-based samples is not well established. Furthermore, the majority of studies have compared the diagnostic stability of diagnostic tools (e.g., ADOS/ADI-R) and clinical judgement, rather than identifying individual behaviours that predict crossover from ASD to non-ASD diagnoses, and comparing the cognitive profiles of ASD-stable versus ASD-crossover groups.

Objectives: The primary objective in this longitudinal study was to investigate the diagnostic stability of ASD diagnoses from 2-years to 4/5-years in children prospectively identified through routine developmental surveillance in a community-based setting. A secondary aim was to identify the individual behaviours that were most predictive of crossover from ASD to non-ASD diagnoses, and compare the cognitive profiles of the ASD-stable versus ASD-crossover groups.

Methods: A total of 99 children received a best estimate diagnosis of Autistic Disorder (AD), Autism Spectrum Disorder (ASD), or developmental and/or language delay (DD/LD) at 24-months (Time 1) as part of the Social Attention and Communication Study (SACS). 77 children returned for a follow-up diagnostic assessment between 4- to 5-years (Time 2). Diagnoses at Time 1 were based on expert clinical judgement utilising the ADOS, ADI-R, and Mullen Scales. Mean scores at Time 1 on the individual items of the ADOS Module 1 and the separate subscales of the Mullen (minus gross motor) were also compared between ASD-stable and ASD-crossover groups.

Results: Diagnostic stability was high, with 86% of children retaining an ASD diagnosis from Time 1 to 2. However, stability of diagnoses within the spectrum (i.e., AD vs ASD) was more variable, although no children in the DD/LD group moved *onto* the spectrum. ANOVAs revealed significant differences in ADOS Time 1 scores for 'Unusual Eye Contact', 'Frequency of Vocalizations Directed to Others', and 'Integration of Gaze and Other Behaviors' between ASD-stable (n = 53) and ASD-crossover (n = 9) groups, with the ASD-stable group displaying higher mean scores (greater abnormality) in these behaviours. Furthermore, investigation of the cognitive profiles of the two groups at Time 1 revealed that the ASD-crossover group had significantly higher visual reception, fine motor, and receptive language age equivalents, with the greatest mean difference in receptive language.

Conclusions: The current study suggests that, consistent with previous studies utilising high-risk samples, diagnoses of ASDs at 2-years-of-age is stable in children identified through routine developmental surveillance in a low-risk sample. Furthermore, the best individual predictors on the ADOS of diagnostic crossover from Time 1 to 2 were social attention and communication behaviours, and included not only the use of eye contact and direction of vocalisations towards others, but the *integration* of these behaviours. Higher receptive language in the ASD-crossover versus ASD-stable group is consistent with our previous findings that higher receptive language skills in the latter part of the second year of life may place children on a developmental trajectory away from the autism spectrum.

155.005 5 IDENTIFYING AUTISM Spectrum DISORDERS (ASD) In A MIXED POPULATION of Adults with ASD or ADHD Woth the AQ and the Temperament and Character INVENTORY Personality Questionnaire. B. B. Sizoo*[1], R. J. van der Gaag[2] and W. van den Brink[3], (1)*Dimence*, (2)*Karakter Child & Adolescent Psychiatry*, (3)*Amsterdam Institute for Addiction Research (AIAR)*

Background: Diagnosing ASD and ADHD in adults is hampered by the lack of reliable developmental information, and the heterogenic phenotypes with overlapping symptoms. In adults, both ASD and ADHD present with symptoms that could also be attributed to personality pathology on account of affective, cognitive and interpersonal problems. In other words, we could also consider differences between both developmental disorders from the perspective of personality pathology. Given the diagnostic ambiguity between ASD and ADHD in clinical practice, it is important to determine the extent to which the personality perspective can differentiate between ASD and ADHD.

Objectives: To investigate whether ASD can be identified more effectively in a mixed population of adults with ASD or ADHD using a personality instrument rather than an ASD-specific instrument. More specifically we examine (a) the association between the autism spectrum quotient (AQ) subscales and the abbreviated temperament and character inventory (VTCI) subscales, (b) which instrument is the best predictor of ASD in this mixed population, and (c) whether the VTCI adds to the predictive value of the AQ in the identification of ASD and vice versa.

Methods: 54 adults with ASD and 21 with ADHD all without a (history of) substance use disorder completed the AQ (50 items) and the VTCI (105 items). The relationship between the VTCI and the AQ was examined using a principal component analysis pooling the 7 VTCI subscales and the 5 AQ subscales. We computed the percentage correctly identified ASD cases in the mixed sample with binominal logistic regression analysis.

Results: The ASD and ADHD groups were comparable with respect to age and IQ, but male patients were overrepresented in the ASD group (X^2=5.812, p=.016). ASD and ADHD patients differ significantly and on 3 of the 5 AQ subscales as well as on 4 of the 7 VTCI scales. There were significant and substantial correlations between the AQ total score and the AQ social skill subscale and most of the VTCI scales, with the exception of persistence. Furthermore, the principal component analysis with all scales of both instruments showed that the subscales of both instruments were complimentary to each other in the first three of the five factors that were extracted. Furthermore, our results showed that the autism-specific instrument (AQ) is not superior to the personality instrument (VTCI) in differentiating between ASD and ADHD. In fact both instruments yield the same improvement in correctly diagnosing ASD and ADHD compared to pure chance: from 75% to 86.7% correctly identified cases.

Conclusions: This current study suggests that in a mixed sample of adults with ADHD or ASD, autistic features as measured by the AQ are highly correlated to personality characteristics as measured by the VTCI. Both instruments differentiate ASD from ADHD in this mixed sample with the same accuracy. More research is needed to understand the relationship between developmental disorders and personality characteristics.

155.006 6 Development of Thai Version of Autism Spectrum Screening Questionnaire (Thai-ASSQ). W. Kittitharaphan*,

Development of Thai Version of Autism Spectrum Screening Questionnaire (Thai-ASSQ)

Background: Autistic Spectrum Disorder can manifest in wide range of cognitive level and severity. In this decade, prevalence of PDDs in Thailand has been significantly increasing. Even if there is PDDSQ Thai version developed and used as screening test for the individuals with PDD. It is the useful to identify the severe or full-criteria cases of autism but it cannot be utilized well to indicate the children in mild severity, such as high-functioning autism and Asperger Syndrome. Thus mild ASD were unidentified.

Objectives: To develop the screening questionnaires called Thai version of Autism Spectrum Screening Questionnaire (Thai-ASSQ) which were designed in order to screen Asperger disorder, Pervasive Developmental Disorder,

Not-otherwise Specified (PDDNOS), the high function Autism Spectrum disorders in school age children in Thailand.

Methods: 400 of Parents and Teachers of Children aged 4-18 years with PDDNOS, high function autism and Asperger disorder, other psychiatric problems as well as normal typical children were asked to complete Thai-ASSQ. Reliability of the questionnaire was assessed by testing the two-week test-retest reliability and internal consistency. In addition, to test the validity, the authors identified the sensitivity, specificity and kappa index of agreement comparing with clinical diagnosis performed by child and adolescent psychiatrist. Ultimately, factor analysis was also conducted.

Results: Initial results of this study, such as reliability, validity, kappa index of agreement as well as the cut of point of this screening test will be presented at the conference.

Conclusions: The results, the capacity of this test in using as the screening test of mild-degree of PDD, the epidemiological study and the implications in clinical use will be discussed.

Keywords: Development, Screening questionnaire, Pervasive Developmental Disorder, Asperger Disorder, High function Autism

155.007 7 Shortening the Behavioral Diagnosis of Autism Through Artificial Intelligence and Mobile Health Technologies. D. P. Wall*, *Harvard Medical School*

Background:

The incidence of autism has increased dramatically over recent years, making this mental disorder one of the greatest public health challenges of our time. The standard practice of diagnosis is strictly based on behavioral characteristics, as the genome has largely proved intractable for diagnostic purposes. Yet, the most commonly used behavioral instruments take as much as 3 hours to administer by a trained specialist, contributing to the substantial delays in diagnosis experienced by many children, who may go undiagnosed and untreated until ages beyond when behavioral therapy would have had more substantive positive impacts.

Objectives:

In the present study, our aim was to apply machine learning techniques to one of the most commonly used behavioral instruments, the Autism Diagnostic Interview-Revised (ADI-R), to determine if the exam could be shortened without loss of diagnostic accuracy.

Methods:

We used several machine-learning techniques to study the complete sets of answers to the ADI-R available at the Autism Genetic Research Exchange (AGRE) for 891 individuals diagnosed with autism and 75 individuals who did not meet the criteria for autism diagnosis. Through cross-validation we measured the sensitivity and specificity of the classifier and then further tested the accuracy against item-level data from two independent sources, a collection of 1654 autistic individuals from the Simons Simplex Collection and a collection of 322 autistic individuals from the Boston Autism Consortium.

Results:

Our analysis showed that 7 of the 152 items contained in the ADI-R were sufficient to diagnosis autism with 99.9% statistical accuracy. In both our external validation experiments, the 7-question classifier performed with nearly 100% statistical accuracy, properly categorizing all but one of the individuals from these two resources who previously had been diagnosed with autism through the standard ADI-R.

Conclusions:

With incidence rates rising, the capacity to diagnose autism quickly and effectively requires careful design of behavioral diagnostics. Our retrospective analysis yielded a highly accurate, but significantly abbreviated diagnostic instrument that appears to capture the key elements of the ADI-R while reducing the exam time from hours to minutes. Although more testing is required, this abbreviated approach may prove useful for initial screening and faster recognition in clinical settings as well as in mobile technologies to enable administration in remote areas.

155.008 8 Simons Simplex Collection: A Model of Quality Assessment in Multi-Site Phenotyping Research. E. Brooks[1], J. E. Olson*[1], L. Green-Synder[1], S. Risi[1], J. Tjernagel[2], L. C. White[1], R. K. Rumsey[3], A. Gallego[2] and M. Greenup[2], (1)*University of Michigan Autism & Communication Disorders Center*, (2)*Simons Foundation*, (3)*University of Minnesota*

Background: Quality assurance measures, retrospective chart reviews and meta-analyses have been a mainstay in pharmacological research for years yet emerge only sporadically within autism literature. Significant progress has been made establishing multi-site surveillance networks (e.g., ADDM network and CADDRE by the CDC), international collaborations including the Autism-Genome (AGP) and CIHR Pathways Projects, and other high-quality partnerships including Autism Genetic Resource Exchange (AGRE), and Autism Treatment Network. Improved alliances explor*ing* emerging research initiatives are no longer the exception but the norm. This progress presents new challenges to methodological design including systematic and rigorous application of consistent criteria and standardized assessment measures across sites. By requiring rigorous phenotyping of its permanent genetic sample repository the Simons Simplex Collection and Simons Foundation Autism Research Initiative (SFARI) have revolutionized the standards of data quality assurance within autism research.

Objectives: To characterize the findings of a random review of charts as part of an ongoing data quality assurance program by the Simons Foundation of SSC data.

Methods: After completion of data collection for the SSC, a repository of genetic, phenotypic and biological data from 2663 'simplex' families collected across 12 sites, chart reviews were conducted on 10% of each site's total collection. Review teams were comprised of at least one clinician and one administrative staff, all credentialed by the SSC PI. Teams visited each site and reviewed charts manually for completeness, appropriate documents and authorization (i.e., consent forms), adherence to inclusion/exclusion criteria, scoring, confirmed reliability of diagnosticians and documentation of any validation issues. Cases were computer generated at random to reflect a distribution across each quarter the site participated, representing 10% of the site's total contribution. Sites were notified in advance of the team's scheduled arrival dates but were not informed of the case IDs that would be reviewed*. Checklists were completed for each chart, and then used to create statistical reports for each site, each which was then shared with the local Principal Investigators.

Results: A total of 277 charts (10.4% of entire SSC collection) were reviewed at 12 SSC sites over 4-months. Of these 277 cases, 228 (79%) were 'complete', having all primary required measures and 254 (92%) included appropriately completed authorization (consent forms). Twenty-three (8%) charts reviewed were such that based on inadequate examiner protocol notes the clinician could not confidently assert that the correct ADOS module had been administered. A total of 48 charts (17%) were flagged for clinical follow-up to ensure proper adherence to inclusion/exclusion criteria, yet 99% of those reviewed reflected that someone maintaining SSC standards for research reliability on the ADOS and ADI had in fact conducted the measure.

Conclusions: These results reveal a program that effectively provided remote support to multiple sites as well as identification of possible protocol improvements. Specifically, the data speak to the strength of the research reliability maintenance plan put into place by SSC, while at the same time offer insight into the complexity of this study design and the rigors of our sample selection.

155.009 9 The Implications of DSM V: Changes in Diagnostic Outcomes in An Adult Clinical Sample Re-Diagnosed According to the Proposed DSM V. G. Roberts*[1], N. Gillan[2], K. Johnston[3], S. Maltezos[4], C. M. Murphy[5], D. G. Murphy[2], D. M. Robertson[6], D. Spain[7], E. Wilson[7] and F. Happe[8], (1)*South London and Maudsley NHS Foundation Trust*, (2)*Institute of Psychiatry, King's College London*, (3)*Kings College London, Institute of Psychiatry*, (4)*The Maudsley Hospital*, (5)*King's College London, Institute of Psychiatry*, (6)*South London and Maudsley NHS Trust*, (7)*King's College London*, (8)*Institute of Psychiatry*

Background: Major changes in diagnostic criteria are proposed for DSM-V, including the collapsing of autistic

disorder, Asperger's disorder and PDD-NOS into a single diagnosis; 'autism spectrum disorder (ASD)'. The effects of these changes are as yet unclear; will individuals diagnosed by current criteria still meet diagnostic criteria with the proposed diagnostic scheme? While some work has been reported addressing this issue in children, no studies in adults have been published to date. Adults, including those first receiving a diagnosis in adulthood, are an important, and somewhat neglected, group in autism spectrum clinical services and research and are the focus for the present study.

Objectives: To review the effect of proposed DSM V diagnostic algorithms on the diagnostic outcome of a clinical sample of patients assessed for ASD in adulthood.

Methods: Diagnostic information was reviewed for 100 consecutive adult patients who attended the Behavioural Genetics Clinic, a specialist clinic providing assessment of ASD at the Maudsley Hospital, London. Original diagnosis was made in accordance with the ICD-10 criteria. Diagnostic assessment included a detailed neuropsychiatric interview, Autism Diagnostic Interview-Revised (ADI-R) and / or Autism Diagnostic Observation Schedule (ADOS) pending consent to contact parents/parental availability and physical examination. Information from the ICD 10 algorithm, ADI-R, ADOS and neuropsychiatric assessment reports was used to recode diagnostic outcomes in accordance with the proposed DSM 5 ASD algorithm as posted by the American Psychiatric Association.

Results: Data will be presented showing the degree of agreement between current ICD 10 diagnoses (Asperger's Syndrome, Childhood Autism, Atypical Autism, Pervasive Developmental Disorder-not otherwise specified) and the proposed new DSM 5 diagnosis of ASD.

Conclusions: Implications for proposed changes to diagnostic criteria will be highlighted.

155.010 10 The Role of Comprehensive Evaluation in the Differential Diagnosis of Autism in a Clinic Setting. C. M. Hall*[1] and J. Hamel[2], (1)*The Marcus Autism Center*, (2)*Marcus Autism Center*

Background: With heightened public awareness, parents and professionals are increasingly likely to raise concerns specifically about autism spectrum disorders, and to seek the expertise of a variety of specialists. Current guidelines from the Academy of Pediatrics (2010) recommend that children suspected of having ASDs should receive a comprehensive evaluation, but unfortunately these are not always available, and when they are, long waiting lists exist. The present study examines findings from comprehensive evaluations conducted in a clinic setting at the Marcus Autism Center, in Atlanta, GA. The center serves a diverse geographic and socioeconomic population and conducts more than 300 comprehensive autism diagnostic assessments within a year.

Objectives: The purpose of this study is to analyze diagnostic trends in a clinical population, specifically with regard to changes in diagnosis based on the use of a comprehensive assessment using standardized measures.

Methods: A record review was conducted of 326 diagnostic evaluations conducted between November 2010 and October 2011 at the Marcus Autism Center. To be included in this study, the evaluation report had to include the following components: diagnostic interview, a developmental/cognitive measure (e.g. Bayley Scales, DAS-II), an adaptive measure (e.g. Vineland Scales), and the Autism Diagnostic Observation Scale (ADOS). Information extracted from the reports included child's age, gender, prior diagnosis, prior measures given, and primary diagnosis given after receiving the comprehensive assessment. Of the 326 reports that were reviewed, 299 had sufficient data to be included in this study.

Results: 31% percent of the children in this sample had previously been seen by a specialist (developmental pediatrician, psychiatrist, psychologist, or neurologist) and 16% had already been given a diagnosis within the autism spectrum. Of the children who had a prior ASD diagnosis, only 4(8%) were known to have been given an ADOS and/or ADI. After receiving a full standardized assessment, 55% of the sample was found to meet DSM criteria for an ASD diagnosis and the average age of these children was 63 months. Differential diagnoses for the 45% of children who did not fall within the autism spectrum included the following: Behavior disorder (11%), mood and anxiety disorders (8%),

developmental delay/cognitive impairment (10%), and language disorders (8%). Interestingly, of the 48 children who came into the clinic with a pre-existing diagnosis of autism, only 65% were found to meet diagnostic criteria for an ASD, based on the assessments given. The remaining 35% were found to meet criteria for other diagnoses including behavior disorders, mood disorders, anxiety, developmental delay, and language disorders.

Conclusions: In a sizeable minority of cases (35%), a previous diagnosis of ASD was not confirmed once standardized measures of observable behavior were used. This highlights the importance of comprehensive evaluations that include consideration of other childhood disorders and that measure functioning across multiple domains. Furthermore, given the relatively high average age of diagnosis (5 years old), a continued emphasis on early screening and referral for comprehensive assessment in the toddler and preschool years is imperative so that the benefits of early intervention can be maximized.

155.011 11 Sensitivity of Current and Proposed Diagnostic Criteria: Are We on the Path to Exclusion?. K. S. D'Eramo*[1], T. M. Newman[1], A. Naples[2], C. M. Cotter[1], J. W. Loomis[1], M. J. Palmieri[1] and M. D. Powers[1], (1)*Center for Children with Special Needs*, (2)*Yale Child Study Center*

Background:

Ongoing concerns about the utility and reliability of diagnostic distinctions between specific autism spectrum disorders (e.g., Autistic Disorder, Asperger's Disorder, Pervasive Developmental Disorder: NOS) have led to proposals for reform in the upcoming revision of the Diagnostic and Statistical Manual (DSM-V). Under the current proposal, the DSM-V will offer only one diagnosis, "Autism Spectrum Disorder" (ASD), rather than the five diagnoses currently falling under the umbrella of Pervasive Developmental Disorders. However, some clinicians and researchers have raised concerns about the proposed DSM-V diagnostic criteria. Retrospective reviews of existing data sets suggest that the DSM-V may not be as sensitive as DSM-IV, particularly for individuals with IQs in the average range or above.

Objectives:

The goal of this study was to better understand the distinctions between DSM-IV and DSM-V criteria, and to determine whether there are specific features that distinguish individuals who differentially meet criteria across the two versions of the Diagnostic and Statistical Manual.

Methods:

Data are currently being collected from individuals presenting for psychological evaluation at a clinical center specializing in assessment and treatment of ASD's. The comprehensive psychological evaluation includes developmental history, cognitive/ developmental testing, diagnostic assessment, and adaptive assessment. Licensed psychologists complete the evaluations and most patients are seen by two psychologists. Following assessment, the psychologist(s) complete a rating form indicating which of the specific symptoms of ASD the individual meets under DSM-IV criteria and a separate form indicating the specific symptoms met under DSM-V criteria.

Results:

Based on the number of patients currently scheduled for assessment, we expect our subject pool to reach 100 by the end of April, with a range of cognitive functioning. Preliminary results indicate that among the 22 children who met DSM-IV criteria for ASD, three did not meet criteria for diagnosis under DSM-V. All children who met criteria under DSM-V also met under DSM-IV. A multilevel item response model was conducted to explore sources of variability contributing to the discrepancy between criteria in DSM-IV and DSM-V. Current results suggest that DSM-V criteria are met as the severity of symptoms increases, i.e., higher functioning individuals are less likely to meet criteria for diagnosis on DSM-V. Further, individuals exhibiting more heterogeneous patterns of behavior are less likely to meet diagnostic criteria under DSM-V. Ongoing analyses will extend this model with predictive power from the Vineland Adaptive Behavior Scales, ADOS classification and IQ.

Conclusions:

Current results replicate findings that the proposed DSM-V criteria for ASD have reduced sensitivity for higher functioning individuals diagnosed with ASD according to DSM-IV. Our pending results represent the first field trial of the proposed criteria in a clinic sample and suggest that the DSM-V will have a significant impact on ASD diagnosis. This has the potential to affect access to intervention across all ages and in a number of settings. In addition to educational services, 26 states in the U.S. specifically require insurers to provide coverage for the diagnosis and treatment of autism. Many children could lose access to these entitlements under the proposed DSM-V criteria.

155.013 13 Estimating Cognitive Functioning in ASD: A Longitudinal Study From Developmental Profile to IQ Level. L. Reale*[1], V. Mannino[2], M. Guarnera[1] and L. Mazzone[3], (1)*Division of Child and Adolescents NeuroPsychiatry, Department of Pediatrics, University of Catania, Catania, Italy* , (2)*UONPIA - IRCCS Foundation Ca' Granda, Ospedale Maggiore Policlinico, Milan, Italy*, (3)*Child Neuropsychiatry Unit, Department of Neuroscience, Bambino Gesù Children's Hospital, Rome, Italy*

Background:

Over the last decade or more, besides an increased prevalence of autism diagnoses, the rate of associated Intellectual Disability (ID) tended to decrease.

Among Autism Spectrum Disorders (ASDs), IQ was found to be a strong predictor of short- and long-term outcomes, such as a potential moderator of response to treatment strategies. Thus, a specific assessment of cognitive functioning, as soon as possible, should be rigorously performed to obtain an appropriate evaluation of ASD subjects. Unfortunately, in the clinical practice, administering IQ tests can be difficult and potentially result in lower scores due to the typical clinical phenotype and behavioral problems. In young ASD children, the Psychoeducational Profile-3 (PEP-3) represents the most useful and manageable tool for the assessment. Building on existing literature, although most studies to date have been cross-sectional, PEP scores were found to be related to IQ levels; thus, developmental profile could be used to estimate cognitive functioning of preschooler children with ASD, but referring to a single point-in-time.

Therefore, even if cross-sectional studies can be extremely useful for generating hypotheses, these hypotheses need to be further confirmed by longitudinal investigation.

Objectives:

Our aim was to evaluate the longitudinal cognitive profile from the first evaluation to IQ assessment, addressing three questions: 1) At each time point, does the ASD group show a different developmental profile compare to typically-developing? 2) Is there one or more PEP domains at the first time point related to final IQ level? 3) What is the prevalence of ID in our ASD sample?

Methods:

61 ASD and 18 Typically-Developing (TD) matched children were assessed at 3 time points, each 12-24 months apart (mean age at Time 1: ASD=3.4±0.2 years; TD=4.1±0.4 years). ASD subjects were diagnosed using ADI-R and ADOS-G. No differences were detected on treatment strategies among ASD. PEP-3 (T_1 and T_2) and Leiter-R (T_3) were administered to all participants.

Results:

T_1: All PEP-3 domains exhibited a greater developmental delay in ASD compared to TD, also distinguished for typical disharmonic profile that showed expressive language, visual-motor imitation and social reciprocity as areas of weakness.

T_2: On gross motor, visual-motor imitation and affective expression subtests no significant differences were observed between ASD and TD.

All PEP-3 domains at T_1 not revealed significant correlation with Leiter-R IQ at T_3.

In our sample of ASD, the prevalence of ID was 29% (mean IQ=88.9±15.7).

Conclusions:

Although, at baseline our data confirm a greater developmental delay (also on cognitive domain) in all ASD children, only the 29% of these subsequently shows an intellectual disability. Moreover, no correlation between PEP-3 scores and IQ levels was detected; thus, a developmental delay should not be used to predict lower IQ level.

Finally, a better understanding of the cognitive level may not only have positive implications for an early diagnosis but also for intervention and long-term outcome, as well as to differentiate cognitive phenotypes in the clinical research.

Clinical Phenotype Program

156 Clinical Phenotype : Medical & Biological Profiles

156.014 14 Body Size and Neurological Abnormalities in Jamaican Children with Autism. R. Melbourne-Chambers*[1], J. Tapper[2], M. H. Rahbar[3] and M. Samms-Vaughan[1], (1)*The University of the West Indies*, (2)*Bustamante Hospital for Children*, (3)*The University of Texas Health Science Center at Houston*

Background:

Autism is a complex lifelong neurodevelopmental and behavioral disorder manifesting in infancy or early childhood. The prevalence of neuromotor abnormalities in children with autism has been widely studied. Studies have shown that neurologic abnormalities including hyporeflexia, stereotypies, and hypotonia are more prevalent in children with autism. This has not previously been documented in Jamaican children.

Objectives:

To determine the prevalence of abnormal neurologic findings on standard examination of Jamaican children with autism and autistic spectrum disorder (ASD) and to describe the associated factors.

Methods:

Forty-three children with autism/ASD age 2-8 years were invited to participate. Each child with autism/ASD was matched with a peer for age and gender. Informed consent was obtained. Parents and caregivers were interviewed to obtain information on demographics and the medical records were reviewed. The diagnosis of autism/ ASD was established according to DSM IV criteria, the Childhood Autism Rating Scale (CARS) and the Autism Diagnostic Observation Schedule (ADOS). The height, weight and head circumference were measured by one trained research assistant. A standardised neurological examination was performed on all children by one of three paediatric neurologists. Joint hypermobility was evaluated using the Beighton score. Ethical approval was obtained. Data were analysed to determine the association of growth characteristics with neurologic abnormalities and factors predictive of neurologic abnormalities.

Results:

The mean age was 5.50 years (S.D. 1.57 years). There were significant differences in the prevalence of joint hypermobility and incoordination between the two groups. Joint hypermobility was found in 41.8% and motor coordination abnormalities in 30% of children with autism/ASD (P=0.00, 0.04 respectively). The prevalence of these findings was not significantly different among autism subgroups. In children with autism/ASD, tall stature and macrocephaly were significantly associated with the finding of abnormal motor coordination (P=0.00, 0.04 respectively) and a BMI > 85th centile was significantly associated with the finding of joint hypermobility (P=0.02). Tall stature was significantly associated with hypotonia (P= 0.036). Logistic regression analysis determined that controlling for age and gender, head circumference (B=0.63, P=0.02) and height (B=0.16, P= 0.03) were significantly associated with abnormal motor coordination in children with autism/ASD.

Conclusions:

The prevalence of motor coordination abnormalities and joint hypermobility is higher in Jamaican children with ASD/ autism than their peers. Growth dysregulation is significantly associated with motor coordination abnormalities. The association with height has not been widely reported. Dysregulated growth in height and head circumference may represent the physical manifestations of a subtype of autism/ASD with significant motor coordination abnormalities.

Medical Co-Morbid Conditions Program

157 Co-Morbid Medical Conditions

This session presents data related to co-morbid medical conditions in individuals with ASD including epilepsy, sleep disturbance, GI disorders, feeding difficulties, metabolic abnormalities and specific genetic conditions among others.

157.015 15 Feeding Difficulties Among Children with Autiusm Spectrum Disorders of Preschool Age: A Controlled Sudy. A. Kotsopoulos*[1], A. Troupou[2], M. Gyftogianni[3], A. Gasteratos[4] and A. Gyftogianni[5], (1)*Technological Institute of Patras*, (2)*Day Centre for Chiuldren with Developmental Disorders, Messolonghi, Greece*, (3)*Day Centre for Children with Developmental Disorders, Messolonghi, Greece*, (4)*Day Centre for Children with Develomental Disorders, Messolonghi, Greece*, (5)*Day Centre for Children with Developmental Disorders*

Background: Feeding difficulties are often observed among children with autism spectrum disorders (ASD). The frequiency reported varies from 46% to 89%.

Objectives: The study investigated the feeding difficulties among Greek preschool age children with ASD.

Methods: A questionnaire, constructed by the interdisciplinary team of the Day Centre for Children with Developmental Disorders (Messolonghi, Greece), was answered by the parents of 25 children diagnosed with ASD on the DSM-IV criteria, with age ranging from 2 yrs to 5 yrs 11mths (mean 4,3 months). They were matched closely one-by-one for age and sex with a control group of 25 children with typical development. The questionnaire consisted of 40 questions under five entities: developmental history, feeding during infancy and possible difficulties, current feeding habits and possible problems. The two groups were compared using non-parametric statistics (chi-square test).

Results: The main finding of the study was that children with ASD at the early ages of 1 to 3 yrs progressed at a slower pace in: 'abandoning the bottle to take fluids' ($p<0.001$), 'using a straw to sip' ($p<0.001$), 'starting to use the spoon' ($p<0.001$), 'starting to chew' ($p<0.002$) and 'starting to drink from a glass' ($p<0.003$). There were no significant differences in the other measures e.g. avoiding certain foods, time to take a meal,

Conclusions: The results of the study indicate that at an early stage of development children with ASD may present signs of dysphagia. These findings are consistent with observations in the clinical practice at the Day Centre among children at the ages of 2 to 3 yrs. with feeding problems who usually require therapeutic intervention. The present findings raise the questions whether: there is a relationship between early dysfagia and severity of autism, and whether early eating difficulties are associated with speech problems (developmental dyspraxia).

157.016 16 Feeding Problems and Nutrient Intake in Children with Autism Spectrum Disorders: A Meta-Analysis and Comprehensive Review of the Literature. W. G. Sharp*[1], D. L. Jaquess[2], R. Berry[2], W. Jones[3], C. McCracken[1], C. A. Saulnier[4] and A. Klin[3], (1)*Emory University School of Medicine*, (2)*Marcus Autism Center*, (3)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (4)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine*

Background:

Feeding problems are frequently associated with autism spectrum disorders (ASD), yet there has been no systematic integration of empirical studies focusing on eating behaviors and related nutritional concerns in ASD.

Objectives:

Our goal was to compare the level of feeding problems and nutrient intake in children with ASD to peers.

Methods:

We conducted a systematic review and meta-analysis in accordance with guidelines outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. We searched MedLine, PsychINFO, and PubMed databases (January 1980 and June 2011), reviewed

reference lists, and conducted ancestral and online first searches in English language journals for eligible studies. The search yielded 17 empirical studies involving a comparison group. Two researchers independently coded all extracted information using a standardized protocol and agreement between coders was high. We calculated effect sizes and associated 95% confidence intervals using a random-effects model and conducted heterogeneity tests, assessment of bias, and sensitivity analyses.

Results:

Children with ASD experienced significantly more feeding problems, characterized by food selectivity, food refusal, and behavioral rigidity during meals, when compared with typically developing peers, siblings, or children with other developmental concerns. The effect size for feeding problems between children with ASD and the combined comparison group was .89 (.087), 95% CI: .72 - 1.06. Nutrient analysis also indicated significantly lower intake of calcium (0.65 [.28]; 95% CI: -1.21 to -0.09) and protein (-.58 [.25]; 95% CI: -1.07 to -0.09) in children with ASD. The groups had similar levels of Vitamins A, C, D, & E, Zinc, Iron, Fiber, Energy, Total fat, and Carbohydrates.

Conclusions:

This meta-analysis supports the historical association between ASD and feeding problems, while also highlighting lower intake of calcium and protein compared with peers. Future research can expand on these findings through more detailed ASD diagnostic screening, increased uniformity in the assessment of feeding problems, and exploration of potential moderators, including ASD severity and parent imposed dietary restrictions.

157.018 18 Food Selectivity and Autism: A Retrospective Chart Review Regarding the Anthropometric Status, Nutritional Intake and Dietary Variety Among Children with and without ASD. R. Berry*[1], W. G. Sharp[2], D. L. Jaquess[1] and S. Hartwig[1], (1)*Marcus Autism Center*, (2)*Emory University School of Medicine*

Background:

Food selectivity (i.e., consuming a narrow range of food by type, texture, and/or presentation) is often cited among children with ASD. Typically, children with ASD have strong preferences for carbohydrates, snacks, and/or processed foods and rejection of fruits and vegetables. Little is known, however, regarding the impact of selective eating patterns on the nutritional status of children with ASD. Children with ASD often have appropriate caloric intake; therefore, analysis on the macro- and micro-nutrient level is indicated. Provisional evidence suggests food selectivity in ASD may result in nutrient inadequacy and that this risk may not be unique to the diagnosis, although more research is needed to determine the relationship between dietary patterns and nutrient status among selective eaters with and without ASD.

Objectives:

Our goal was to examine the dietary variety, nutrition status and anthropometric parameters among a group of children with and without autism spectrum disorders (ASD) referred to a feeding program for the evaluation and treatment of food selectivity.

Methods:

We conducted a retrospective chart review of children with food selectivity seen at an interdisciplinary feeding disorders program over a 2 year time period. We identified a total of 86 children and divided the sample into children with and without ASD. Data collection focused on dietary variety by food group (i.e., meats, starches, fruits, vegetables, and dairy), nutrient intake (calories, calcium, vitamins A, C, D, & E, iron, zinc, fiber, & protein), and anthropometric status (weight, height, % ideal body weight). Descriptive (mean, standard deviation, range) and inferential statistics (t tests, odd ratio) are presented.

Results:

Children with ASD consumed significantly fewer foods in the dairy group, but a similar number of meats, starches, fruits and vegetables compared to children who presented with food selectivity who do not have an ASD diagnosis. Consistent with this pattern of intake, the ASD group was significantly more likely to have deficits in calcium. Children without ASD were found to be at greater risk for inadequate fiber intake. No

significant group differences were detected in the number of children identified as deficient in calories, vitamins A, C, D, E, iron, zinc, or protein. The two groups were similar in terms of weight and percent of ideal body weight, although the ASD group was significantly taller.

Conclusions:

Findings suggest children with ASD and food selectivity may consume fewer foods from the dairy group and be at an increased risk for calcium deficiency, while children without ASD are more likely to have deficits in fiber. The source of the observed effect remains unclear, with possible contributors including unique patterns of food selectivity and/or greater likelihood of parent-mediated dietary restrictions targeting dairy. Implications for assessment and treatment of food selectivity in ASD, as well as parent consultation regarding dietary manipulation are discussed.

157.019 19 Assessment of Feeding Difficulties Among Children with Autism Spectrum Disorders. D. L. Jaquess*[1], W. G. Sharp[2] and C. T. Lukens[3], (1)*Marcus Autism Center*, (2)*Emory University School of Medicine*, (3)*Children's Hospital of Philadelphia*

Background:

Estimates suggest that atypical eating may occur at epidemic levels among children with autism spectrum disorders (ASD); however, lack of established assessment standards represents a significant barrier to determining the nature and prevalence of feeding problems in ASD. Past studies in this area have relied primarily on chart audits or study specific questionnaires to investigate feeding problems and nutritional intake among children with ASD, presenting a need to identify and evaluate standardized feeding measures with potential for widespread dissemination and replication.

Objectives:

To explore the relationship among three general methods (i.e., standardized questionnaires, estimates of nutrient intake, mealtime observation) applied in previous research to assess feeding related concerns in ASD.

Methods:

We developed a multi-method assessment core for feeding problems in ASD, including the Brief Autism Mealtime Behavior Inventory [BAMBI], a food preference inventory (FPI), and structure mealtime observation, and administered this battery to a sample of 31 children with ASD. Data analysis explored the relationships among variables both within and between measures, as well as the relationship with ASD diagnostic indicators.

Results:

Most caregivers (81%) expressed concerns regarding their child's eating habits. Selective eating patterns and food refusal were detected in the sample across measures, including high rates of problem behaviors and few bites accepted during the mealtime observation and more than a third of the foods on the food inventory identified as never consumed. The BAMBI's Limited Variety subscale positively correlated with the number of foods reported as never consumed and the percentage of the meal observation involving negative vocalizations. Finally, we did not detect a relationship between feeding measures and ASD characteristics as measured by the Social Responsiveness Scale (SRS).

Conclusions:

This represents the first study comparing standardized questionnaires with direct mealtime observations. Findings are consistent with previous descriptions of children with ASD as exhibiting strong preferences for certain foods and displaying strong emotional responses when presented with non-preferred food. It also appears that degree of food selectivity, as captured by the BAMBI or FPI, among children with ASD may be an important indicator of a child's emotional response to the presentation of novel and/or non-preferred foods during meals. Implications for practitioners interested in assessing feeding problems in children with ASD are discussed.

157.020 20 Assessment of Omega-3 Fatty Acids Status in Omani Autistic Children. M. I. Waly*[1], Y. M. Al-Farsi[1], M. Al-Sharbati[1], M. M. Al-Khaduri[1], A. Ali[1], M. M. Essa[1], A. Ouhtit[1], O. A. Al-Farsi[1], M. Al-Shafaee[1] and R. Deth[2], (1)*Sultan Qaboos University*, (2)*Northeastern University*

Background:

Low intake of omega-3 fatty acids during early childhood has been associated with neurodevelopmental disorders, including autism spectrum disorder (ASD). In Oman, westernization in food choices has been adopted by many families on the expenses of consuming traditional foods that were rich in omega-3 fatty acids.

Objectives:

This study was conducted to evaluate the daily intake of omega-3 fatty acids [eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)] and their serum levels in Omani autistic children.

Methods:

A case-control study included 40 children with ASD and 40 their age and gender matched controls. EPA and DHA were measured in the sera of all children enrolled in this study, using HPLC-modified technique. Mothers of the children were interviewed using a semi-quantitative food frequency questionnaire. The daily dietary intake of EPA and DHA were analyzed using food processor software.

Results:

The serum DHA levels of ASD children were significantly ($P < 0.05$) lower than control children. Whereas the serum EPA levels were comparable among both groups. The daily intake of DHA and EPA for ASD children was less than control children and less than the recommended daily reference intake levels. The frequency of consumption of foods rich in omega-3 fatty acids was similar among all children with no statistically significant difference ($P>0.05$).

Conclusions:

Low status of DHA was observed among ASD children in Oman. DHA deficiency might predispose ASD children to an impaired cellular membrane fluidity which is associated with an increased risk of ASD as reported in many studies in developed nations. Omega-3 fatty acids supplements are recommended for the treatment and management of ASD.

157.021 21 Serum Levels of Anterior Pituitary Hormones in Children with Autism. K. Iwata*, H. Matsuzaki and N. Mori, *Hamamatsu University School of Medicine*

Background: The aetiology of autism is not well understood, although it likely involves genetic, immunologic and environmental factors. The diagnosis of autism is based solely on behavioural characteristics, since there is currently no biological marker for autism. Several studies have examined anterior pituitary hormones as possible biological markers for autism. However, many of these studies have yielded contradictory results.

Objectives: To test whether the anterior pituitary hormones and cortisol were useful as biological markers for autism, we assessed the basal serum levels of them in serum from male, drug-naïve subjects with autism.

Methods: We determined the serum levels of six anterior pituitary hormones, including adrenocorticotropic hormone and growth hormone in 32 male subjects with autism (age: 6-18 years) and 34 healthy age- and sex-matched control subjects by a Bio-Plex suspension array system. Additionally, we also determined cortisol in these subjects by enzyme-linked immunosorbent assay.

Results: Serum levels of adrenocorticotropic hormone, growth hormone and cortisol were significantly higher in subjects with autism than in controls. Additionally, there was a significantly positive correlation between cortisol and adrenocorticotropic hormone levels in autism.

Conclusions: Our results suggest that increased basal serum levels of adrenocorticotropic hormone accompanied by increased cortisol and growth hormone might be implicated in the pathophysiology of autism.

157.022 22 Altered Antioxidant Enzymes in the Plasma of Autistic Omani Children. M. M. Essa[1], G. J. Guillemin*[2], F. L. Hakkim[3], M. I. Waly[3], M. Al-Sharbati[3], Y. M. Al-Farsi[3] and A. Ali[3], (1)*University of New South Wales*, (2)*UNSW*, (3)*Sultan Qaboos University*

Background: Autism spectrum disorder (ASD) is a neuro-developmental disorder characterized by qualitative impairments in social interaction, and verbal and non-verbal

communication, along with stereotyped interests and behaviors. The prevalence and diagnostic evidence for ASD in children is higher in Western countries as compared to developing countries such as sultanate of Oman. Abnormality in the antioxidant status were reported in autism and other neuropsychiatric disorders such as depression and ADHD. No such biochemical data is available for normal and autistic children in Sultanate of Oman.

Objectives: This study was aimed to compare the status of circulatory enzymatic antioxidant status in normal and Omani autistic children.

Methods: We have analyzed the activities of plasma antioxidant enzymes such as superoxide dismutase (SOD), catalase and glutathione peroxidase (GSH-Px) by using commercially available kits.

Results: There was a significant reduction in the activities of the SOD, catalase and GSH-Px were observed in Omani autistic children as compared with controls, which shown an agreement with previous studies from other countries.

Conclusions: This is the first study in Omani autistic children about enzymatic antioxidant status and the outcome of this study may give a lead to develop a novel biomarker for early detection of autism. Also this study will give the relationship between oxidative stress and the pathophysiology of autism.

157.023 23 VLDL-Specific Hypolipidemia Pattern in Human Subjects with Autism and Autistic Rodent Models. H. Matsuzaki*, K. Iwata and N. Mori, *Hamamatsu University School of Medicine*

Background: The neurobiological basis for autism remains poorly understood, but evidence is mounting in support of lipid metabolism playing a role in autism.

Objectives: In order to clarify the role of lipids in autism, we examined serum lipid profiles of human subjects with autism and autistic rodent models.

Methods: This study enrolled 112 subjects with high-functioning autism recruited from the Asperger Society Japan and 106 age-matched healthy control subjects recruited by advertisement. All participants for both groups are Japanese male. In animal model experiment, valproic acid (VPA) exposed model mouse (Kolozsi et al 2009), human chromosome 15q11-13 duplication mouse (Nakatani et al 2009) and CD38 null mouse (Jin et al 2007) were tested as autistic rodent models. Fasting human blood samples were collected by venipuncture in a sitting position with a tourniquet from all participants between 8:00 and noon. Mice were anesthetized by diethyl ether and then its blood samples were collected from the left ventricle. All blood samples were kept at room temperature for 30 min and centrifuged at 2000g for 10 min in a refrigerated centrifuge. After that, they were divided into 200-µl of aliquots and stored at -80°C for subsequent analyses. The size distribution of serum lipoprotein particles was evaluated by high sensitivity lipoprotein profiling system with high-performance liquid chromatography (Skylight Biotech, Inc., Akita, Japan).

Results: The serum levels of total cholesterol and triacylglycerol in the infant subjects (under 20 years old) with high-functioning autism were significantly lower (Mann-Whitney U test: $p < 0.001$) than those of normal control subjects. In each fraction, there were significant differences in the serum levels of very-low density lipoprotein (VLDL) and high density lipoprotein (HDL) fraction. In particular, it's remarkable in VLDL fraction of triacylglycerol ($p< 0.00003$). However, there were no differences between the patients with autism and healthy subjects in serum chylomicron and low density lipoprotein (LDL) levels. In animal experiment, CD38 null mice in 4 weeks old have also shown serum lipid profile as above, but the other mice didn't.

Conclusions: The association between autistic phenotype and abnormal serum lipid profile in human subjects and rodent models suggests that individuals with autism may be at increased risk for VLDL hypolipidemia in infancy and which might be implicated in the pathophysiology of autism.

157.024 24 A Comparison Study of Inorganic and Organic Compounds in Children with Autism and Controls. S. Faber*[1], G. M. Zinn[2], T. Fahrenholz[2], A. Boggess[2], J. C. Kern[2] and H. M. S. Kingston[2], (1)*The Children's Institute*, (2)*Duquesne University*

Background: Recent literature supports the presence of a complex genetic/environmental interaction underlying at least

some children's autism presentations. The concentration of heavy metals and chemicals in the environment may be contributory to the etiology of autism. The metalloprotein system, underlying heavy metal detoxification, and the methylation/sulfation system, underlying chemical transformation, may be altered in some children with autism. Deficits in heavy metal detoxification are associated with changes in glutathione concentration and speciation. Increased toxin concentrations can be associated with immunological abnormalities.

Objectives: This study measured concentrations of elements, including heavy metals, total glutathione, and T and B cell subsets in children with autism and matched controls to determine whether there were significant differences present between the two groups that could contribute to the creation of a theoretical perspective that includes environmental toxicity.

Methods: Sixteen children, ages 2-9, with autism confirmed by Autism Diagnostic Observation Scale (ADOS), who were seen for their first visit to the Neurodevelopmental Service and not on exclusionary diets or nutrients, were eligible. They were negative for genetic findings on chromosomes, fragile X, and oligoarray testing. They were paired with 16 age, sex, and socioeconomically matched controls, found through a recruitment poster, who did not meet ADOS criteria for autism. Blood was drawn from each child that measured plasma zinc/serum copper, T and B cell subsets, total glutathione, and plasma, serum, and red blood cell heavy metals, along with a large selection of elements including lead. Hair samples were taken from all participants and heavy metal concentrations were measured. Study analyses included t-test comparisons of all measures.

Results: Children with autism had higher average serum antimony (13 pairs) than controls ($p=0.005$) and had higher average hair selenium, tin, and lead (9 pairs) than controls ($p=0.002$, $p=0.014$, $p=0.030$ respectively). Children with autism (16 pairs) had lower mean total red blood cell glutathione than controls ($p=0.006$). Children with autism had a higher average CD4 number (15 pairs) than controls ($p=0.046$).

Conclusions: Children with autism may have had more difficulty eliminating antimony from their serum and may have had less ability to retain selenium, a micronutrient, than their matched controls. Passive effluence of tin and lead through the hair may be increased in children with autism who did not have statistically higher blood levels of these elements than controls. The increased amounts of tin and lead in the hair of children with autism versus controls is a finding that opposes recent literature. Children with autism, who had significantly less red blood cell glutathione than controls, may have had decreased functioning of their metalloprotein system, affecting antimony elimination. Detoxification differences in children with autism may have contributed to immune dysregulation, as evidenced by their significantly higher CD4 number than controls. Overall, children with autism displayed mixed evidence of decreased heavy metal detoxification, clearly decreased total glutathione levels, and increased helper cell prevalence than controls.

157.025 25 Atypical Pupillary Light Reflex and Heart Rate Variability in Children with Autism. C. L. Daluwatte*[1], J. H. Miles[1], S. E. Christ[1], D. Q. Beversdorf[1], T. N. Takahashi[2] and G. Yao[1], (1)*University of Missouri*, (2)*University of Missouri - Thompson Center for Autism and Neurodevelopmental Disorders*

Background: Atypical pupillary light reflexes (PLR) were previously reported in children with Autism Spectrum Disorder (ASD). A replication study is being conducted in a larger population to further investigate PLR profiles in children with ASD. Heart rate variability (HRV) was also measured simultaneously to explore potential impairments in the autonomic nervous system (ANS) associated with ASD.

Objectives: To study PLR and HRV profiles in children with ASD.

Methods: PLR and HRV were analyzed in 143 children with ASD (age 10.7±3.4 years, 128 males and 15 females) and 109 children of typical development (age 11.0±2.9 years, 80 males and 29 females). PLR induced by a 100ms green light was measured in both light adapted (LA) and dark adapted (DA) conditions using a two channel binocular apparatus. Five basic PLR measurements including resting pupil diameter, relative constriction, latency, constriction velocity and

redilation velocity were calculated to quantify PLR. HRV was measured using a remote heart rate device during the entire PLR test. In addition to time domain HRV parameters, Fourier transform was applied to calculate the high frequency ("HF") and low frequency ("LF") components of the RR tachogram power spectrum.

Results: Similar to the previous findings, children with an ASD had significantly longer PLR latency ($p < 0.0001$) and smaller PLR constriction ($p = 0.0034$) than the typical controls. In typical controls, the PLR latency decreased significantly from 6 to 8 years old (one way ANOVA $p < 0.05$) and stabilized thereafter. No significant age effect was observed in latency obtained in the ASD group. The average heart rate was significantly higher in children with an ASD ($p < 0.05$). The control group showed lower normalized HF power (high frequency power divided by total of high frequency and low frequency power) and higher LF/HF ratios (ratio between high frequency power and low frequency power) during the PLR test than during the resting periods ($p < 0.05$). The same change was also observed in the ASD group, but the magnitude of change was much smaller than that of the controls.

Conclusions: The atypical PLR profiles found in our preliminary study were confirmed in a larger ASD population in this study. The different age effect on PLR latency suggests that the developmental trajectory associated with PLR pathway may be altered in children with ASD. The observed high average heart rate indicated elevated sympathetic tone in the ASD group. HRV changes during administration of the PLR (higher LF/HF and lower HF power) suggest that children with ASD have an altered ANS response to the PLR.

157.026 26 Incidence of Gastrointestinal Distress and Effects of Diet in 1- to 6-Month-Old Infants At High Risk for Autism Spectrum Disorders. K. R. Dobkins*[1], A. Penn[1], S. Taylor[2], L. J. Carver[1], C. Herbert[1] and G. W. Schmid-Schonbein[1], (1)*University of California, San Diego*, (2)*Rady Children's Hospital San Diego*

Background: Gastrointestinal (GI) distress (constipation, diarrhea, vomiting, etc.) is reported to be co-morbid in children with Autism Spectrum Disorders (ASD) although its etiology is not well understood. Preliminary evidence suggests that GI distress in ASD may be associated with "Leaky-Gut", i.e. increased permeability of the intestinal mucosal barrier due to either delayed or abnormal development. During normal digestion, the mucosal barrier is responsible for keeping the powerful digestive enzymes out of the intestinal wall. If these degrading enzymes enter the wall of the intestine, they cause major damage to the intestinal wall, resulting in GI distress. Factors in breast-milk, such as somatostatin, have been hypothesized to protect the intestine by inhibiting the release of digestive enzymes while intestinal barrier is still developing. In sum, we hypothesize that GI distress in association with ASD may result from an interaction between 1) increased permeability of the intestinal mucosal barrier and 2) diet.

Objectives: In the current study, we examined whether infants at "High-Risk" for ASD because they have an older sibling diagnosed with the disorder, show an elevated predisposition for GI distress (possibly due to Leaky-Gut), and whether this predisposition is affected by choice of diet.

Methods: Our sample included 38 "High-Risk" infants (from families with an older sibling with ASD) and 83 "Low-Risk" control infants (from families with an older sibling, but no ASD history). Parents filled out extensive questionnaires about their infant's GI history and diet, between the ages of 1- and 6-months. They were asked to report on the absence/presence of GI problems that were serious enough to seek medical advice, and at what age this occurred. They were also asked to report the infant's diet history between 1- and 6-months, selecting one of three categories: breast-milk only (BMO), no breast-milk (NBM) and sometimes breast-milk (SBM).

Results: Across diet categories, the incidence of GI problems in High-Risk infants (47%) was 1.5-fold higher than in Low-Risk infants (33%). These effects varied with diet category. Whereas High- and Low-Risk infants exhibited about the same incidence of GI distress when fed a BMO diet (High-Risk = 25%, Low-Risk = 24%), when fed a NBM diet, GI problems in High-Risk infants (61.5%) were 2.9-fold higher ($p = 0.034$, chi-squared) than in Low-Risk infants (21.4%). These effects were not driven by age, i.e., they were not due to infants tending to be younger in the BMO, than in the NBM, category.

Conclusions: The impact of a non-breast milk diet on GI distress is greater in High-Risk, than Low-Risk infants, with High-Risk infants showing atypically elevated GI distress when not on a BMO diet. Such findings are consistent with the possibility that GI distress in association with ASD may result from an interaction between Leaky-Gut and diet early in development. We are tracking biological markers of Leaky-Gut in these infants, which will help elucidate the nature of their GI distress and hopefully lead to effective early intervention. Supported by NS071580.

157.027 27 Gene Expression Profiles of Inflamed Bowel Biopsy Tissue in ASD Children Are Consistent with Inflammatory Bowel Disease. S. J. Walker*[1], J. Fortunato[2] and A. Krigsman[3], (1)*Wake Forest Institute for Regenerative Medicine*, (2)*Wake Forest University Health Sciences*, (3)*Pediatric Gastroenterology Resources of New York*

Background: Chronic gastrointestinal (GI) symptoms in children with autism spectrum disorders (ASD) are common and not well understood. It is unclear if GI symptoms and intestinal mucosal inflammatory changes seen in children with ASD represent a variant of inflammatory bowel disease (IBD) versus non-specific colitis or "normal" mucosal cellular composition. Some studies have demonstrated histochemical and immunohistochemical features of the bowel mucosa, lamina propria and mucosal basement membrane which may be unique to children with ASD. The recent emergence of gene expression profiling as a valid methodology for distinguishing various forms of IBD potentially adds a further tool in defining the characteristics of ASD-associated intestinal inflammation.

Objectives: The goal of this study was to use a molecular approach to evaluate gene expression profiles in both histologically inflamed and non-inflamed ileocolonic biopsy specimens from ASD children with chronic GI symptoms and to compare them to gene expression profiles in ileocolonic tissue of neurotypical children with Crohn's disease. Significant overlap of gene expression in these two groups would suggest that ASD-GI represents an IBD variant; differences in the ASD-GI gene expression profile would highlight the nature of its distinction from Crohn's disease.

Methods: Study tissue consisted of ileocolonic biopsies from two groups: (1) children with an ASD undergoing ileocolonoscopy for active gastrointestinal symptoms and, (2) neurotypical children diagnosed with Crohn's disease. All tissue specimens were collected under appropriate IRB approval. For each individual (seven per group; fourteen in total) two biopsies were used: one from the terminal ileum with active inflammatory changes and one from the colon demonstrating normal mucosa (control). Total RNA was isolated from the individual tissue biopsy specimens and used to query whole genome DNA microarrays. For each of the two groups, ASD-GI and CD, differential gene expression was determined by comparing the inflamed tissue within a group to the control tissues from the same group. Next, differential gene expression was compared between the ASD-GI and CD groups to evaluate similarities and differences.

Results: In each group there were ~2000 transcripts differentially expressed between inflamed and control tissue. Within the 900 differentially expressed genes shared by both ASD-GI and CD, two highly relevant biological functional groups represented by these transcripts were *gastrointestinal disease* (including CD [$p = 0.001$] and IBD [$p = 0.001$]) and *inflammatory response* [$p = 0.000003$]. In the 912 differentially expressed transcripts unique to ASD-GI, the most significant biological functional group represented was *gastrointestinal disease* (including IBD and CD). In contrast, there were 1200 genes uniquely differentially expressed in CD and the primary biological functions represented by these transcripts were *immune response* [$p = 6.6 \times 10^{-14}$] and *autoimmune disease* [$p = 4 \times 10^{-7}$].

Conclusions: These results demonstrate that ASD-GI presents a gene expression profile significantly overlapping with Crohn's disease and consistent with the larger category of inflammatory bowel disease.

157.028 28 Increased Sympathetic Nervous System Tone in Autism Spectrum Disorders with Comorbid Gastrointestinal Symptomatology. B. J. Ferguson*[1], J. R. Day[1], B. R. Wexler[1], R. E. Lavoy[1], R. M. Zamzow[1], P. S. Foster[2] and D. Q. Beversdorf[1], (1)*University of Missouri*, (2)*Middle Tennessee State University*

Background: There appears to be a high prevalence of gastrointestinal (GI) symptomatology in children with autism spectrum disorders (ASD) (e.g., Williams et al., 2010), and evidence suggests that the response to stress in ASD is augmented (Corbett et al., 2008). Furthermore, an association exists between stress and GI disorders (e.g., Suarez et al., 2010). In addition, sensory dysfunction is commonly linked to core symptomatology in ASD (e.g., Boyd et al., 2010) and may interact with stress in the maintenance of GI disorders in ASD. However, despite this knowledge, the relationship between stress indices, GI disturbances, and sensory functioning has not been explored in ASD.

Objectives: We sought to examine the relationship between the response to stressful stimuli in children with ASD both with and without gastrointestinal disorders or significant GI symptomatology. Galvanic skin response (GSR), a measure of eccrine gland activity, and electrocardiogram (ECG), a measure of the electrical signals of the heart, were used as indicators of sympathetic nervous system activation. Data were recorded for a baseline condition as well as in response to auditory and vibrotactile stimulation as well as cold temperature. We hypothesized that the response to stress in children and adolescents with ASD with a GI disorder or significant GI symptomatology would be higher than those with ASD alone. Furthermore, we sought to determine if the response to stress was independent of generalized sensory dysfunction.

Methods: Children and adolescents with an ASD diagnosis with a comorbid GI disorder, as assessed by the Pediatric Questionnaire on Pediatric Gastrointestinal Symptoms (QPGS-RIII), and those with ASD without a GI diagnosis or significant GI symptomatology had GSR and ECG data recorded for a baseline condition as well as independent conditions of auditory, vibrotactile, and cold temperature stimulation. Current sensory functioning in 7 different domains was assessed using a sensory questionnaire completed by the participant's caregiver.

Results: An omnibus one-way ANOVA across all stress conditions, including baseline exposure to the testing environment, indicated that mean GSR was significantly higher for the ASD GI group. The same effect was revealed for ECG, where mean RR interval was lower (i.e., faster heart rate) for the ASD GI group. Total score on the sensory functioning questionnaire did not differ significantly among the groups. The effects on GSR and ECG remained significant after controlling for the effect of sensory functioning.

Conclusions: Preliminary results from our pilot study suggest that the psychophysiological response to sensory stimuli, as evidenced by GSR and ECG, may differ in those with ASD with a GI disorder or significant GI symptomatology relative to those with ASD alone. Moreover, these differences appear to be largely independent of generalized sensory dysfunction. Although our data indicate differences in physiological responding among the groups, a larger sample size is needed to determine if the effects can be substantiated. Identifying the aspects contributing to GI problems in ASD will be important for optimizing future treatment strategies.

157.029 29 Molecular Characterization of Gastrointestinal Microbiota in Children with Autism (both with and without gastrointestinal dysfunction) and Their Neurotypical Siblings. S. V. Gondalia*, D. W. Austin and E. A. Palombo, *Swinburne University of Technology*

Background: In addition to core behavioral symptoms of autism, reports of gastrointestinal dysfunctions such as constipation, diarrhoea, and abdominal bloating are common. These observations have stimulated investigation of abnormalities of intestinal microbiota in autistic patients. Disruption of normal neurodevelopment by bacterial products, including lipopolysaccharides, toxins and metabolites, has been theorized to contribute to autistic pathology. We note that not all autistic individuals suffer from GI dysfunction; only a sub-population is affected. Although numerous intestinal microbial abnormalities have been identified in autism, conflicting results have often been reported. The purpose of this study was to identify whether a difference exists between the resident GI microbiota in children with autism (with and without GI dysfunction) and their neurotypical siblings.

Objectives: Generally, the GI microbiota is influenced by diet and environmental sources. Therefore, this study was designed to identify differences (and/or similarities) of the gut microbiota in children with autism (with and without GI

dysfunction) and their neurotypical siblings who share a similar environment.

Methods: Faecal samples from children with autism (without GI dysfunction: n = 23; with GI dysfunction; n = 28), healthy sibling controls (n = 53) were studied by using the bacterial tag encoded FLX amplicon pyrosequencing (bTEFAP) procedure.

Results: Differences in bacterial composition between cases and controls were evaluated by UniFrac and analysis of similarity matrices. Overall, Firmicutes (70%), Bacteroidetes (20%) and Proteobacteria (4%) were the most dominant phyla in the total sample. Although autism samples differed from control across several species-specific variables, there were no clinically meaningful significant differences between the groups. Nevertheless, when the autism group was divided according to GI dysfunction, several significant microbial differences were apparent, although, these were not consistent across individuals and showed substantial variation.

Conclusions: The data do not support an association between autism and gastrointestinal microbiota generally; however, the data do indicate that there is a sub-population within autism that experience GI dysfunctions which may be associated with aberrant GI microbiota. This study has implications for treatment strategies in autism aimed at manipulation of the microbiota to reduce GI dysfunction. Further research is required to determine the optimal approach (e.g. anti/pro-biotic, dietary) and such approaches may necessarily need to be tailored to individual patients based on clinical microbial findings.

157.030 30 Gastrointestinal Problems, and Abdominal Pain in Particular, Are Associated with Affective Problems but Not Externalizing Behaviors in Children with High-Functioning Autism. D. R. Schreiber*[1], C. A. Mazefsky[2] and N. J. Minshew[2], (1)*University of Pittsburgh School of Medicine*, (2)*University of Pittsburgh*

Background: Many children with autism spectrum disorders (ASD) exhibit emotional and behavioral problems as well as gastrointestinal (GI) symptoms at high rates. While both problems have received attention separately, there is limited knowledge concerning how emotional and behavioral problems may be associated with GI symptoms in ASD. As emotional and behavioral problems can often be manifestations of underlying medical conditions, it was of interest to explore how GI symptoms may relate to behavioral problems in a population of children with high-functioning ASD. Further, there has been extensive research in typical populations on associations between abdominal pain and anxiety and depression, but little information exists on this relationship in ASD.

Objectives: The goals of this study were to identify patterns of emotional and behavioral problems and GI symptoms in children with high-functioning autism, and to explore how GI conditions may relate to emotional and behavioral problems in this population. This included a more targeted exploration of the relationship between abdominal pain in particular and emotional and behavioral presentation in ASD.

Methods: Participants included 95 children who met criteria for autism on The Autism Diagnostic Observation Schedule (ADOS-G) and the Autism Diagnostic Interview (ADI-R). All children had IQ scores ≥80. Parents completed the Social Responsiveness Scale (SRS), the Vineland Adaptive Behavior Scale and the Child Behavior Checklist (CBCL). GI symptoms were measured with the Autism Treatment Network's (ATN) GI Symptoms Inventory Questionnaire.

Results: Overall, 61% of children were reported to have some type of GI symptom. Of the GI symptoms, abdominal pain was most common (41.1%) followed by not feeling hungry after eating very little (40%), other symptoms not otherwise reported (17.9%; e.g. constipation, diarrhea), and bloating (10.5%). There was no difference between children with GI symptoms and those without GI symptoms on scores on the SRS, overall adaptive behavior, or the Total Problems scale of the CBCL. When specifically looking at the DSM-oriented scales on the CBCL, it was found that the number of GI symptoms was positively correlated with Affective Problems (r = .39) and Somatic Complaints (r = .36), $p < .001$. Children with reported abdominal pain had higher CBCL t-scores for Somatic Complaints ($p < .001$) and Affective Problems ($p = .001$) compared to children without abdominal pain. The presence

of abdominal pain accounted for 7.2% of the variance in Affective Problems above and beyond IQ and age.

Conclusions: A high prevalence of GI conditions is reported by parents of children with high-functioning autism. A relationship between abdominal pain and externalizing behaviors was not supported. However, abdominal pain was significantly associated with both somatic complaints and affective problems, consistent with research in typically-developing populations. This is an important finding given that research in typical populations suggests a greater degree of functional disability when both abdominal pain and depression co-occur. Additional research is needed to further explore the relationship between GI symptoms and behavioral and emotional concerns in ASD, as well as to identify potential casual factors and treatment implications.

157.031 31 Sleep Issues In ASD: Behavioral Implications for Adolescents. D. M. Antovich[1], J. Munson[1], T. St. John[2], S. R. Dager[1] and A. M. Estes*[1], (1)*University of Washington*, (2)*University of Washington Autism Center*

Background: It is estimated that two-thirds of children and adolescents on the autism spectrum have sleep problems. The most common type of sleep problems reported in ASD include delayed sleep onset, waking during nighttime sleep, and early awakening. Greater night-to-night variability, breathing problems, morning rise problems, and daytime sleepiness have also been reported. Behavioral conditions (e.g., autism symptoms, social interaction problems, stereotypic behavior) have been found to be associated with sleep problems in children with ASD. However, the relationship between problem behaviors and sleep problems in adolescents with ASD is currently not well understood.

Objectives: The present study aims to explore the relationship between sleep disturbance and (1) social impairment, (2) problem behavior, and (3) peer relations in adolescents with ASD.

Methods: As part of a larger, ongoing, longitudinal study (NIH-ACE, Estes, PI) of adolescents with ASD (ASD; Mean age=14 years, 5months) and an age-matched, typically developing control group (TYP) were assessed for sleep problems via parent report on the Pediatric Sleep Questionnaire (PSQ), yielding four subscales and an overall score for symptoms of sleep related breathing disorders (SRBDs). Social impairment was assessed with the Social Responsiveness Scale (SRS). Problem behaviors were assessed with the Aberrant Behavior Checklist (ABC) utilizing the Irritability, Agitation, Social Withdrawal, Stereotypic Behavior, Stereotyped Speech, and Hyperactivity subscales, and the Conner's 3rd Edition (Conner's), utilizing the Hyperactivity and Aggression subscales. Peer relations were assessed with the Conner's Peer relations subscale.

Results: The ASD group (n=22; Mean IQ=104) demonstrated significantly higher rates of SRBDs than the TYP group (n=24; Mean IQ=124; $p<0.05$). Analyses will investigate (1) whether in the social impairment domain, worse social impairment on the SRS is significantly related to higher levels of SRBDs in the ASD and TYP groups; (2) whether in the problem behavior domain, higher levels of problem behaviors are significantly related to higher levels of SRBDs in the ASD and TYP groups, and (3) whether in the peer relations domain, worse peer relations are related to higher levels of SRBDs in the ASD and TYP groups.

Conclusions: This study is consistent with previous research demonstrating that sleep problems frequently occur in ASD. We will investigate whether these sleep problems may have an impact on daytime functioning in the domains of problem behavior, social impairment, and peer relations in adolescents with ASD. If these relationships are found, they will have implications for assessment and intervention with adolescents with ASD. It would suggest that widening the scope of clinical assessment protocols to include sleep disturbance is warranted. It would also suggest that sleep disturbance may be an important target for ASD intervention programs aiming to improve adolescent functioning. Further research is needed to clarify the direction of these relationships, specifically whether sleep disturbance causes behavioral and social impairments in ASD, or vice versa, or whether an unidentified factor may contribute to the co-occurrence of daytime and nighttime difficulties. Future studies may also benefit from the use of more direct methods of sleep quality assessment such as polysomnography or actigraphy.

157.032 32 The Validity of Actigraphy As a Diagnostic Tool for Sleep Disturbances in Children with Autism Spectrum Disorders. H. Holbrook*[1], K. Maski[1], E. Hanson[1], D. S. Manoach[2] and R. Stickgold[2], (1)*Children's Hospital Boston*, (2)*Harvard Medical School*

Background: Children with autism spectrum disorders (ASD) experience sleep disturbances at a disproportionate rate compared to their typically developing peers. Due to the inherent difficulties in performing polysomnography (PSG) with children in this population, actigraphy is often used to collect data about sleep habits and disturbances. As this data is frequently used diagnostically, it is crucial to determine its validity to ensure that children with ASD are receiving appropriate sleep diagnoses and interventions.

Objectives: This study aims to characterize the degree to which actigraphy is an accurate measurement of sleep habits and a valid tool in diagnosing sleep disturbances in children with ASD. Additionally, this study explores the feasibility of using in-home ambulatory PSG as an alternative diagnostic tool for this population of children, and will report on the detailed sleep architecture of children with ASD.

Methods: 19 adolescents aged 9-18 years have been recruited and have completed study requirements. Currently, data have been analyzed for 11 typically developing (TD) children and 8 children with a previous diagnosis of ASD, confirmed by the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised. Data regarding typical sleep habits were collected via actigraphy and sleep diaries during one week leading up to a home-based PSG recording. Recruitment and data analysis are ongoing.

Results: Preliminary analyses indicate discrepancies between actigraphy and PSG reports of sleep efficiency, exclusively for the children with ASD. In these children, actigraphy significantly underestimated sleep efficiency compared to PSG recordings ($p<.05$). In-home PSG recording has been successful in all ASD participants run thus far.

Conclusions: Based upon preliminary analyses, actigraphy does not appear to be a valid measurement of all sleep parameters. This is problematic, particularly in the ASD population, for which actigraphy is frequently used due to aversion to PSG. However, we have found great success with ambulatory in-home PSG, incorporating desensitization protocol when necessary. Taking the discrepancy findings alongside the successful PSG recordings, this study has strong clinical implications for the support of in-home PSG recordings in assessing sleep disturbances in children with ASD.

157.033 33 Sleep Behaviors in Infants At High and Low Risk for Developing Autism Spectrum Disorders. S. Kauper*[1], M. C. Souders[2], S. Paterson[1] and I. Network[3], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania/The Children's Hospital of Philadelphia*, (3)*UW, UNC, WASTL, CHOP*

Background: Sleep in children with Autism Spectrum Disorder (ASD) is seen as a serious problem by many parents. Evidence shows prolonged sleep latency (time taken to go to sleep) as well as diminished sleep quality in children with ASD (Mallow, 2006). Given that about 20% of infants with an older sibling with ASD will develop ASD themselves (Ozonoff et al., 2011), it is important to characterize the sleep behavior of infants high risk for ASD (HR), so that difficulties can be addressed as early as possible.

Previous research using sleep items from a temperament questionnaire (IBQ-R Rothbart, 2000) has shown that at 6 months of age, sleep behaviors are similar in HR infants and those that are low risk (LR) for developing ASD. However, the groups begin to differentiate at 12 months, when the prevalence of sleep problems increases in HR children (Souders et al., 2010). In addition, direct measures of sleep behavior using actigraphy have demonstrated that children with ASD had greater occurrences of sleep disturbances compared to typically developing children, with particular problems with sleep latency (Souders, et al. 2009).

Objectives: The primary goal of the current project is to examine sleep behaviors in 6 and 12 month infants and later in toddlers at 24 months using a specialized sleep measure - The Brief Infant Sleep Questionnaire – (Sadeh, 2004) to investigate whether accepted measures of sleep pathology are more severe in HR infants.

Methods: Data were collected from parent report measures on 6 and 12-month-old infants who were enrolled in a multi-site longitudinal study of brain and cognitive development. The Brief Infant Sleep Questionnaire (BISQ) was administered at one site as part of a battery of cognitive and behavioral measures. Thus far data has been collected from 14 HR infants (mean age: 8.7, 10 males) at high-risk for developing autism and 5 TD infants (mean age: 11.4, 4 males), but data collection is ongoing. Data analyses focused on the 3 areas: sleep latency, duration of sleep and number of night wakings, which were highlighted by Sadeh (2004).

Results: Preliminary analyses revealed that sleep latency differed between the high risk and low risk groups, with the HR infants taking a 21 minutes to go to sleep and the LR infants taking 11 minutes, $t(15) = 2.99$, $p<.01$. However, no differences were found between groups in the number of night wakings or the total duration of sleep. These data suggest that HR infants struggle with going to sleep, confirming results from other studies using direct measures of sleep.

Conclusions: Sleep difficulties have often been reported in older children and adults with ASD. The current preliminary data suggest that these difficulties may already be present in infancy. Further analyses are planned to investigate the developmental trajectory of sleep behaviors in these infants from 6 to 24 months as data continues to be collected in both infants and in an additional group of toddlers.

157.034 34 Sleep Quality in Children and Adolescents with Autism Spectrum Disorder with and without Anxiety Compared to Typically Developing Children. M. C. Souders*[1], L. Berry[2], I. Giserman[2], C. M. Puleo[2], W. Eriksen[3], A. Bennett[2] and J. D. Herrington[2], (1)*University of Pennsylvania/The Children's Hospital of Philadelphia*, (2)*Children's Hospital of Philadelphia*, (3)*University of Pennsylvania*

Background: One of the most common medical conditions in children with ASD is chronic severe insomnia, with a prevalence estimate of 60-80% (Wiggs and Stores, 2004, Souders et al , 2009). This is a 2-3 fold increase over typical developing children (TDC). Adequate sleep is critical for the most advantageous neurobehavioral and physiological development and functioning (Banks and Dinges, 2007, Goel, et al, 2009). Inadequate sleep has been shown to have detrimental effects on cognition, behavior, mood, and attention (Gozal, 1998, Maquet, 2001). The core deficits of ASD, and their underlying neurobiology, may predispose children with ASD to intrinsic and extrinsic factors that threaten sleep. There are many possible causes of sleep disturbances in ASD, however, the two predominant sleep disorders in ASD are behavioral insomnia and insomnia secondary to their ASD (Wiggs and Stores, 2004, Souders et al , 2009). One hypothesis for intrinsic insomnia in ASD is that synaptic pathway anomalies alter levels of excitory neurotransmitters (Bourgeon, 2007). This arousal dysregulation may be the underlying mechanism of the high levels of anxiety, fears and hypersensitivity to environmental stimuli experienced in ASD and may contribute to difficulties initiating and maintaining sleep. Anxiety is considered a part of the arousal continuum and to date we have limited understanding of the relationship between anxiety symptoms in ASD and insomnia.

Objectives: The purpose of this study is to investigate the nature of the relationship between anxiety symptoms and sleep in children with ASD as compared to TDC.

Methods: Thirty one of the projected sample of 50 children with ASD, ages 6-17, were recruited from a larger funded study and compared to 8 of the projected sample of 50 TDC. The subjects had general cognitive function testing and ASD diagnose confirmed by ADOS/ ADI. The anxiety symptoms were evaluated by the neuropsychology team utilizing the Anxiety Diagnostic Interview Schedule (ADIS- C/P), child and parent version , a two hour structured interview, and anxiety questionnaires. Sleep was characterized by 5-7 nights of an objective measure, actigraphy using the Sadeh algorithm, sleep diaries, sleep questionnaire and a comprehensive medical interview by the nurse researcher.

Results: A DSM-IV-TR anxiety diagnosis was identified with the ADIS-C/P in 18 of the 31 ASD subjects (58%). One ASD subject met criteria for Anxiety Disorder- NOS. One of the 8 TDC was identified with a specific phobia. Insomnia was identified in 51% of the ASD, defined as a sleep latency greater than 30 minutes by actigraphy. No TDC were identified with insomnia. We found significant differences in sleep latency ($p= .oo4$), sleep efficiency ($p=.049$) and wake in

minutes (p=0.014) and a trend in sleep minutes (p=.064) when comparing ASD children with anxiety (n=19) and without anxiety (n=12). Moreover, we found no significant difference in the four sleep parameters between the TDC and the ASD group without anxiety.

Conclusions: This preliminary data suggests that anxiety and insomnia are linked. We hope after the completion of this study we will provide insights into the co-treatment of anxiety and insomnia in ASD.

157.035 35 The Relation Between Poor Sleep and Executive Functioning in Children with Autism Spectrum Disorders. O. Hsin*, M. C. Souders, R. T. Schultz and S. F. Epstein, *Children's Hospital of Philadelphia*

Background: Poor sleep has been associated with executive function impairments in clinical and typical populations. Specific effects of sleep among youths with autism spectrum disorders (ASD) are less clear. Cognitive and behavioral rigidity, and working memory weaknesses are aspects of executive function frequently observed in ASD.

Objectives: (1)Examine whether poorer sleep is associated with greater impairment in emotional lability, cognitive and behavioral rigidity, working memory, and overall executive function impairment among ASD and Typically Developing Children (TDCs). (2)Test ASD as a moderator of the association between sleep and executive functions.

Methods: Participants were 100 youths aged 6 to 17 with ASD (*n*= 58; 83% male; mean age 9.3±2.8) or TDC (*n*=42; 62% male; mean age =9.2±2.3). ASD diagnoses were made based on ADOS, ADI-R, and clinical judgment. Youths were administered the DAS II to assess their General Cognitive Abilities (ASD=100.6±19.1; TDC=100.0±11.6). Parents completed (1) the Behavior Rating Inventory of Executive Function (BRIEF) which yielded a measure of cognitive and behavioral rigidity (Shift Scale; ASD=68.2±13.2; TDC=44.5±8.4), emotional lability (Emotional Control scale; ASD=62.1±11.1; TDC=44.8±8.3), working memory (Working Memory scale; ASD=65.3±10.3; TDC=45.9±8.3) and overall executive function impairment (Global Executive Composite; ASD=67.3±9.3; TDC=44.1±8.6) (higher scores indicated greater impairment); (2) the Children's Sleep Habits Questionnaire (CSHQ) which yielded a total subscale score (ASD=47.7±11.8; TDC=43.2±12.3; higher score indicated poorer sleep). Hierarchical regression examined "predictors" of specific and overall executive function impairment, by entering control variables of age, sex, and cognitive functioning (Steps 1-3), followed by group (ASD or TDC) (Step 4), CSHQ score (Step 5), and sleepxgroup Interaction term (Step 6).

Results: Main effects were found, such that group (ASD) and sleep were both significant independent "predictors" of Emotional Control, Shift, Working Memory, and Global Executive Composite scores (p<.001 for all β's). Significant moderations for group were found for Shift, Working Memory, and Global Executive Composite scores. Posthoc analyses revealed that poorer sleep and higher Shift scores were associated (β=.50, p<.001) for the ASD group but not the TDC group. Poorer sleep explained 17.1% of variance in working memory among youths with ASD (β=.44, p<.001), but was not significant among TDCs. Lastly, poorer sleep and greater levels of impairment in Global Executive Composite scores were positively associated with ASD (β=0.55, p<.001) and negatively among TDCs (β=-.04, p<.001).

Conclusions: Poorer sleep and poorer emotional control were associated for all youths. Poorer sleep was not associated with impaired Shift, Working Memory, and Global Executive Composite scores in TDCs. It is unclear if findings are due to a lack of association, or smaller variance in sleep among the TDC sample. Poorer sleep *was* associated with more impaired Shift, Working Memory, and Global Executive Composite scores in the ASD group. These scores reflect functions that are associated with the core deficits in ASD that have a significant impact on academic, community, and social functioning. We hypothesize that poor sleep causes problems with day-to-day cognitive and emotional control that negatively impacts adaptive functioning and quality of life. If true, more effort should be devoted to sleep intervention for ASD.

157.036 36 Correlations Between Sensory Processing Symptoms and Sleep Disturbances Among Children with Autism Spectrum Disorders. M. Mosner*[1], L. E. Bradstreet[2], L. Guy[1], R. Schaaf[3], R. T. Schultz[2] and M.

C. Souders[2], (1)*Children's Hospital of Philadelphia, Center for Autism Research*, (2)*Children's Hospital of Philadelphia*, (3)*Thomas Jefferson University*

Background: Delayed sleep onset and short sleep duration are functions of arousal dysregulation and are commonly reported for individuals with Autism Spectrum Disorders (ASD). In a study by Souders et al. (2009), parents reported that their children's hypersensitivity to environmental stimuli may have contributed in part to their sleep disturbances. Sensory modulation disorders can also be viewed as reflecting difficulties with arousal regulation. Upwards of 90% of individuals with ASD demonstrate unusual sensory symptoms that interfere with their daily routines (Baranek, et al, 2006). However, despite personal accounts and a growing body of evidence regarding the disability associated with poor sensory processing among individuals with ASD, (O-Riordan et al., 2006), these symptoms are poorly characterized among this population, the underlying mechanisms are not well understood, and current practices to address sensory problems lack an adequate theoretical basis and empirical data to support their utility (Rogers & Ozonoff, 2005). In addition, few studies have explored the role of sensory impairments as a contributor to sleep disturbance in an ASD population.

Objectives: The aim of this study was to examine the relationship between sleep disturbance and sensory processing impairments in a well-characterized sample of children with ASD. Our specific focus was to determine if higher rates of sleep disturbance are associated with particular sensory symptoms within this population.

Methods: The preliminary sample included 22 individuals with ASD ages 6-10 years of age (*M*=7.64, *SD*=1.39) and 25 typically developing control individuals (*M*=7.60, *SD*=1.38) matched for IQ. All subjects were part of a larger neuroimaging study at the Center for Autism Research. The diagnosis of ASD was confirmed using ADI-R and ADOS, and IQ was assessed using the DAS-II. Sleep disturbance was measured by parent report using the Children's Sleep Habits Questionnaire (CSHQ; Owens, 2000), which yields a total Sleep Disturbance score and 8 subscale scores. The subscales of Sleep Onset Delay and Sleep Duration were the focus for this project. The scores from the Sensory Profile (Dunn, 1999), a parent-report measure, were used to measure sensory processing symptoms. This measure classifies individuals into the subgroups of Sensory Sensitive, Sensory Avoiding (low threshold groups), Low Registration and Sensation Seeking (high threshold groups). Additionally, a total score for the Short Sensory Profile (SSP) was calculated.

Results: Data collection is ongoing. Preliminary analyses indicated that the ASD group demonstrated more sensory processing symptoms overall on the SSP, $t(31.23)=-6.00$, $p=.00$. There were no group differences on the CSHQ Total, $t(45)=-.31$, $p=.76$. No significant correlations were found between sleep disturbance and the Sensory Profile domain scores or the Short Sensory Profile total. Additional analyses will explore this relationship in more detail.

Conclusions: Gaining a better understanding of the relationship between sleep disturbance and sensory modulation disorders among children with ASD may aid in the development of more effective interventions tailored to individuals based on their particular sensory deficits.

157.037 37 Distinct Facial Phenotypes in Children with Autism Spectrum Disorders and Their Unaffected Siblings. J. R. Austin*[1], I. D. George[1], K. K. Cole[2], T. N. Takahashi[1], Y. Duan[3], J. H. Miles[1] and K. Aldridge[1], (1)*University of Missouri - Thompson Center for Autism and Neurodevelopmental Disorders*, (2)*University of Missouri School of Medicine*, (3)*University of Missouri*

Background:

The neurodevelopmental hypothesis of autism holds that the cause(s) of autism spectrum disorders (ASD) occur during early prenatal development, affecting the developing brain. The brain and face are intimately related during development, sharing molecular, biochemical, and biomechanical influences. Our previous work has shown that boys with ASD display subtle, but distinct facial phenotypes as compared to typically- developing boys, and that these facial phenotypes are correlated with cognitive and clinical phenotypes. Further, facial phenotypic differences correspond to distinct developmental structures of the face. Given the shared genetics between siblings, we expect that children with

ASD and their unaffected siblings will share facial phenotypic characteristics that distinguish them from typically-developing children.

Objectives:

Here, we test the hypothesis that unaffected siblings possess a facial phenotype that is intermediate between children with ASD and typically-developing children.

Methods:

Our sample included a total of 213 participants, ages 4-18 years: 68 boys with ASD, 77 unaffected siblings of probands, and 69 typically-developing children. 3-D photographs were collected using the 3dMD Cranial® system. 3-D coordinates were collected for 17 anthropometric facial landmarks using 3dMD Patient® software. All possible linear distances between these landmarks were analyzed and statistically compared among the groups using Euclidean Distance Matrix Analysis (EDMA) and Principal Coordinates Analysis.

Results:

Our results indicate that there are some phenotypic differences that distinguish both the affected and unaffected siblings from the typically-developing boys; these differences are localized to the lateral eye and temporal region. However, unaffected siblings show greater differences from the typically-developing children than the children with ASD. Features that distinguish the unaffected siblings from the typically-developing group that are not observed in the probands include the region around the temples, narrowing of the eyes, and shorter and narrower measures of the philtrum. Further, unaffected siblings have narrower mouths than the children with ASD.

Conclusions:

Unaffected siblings of children with ASD differ more from their affected siblings than from the typically-developing controls. Although the cause of this variation cannot be definitively identified from this study, it is clear that the sibling pairs and typically-developing children undergo diverse patterns of head development. Localization of this facial phenotypic variation provides clues to when and where this divergence may arise, and how these divergent patterns correlate with gene expression. Future study will assess the relationships between these distinct facial phenotypes with behavioral phenotypes, and with genetic variation.

157.038 38 2D Facial Pattern Analysis for Autism. T. Obafemi-Ajayi[1], B. Morago[1], J. Wilson[1], T. N. Takahashi[2], K. Aldridge[2], J. H. Miles[1] and Y. Duan*[1], (1)*University of Missouri*, (2)*Thompson Center for Autism and Neurodevelopmental Disorders*

Background:

Recent studies suggest that differences in facial morphology in children with autism spectrum disorder (ASD) compared to typically developing children (control) exist and may reflect alterations in embryologic brain development. As ASD can present a wide range of symptoms, the same variations of facial morphology may help pinpoint differing forms of this disorder. Experiments run on 3D facial images indicate statistically significant differences in facial morphology for various ASD subgroups. In this study, we investigate whether similar findings can be observed using 2D facial images, as they are more readily available and easier to capture. Our study includes tests for distinguishing between the ASD and control groups as well as for identifying subgroups within the ASD group.

Objectives:

The goals are to define discriminant facial phenotypes directly from the 2D facial photographs in order to aid in the early diagnosis of ASD, as well as to identify meaningful subgroups for clinical and genetic study.

Methods:

We defined facial features based on anthropometric landmark points which were extracted from the 2D facial photos. From these landmarks, we calculated feature distances on each face by computing the Euclidean distance between pairs of landmarks. Our study sample consisted of 172 children with autism and 54 typically developing children. To identify potentially strong features for distinguishing between the groups, we first performed Principle Component Analysis on

varying subsets of the feature distances. This step allowed us to see which feature distances account for large variations within the dataset. The data set was then separated into groups by using Expectation–Maximization clustering. The obtained clusters were validated using Adaboost ensemble classification. The discriminant facial features from this step were selected by evaluating the ranked significance of each feature using the Info-Gain attribute evaluator and Forward Feature selection.

Results:

First, we identified significant differences in 2D facial morphology in children with ASD compared to typically developing children. Second, we observed five facial feature distances that may be highly discriminant in identifying several subgroups of ASD children from typically developing children.

Conclusions:

2D facial images contain clinically-meaningful facial phenotype information capable of distinguishing ASD children from typically developing children as has been described previously by 3D studies.

157.039 39 A Prospective Case Series of Premature Infants Who Developed Autism Spectrum Disorder. C. Roncadin*[1], F. Nawaz[2], J. Brian[3], S. E. Bryson[4], A. Niccols[5], W. Roberts[3], I. M. Smith[4], P. Szatmari[6] and L. Zwaigenbaum[7], (1)*Peel Children's Centre*, (2)*University of Toronto Mississauga*, (3)*Holland Bloorview Kids Rehabilitation Hospital*, (4)*Dalhousie University/IWK Health Centre*, (5)*Hamilton Health Sciences Centre*, (6)*Offord Centre for Child Studies, McMaster University*, (7)*University of Alberta*

Background: Prematurity has been identified as a significant perinatal risk factor for Autism Spectrum Disorder (ASD), but no study has used standardized measures to follow a cohort of premature infants prospectively to examine the emergence of autistic symptomatology.

Objectives: To document the emergence of ASD in a case series of premature infants.

Methods: We recruited 49 participants (2 sets of triplets, 11 sets of twins, 21 singletons) at 12 months corrected age for our prospective study. All participants completed the Mullen Scales of Early Learning at ages 1, 1.5, 2, and 3 years. The Autism Observation Scale for Infants (AOSI) was completed at the 1- and 1.5-year visits, and the ADOS was completed at the 2- and 3-year visits. Independent diagnoses were made/confirmed at age 3 by a clinician blind to previous study data, and were based on the Autism Diagnostic Interview-Revised, Autism Diagnostic Observation Schedule (ADOS), and clinical judgment using DSM-IV criteria.

Results: Five out of the 17 cases seen to date for their 3-year visit received an ASD diagnosis. Cases 1 and 2 were fraternal twin girls, cases 3 and 4 were identical twin girls, and case 5 was a fraternal twin boy (born at 32, 26, and 28 weeks gestation, respectively). Cases 1, 3, and 5 had average cognitive functioning at 12 months; Case 5 remained in the average range at age 3, whereas Cases 1 and 3 showed a dramatic decrease in cognitive functioning through age 3. Cases 2 and 4 had below average cognitive functioning at 12 months and showed a further decrease through age 3. All five cases showed an increase in ADOS severity scores between ages 2 and 3 (Case 5 had the lowest ADOS severity score at age 3). Cases 1 and 5 had few signs of ASD on the 12-month AOSI, and then showed more ASD signs at each subsequent visit through age 3. Cases 3 and 4 showed fewer ASD signs on the AOSI at 18 months compared to 12 months, but then scored in the Autism range on the ADOS at ages 2 and 3. In Cases 1 through 4, one particular ASD sign, lack of social babbling, was present at 12 months, and another, lack of social smiling, was present at 18 months.

Conclusions: Preliminary examination of the first five cases of ASD in our premature sample indicated that signs of ASD were evident as early as 12 months of age, but that there was heterogeneity in the particular signs manifested across children. There was a pattern of cognitive decline in the majority of cases, although none had a measured or reported language regression. These results suggest that premature infants should be monitored more closely in the second year of life for both developmental delay and ASD signs, particularly if they are multiples. It will be important to assess ASD outcome

for the remainder of the sample to determine whether the patterns in cognitive development and ASD emergence seen in the first five cases are consistent findings.

157.040 40 Refined Subtyping of Autistic Patients Based on Pathogenetic Components. R. Sacco*[1], S. Rossi[2], B. Manzi[2], P. Curatolo[3], C. Bravaccio[4], C. Lenti[5] and A. M. Persico[2], (1)*IRCCS "Fondazione S. Lucia"*, (2)*Child Neuropsychiatry Unit, Univ. Campus Bio-Medico*, (3)*Child Neuropsychiatry, Univ. of Rome 'Tor Vergata'*, (4)*Dept. of Pediatrics, Univ. 'Federico II'*, (5)*Child Neuropsychiatry, Univ. of Milan*

Background: Using principal component analysis and cluster analysis on 245 patients, we have recently described four patient clusters: (a) patients with prominent immune abnormalities accompanied by some circadian and sensory issues; (b) individuals displaying major circadian and sensory dysfunction, with little or no immune symptoms; (c) a third group of patients characterized by prominent stereotypic behaviors, and (d) a residual group showing a mixture of all four components, with slightly greater developmental delay.

Objectives: To replicate and extend this initial clustering of ASD patients using a larger and complete data set.

Methods: We performed 1) hierarchical cluster analysis using a dendrogram and 2) k-means clustering of 286 patients with complete clinical reports, using regression-based factors, each representing one cumulative component score preliminarily obtained by principal component analysis. Hierarchical clustering is a method of cluster analysis which seeks to build a hierarchy of clusters through a "top down" dendrogram approach, where all observations start in one cluster and splits are performed recursively as one moves down the hierarchy. The K-means method is an unsupervised learning algorithm that assumes k clusters fixed a priori and defines k centroids, one for each cluster.

Results: ASD patients could be categorized into seven subtypes according to cluster dendrogram: three clusters, collectively including 72 patients (25.0%), are characterized by intense immune-related symptoms, accompanied by either normal neurodevelopment, isolated language delay or global developmental delay. A forth cluster displays frequent mental retardation with prominent motor/verbal stereotypies, but little or no immune dysfunction (N=64 patients, 22.0%). A fifth cluster shows a predominance of circadian and sensory-related symptoms in the absence of other relevant features (N=67 patients, 23.3%). A rare sixth cluster displays prominent neurodevelopmental delay (N=2, 0.7%). Finally, 81 (29.0%) patients show a mixed pattern.

Conclusions: These results confirm and extend our previous 4-cluster definition, by splitting our original “immune” cluster into three “immune” subgroups based on neurodevelopmental delay and by separating out the neurodevelopmental delay subtype which is quite rare in our sample. Despite the long-recognized interindividual variability in clinical phenotype, it seems increasingly possible to dissect clusters of autistic patients based on clinical, patient and family history variables. We shall now proceed to replicate and extend these results using external validators, such as genetic variants, immune underpinnings, developmental trajectories, biomarkers and response to treatment.

157.041 41 Reported Epilepsy and Abnormal EEG Activity in Individuals with ASD with and without Regression: A Meta-Analysis. J. Campbell, B. Barger*, J. Donald and A. Dubin, *University of Georgia*

Background: A recent meta-analysis reported different rates of regression depending on whether the term regression was operationalized as encompassing mixed, language, social, or language/social (Barger, Campbell, & Donald, 2011). This work is extended by investigating whether children with an autism spectrum disorder with regression (ASD-R) and those without regression (ASD-NR) differ in regards to epilepsy related measures (reported epilepsy and abnormal EEG).

Objectives: We performed meta-analyses of the literature comparing children with ASD-R and ASD-NR on (a) reported rates of epilepsy and (b) rates of abnormal EEG readings.

Methods: Data regarding reports of epilepsy were extracted from 16 published studies across 2,533 participants. Six studies reported data on mixed, 7 studies reported data on language, no studies reported data on social, and 3 studies reported data on language/social regression. Abnormal EEG readings were extracted from 14 studies across 3,834

participants. Eight studies reported data on mixed, 5 studies reported data on language, no studies reported data on social, and 2 studies reported data on language/social regression.

Results: Across all regression types, reports of epilepsy were no more likely for ASD-R (22%) than ASD-NR (18%). This same pattern was found for mixed (ASD-R=34%; ASD-NR=18%), language (ASD-R=13%; ASD-NR=12%), and language/social regression (ASD-R=17%; ASD-NR=12%). Prevalence of social regression could not be calculated due to a lack of data. Furthermore, for children with ASD-R, reported rates of epilepsy were significantly higher for reports of mixed (34%) than reports of language (13%) or language/social (17%) regression. Furthermore, across all regression types, abnormal EEG readings were no more likely for ASD-R (44%) than ASD-NR (48%). This same pattern was found for mixed (ASD-R=48%; ASD-NR=52%), language (ASD-R=32%; ASD-NR=25%), and language/social regression (ASD-R=39%; ASD-NR=35%). Prevalence of social regression could not be calculated due to a lack of data. Finally, for children with ASD-R, reported rates of abnormal EEG readings were higher when mixed regression was reported (48%) than when language (32%) or language/social (39%) regressions were reported.

Conclusions: The data reported here indicate no differences between ASD-R and ASD-NR children in regards to reported epilepsy and abnormal EEG readings for any of the regression types. In the ASD-R group, both rates of reported epilepsy and abnormal EEG readings were higher for studies investigating mixed regression compared to language or language/social regressions.

157.045 45 Asthma and Allergies in Children with Autism Spectrum Disorders. K. Lyall*[1], J. Van de Water[2], P. Ashwood[3] and I. Hertz-Picciotto[3], (1)*Harvard School of Public Health*, (2)*University of California, Davis*, (3)*University of California, Davis, MIND Institute*

Background: Alterations in the immune system in children with autism have been noted in prior work. Whether the prevalence of immune-related conditions such as asthma and allergies is higher in children with autism is not clear.

Objectives: We sought to determine whether 1) child asthma and allergies are more common in children with autism spectrum disorder (ASD) and 2) whether asthma and allergies are associated with other subphenotypes within autism.

Methods: Participants were members of the CHildhood Autism Risks from Genetics and the Environment (CHARGE) study, a large population-based case-control study. Children were 3-5 years at study enrollment. Typical development in general population controls was confirmed through scores on the Social Communication Questionnaire (SCQ), Mullen Scales of Early Learning (MSL), and the Vineland Adaptive Behavior Scales, while ASD diagnosis was confirmed through scores on the SCQ, ADOS, and ADI-R. The primary study group included typically developing controls and confirmed cases of autism spectrum disorder (ASD). We compared basic frequencies of child asthma and allergy, and types of allergies, between cases and controls, and used multivariate logistic regression to obtain crude and adjusted odds ratios of the association between the child conditions and ASD status. We also assessed whether these child conditions were associated with differences in scores on the MSL, and Aberrant Behavior Checklist (ABC) in all children, and on the ADOS and ADI-R for case children. Multivariate linear regression was used to obtain adjusted estimates of these associations within cases and overall.

Results: 553 children with ASD and 377 typically developing children were included in these analyses. Prevalence of asthma and allergy did not differ in cases and controls. When assessing conditions according to diagnostic subgroup, allergy was more common in children with a diagnosis of autistic disorder (50%) than in children with a broader ASD phenotype (40%); this association was significant in adjusted analyses, but when considering only medical-record confirmed allergy, the association was non-significant. Child asthma was not associated with scores on the MSL, ABC, ADOS, or ADI-R. Child allergy was associated with lower fine motor scores on the MSL and higher stereotypy scores on both the ABC (in all children and in case children only) and the ADI-R in crude comparisons. In adjusted analysis, child allergy was associated with a modest but significant increase in stereotypy scores, though fully adjusted results of this association utilizing only medical-record confirmed allergy were no longer significant.

Conclusions: Our results suggest that asthma and allergies are not more common in young children with autism spectrum disorder, and that the presence of these conditions does not significantly affect cognitive and behavioral scores. However, future work should further assess the preliminary association we saw with a tendency for higher stereotypy scores in case children with allergies.

157.046 46 Phenotypic Similarity Between XYY Syndrome and Autism Spectrum Disorder. B. M. Winder*[1], L. Rescorla[1] and J. Ross[2], (1)*Bryn Mawr College*, (2)*Thomas Jefferson University*

Background: XYY syndrome is a sex chromosome condition in which a male receives an extra Y-chromosome. Since there are subtle physical or medical findings, XYY is often not detected unless genetic testing is conducted. Although research on the behavioral characteristics of individuals with XYY is in its infancy, there is emerging evidence that many boys with XYY exhibit behavioral profiles that share key characteristics with autism spectrum disorder (ASD).

Objectives: Because there is little known about the behavioral profiles of boys with XYY, our goal was to determine which behavioral characteristics best differentiated the XYY group from controls. Additionally, we were interested in evaluating behaviors suggestive of ASD in children with XYY to better understand the behavioral profiles of these children.

Methods: The Child Behavior Checklist 4-18 (CBCL; Achenbach, 1991) and the Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord) were administered to the parents of thirty-two XYY and thirty age-matched normal control participants. The average age was nine-years-old for both groups.

Results: Mean scores on all eight CBCL syndromes were significantly higher in the XYY group than the control group, with the largest effect sizes (ESs) on Social Problems (43%), Attention Problems (42%), and Aggressive Behavior (31%). To test which CBCL items differentiated the XYY group from the control group, we conducted a MANOVA on all 118 items and aggregated those that were significant into a XYY scale (34 items). This XYY scale had a larger ES than any other CBCL scale (ES = 53%). Finally, we compared the XYY group and the control group on an ASD scale derived from CBCL items by Ooi et al. (2010) in Singapore. Results indicated that the ASD scale actually had the overall largest ES (54%). To further investigate the presence of ASD symtomatology, we analyzed the results of the Social Communication Questionnaire. SCQ data were available for 29 XYY and 22 control participants. Results indicated that 14 children in the XYY group scored at or above the recommended cutoff of 15 whereas no children in the control group scored at or above the cutoff.

Conclusions: The existing research on the behavioral profiles of children with XYY is scarce. The existing stereotype of XYY is that these males are impulsive and aggressive; however, this study suggests that, in comparison to typically developing controls, they have significant social and attentional problems. Furthermore, the XYY boys, as a group, have many symptom characteristics similar to children with ASD. Implications of this study are that some of the treatments that are effective with higher functioning children with ASD – such as behavioral interventions, speech therapy, and social skills training – might be helpful for XYY youngsters as well.

157.047 47 Autistic Symptomatology in Prader-Willi Syndrome. A. Dimitropoulos*[1] and C. Klaiman[2], (1)*Case Western Reserve University*, (2)*Marcus Autism Center*

Background:

Prader-Willi syndrome (PWS) is caused by either the structural loss of material or the absence of gene expression from the paternally inherited copy of chromosome 15 (q11-q13). In addition to a well-described behavioral phenotype that includes hyperphagia, obsessive-compulsive symptoms, disruptive behavior, cognitive delays, research also suggests that some persons with PWS have repetitive behavior and social deficits reminiscent of autism spectrum disorders (ASD). In particular, it appears as though those individuals with the maternal uniparental disomy (m-UPD) subtype of PWS are at greater risk for autistic symptomatology than those with paternal deletions (DEL) of 15q11-q13. These findings are particularly intriguing in light of data implicating maternal duplications of the same chromosomal interval in idiopathic autism, as well as evidence that functional alterations of genes

in this region are associated with social deficits found in a variety of neurodevelopmental disorders.

Objectives:

The primary objective of this research is to examine social functioning in individuals with PWS and to further test the hypothesis that m-UPD is a specific risk factor for autistic symptomatology.

Methods:

42 individuals with PWS (23 DEL, 19 m-UPD) and 19 individuals with an ASD (7-36 years old) and their caregivers comprised the total sample. Participants underwent intelligence testing (WISC-IV, WAIS-III, or WASI), adaptive functioning (Vineland Adaptive Behavior Scales), and the Autism Diagnostic Observation Schedule (ADOS). Parents completed the Autism Diagnostic Inventory-R (ADI-R), as well as the Social Competence Inventory (SCI; Rydell, 1997) and Social Responsiveness Scale (SRS; Constantino & Gruber, 2005).

Results:

For social responsiveness, SRS-Total score significantly differed between ASD, m-UPD, and DEL groups ($F = 7.275$, $p = .002$; controlling for age and IQ). Post-hoc comparisons indicate significantly more social difficulties were present for participants with ASD and m-UPD than those with DEL. 78.9% of m-UPD and 36.4% of DEL participants scored in the highest clinically significant range indicating severe interference in everyday social interactions. Groups also differed significantly on measures of social competence. Participants with m-UPD and ASD evidenced greater impairment in the SCI Prosocial Orientation Subscale (e.g., empathy, understanding of others, helpfulness) than those with DEL ($F=7.2$, $p=.002$ controlling for age and IQ). No differences were found between groups on the Social Initiative Subscale [DEL = 3.04(.82), m-UPD = 2.64(.72), ASD = 2.51(.72)]. Among those with PWS, the SRS-Total score and SCI Prosocial Orientation was significantly negatively correlated with Vineland Social Subscale.

Conclusions:

These findings indicate individuals with PWS have difficulty initiating social interaction (e.g., making contact with unfamiliar peers) and may be prone to social hesitancy or withdrawal similar to those with an ASD. Prosocial behaviors such as generosity, empathy, and helpfulness were more evident in those with DEL subtype than in individuals with m-UPD or ASD. Results will be discussed in relation to ADOS and ADI-R findings. These results give further insight into the social functioning of persons with PWS and indicate need for social-skills intervention in this population.

157.048 48 Autistic Traits in Women with Polycystic Ovary Syndrome. S. Herguner*, H. Harmancı, A. Herguner and H. Toy, *Meram Faculty of Medicine*

Background:

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder of reproductive-aged women. It is characterized by androgen excess, chronic oligoanovulation and polycystic ovaries on ultrasound. Its etiology remains largely unknown however several studies suggested that prenatal androgen exposure might contribute to development of PCOS.

Objectives:

An association between sex-steroid hormones and autism spectrum conditions (ASC) is established. Prenatal androgen levels are associated with autistic traits, and several genes involved in steroidogenesis are associated with autism. Furthermore, higher rates of androgen-related conditions including PCOS, hirsutism and acne are reported in women with ASC.

In this study, we aimed to measure the autistic traits in women with PCOS.

Methods:

Forty females who had a clinical diagnosis of PCOS based on Rotterdam diagnostic criteria were recruited for the study group. For comparison, regularly cycling healthy controls who agreed to participate in the study (n = 40), none of whom met the diagnostic criteria for PCOS, were recruited in control groups. A physical examination was performed by the same

physician on all women in Gynecology Department. All participants were then invited to complete the Autism Quotient (AQ). The study was approved by the Meram Faculty of Medicine Ethical Committee, Konya, Turkey.

The AQ is a 50-item, self-report questionnaire, which assesses social skills, communication skills, imagination abilities, attention switching, and attention to details. The higher the score on the AQ, the more autistic traits the individual possesses.

Results:

There were no significant differences in age, education, and BMI between groups. Total AQ and Communication scores were statistically higher in females with PCOS (Table 1). Correlation analysis revealed that there was no effect of age and BMI on AQ scores.

Table 1: Means (± SD) for total AQ and subscale scores by group.

	PCOS n = 40	**Control n = 40**	**p value**
Social skills	3.40 ± 1.76	3.05 ± 1.77	.378
Communication	2.25 ± 1.53	1.55 ± 1.30	**.030**
Imagination	3.43 ± 1.63	3.08 ± 1.35	.299
Attention to detail	6.23 ± 1.69	5.65 ± 2.25	.200
Attention switching	4.93 ± 1.72	4.50 ± 1.26	.211
Total AQ	20.28 ± 5.04	17.83 ± 3.57	**.014**

Conclusions:

This study showed that autistic traits were higher in women with PCOS than healthy controls which confirms that prenatal exposure to high levels of androgen may be involved in development of ASC. Further studies are needed to investigate the association between PCOS and ASC.

157.049 49 Parent-Reported Autism Spectrum Symptomatology in Children with Williams Syndrome. F. van der Fluit*, B. P. Klein-Tasman and E. C. Bennaton, *University of Wisconsin, Milwaukee*

Background: Recent research has revealed a growing body of literature concerning the behavioral overlap between individuals with Williams syndrome (WS) and those with autism spectrum disorders (ASDs). WS is a genetic syndrome characterized by a typical physical appearance and cognitive profile, as well as an outgoing and friendly personality profile coupled with some degree of social reciprocity difficulties. Previous investigations have examined the socio-communicative behavioral profile of young children with WS using the Autism Diagnostic Observation Schedule (ADOS), as well as with parent questionnaires. However, patterns of behavior reported by parents of children with WS using a structured interview, the Autism Diagnostic Interview-Revised (ADI-R), have not been previously reported. These findings will be necessary in order to better understand the nature of socio-communicative difficulties present in WS.

Objectives: The current study examined the behavioral profiles of 15 children with WS as reported by their parents using the ADI-R. Domain-level difficulties, as well as specific items commonly endorsed by parents, will be reported. In addition, relations between socio-communicative difficulties and developmental level will be examined.

Methods: The 15 children represented in the present study included eight boys and seven girls with WS between 2 and 6 years old. At least one parent of each child completed the ADI-R as part of a comprehensive evaluation that included a measure of early developmental level, the Mullen Scales of Early Learning (MSEL). This is not a random sample; many (though not all) of the participants were referred due to concerns about socio-communicative difficulties.

Results: Of the fifteen children with WS assessed, seven (46.7%) met the autism cutoff for the reciprocal social interaction (RSI) domain. Twelve children (80%) met the autism cutoff in the communication domain and nine (60%) met the autism cutoff for restricted, repetitive, and stereotyped patterns of behavior (RRSB). Overall, seven children (46.7%)

met the autism cutoff in all three domains. Patterns of individual item endorsement will also be analyzed. MSEL raw scores were not related to ADI domain scores. MSEL receptive and expressive language T-scores and overall developmental level were were negatively related to the RSI domain score.

Conclusions: The results of the current study indicate that some children with WS do demonstrate socio-communicative difficulties that overlap with those typically seen in ASDs. In this sample of children with WS referred due to concerns about socio-communicative functioning, more than half met or exceeded the cutoff for ASD on the communication and repetitive behavior domains. The proportion demonstrating difficulties in the reciprocal social interaction domain was smaller but only marginally so. While not necessarily indicating that all of these children met criteria for a comorbid diagnosis on the autism spectrum, the results reveal that a number of children with WS, especially those with weaker receptive and expressive language, show sociocommunicative and repetitive behavior that overlaps with that seen for children with ASD. Implications of these findings will be discussed.

157.050 50 Simons Variation in Individuals Project: Characterizing the Phenotype of 16p11.2 Duplication Syndrome. L. Green Snyder[1], S. M. Kanne[2], R. Bernier[3], J. A. Burko[1], B. M. Cerban[1], W. Chung[4], R. P. Goin-Kochel[2], A. Laakman[2], A. Lian Cavanagh*[1], R. McNally Keehn[5], F. K. Miller[6], J. E. Olson[1], A. V. Snow[5], J. E. Spiro[7], A. D. Stevens[3], J. Tjernagel[7], N. Visyak[1], J. R. Wenegrat[3] and E. Hanson[1], (1)*Children's Hospital Boston*, (2)*Baylor College of Medicine*, (3)*University of Washington*, (4)*Columbia University*, (5)*Harvard Medical School*, (6)*University of Michigan*, (7)*Simons Foundation*

Background: Twin and family studies suggest that genetic factors are important in the development of ASD although it is also clear that these influences are complex. Much past work in this field has been marred by inconsistent diagnostic methodology and poorly defined subject populations making it challenging to link particular genes to clinical subtypes. While the exact incidence of ASD in individuals with 16p11.2 duplication is unknown, ASD and ASD-like features appear to be more prevalent in these individuals than in the general population. Increased incidence of ADHD has been reported in individuals with 16p11.2 duplication (Shinawi et al. 2009). There are also reports of increased incidence of psychiatric disorders, particularly schizophrenia (McCarthy et al. 2009, Levinson et al. 2011). Recent reports have highlighted issues of underweight (Jaquemont et al. 2011). In addition, there have been reports of specific neurological findings in these individuals (Horev et al. 2011, Bedoyan et al. 2010). Simons VIP is characterizing the phenotype of this disorder by studying over 100 individuals with this recurrent genetic disorder.

Objectives: To characterize the phenotype of the 16p11.2 duplication syndrome.

Methods: Subjects are recruited from across the United States through the Simons VIP Connect website, and they travel to the clinical sites for a 2-3 day research visit. All consenting participants with a documented duplication in 16p11.2 (29,557,497-30,107,356 bp) receive a comprehensive diagnostic assessment including an Autism Diagnostic Observation Schedule (ADOS), a DISC (Diagnostic Interview Schedule for Children), cognitive, language, behavioral and adaptive skills assessments. The Autism Diagnostic Interview – Revised (ADI-R) is administered when SRS, SCQ or ADOS scores are elevated or there is a clinician concern for ASD. Comprehensive medical information is obtained from participant/family report, and is also extracted from medical records.

Results: To date, we have enrolled 65 individuals (from 29 families) with a 16p11.2 duplication. The first 17 children with the duplication are included in this interim analysis. Within the duplication sample, 8 are male. Individuals range in age from 6 months to 14 years, and have a mean FSIQ of 73 (SD = 22.1). Three individuals received a research diagnosis of an ASD. In addition, a number of probands (n=4) met criteria on either ADOS or ADI, but not both measures, and so did not meet full research criteria for an ASD. The most common diagnoses are Language Disorders (n = 7) and Intellectual Disability (n = 2). Other common diagnoses include Borderline Intellectual Functioning (n=4), Phonological Disorder (n=2), and Disruptive Behavior Disorders/ODD (n=2). Four individuals received no neurodevelopmental diagnosis.

Conclusions: Among individuals with a 16p11.2 duplication, co-morbid diagnosis was common, with 7 (41%) participants receiving one or more neurodevelopmental diagnoses. Several individuals have a language delay. Further analysis will be conducted to fully characterize the phenotype of individuals with a 16p11.2 duplication.

157.051 51 Osteoporosis and Ambulation in Girls with Rett Syndrome. K. Smith*[1], L. Yin[1], A. Pitts[2] and L. H. Wills[2], (1)*University of Southern California, Keck School of Medicine*, (2)*Children's Hospital Los Angeles*

Background:

Rett syndrome (RTT) is a severe neurodevelopmental disorder associated with a broad spectrum of symptoms including diminished motor skills and locomotion, epileptic seizures, developmental regression, movement disorders and subsequent global developmental delay. For the majority of patients with RTT, the cause is a de novo mutation in the X-linked gene methyl-CpG-binding protein 2 (MECP2) located at Xq28. Growth failure can complicate the clinical course of RTT. The growth trajectory of children with RTT deviates from the typical pattern of growth failure in children who have chronic illnesses or other central nervous system or chromosomal disorders which is characterized by early deceleration of head growth, followed by deceleration of height and weight gain.

Prior studies have investigated some of the multiple factors responsible for the growth abnormalities seen in girls with RTT such as the rett/MECP2 mutation, nutrition, and medications. The frequent occurrence of osteoporosis and generalized growth failure in RTT raises the question of the influence maintaining ambulation has on bone health. Bone formation and remodeling are complex processes and dependent upon various conditions, ambulation and exercise being important factors.

Objectives: We hypothesized if girls with RTT maintain ambulation, they will have improved bone growth and thus a higher percentile (z-score) in height for age. This study was designed to broaden our understanding of the effects maintaining ambulatory status on children with RTT.

Methods: All girls with Rett syndrome seen in the Rett Clinic at Children's Hospital Los Angeles were weighed and measured by a clinical dietician familiar with girls with Rett syndrome. Growth was plotted on a standard growth chart and z-score for height was calculated.

Results: Girls who were independent ambulators had a higher height Z-score for age compared to those who were nonambulators or partially dependent ambulators. Further, the height z-score for age was closer to the 50%th percentile regardless of age.

Conclusions: Girls with Rett syndrome who are able to ambulate have higher height z-score for age compared to those girls who were either nonambulators, or partially dependent ambulators. Therefore, promotion of ambulation may benefit girls with Rett syndrome by promoting bone health and growth.

157.052 52 Audiometric Profiles of Children with Autism Spectrum Disorders. C. Demopoulos*[1], C. Keller[1], G. Schroeder[2], K. DePlonty[1], B. E. Kopald[1], K. Cooper[1], N. Bangera[1] and J. D. Lewine[1], (1)*MIND Research Network*, (2)*Lutheran General Hospital*

Background: Several lines of data indicate that abnormalities in auditory processing contribute to functional deficits in the autism spectrum disorders (ASDs). However, the relative impact of peripheral versus central dysfunction is presently underspecified. Particularly concerning is the possibility that partial hearing loss or other peripheral problems may have a cascade effect leading to a systemic failure in auditory processing, especially since distorted auditory perception may have more pervasive impact on functioning than a failure to hear at all (Klin, 1993).

Objectives: To characterize audiometric profiles in children with ASDs.

Methods: Participants were 28 children (aged 5-16) diagnosed with an ASD. Diagnosis was confirmed through detailed assessment, including the ADI-R, ADOS and clinical history. Audiological examination included Tympanometry and Pure Tone Audiometry (PTA), along with evaluation of Transiently Evoked Otoacoustic Emissions (TEOAE), the

Stapedius Reflex Threshold (SRT), and Uncomfortable Loudness Levels (UCL).

Results: Rates of missing data due to limited comprehension of task demands or noncompliance with procedures included 3.57% (n=1) for PTA and Tympanometry, 42.86% (n=12) for SRT and UCL, and 7.14% (n=2) for TEOAE. Three participants (11.54%) had abnormal tympanometry measures, with one additional participant demonstrating excessive, although not definitively abnormal, eardrum mobility. Only one subject showed evidence of significant hearing loss on PTA. TEOAE was clearly abnormal in 15.38% (n=4) of the 26 participants that could be tested, with three additional subjects showing anomalous emissions for at least one of the tested frequencies. An abnormal SRT was found in 18.75% (n=3) of the 16 participants who could be tested. Overall, 35.71% of participants (n=10) were rated as abnormal on at least one measure of audiological functioning. It is also noteworthy that abnormal loudness perception, as defined by uncomfortable loudness levels less than 90dB was identified in 8/18 participants (44.44%) for the right ear, and 7/18 for the left ear (38.89%). Point-biserial correlations between average bilateral UCL level and measures of peripheral audiology were not significant across PTA, TEOAE, and SRT.

Conclusions: The incidence of an abnormal finding on at least one measure of audiological functioning was higher in children with an ASD than has been reported for the general population (35.71% for the present study versus 14.9% of children aged 6-19 years according to CDC's Third National Health and Nutrition Examination Survey, 1988 – 1994). The presence of sound sensitivity in at least one ear was also considerably higher for the ASD population (44.44% for ASD versus a general population estimate ranging from 8-15.2%; Baguley, 2003). Patients with tinnitus and those with William's syndrome also demonstrate a high prevalence of sound sensitivities. In these conditions, the anomalies in loudness perception are almost always associated with peripheral hearing loss. In contrast, sound sensitivities in children with autism were not significantly associated with peripheral hearing anomalies. This suggests a central origin for sound sensitivities in autism, and it indicates that treatment approaches viable in tinnitus and Williams syndrome may not be applicable in the ASDs.

157.053 53 Aetiologies and Outcomes in Children with Comorbid Autism Spectrum Disorder and Severe-Profound Hearing Impairment. M. Charlton*, *Royal Children's Hospital and Taralye Oral Language Centre for Deaf Children*

Background: Autism Spectrum Disorder is a high incidence disability found in approximately 5% of hearing impaired children, with common aetiological pathways. Previous policies advised against cochlear implantation of children with these co-conditions. There is little published outcome information as evidence base for treatment expectations and parent counselling.

Objectives: To study aetiologies and outcomes of children with co-morbid severe-profound hearing impairment and Autism Spectrum Disorder followed from 1999 to 2010.

Methods: Children with severe-profound hearing loss who received cochlear implants were enrolled through the Royal Victorian Eye and Ear Hospital programme following multidisciplinary diagnosis of Autism Spectrum Disorder. Assessment used DSM-IV criteria and specialist instruments, the ADOS and ADI-R. All 19 children had non-verbal cognitive assessments, and 17 had post-implant speech and language outcome data. Tests were selected appropriate to each child, mostly WPPSI-3/Griffiths-R and PLS-4.

Results: The children's mean age of cochlear implantation was 31.7 months (range 9-101), and mean age of Autism diagnosis was 50.8 months (range 24-105). Hearing impairment aetiologies were known for 14 children: very preterm (1), Cytomegalovirus (3), Connexin 26 (4), nonspecific genetic/familial (3), and vestibular aqueduct syndrome (3). Of five children with unknown aetiologies, two had abnormal MRI brain imaging. Communication outcomes were associated with cognitive ability. The five children with cognitive ability in/above Average (within/above 1 standard deviation of the mean) had speech and language outcomes Average and above. All 12 children with below Average cognitive scores, including 9 with intellectual disability, had communication outcomes in the Disability range (greater than minus 2

standard deviations below the mean), with 10 Moderate-Severe (greater than minus 3 standard deviations). Children were taught communication modes including speech, sign and picture exchange. All children received early intervention for hearing impairment, and 12 also received early intervention for developmental delay and/or Autism. At school-age, children with normal cognitive ability (within 2 standard deviations of the mean) were in inclusive mainstream education.

Conclusions: Universal infant screening has meant that hearing impairment is normally diagnosed before symptoms of Autism Spectrum Disorder are recognized. As children normally first enter services for hearing impairment and continue in shared care, professionals in the hearing impairment field need training in screening and interventions appropriate to children with these co-conditions. There was no dominant aetiology for hearing impairment in the study group. Communication outcomes were encouraging. They showed that implanted children with severe-profound hearing loss can develop functional oral language, provided their cognitive ability is within the normal range for age. Even more encouraging was the finding that children with Average and above Average cognitive ability can develop formal oral language appropriate to ability. Children with ability within the normal range can be accommodated within mainstream education. Further study of the profiles, treatments and outcomes of these children is needed in order to provide an adequate evidence base for treatment expectations and parent counselling.

157.054 54 Clinical Phenotyping in Post-Mortem Brain Tissue Research- Progress and Challenges. C. K. Hare*[1] and J. Pickett[2], (1)*Autism Speaks*, (2)*Autism Tissue Program, Autism Speaks*

Background: As the scientific and clinical interests in autism have increased, there has been a correlative increase in the research dedication to tissue based studies and the importance of post-mortem brain tissue in autism research. This interest is demonstrated by the elevated demand by researchers for post-mortem brain tissue from dedicated facilities such as the Autism Speaks Autism Tissue Program (ATP) and The NICHD Maryland Brain Bank. While characterization and preservation of post-mortem brain tissue has been of paramount concern to researchers, little attention has been paid to standardizing essential phenotypic and clinical data. Having responded to more than a dozen inquiries in 2011 from ATP board-approved researchers regarding clinical information associated with post-mortem brain tissue it is evident that clinical standards and protocols need to be established. Furthermore, as additional post-mortem tissue resources are developed, there is a mounting sense of urgency in establishing exemplary standards.

Objectives: The purpose of this study is to explore existing clinical standards and protocols in post-mortem brain tissue research. This exploration is conducted in consideration of: provision of pertinent phenotypic and clinical information to researchers *and* collection of phenotypic and clinical date from families while providing essential bereavement support.

Methods: Interview three authors of scholarly papers utilizing phenotypic or other relevant clinical data obtained via the ATP's Clinical Standard Operating Procedures combined with a case study of three ATP donor families' experiences participating in the ATP donation process from the point of donation through the home visit.

Results: ATP Board-approved researchers have been specifically interested in the following types of clinical data provided by the ATP: diagnosis, regression and agonal state. Researchers had questions regarding the consistency of data across donors (particularly diagnosis). Additionally, clinicians need to spend more time learning about the scientific research and establishing cross-program standards for collecting and disseminating data. The ATP has spearheaded a post-mortem brain tissue clinical workgroup in response to these needs.

Clinical information is obtained from the families utilizing a variety of clinical tools over time, but a majority of this information is collected during the home visit. Donor families have consistently expressed appreciation for the time spent participating in this process and consider the home visit a key element of the bereavement support provided by the ATP.

Conclusions:

1. Ongoing dialogue is required between researchers and clinicians to increase potential for translational science to occur. This dialogue should be focused on informing clinicians to improve the relevance of clinical data collection; likewise clinicians can encourage greater use of the clinical data that already exists.

2. Donor families require ongoing bereavement support and recognition for making the decision to donate their loved one's brain tissue for autism research.

3. Ongoing dialogue is required across post-mortem brain tissue banks and the ATP. This dialogue should be focused on improving upon existing processes in an effort to provide researchers with gold-standard phenotypic and clinical data. The clinical workgroup spearheaded by the ATP is dedicated to engaging in this dialogue.

157.056 56 Growth Characteristics of Jamaican Children with Autism. R. Melbourne-Chambers*[1], J. Tapper[2], M. H. Rahbar[3] and M. Samms-Vaughan[1], (1)*The University of the West Indies*, (2)*Bustamante Hospital for Children*, (3)*The University of Texas Health Science Center at Houston*

Background:

Disorders of growth have been reported to be associated with autism, particularly macrocephaly and obesity. The association with tall stature has been less commonly reported.

Objectives:

To evaluate the prevalence of growth disorders amongst Jamaican children with autism and autistic spectrum disorder (ASD**).**

Methods:

Forty-three children age 2-8 years with autism/ASD were invited to participate. They were matched with their peers for age and gender. Informed consent was obtained. Parents and caregivers were interviewed to obtain information on demographics and socioeconomic status and the medical records were reviewed. The diagnosis of autism/ ASD was established according to DSM IV criteria, the Childhood Autism Rating Scale (CARS) and the Autism Diagnostic Observation Schedule (ADOS). The height, weight and head circumference were measured by one trained research assistant. Student's T test was used to compare group means, Chi square analysis to evaluate categorical variables and logistic regression analysis to identify associated factors. Ethical approval was obtained.

Results:

There were 73 (84%) males; mean age 5.50 years (S.D. 1.57 years). The two groups of children, those with autism/ASD and those without autism/ASD were similar in socioeconomic status. Nineteen (44.20%) children were diagnosed with mild – moderately severe autism; 16 (37.20%) were severe. Children with autism/ ASD had significantly (P=0.04) greater heights (mean z score 0.77 S.D. 1.11) than children without autism/AS (mean z score 0.27 S.D. 1.00). Children with autism/ ASD also had significantly (P=0.02) greater weights (mean z score 0.62, S.D. 1.02) than children without autism/ASD (mean z score 0.12 S.D. 0.94). Head circumferences were also significantly larger (P=0.04) in children with ASD/ autism (mean 52.12 cm, S.D. 1.78) than children without autism/ASD (mean 51.36 cm, S.D. 1.49). The height/age was significantly lower (P= 0.04) in children with autism ages 4.1-8 years (mean z score 0.59, S.D. 1.14) than in children with autism/ASD ages 2-4 years (mean z score 1.5, S.D. 0.59).

The prevalence of tall stature (height>97th centile) was 21.90% in children with autism/ASD and 7.14% in children without autism/ASD (P=0.05). . The prevalence of overweight/obesity (body mass index >85th centile) was 41.00% in children with autism/ASD and 16.70% in children without autism/ASD (P=0.10). Macrocephaly (head circumference > 97th centile) occurred with a prevalence of 9.52% in children with autism/ASD and 4.7% in children without autism/ASD (P=0.40). There was no significant difference among subcategories of autism/ASD. Logistic regression analysis showed that when socioeconomic status was controlled for, the z score of weight for age was significantly associated with the diagnosis of autism/ASD (P=0.03, C.I. 0.01, 0.246) and the z score of height was significantly associated with age in children with autism/ASD (P=0.05, B coefficient – 1.23, C.I.0.08, 0.98)

Conclusions: Jamaican children with autism/ASD are heavier than their peers. This is similar to other reports and may be due to increased nutritional intake, decreased energy expenditure or may represent an endogenous dysregulation of growth. Height for age is greater in younger Jamaican children with autism/ASD. This may be due to accelerated linear growth in these children at an early age.

157.057 57 Poor Movement Skill in the Broader Autism Phenotype: Identification and Stability Over Time. H. C. Leonard* and E. L. Hill, *Goldsmiths, University of London*

Background: Previous research has reported movement difficulties in children diagnosed with autism spectrum disorders (ASD) as well as in their younger siblings, who are at increased risk of developing ASD. Early motor abilities can affect the development of other domains, including language and communication (Iverson, 2010), which are core areas of difficulty in ASD. Understanding the stability of motor assessments over infancy and the early years could therefore help in identifying those most at risk of ASD-related difficulties later in development.

Objectives: One aim of the current study was to assess motor abilities in the younger siblings of individuals diagnosed with autism, once they had reached school age. Previous research has focused on younger children and infant siblings, or on older children with a diagnosis of ASD. A second objective was to assess how well early measures of motor ability used in studies of younger siblings related to assessments more commonly used in clinical settings and motor development research.

Methods: Twenty younger siblings of individuals diagnosed with autism were visited at the age of 5-7 years (mean = 6 years, 2 months) and their motor development was assessed through a standardised measure (the Movement ABC-2: MABC) and parental reports (the Vineland Adaptive Behavior Scales: VABS). These data were compared to those collected from two earlier visits, at mean ages of 9 and 40 months, through parental reports and a direct assessment, the Mullen Scales of Early Learning (MSEL).

Results: On the MABC, 3 of the 20 children had significant movement difficulties (falling at or below the 5th percentile), with a further 4 children having borderline movement difficulties (6th - 15th percentiles). Using these same criteria, 5 children had significant movement problems based on a motor composite score from the VABS. In addition, analyses of the VABS raw scores for gross and fine motor skills revealed significant correlations with the Manual Dexterity scale on the MABC ($ps < .01$).

Inspection of the infant data revealed that those children with significant movement difficulties on the MABC had movement problems highlighted on either the VABS or the MSEL during at least one of the earlier visits. This was also the case for 3 of the 4 children with borderline movement difficulties at 5-7 years. As in our previous research (Leonard et al., 2011), gross and fine motor scores on parental report and direct assessment were well correlated during infancy and early childhood ($ps < .05$).

Conclusions: Significant movement difficulties were present in 35% of a group at increased risk of developing ASD. A further 20% had difficulties with at least one area of motor ability measured by the MABC. In the majority of these cases, motor problems had been highlighted earlier in development either by parental report or direct assessment. These data build on previous research that has found poor motor skills in infant siblings by highlighting the stability of these difficulties into early childhood. Future analyses will assess the impact of motor problems on the development of other domains and ASD-related symptoms.

157.058 58 Pilot Study for Subgroup Classification for Autism Spectrum Disorder Based on Dysmorphology and Physical Measurements in Chinese Children. P. T. Y. Wong and V. C. N. Wong*, *The University of Hong Kong*

Background: Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder affecting individuals along a continuum of severity in communication, social interaction and behaviour. The impact of ASD significantly varies amongst individuals, and the cause of ASD can originate broadly between genetic and environmental factors.

Objectives: Previous ASD researches indicate that early identification combined with a targeted treatment plan involving behavioural interventions and multidisciplinary therapies can provide substantial improvement for ASD patients. Currently there is no cure for ASD, and the clinical variability and uncertainty of the disorder still remains. Hence, the search to unravel heterogeneity within ASD by subgroup classification may provide clinicians with a better understanding of ASD and to work towards a more definitive course of action.

Methods: In this study, a norm of physical measurements including height, weight, head circumference, ear length, outer and inner canthi, interpupillary distance, philtrum, hand and foot length was collected from 658 Typical Developing (TD) Chinese children aged 1 to 7 years (mean age of 4.19 years). The norm collected was compared against 80 ASD Chinese children aged 1 to 12 years (mean age of 4.36 years). We then further attempted to find subgroups within ASD based on identifying physical abnormalities; individuals were classified as (non)dysmorphic with the Autism Dysmorphology Measure (ADM) from physical examinations of 12 body regions.

Results: Our results show that there were significant differences between ASD and TD children for measurements in: head circumference (p=0.009), outer (p=0.021) and inner (p=0.021) canthus, philtrum length (p=0.003), right (p=0.023) and left (p=0.20) foot length. Within the 80 ASD patients, 37(46%) were classified as dysmorphic (p=0.00).

Conclusions: This study attempts to identify subgroups within ASD based on physical measurements and dysmorphology examinations. The information from this study seeks to benefit ASD community by identifying possible subtypes of ASD in Chinese population; in seek for a more definitive diagnosis, referral and treatment plan.

Psychiatric/Behavioral Comorbidities Program
158 Co-Morbid Psychiatric and Behavioral Conditions
These papers present data on behavioral and psyciatric co-morbidities in individuals with ASD.

158.059 59 Multimodal Anxiety and Social Skills Intervention for Adolescents with Autism Spectrum Disorders (ASD): Feasibility and Preliminary Efficacy. S. W. White*[1], T. Ollendick[1] and L. Scahill[2], (1)*Virginia Polytechnic Institute and State University*, (2)*Yale University*

Background: Anxiety is more common in children and adolescents with ASD than age mates without ASD (White et al., 2009; Merikangas et al., 2010). When present, anxiety may compound the social disability that characterizes these disorders. Moreover, untreated anxiety may hinder clinical efforts solely aimed at improving social skill deficits. There is evidence that anxiety may be most problematic during adolescence for people with ASD (Tse et al., 2007; Witwer & Lecavalier, 2010). There are few manual-based treatment curricula, however, developed specifically for adolescents with ASD.

Objectives: We assessed the feasibility (i.e., consumer acceptability and satisfaction, treatment fidelity, and subject compliance with treatment) of a cognitive-behavioral intervention program (Multimodal Anxiety and Social Skills Intervention for Adolescents: MASSI) that addresses anxiety and ASD-related social disability in adolescents. Secondarily, we explored preliminary outcome data to judge whether further investigation is warranted.

Methods: We conducted a randomized controlled trial (RCT) with 30 adolescents (ages 12 – 17) with ASD and at least one co-occurring anxiety disorder. All participants were in the average IQ range (mean verbal IQ = 97.07). Social Phobia was the most common anxiety disorder in the sample (77%), but most subjects had multiple anxiety disorders. Participants were randomized, 15 per group, to MASSI or a 14-week waitlist condition. Intent-to-treat and completer analyses are presented.

Results: The intervention was acceptable to the adolescents and their parents as evidenced by average attendance at 93% of required treatment sessions, and the high study completion rate (83.3%). Adolescents reported that the group therapy meetings were the most useful component of the intervention. By contrast, parents reported that the individual sessions were most helpful. Mean subject adherence across sessions,

measured by homework completion, was 58% (range 0% to 100%). Therapist fidelity ranged from 87.5% to 100% (mean 94.09%). Preliminary efficacy results on parent-reported symptoms of ASD-related social disability and anxiety were inconsistent. There was a large, within-group effect size of 1.18 on parent-reported social disability (Social Responsiveness Scale; Constantino & Gruber, 2005). However, the within-group effect size on parent-reported anxiety symptoms was modest at .55 (Child and Adolescent Symptom Inventory-4 Anxiety Scale; Sukhodolsky et al., 2008).

Conclusions: Results from this pilot study suggest that the intervention is acceptable and can be delivered reliably. The outcome data are promising and suggest that a larger trial is warranted.

158.060 60 The Importance of the Reporter: Parents' State and Trait Anxiety. C. M. Conner*, B. B. Maddox and S. W. White, *Virginia Polytechnic Institute and State University*

Background: Anxiety is a common comorbid condition among high-functioning individuals with Autism Spectrum Disorders (ASD; White et al., 2009). Previous research has been inconclusive about increased affective disorders in parents of children with ASD (Bolton et al., 1998; Lainhart, 1999), although parental anxiety symptoms have been shown to predict comorbid anxiety in adolescents with ASD (Mazefsky, Conner, & Oswald, 2010). Increased levels of parental anxiety may decrease parents' ability to accurately report on their child's behavior and/or affect treatment effectiveness for the child with ASD.

Objectives: The purpose of this study was to investigate the relationship between parent self-reported state and trait anxiety and parent-reported anxiety in their adolescents with ASD. A related purpose was to explore if parental anxiety was associated with the adolescents' treatment outcome.

Methods: Data were collected from thirty adolescents (12-17 years old; 7 females) who participated in a randomized controlled trial of a cognitive-behavioral treatment program (White et al., 2010). All participants had a confirmed ASD diagnosis, based on the ADOS (Lord et al., 2002) and ADI-R (Lord et al., 1994), met diagnostic criteria for at least one anxiety disorder (based on ADIS-C/P; Silverman & Albano, 1996), and were cognitively higher functioning (i.e., IQ > 70). Prior to the treatment, parents completed the State-Trait Anxiety Inventory (STAI; Spielberger, 1983) as a measure of their own anxiety, in addition to the Child and Adolescent Symptom Inventory-4 ASD Anxiety Scale (CASI-Anx; Sukhodolsky et al., 2008) as a measure of adolescent anxiety. A second familiar adult reporter (e.g., teacher) also completed the CASI-Anx for each participant. Treatment response was assessed by an independent evaluator who was blinded to treatment assignment (active treatment or waitling list) using the Clinical Global Impressions-Improvement rating (CGI-I; Guy, 1976) and the Developmentally Disabled Children's Global Assessment Scale (DD-CGAS; Wagner et al., 2007).

Results: At baseline, parental state-based anxiety (STAI) was positively correlated with parent-reported symptoms of anxiety in the adolescents (CASI-Anx), after controlling for teacher-reported anxiety (CASI-Anx) ($r = .462$, $p < .05$). Of the 15 families randomly assigned to the active treatment condition, adolescents whose parents reported higher baseline STAI-Trait anxiety showed less improvement on the DD-CGAS at the end of treatment ($r = -.593$; $p < .05$). Additionally, a paired-samples *t*-test revealed that STAI-Trait scores significantly decreased from baseline to endpoint for parents of treatment responders, defined by a "Much Improved" or "Very Much Improved" rating on the CGI-I, $t(5) = -2.870$, $p < .05$.

Conclusions: In a clinical sample of high-functioning adolescents with ASD participating in a social skills and anxiety treatment program, parents with higher state-anxiety reported more baseline anxiety in their children, significantly above teacher-reported anxiety. In addition, the adolescents whose parents had higher baseline trait-anxiety showed less global improvement with treatment. Findings suggest that parental anxiety is a potentially important consideration in understanding how to assess treatment outcome for adolescents with ASD and anxiety. Future research studies with larger samples should further explore this relationship between anxiety symptoms and improvement in parents and their children with ASD.

158.061 61 The Relationship Between Restricted Interests and Anxiety Disorder Symptoms in Children with Autism Spectrum Disorders (ASD). C. E. Lin*[1] and J. J. Wood[2], (1)*UC Santa Barbara*, (2)*University of California, Los Angeles*

Background: A preoccupation with restricted interests (RI) is a core symptom of autism spectrum disorders (ASD) associated with further impacting the overall functioning of children with ASD. The presence of anxiety disorders and overlap in the symptomatology of RI (e.g. obsessive compulsive disorder (OCD)), suggests a possible linkage. Children engage in their RI through various forms of activities, such as fact collection or symbolic enactment through play (Klin et al., 2007). Similarly, the role that RI play in the functioning of ASD has also been speculated to be multidimensional. At this time, there is little research examining the linkage between RI and anxiety.

Objectives: The current study examined the association between RI expression and anxiety disorder symptoms in children with ASD. The goals were to examine (a) the association between RI and anxiety symptomatology; (b) differences in anxiety symptoms based on the expression of RI; (c) the relationship between time engaged in RI and anxiety.

Methods: Data were analyzed from children diagnosed with ASD (N = 68; 7-13 years of age; IQ > 70) and co-occuring anxiety disorders who had participated in a federally funded investigation of a treatment program for anxiety in ASD (c.f. Wood et al., 2009). Measures from the Yale Special Interest Survey (YSIS; Klin et al., 2007), the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Goodman et al., 1989), the Anxiety Disorders Interview Schedule (ADIS; Silverman and Albano, 1996), and the Multidimensional Anxiety Scale for Children–Parent Version (MASC-P; March, 1997) were analyzed. Time spent engaging in RI and categories of RI expression comprised of (a) facts/verbal memory and learning, (b) attachment to objects, and (c) symbolic enactment were coded using the YSIS.

Results: Findings indicated that symbolic enactment of RI in the form of play, rather than information collection or time engaged in RI, was significantly linked with the increased presence and severity of anxiety symptoms. The manner in which RI were manifested was highly associated with anxiety symptoms and severity. Children who exhibited symbolic enactment of RI were more likely to demonstrate a greater number of anxiety symptoms ($t(68)=2.48$, $p < .01$), including OCD ($t(68)=2.27$, $p<.05$) and general anxiety symptoms, in addition to increased severe of primary anxiety diagnoses ($t(57)=2.55$, $p = .05$). RI expressed through facts/verbal memory and learning were unrelated to symptoms of anxiety. Time engaged in RI seemed to play only a small role in relation to anxiety symptoms, associated only with increased frequency of OCD-compulsive symptoms ($r(68)=.23$, $p=.05$).

Conclusions: The association between symbolically enacted RI and heightened anxiety suggest that RI can be conceptualized as a way to cope with anxiety. Expression of RI that are more intense or take on specific (symbolically enacted) forms could be used as a way to manage anxiety. In the absence of more effective coping strategies, engaging in intensive RI may serve as a limited relief. Further exploration is warranted and research to develop effective alternatives for RI (e.g., coping behaviors) appears to be essential.

158.062 62 Intolerance of Uncertainty and Anxiety in Adolescents with Autism Spectrum Disorder. J. H. Filliter*, K. M. Rancourt, M. E. Kerr and S. A. Johnson, *Dalhousie University*

Background: A recent meta-analysis indicated that almost 40% of youth with autism spectrum disorder (ASD) experience significant anxiety symptoms (i.e., clinically-elevated levels of anxiety or at least one DSM-IV anxiety disorder; van Steensel et al., 2011). It has been suggested that fear about unpredictable future events may be particularly problematic for individuals with ASD (Lainhart, 1999). In the anxiety literature, the term *intolerance of uncertainty* (IOU) has been used to describe negative beliefs about, and reactions to, novel, uncertain, or changing situations (Buhr & Dugas, 2009). It has been suggested that increased IOU may predispose individuals to develop excessive worry (Koerner & Dugas, 2008).

Objectives: To further explore the relationship between anxiety and the unpredictability of future events in ASD we: 1) examined potential differences in IOU and anxiety between adolescents with ASD and typically developing (TYP)

comparison participants, and 2) evaluated the relationship between IOU and anxiety in both ASD and TYP participants.

Methods: To date, 23 youths (aged 12 to 18 years) with ASD and 23 age-, sex-, and IQ-matched comparison participants have completed the study. Two parent-report questionnaires, the Intolerance of Uncertainty Scale for Children (IUSC; Comer et al., 2009) and the Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997), were completed for each participant. Total raw scores, ranging from 27 to 135 for the IUSC and 0 to 82 for the SCARED, were examined as dependent variables. On these measures, higher scores indicate greater IOU and anxiety symptoms, respectively. As IOU has been hypothesized to be predictive of excessive worry, the Generalized Anxiety Disorder (GAD) subscale of the SCARED was also examined.

Results: Independent samples *t*-tests were used to compare groups on both parent-report measures. Results revealed significantly higher scores on the IUSC for the ASD group (M=61.59, SD=15.34), compared to the TYP group (M= 38.48, SD=11.54; $t(41)=-5.56$, $p < .01$). The same pattern of results was observed for the SCARED total score (ASD: M=17.14, SD=11.99; TYP: M=8.86, SD=6.87; $t(41)=-2.76$, $p<.01$) and the SCARED GAD subscale (ASD: M=5.41, SD=4.37; M=2.86, SD=3.27; $t(41)=-2.16$, $p<.05$). Pearson's correlations were used to examine the relationship between IUSC and SCARED scores within each group. For the TYP group, IUSC scores were significantly correlated with SCARED scores for both the total scale ($r(21)=.68$, $p<.01$) and the GAD subscale ($r(21)=.55$, $p<.01$). However, there were no significant relationships in the ASD group; IUSC with total SCARED ($r(22)=.26$, $p>.05$) and GAD subscale ($r(22)=.20$, $p>.05$).

Conclusions: As expected, results indicate that youth with ASD have greater IOU and more anxiety symptoms than their TYP peers. Interestingly, we found significant associations between IOU and anxiety in the TYP group, but not the ASD group. These findings suggest that the relationship between these constructs is unique in youths with ASD, relative to their TYP contemporaries. These results have important implications for our understanding of fear about unpredictable future events, and anxiety more generally, in ASD.

158.063 63 Exploring the Relationship Between Anxiety and Insistence on Sameness in Autism Spectrum Disorders. K. Gotham*[1], V. Hus[1], S. L. Bishop[2], M. Huerta[3], A. Buja[4] and C. E. Lord[3], (1)*University of Michigan*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*Weill Cornell Medical College*, (4)*The Wharton School University of Pennsylvania*

Background: Elevated anxiety symptoms are one of the most common forms of psychopathology to co-occur with autism spectrum disorders (ASD). Evidence exists to suggest a shared genetic risk between ASD and anxiety disorders, however it is unclear whether this explains the high rates of co-occurrence or suggests that anxiety is an intrinsic feature of ASD, possibly as a result of restricted, compulsive behaviors. Of note, rates of overlap in anxiety and Insistence on Sameness (IS) have not yet been documented and replicated in large ASD samples.

Objectives: The purpose of this study was to explore the association between anxiety and ASD symptoms, particularly the degree to which the relationship is explained by IS behaviors and/or cognitive ability.

Methods: The sample included 1429 individuals aged 5:8 to 18:0 years who participated in the Simons Simplex Collection (SSC), a genetic consortium study of ASD. Child Behavior Checklist Anxiety Problems T-scores and Autism Diagnostic Interview-Revised "Insistence on Sameness" item raw totals were treated as both categorical and continuous measures of anxiety and IS respectively. Chronological age, verbal IQ, and a variety of ASD phenotype-related and other behavioral variables were assessed for potential association with anxiety and IS.

Results: Anxiety and IS continuous variables were minimally though significantly associated with each other and with chronological age and verbal IQ. Neither anxiety nor IS was associated with other core autism diagnostic scores. Anxiety was associated with a variety of other psychiatric and behavioral symptoms in ASD, including irritability, attention problems, and aggression, while IS was not.

Conclusions: Anxiety and Insistence on Sameness appear to function as distinct constructs, each with a wide range of

expression in children with ASD across age and IQ levels. Thus, both variables could be of use in ASD behavioral research or in dimensional approaches to genetic exploration. Unlike IS, however, anxiety is related to non-ASD-specific behavioral symptoms.

158.064 64 Predicting Social Outcomes for Children and Adolescents with Autism Spectrum Disorder: Is Anxiety Helpful?. K. H. Johnston* and G. Iarocci, *Simon Fraser University*

Background: In typically developing children and adolescents, there is a negative relationship between anxiety and friendship; that is, the less anxiety one has the more friendships they also tend to have (Bukowski, Hoza & Boivin, 1994; Hodges, Boivin, Vitaro & Bukowski, 1999; Ladd, 1990). However, recent research by Mazurek and Kanne (2010) has shown that this does not seem to be the case for youth with ASD. These researchers found higher levels of anxiety to be associated with more dyadic friendships even when controlling for IQ and level of autism severity. This finding is surprising because anxiety is generally found to be associated with negative social outcomes such as avoidance or social awkwardness, which are in turn expected to be associated with more negative friendship outcomes, not positive outcomes as these findings suggest.

Objectives: This study builds upon Mazuek and Kanne's (2010) findings by 1.) attempting to replicate these findings in a sample of high functioning youth with ASD with a comparable mean age and IQ 2.) investigating whether the relationship between anxiety and friendship is mediated by social awareness, social motivation and insight into social relationships. We hypothesize that once these mediating variables are taken into account, the relationship between anxiety and friendship will no longer be significant.

Methods: Participants are children and adolescents with high functioning autism (i.e., IQ >85 as measured by the Stanford Binet Intelligence Scale, Abbreviated Battery; Roid, 2003) between the ages of 7 and 17 and one of the youth's parents. Data collection for this project is in progress, however, data from approximately 35 participants has already been collected and we anticipate having 50 participants in total. Several measures will be employed to measure friendship outcomes, anxiety, and each of the specified mediator variables including: The Social Responsiveness Scale (Constantino, 2005), parent- and self-report versions of the Behaviour Assessment System for Children, Second Edition (Reynolds & Kamphaus, 2004), and a Brief Friendship Questionnaire developed for this project.

Results: Results from the proposed research may reveal that, in the case of high functioning individuals with autism, anxiety is signaling something beneficial; that is to say, anxiety is indicating the presence of higher levels of the mediator variables, which are generally associated with positive social outcomes.

Conclusions: It will be important to acknowledge that these youth with ASD are experiencing positive friendship outcomes in spite of the anxiety they are experiencing, and that this anxiety is likely to have a negative impact on other areas of their life. Noting the exceptionally high levels of anxiety in youth with high functioning ASD raises an important implication for educational initiatives aimed at developing social skills (such as social awareness and insight) in this population for both schools and home-based programs: It is not sufficient to teach social skills and increase levels of social awareness, motivation and insight into social relationships without also teaching youth how to manage the anxiety that can develop as they become more knowledgeable about their social deficits.

158.065 65 Investigating the Autonomic Nervous System Response to Anxiety in Children with Autism Spectrum Disorders. A. Kushki*, M. Pla Mobarak, E. Drumm, N. Tanel, T. Chau and E. Anagnostou, *Holland Bloorview Kids Rehabilitation Hospital*

Background: Anxiety in individuals with autism spectrum disorders (ASD) is a pressing concern due to its high prevalence in this population, its negative impact on physical and mental well-being, and its complex and bidirectional relationship with the core-deficits of ASD. Assessment of anxiety in individuals with ASD is complicated by two factors: 1) the overlap between behavioural symptoms of anxiety and the core-deficits of ASD, and 2) this population's difficulties in identifying and describing emotional experiences. In light of these issues, it is suggested that changes in the activity of the

autonomic nervous system (ANS) can be used as a language-free measure to detect arousal that accompanies anxiety. While a detectable anxiety-related ANS pattern is reported in typically developing individuals, it is suggested that these changes may present differently in individuals with ASD due to autonomic dysfunction (Groden et al., 2005; Ming et al., 2005).

Objectives: The goal of this study was to investigate the differences, if any, in ANS activity between typically developing children and those with ASD during an anxiety-inducing task.

Methods: Heart rate, electrodermal activity (EDA), and skin temperature were used as measures of ANS activity. These signals were recorded during a baseline activity (10 minutes of movie watching) followed by anxiety (Color Stroop test) in typically developing children (n=16; age=10.9+/-2.4 years) and children with ASD (n=10; age=11.1 +/-2.2 years). We examined group differences (ASD versus TD) in mean heart rate, mean EDA level, number of EDA reactions, and mean skin temperature using repeated measures multiple linear regression (controlling for gender and IQ effects).

Results: Consistent with reported patterns of ANS arousal during anxiety, the TD group showed a significant increase in heart rate ($p<0.0001$), mean EDA ($p<0.0001$), number of EDA reactions ($p<0.0001$) and a significant decrease in skin temperature ($p<0.001$). The ASD group also showed a significant increase in heart rate ($p<0.0001$) and mean EDA ($p<0.001$) during anxiety. However, for the ASD group, there were no significant changes in the number of EDA reactions ($p=0.14$) and mean skin temperature ($p=0.87$) in response to anxiety (group x time interaction $p=0.01$ and $p=0.02$ for EDA reactions and skin temperature, respectively).

Conclusions: The results suggest that measures of ANS activity can be used to detect anxiety in children with ASD, although a differential pattern in the anxiety response is evident between typically developing children and those with ASD. Understanding these differences is needed before ANS activity can be used effectively for detection of anxiety in ASD.

158.066 66 The Relationship Between Heart Rate and Anxiety in Autism Spectrum Disorders. M. J. Hollocks*, L. Grayson, P. Howlin and E. Simonoff, *Institute of Psychiatry, King's College London*

Background:

Numerous studies have reported elevated rates of anxiety symptoms and disorders in people with autism spectrum disorders (ASDs). However, the assessment of anxiety symptoms in this population is hindered by difficulties in acquiring good quality personal reports, which are the usual gold standard. The investigation of the underlying physiology of anxiety in this population is particularly important.

Objectives:

To determine whether people with ASDs show a similar physiological response to psychosocial stress measured by heart rate compared to controls, and if this physiological response relates to anxiety.

Methods:

This study is ongoing but currently includes 28 children with ASDs and 9 typically developing controls. We expect our sample size at presentation to include 50 ASD cases and 25 controls.

Participants were aged 10-16 years with a full-scale IQ ≥ 70 measured using the Wechsler Abbreviated Scale of Intelligence. The ASD sample was recruited from clinical services and controls via public advertisement. We specifically recruited ASD participants with and without anxiety problems.

Anxiety was assessed using the Spence Child Anxiety Scale (SCAS) – parent version. For the present analysis, the ASD group was collapsed and anxiety symptoms treated as an independent measure. Participants underwent a psychosocial stress test (Kirschbaum et al, *Neuropsychobiology,* 1993) consisting of 40 minutes rest, 20 minutes stress and finally 40 minutes recovery. The stress test comprised a non-verbal drawing task and a public speaking task. Mean heart rate was measured in the resting, stress and recovery stages. A stress responsiveness variable was calculated by deducting the

mean heart rate at rest from mean heart rate during the stress stage.

Results:

Mean Heart Rate. A 2x3 ANOVA revealed a significant group difference in the resting phase ($F(1, 33)=12.56, p=.001$) and the recovery phase ($F(1, 33)=5.03, p=.03$), but not in the stress phase ($F(1, 33)=1.49, p=.23$). The basal difference remained significant when anxiety symptoms were accounted for.

Stress responsiveness. The ASD group had a mean heart rate increase of 4.62 beats-per-minute compared to 14.29 in the control group ($F(1, 35)=22.63, p \leq .001$).

A regression analysis examined the independent roles of anxiety and participant group on stress responsiveness, revealing a significant SCAS by group interaction ($\beta=-.27$, $p=.02$). In the control group, increasing SCAS scores were positively associated with increased stress reactivity while the opposite relationship was seen in the ASD group.

Conclusions:

Overall, young people with ASDs display a significantly increased resting heart rate compared to controls and a lack of responsiveness when entering a stressful situation. Furthermore the relationship between stress responsiveness and baseline anxiety symptoms appears to differ between groups. It may be that a high resting heart rate allows less flexibility to adapt to stress. Alternative interpretations will be discussed.

158.067 67 Evaluating a Parent-Rated Measure of Anxiety Symptoms in Children with Autism Spectrum Disorders. V. Hallett*[1] and L. Scahill[2], (1) *Yale University*, (2) *Yale University*

Background: Anxiety disorders affect 30-40% of children and adolescents with autism spectrum disorders (ASDs). Due to the cognitive and language deficits in this population, measuring anxiety symptoms is particularly challenging. A reliable and valid measure of anxiety in children with ASDs, that is sensitive to change with treatment, is a prerequisite for use in pharmacological and psychosocial intervention studies.

Objectives: The purpose of this study was to evaluate the psychometric properties of a 20-item, parent-rated anxiety scale derived from the Child and Adolescent Symptom Inventory (CASI Anxiety) in children with ASDs (Gadow et al., 2002; 1997; Sukhodolsky et al., 2008). Items of this DSM-IV-based scale are rated from 0 to 3 with higher scores reflecting greater severity. We examined the clinical characteristics of children with high anxiety symptoms and explored the symptom patterns in ASD subgroups (autistic disorder, verbal and non-verbal children; children with IQ above and below 70).

Methods: The 404 participants (343 boys, 61 girls; age 4-17 years) took part in one of four federally-funded, multisite trials: Research Units on Pediatric Psychopharmacology (RUPP) Autism Network: risperidone vs placebo; methylphenidate vs placebo; risperidone only vs risperidone plus parent training) and STAART citalopram vs placebo (RUPP Autism Network, 2002; 2005; King et al., 2009; Aman et al., 2009). Of these 404 participants, 325 were diagnosed with Autistic Disorder, 59 with PDD-NOS and 20 with Asperger's disorder. Across all diagnostic groups, 222 were classified with IQ < 70 and 92 were classified as non-verbal.

We examined the distribution, calculated the internal consistency and compared the item-mean to total correlations of the 20-item CASI Anxiety scale. Mean scores on the CASI Anxiety scale were compared in verbal vs non-verbal participants and children with an IQ above and below 70. For divergent validity, we examined the correlations with the Aberrant Behavior Checklist (ABC) subscales and the modified Children's Yale Brown Obsessive Compulsive Scales (CYBOCS-PDD). Exploratory logistic regression also examined the clinical and cognitive characteristics of participants in the highest and the lowest quartiles on the CASI Anxiety scale.

Results: The 20-item CASI-Anxiety scores ranged from 0 to 50 (mean 14.2 + 9.39); with an alpha coefficient of 0.87. Five language-dependent items (including nightmares, expressed worries and physical symptoms) were rarely endorsed. This pattern was similar in verbal and non-verbal children. However, verbal children showed significantly higher mean scores on the CASI Anxiety scale ($p<0.05$). The high anxiety

group (n=104 in the upper quartile; CASI Anxiety score > 19) was associated with the presence of language (OR: 3.77), IQ above 70 (OR: 3.24) and high scores (top 25%) on the ABC Irritability scale (OR: 3.76). Correlations of the CASI Anxiety scale and ABC subscales, CYBOCS-PDD and Vineland scales were modest (range 0.10 to 0.33) suggesting that the CASI Anxiety scale is measuring a separate construct from these other scales.

Conclusions: The DSM-IV based, CASI Anxiety scale is a starting place for measuring anxiety in children with ASDs. Additional research is needed to confirm sensitivity to change for use in clinical trials.

158.068 68 Anxiety in Children with Autism Spectrum Disorders Is Associated with Affective Symptoms in Their Mothers. M. Uljarevic*[1], J. Lidstone[2], S. R. Leekam[2], H. Kanaris[3], A. M. McKigney[4], J. Mullis[5], R. Paradice[6] and M. Nešić[7], (1)*School of Psychology, Cardiff University*, (2)*Cardiff University*, (3)*St. Cadocs Hospital*, (4)*St Cadoc's Hospital*, (5)*Cardiff & Vale University Health Board*, (6)*St David's Hospital*, (7)*Faculty of Medicine, University of Niš*

Background: Anxiety symptoms have been described as one of the most common comorbid psychiatric conditions in individuals with Autism Spectrum Disorders (ASD). Although the rates of clinically significant anxiety differ between the studies, up to 40% of individuals with ASD are reported to have at least one comorbid anxiety symptom (van Steensel, Bogels & Perrin; 2011). Affective disorders are also considered to be the most commonly observed psychiatric diagnosis in the first degree relatives of autistic individuals (Gerdts & Bernier, 2011). Interestingly, the association between the presence of anxiety in autistic individuals and affective disorders in parents has not been thoroughly examined.

Objectives: to investigate the association between anxiety in children and adolescents with ASD and the presence of affective disorders in mothers.

Methods: The Spence Children's Anxiety Scale (Spence, 1998), and Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) were administered to a sample of 26 parents of children with ASD (mean age= 120.1 months, range= 28.7-214 months). Other potential correlates of children's anxiety were also examined. These included chronological age, autism severity measured by the Social Communication Questionnaire (Rutter et al., 2003) and repetitive behaviours measured by the Repetitive Behaviour Questionnaire 2 (Leekam et al., 2007).

Results: Comparison between autism group and normative group showed a significant difference in mean levels of anxiety (t= 2.485, df= 50, p=0.08, one tailed). 7 children with ASD obtained scores equal or higher than clinical mean (42.48; Spence, 1997). 73% of mothers of children with ASD met criteria for clinically significant anxiety and 30% met criteria for depression. Following these descriptive analyses, regression analysis was performed to determine whether chronological age, autism severity, repetitive behaviours scores of children and anxiety and depression of parents were associated with anxiety in children. It was found that the only significant predictor of anxiety in children was anxiety in parents.

Conclusions: Children with autism were found to have considerably higher levels of anxiety than the normal population which is in line with previous research (van Steensel, Bogels & Perrin, 2011). Our findings that 30% of mothers of children with ASD met the criteria for depression and that 73% of mothers met the criteria for clinically significant anxiety are also in line with the literature (Bolton, Pickles, Murphy, & Rutter, 1998; Micali, Chakrabati, & Fombone, 2004; Ingersoll, & Hambrick, 2011). While the results of our regression analysis are preliminary, finding that anxiety in mothers of children with ASD was associated with levels of anxiety in children lend the support to the hypothesis that affective disorders share common genetic risk with ASD.

158.069 69 Differential Perceptions of Clinical Anxiety Among Clinicians and Parents in Children with Autism Spectrum Disorder. R. A. Vasa*[1], L. Kalb[1], B. H. Freedman[2], A. Keefer[1], S. M. Kanne[3] and M. O. Mazurek[4], (1)*Kennedy Krieger Institute*, (2)*University of Delaware*, (3)*Baylor College of Medicine*, (4)*University of Missouri - Columbia*

Background: Recent data using parent-report measures indicate that anxiety is highly prevalent in children with autism spectrum disorders (ASD) (see review by White et al., 2009). However, no studies have examined levels of agreement between parent report measures and clinician diagnosis regarding the presence of clinical anxiety. This topic has important implications regarding the use of parent-reported anxiety measures in clinical practice, as well as conceptualizing anxiety in the ASD literature.

Objectives: To examine the: a) degree of concordance and discordance between parent and clinician assessments of anxiety in children with ASD; and b) child and parent characteristics associated with clinician-parent discordance.

Methods: Data from 2,262 children (M = 5.77 years, SD=3.48) were obtained from the Autism Treatment Network (ATN) registry. The ATN is a multi-site collaboration among 17 autism centers in the US and Canada that focuses on addressing the medical needs of children with ASD. The ATN enrolls children, ages 2 to 17.9 years, with a diagnosis of ASD as confirmed by the Autism Diagnostic Observation Schedule (ADOS; Lord et al, 2002) and DSM-IV-TR criteria. Clinicians completed customized forms regarding the child's current psychiatric diagnoses and treatments. Parent report of anxiety was measured using the Child Behavior Checklist Anxiety Problems Scale (CBCL; Achenbach and Rescorla, 2001). Concordance was present when the child received an anxiety disorder by the clinician and the parent reported clinical anxiety. Since only 5% of children had a clinician diagnosis of anxiety disorder in the absence of parent reported clinical anxiety, discordance in this study focused on the absence of a clinician diagnosis accompanied by parent reported clinical anxiety. Simple and multivariate logistic regression analyses examined the child and parent characteristics associated with this discordance.

Results: Clinicians diagnosed 224 (9.9%) children with an anxiety disorder, whereas parents reported clinical anxiety in 566 (25%) children. Of these 566 children, clinicians provided a diagnosis for 120 (21%) children, resulting in a discordance of 446 (79%). Results from the bivariate regressions indicated that discordance was more likely if the child was younger, non-Caucasian, had lower cognitive, language, and adaptive functioning, greater ASD severity, increased externalizing behaviors, and lower caregiver education. Multivariate analyses indicated that younger age, greater language impairment, and lower caregiver education were the strongest predictors of discordance (all $p < 0.05$).

Conclusions: Concordance between parents and clinicians regarding the presence of anxiety in the child with ASD was low. Discordance was more likely if the child was younger, had significant language impairments, and their caregiver was less educated. These data underscore the urgent need for developing a unified construct of anxiety for certain profiles of children with ASD, such as those who are lower functioning. Validation studies of parent-report measures of anxiety in children with ASD are also needed.

We acknowledge the members of the Autism Treatment Network (ATN) for use of the data and the families who participated in the Registry. The ATN is funded by Autism Speaks and a cooperative agreement (UA3 MC 11054) from HRSA to the Massachusetts General Hospital.

158.070 70 Factors Associated with Anxiety In Children with ASD. F. J. van Steensel* and S. M. Bogels, *University of Amsterdam*

Background: Parental anxiety, parental rearing, and family (dys-)functioning are found to be associated with anxiety in typically developing children (e.g. Bögels & Brechman-Toussaint, 2006). In accordance, a study of Kelly, Garnett, Attwood, and Peterson (2008) found that family conflict predicted anxiety/depression in children with ASD. Anxiety/depression in turn predicted ASD-severity. Besides parental anxiety, parental rearing and family (dys-)functioning, we hypothesized that anxiety in children with ASD might be associated with externalizing behaviors. That is, because of their difficulties in emotion regulation (e.g. Laurent & Rubin, 2004), children with ASD may respond to anxiety with more acting out behaviors (White, Oswald, Ollendick, & Scahill, 2009).

Objectives: The aim of this study was to examine which factors are associated with anxiety in children with ASD.

Methods: In total 201 children participated in the study; 85 Children with ASD and comorbid anxiety disorders (further referred to as ASD-sample) and 116 children with anxiety disorders without ASD (further referred to as AD-sample). In addition, 194 mothers and 147 fathers participated. Interviews to measure anxiety disorders, and questionnaires measuring psychopathology symptoms in children and parents, as well as parental rearing and family functioning, were administered.

Results: It was found that anxiety in the ASD-sample was positively correlated with maternal anxiety, ASD-symptoms, and with two family functioning scales, namely Enmeshment (mother report) and Control (father report). For the AD-sample, anxiety was found to be associated with parental anxiety, ASD-symptoms, and with four family functioning scales, namely Conflict (mother report), External locus of control, Enmeshment, and Control (father report). Further, a significant correlation was found between anxiety and externalizing behaviors for both samples. Regression analyses revealed that parental anxiety and family functioning predicted anxiety symptoms in children; however, different significant predictors were identified for respondents (fathers and mothers) and for the two samples. Next, for both samples, anxiety symptoms were found to predict externalizing problems as well as ASD-symptomatology; however, the reverse was also found. That is, ASD-symptomatology significantly predicted anxiety symptoms and externalizing problems.

Conclusions: Parental (maternal) anxiety and family factors seem to be associated with anxiety symptoms in children with ASD. The results of this study also suggest a bi-directional relation between ASD-symptomatology and symptoms of comorbidity. That is, anxiety symptoms may enhance ASD-symptomatology, while (certain) ASD-symptoms may also increase comorbidity. Interesting, this result was found for the ASD- as well as the AD-sample.

158.072 72 Factors Implicated in the Prevalence, Phenomenology and Impact of Anxiety Difficulties in Children with Autism Spectrum Disorders and Their Families. I. Magiati*[1], A. Y. Ong[1], X. Y. Lim[1], F. Patrycia[1], M. Sung[2], D. S. Fung[2] and K. Poon[3], (1)*National University of Singapore*, (2)*Institute of Mental Health*, (3)*National Institute of Education*

Background: It has been estimated that, depending on the assessment methodology used, 11-84% of children with Autism Spectrum Disorders (ASD) experience high levels of anxious symptomatology (Kim et al., 2000; White et al., 2009). Rates reported for anxiety disorders in ASD appear to be higher than those in typically developing children, children with non-ASD learning difficulties or children with language disorders (Gillott et al., 277; White et al., 2009; MacNeil et al., 2009). It is also thought that the nature of worries, fears and anxieties is likely to differ between children with and without ASD (i.e. Evans et al., 2005), but it is not yet clear how or whether specific factors related to ASD contribute most to this increased vulnerability to anxiety.

Objectives: The purpose of this study is to examine, in a large community sample of youth with ASD, the distribution, severity, nature and impact of anxiety difficulties in children and young people with ASD and their families in relation to a number of ASD-related factors including age, level of functioning, social skills, repetitive behaviours and interests, severity of other behavioral or emotional difficulties and experiences of bullying.

Methods: A large sample of 6-18 year old Singaporean children with a diagnosis of autism, ASD, Asperger syndrome or Pervasive Developmental Disorders-Not Otherwise Specified (PDD-NOS) and their caregivers were recruited from the community. Currently, 109 participants have completed the study. Data collection is ongoing and will be completed in February 2012 with an estimated total of 200-250 participants. Caregivers completed a number of standardized questionnaires on anxiety, autism severity, adaptive behavior and other behavioral difficulties (Spence Children's Anxiety Scale, Spence, 1997; Developmental Behaviour Checklist, Einfeld & Tonge, 2002; Scales of Independent Behaviour-Revised, Bruininks et al., 1996) and a questionnaire developed for the purposes of the present study. A smaller subgroup of participants who reported high rates of anxiety were followed up in focus groups to further explore the nature and impact of anxiety on the child and the family.

Results: Data collection is ongoing and will be completed in February 2012. This paper will present findings on the developmental presentation of anxiety symptoms in children

and youth with ASD, the effect of diagnostic group membership, level of functioning, ASD severity, social skills deficits and repetitive behaviours and interests on the rates and nature of anxiety symptoms. The impact of anxiety on the youth themselves and their families over and above the impact of ASD will also be discussed based on information obtained from the follow-up focus groups with a smaller subsample of the larger study.

Conclusions: There are very few large scale community based studies of anxiety in ASD. Findings from this study can increase our understanding of how anxiety difficulties present and impact individuals with ASD and which ASD related factors are mostly implicated in increased rates of anxiety in this group. Such knowledge can contribute to improving assessment procedures and intervention efforts in anxiety in youth with ASD.

158.073 73 Mother's Perceptions of Anxiety in Autism Spectrum Disorders. J. Palilla* and M. South, *Brigham Young University*

Background: On measures of well-being – aimed to assess stress, depression, pessimism and quality of relationships - parents of children with autism spectrum disorders report worse outcomes when compared to both parents of typically developing children and parents of children with other disabilities (Smith et al., 2010; Abbeduto et al., 2004). Such results indicate an urgent need to help parents, understand and cope with the challenges of raising a child with ASD. Among adolescents and school-aged children with ASD, anxiety-related concerns are among the most common presenting problems (Ghaziuddin, 2002). Research into this population found that between 11 and 84% experience significant impairment due to anxious symptoms (White et al., 2009). However, the underlying nature of the anxious symptoms in ASD is still unclear. A key obstacle for this area of research is that current measures of anxiety may not always be appropriate for assessing individuals with ASD.

Objectives: This exploratory study was designed to better characterize the co-occurring symptoms of anxiety in individuals with autism as described by their mothers. The rich descriptions gathered from a parent interview will help to determine whether the reported features of anxiety are representative of anxiety or characteristics of ASD.

Methods: Mothers of children diagnosed with ASD and mothers of typically developing children diagnosed with an anxiety disorder were recruited for this study. Children were between the ages of 8 and 16. Each mother completed the Spence Children's Anxiety Scale (SCAS, Spence, 1998) and the Social Responsiveness Scale (SRS; Constantino, 2004). Following the completion of the measures, each mother was given the Spence Children's Anxiety Scale – Parent Interview, which was developed by Dr. Jacquie Rodgers and Ruth Jamieson of Newcastle University. This interview asked the mothers questions about 1) statements on the SCAS they indicated applied to their children; 2) statements of particular interest that may or may not have applied to their child; and 3) any other situations in which the child was anxious that was not captured by the SCAS.

Results: Seventeen mothers were interviewed using the SCAS (9 with ASD children; 8 with anxious children). Mothers of children with ASD endorsed more statements that were on the Obsessive-Compulsive Disorder subscale of the SCAS. In comparison, mothers of typically developing children with anxiety disorders endorsed more statements on the generalized anxiety subscale of the SCAS and more somatic complaints. We highlight a number of specific SCAS items that differentiate the two groups. We are currently collecting more interviews in addition to a larger item-response analysis of SCAS questionnaire data to examine the factor structure of the SCAS in ASD children.

Conclusions: This initial analysis of the data reveals that the anxious features reported by mothers of children with ASD differ from those anxious features reported by mothers of anxious children. Ongoing work in this area will help us to refine an anxiety measure that better fits the profile of anxiety in children with ASD.

158.074 74 Formal Thought Disorder in Children with ASD: Prevalence, Relations with Communication Impairment and Prediction of (pre)Psychotic Symptoms During Adolescence. M. L. Eussen*[1], E. I. de Bruin[2], P. de Nijs[3], F. Verheij[3], F. C. Verhulst[3] and K. Greaves-Lord[3],

(1)*Yulius*, (2)*University of Amsterdam*, (3)*Erasmus MC - Sophia's Children's Hospital*

Background: Formal Thought Disorder (FTD) is a disruption in the flow of thought, which is inferred from the disorganization of spoken language and which is a manifestation of severely disturbed language processing. FTD was once considered as the hallmark of schizophrenia, but nowadays it is considered as an important symptom of autism spectrum disorders (ASD) as well. FTD can be a neurodevelopmental precursor of schizophrenia or it can be mainly a manifestation of severe communication impairment in ASD.

Objectives: The current study investigated in a longitudinal study of 142 individuals with ASD 1) the prevalence of FTD in childhood, 2) the relation between FTD and communication impairment in childhood, and 3) whether signs of formal thought disorder (FTD) during childhood predicted a prodromal state of psychosis during adolescence.

Methods: Overall ASD severity and more specifically communication impairment was assessed during childhood (T1) and adolescence (T2) using the Autism Diagnostic Observation Schedule (ADOS). At T1, the Kiddie-Formal Thought Disorder Scale (KFTDS) was used to systematically measure FTD. At T2, the Thought Problems Scale of the Child Behavior Checklist (CBCL), the Prodromal Questionnaire (PQ) and the Composite Assessment of At Risk Mental Symptoms (CAARMS) were used to assess (pre)psychotic symptoms. The prevalence of FTD was investigated by identifying the children that scored above the KFTDS threshold within the T1 ASD group (n=142). Children that scored above this threshold were compared with the children that scored below the threshold on the T1 ADOS communication impairment subdomain, and they were compared on PQ and CAARMS scores at T2.

Results: During childhood, 69% (n=98) of our ASD sample had a FTD according to the KFTDS threshold. Children that scored above this threshold had significantly higher ADOS communication impairment scores at T1 than those who scored below the KFTDS threshold (p=.04). At T2, individuals with FTD at T1 scored higher on the Thought Problems Scale of the CBCL (p=.05), but not on the PQ or CAARMS.

Conclusions: FTD is very prevalent among children with ASD. FTD seems to be a manifestation of severe communication impairment in ASD and not so much a precursor of psychosis.

158.075 75 Schozophrenia Spectrum Traits and Mental Health In Children with ASD. K. D. Gadow*, *State University of New York*

Background: Autism spectrum disorder (ASD) and schizophrenia spectrum disorder are widely recognized as discrete clinical entities; nevertheless, recent developments in molecular biology and nosology suggest interesting etiological and phenomenological interrelations.

Objectives: Prepubertal children with ASD with and without co-occurring schizophrenia spectrum traits (SST), both positive and negative (anhedonic feelings, apathy) were examined for differences in co-occurring psychiatric symptoms, background characteristics, and mental health risk factors such as symptoms of depression and anxiety.

Methods: Parents and teachers completed a DSM-IV-referenced rating scale with established psychometric properties for a relatively large sample (N=147) of 6-12 year old children with ASD. Mothers also completed a background information questionnaire.

Results: There was a clear pattern of group differences in emotion dysregulation symptom severity (+SST>SST-) and background characteristics, but results varied as a function of informant who served as the basis for group classification. Children with impairing SST had more mental health risk factors. Girls were more likely to be classified SST (mothers' ratings), whereas non-SST youth were more likely to be born in spring-summer (teachers' ratings). ASD and SST symptoms were moderately correlated.

Conclusions: Findings provide tentative evidence for a phenomenologically unique SST syndrome within the ASD clinical phenotype, which may ultimately prove helpful in future research for examining pathogenic processes, developmental trajectory, and response to intervention. The results will be discussed with a special emphasis on the role of emotion dysregulation in this developmental trajectory.

158.076 76 Suicidality and Self-Injury in High-Functioning Adolescents with Autism Spectrum Disorder. B. B. Maddox* and S. W. White, *Virginia Polytechnic Institute and State University*

Background: Recent studies have explored possible triggers and correlates of youth suicidality and non-suicidal self-injury (NSSI), but a specific focus on adolescents with Autism Spectrum Disorder (ASD) has been largely neglected. It may be assumed that suicidal ideation and attempts are uncommon in individuals with ASD, relative to typically developing individuals (Mandell et al., 2005), and NSSI may be characterized as a type of restricted and repetitive self-injury often associated with ASD (Love et al., 2009).

Objectives: The purpose of this study was to investigate the prevalence and correlates of suicidality and NSSI in a sample of clinically referred adolescents with ASD and comorbid anxiety. A related purpose was to qualitatively explore the adolescents' accounts of their suicidality and self-harm behaviors.

Methods: Data for the present study were drawn from a sample of thirty adolescents (12-17 years old) who participated in an experimental trial of a cognitive-behavioral treatment program. All participants had a confirmed ASD diagnosis, based on the ADOS (Lord et al., 2002) and ADI-R (Lord et al., 1994), met diagnostic criteria for at least one anxiety disorder, and were cognitively higher functioning (i.e., IQ > 70). Data on suicidality and NSSI were collected from clinical interviews with the adolescent and parent, individual therapy session notes, and clinical case summaries. All participating adolescents and parents completed the Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995), a measure of adolescent depression symptoms. Parents also completed the Adolescent Symptom Inventory-4 (ASI-4; Gadow & Sprafkin, 1998).

Results: Suicidal ideation and NSSI were fairly common in this sample. Prior to treatment, 12 adolescents (40% of sample) endorsed suicidality and/or self-harm within the previous two years, and 5 (17% of sample) demonstrated suicidality and/or self-harm during the treatment program. None of these behaivors were determined to be a function of the treatment program. Participants who reported suicidality and/or NSSI at baseline endorsed significantly more depressive symptoms on the SMFQ than teens without suicidality and/or NSSI, $t(28) = 2.591$, $p < .05$. The same pattern held for the parent-reported SMFQ, $t(28) = 2.238$, $p < .05$, and the ASI Dysthmic Disorder Symptom Severity scale, $t(28) = 2.295$, $p < .05$. The adolescents with NSSI did not differ from those without NSSI on their ADI-R Stereotyped and Repetitive Motor Mannerisms subscale or ADOS Stereotyped Behaviors and Restricted Interests domain scores.

Conclusions: Based on these results, the incidence of suicidality and/or self-harm is quite common in higher functioning adolescents with ASD and comorbid anxiety. Notably, the adolescents were not seeking treatment for suicidality, self-harm, or depression. In this sample, suicidality and NSSI were associated with self-reported and parent-reported depressive symptoms. The NSSI behaviors were not accurately captured by the repetitive and restricted behaviors domain of ASD. Qualitative descriptions and explanations from the adolescents will also be briefly summarized, which highlight the impulsivity and peer rejection associated with many of these clinical examples. Given the small size and clinical composition of the current sample, further study is needed with larger samples to generalize these findings.

158.077 77 A Review of Cases Presenting with Symptoms of Autism Spectrum Disorder At An Outpatient Mental Health Program. J. Shuster* and J. A. Eichstedt, *London Health Sciences Centre*

Background: Autism Spectrum Disorders (ASDs) are associated with increased rates of comorbid psychiatric disorders including depression, anxiety disorders, and obsessive compulsive disorder (Matson & Nebel-Schwalm, 2007). In a recent study of comorbid psychiatric disorders, 70% of individuals with ASD had at least one comorbid disorder and 41% had two or more (Simonoff, 2008). In some cases, comorbid psychiatric disorders may interfere with or delay the recognition of an ASD. While the average age of an ASD diagnosis is approximately 5.7 years of age (Shattuck et al., 2009), factors such as the presence of comorbid psychiatric diagnoses can delay the diagnosis of ASD (Shattuck & Grosse, 2007). The characteristics of individuals

who receive psychiatric diagnoses before receiving ASD diagnoses are currently unclear. Both non-recognition and misdiagnosis are likely to significantly impair treatment of individuals with ASD (Fraser et al., 2011).

Objectives: The goal of the current study is to identify and describe a group of children and youth with existing learning and/or psychiatric diagnoses who were referred for an ASD assessment. These children and youth were seen by psychiatrists and allied mental health professionals (e.g., social workers) at an outpatient mental health program for a range of presenting problems before being referred for an ASD assessment.

Methods: The files of six individuals referred for an ASD assessment were reviewed to gain a better understanding of the characteristics of this group. Files were reviewed for existing learning and/or psychiatric diagnoses, scores on standardized assessment measures of ASD symptoms, age of onset of ASD symptoms, and history of involvement of mental health services. The standardized assessment measures of ASD symptoms included the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994), the Autism Diagnostic Observation Schedule; Lord et al., 2000; and the Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003).

Results: The majority of individuals referred for an ASD assessment met criteria for an ASD diagnosis. The characteristics of individuals who met criteria for an ASD, as well as those who were referred for an assessment and did not meet criteria, will be described.

Conclusions: Describing this group of children and youth using standardized, gold standard diagnostic measures (e.g., Nachshen et al., 2008), will lead to a better understanding of individuals with ASD with comorbid learning and/or psychiatric diagnoses. This, in turn, will lead to earlier and more accurate diagnosis and treatment for this diagnostically complex group of individuals.

158.078 78 Drug Refractory Irritability in Persons with Autism Spectrum Disorders. B. Adler*, L. Wink, R. Shaffer, N. Minshawi and C. Erickson, *Indiana University School of Medicine*

Background: Of the many reasons patients with Autism Spectrum Disorders (ASD) seek out mental health care, irritable behavior (irritability) marked by aggression, self-injury, and severe tantrums may be the most dangerous to patients, caregivers and society at large. Currently, two medications, risperidone and aripiprazole, are United States Food and Drug Administration (FDA) approved for use in the treatment of irritability in persons with ASD. Despite these drug approvals and significant recent drug research targeting irritability in ASD, little is known about how often irritability becomes refractory to first line drug treatment in this population.

Objectives: We sought to better understand the large number of patients with ASD who presented to our clinic with irritability by identifying variables that would predict whether these patients eventually became refractory to drug treatment. We define the term Drug Refractory Irritability (DRI) by the presence of continuing irritable behavior requiring treatment adjustment despite failure of clinically adequate (duration at least 4 weeks, dosing within range of normal clinical use if such dosing tolerable) treatment trials of both aripiprazole and risperidone *or* failure of at least three previous clinically adequate drug trials (one trial must have included aripiprazole or risperidone).

Methods: The study will review the medical records of 200 consecutive patients evaluated for treatment at the Christian Sarkine Autism Treatment Center. Patients were seen from January 2005 through August 2011 and were diagnosed using Diagnostic and Statistical Manual, 4th Edition, Text Revision criteria for an ASD by a board certified child and adolescent psychiatrist with extensive experience with this population (CAE).

Results: In a preliminary analysis of the first 62 consecutive patients (age range 4-22 years) with a diagnosis of an ASD, 77% (36 males; 12 females) initially presented with the chief complaint of irritability. On initial presentation to our clinic 27% (n=17) of these patients already met criteria for DRI. Among these patients, an additional nine patients (15%) developed DRI during the course of ongoing treatment. Future work will include a statistical analysis of potential variables predictive of the development of DRI including factors such as age, gender,

presence of comorbid intellectual disability, specific ASD diagnosis, and potential known cause of ASD.

Conclusions: Despite the availability of first line FDA approved drug treatment, the results suggest that a large proportion of ASD patients presenting with irritability may go on to experience DRI. Future research investigating appropriate treatment approaches to patients with DRI is indicated.

158.079 79 Response Time Intra-Subject Variability: Commonalities Between Children with Autism Spectrum Disorder and Children with Children with ADHD. N. Adamo*[1], S. B. Lebovitz[1], S. Adelsberg[1], E. Petkova[2], F. X. Castellanos[3] and A. Di Martino[1], (1)*Phyllis Green and Randolph Cōwen Institute for Pediatric Neuroscience*, (2)*NYU Child Study Center*, (3)*Nathan Kline Institute for Psychiatric Research*

Background: The high prevalence of ADHD symptoms in individuals with ASD has been widely reported in clinical and epidemiological samples. Yet, to date, the mechanisms underlying ADHD–like symptoms in ASD and their potential overlap with those present in children with typical ADHD are under-explored. A potential candidate for investigation is response time intra-subject variability (RT-ISV) given consistent findings of increased RT-ISV in typical individuals with ADHD. A few studies have directly compared RT-ISV in children with ASD and ADHD yielding contradictory results.

Objectives: We aimed to examine whether RT-ISV distinguishes children with ASD from those with typical ADHD and whether it characterizes the subgroup of children with ASD and ADHD–like symptoms (ASD^+).

Methods: A group of 133 boys aged between 7 and 14.9 years participated in this study. They included 55 with ASD, 47 with ADHD, and 31 typically developing (TD). RT data were collected during a fixed-sequence 5.5-min version of the Sustained Attention to Response Task (SART). We measured RT-ISV both as standard deviation of RT (SD-RT) and as amplitude of frequency fluctuations measured with Morlet wavelet transform. Specifically, based on theoretical models of neuronal oscillations, we selected *a priori* the following frequency bands: Slow-2 [0.2-0.34Hz], Slow-3 [0.073 – 0.2 Hz], Slow-4 [0.027-0.073 Hz], and Slow-5 [0.010-0.027 Hz]. We first compared the three groups (ASD, ADHD, TD) with one-way ANOVA. We then conducted post-hoc pair-wise group comparisons, Bonferroni corrected.Secondary group comparisons were also conducted after dividing the ASD group in 29 children with ASD^+ and 26 ASD^- per DSM-IV total T-score ≤ 65 on the Conners Parent Rating Scales (CPRS).

Results: The three groups differed in SD-RT with moderate effect size (167±52 vs. 178±54, and 151±45 ms, in ASD, ADHD, and TD children, respectively; Cohen's *d*: 0.4). Additionally, both children with ASD and children with ADHD showed increased RT fluctuations at the fastest frequencies detected by the SART (Slow-2; 33207±19959 vs. 34501±21550, and 21647±10297 in the ASD, ADHD, and TD groups, respectively; $p<0.01$). Relative to TD children increased amplitudes of Slow-2 characterized both ADHD and ASD groups which, in turn, did not differ from each other. Secondary analyses showed that only the ASD^+ and ADHD groups showed significantly increased amplitude of Slow-2 relative to TD. Children with ASD^- did not differ significantly from any of the other groups. Amplitude of frequencies slower than 0.2 Hz did not differ between groups.

Conclusions: Our results suggest that 1) increases of RT fluctuations > 0.2 Hz (i.e., cycles of ~5 sec) can serve as a potential marker of ADHD symptoms regardless of diagnostic categorical boundaries, and 2) children with ADHD and those with ASD^+ may, at least in part share common physiopathological mechanisms. Fluctuations in RT may reflect intrinsic brain activity occurring in similar frequency ranges. Future work will need to directly examine the relationship between RT-ISV and fluctuations of brain intrinsic spontaneous activity.

158.080 80 Prevalence and Risk Factors for Attention-Deficit/Hyperactivity Disorder Among Children with Autism Spectrum Disorders. A. Keefer*, L. Kalb and R. A. Vasa, *Kennedy Krieger Institute*

Background: Approximately 30% to 53% of children with an Autism Spectrum Disorder (ASD) also meet diagnostic criteria for Attention-Deficit/Hyperactivity Disorder (ADHD) (Leyfer et al., 2006; Sinzig et al., 2009). In addition several studies have demonstrated that the presence of comorbid ADHD symptoms in children with ASD deleteriously affects adaptive behavior,

executive functioning, core ASD symptoms, and externalizing behaviors in children (Yerys et al., 2009; Matsushima et al., 2008). However, the studies reporting these findings are fraught with limitations including small sample sizes and significant variability in the measurement and clinical definition of ADHD. Thus, a greater understanding of the prevalence and phenotype of this disorder is of paramount importance.

Objectives: To examine a) the prevalence of parent-reported ADHD symptoms in children with ASD; and b) the demographic, cognitive, psychiatric, and adaptive-behavioral correlates associated with comorbid ADHD.

Methods: Cross-sectional data from 169 children, ages 2 to 16 years (M = 6.39; SD = 3.3), were derived from a local research registry project housed in an urban outpatient pediatric clinic. Children were evaluated for ASD by trained diagnosticians using DSM-IV-TR criteria and the Autism Diagnostic Observation Schedule (ADOS; Lord et al, 2002). Children also underwent standardized cognitive testing. Upon enrollment, parents completed questionnaires such as the Child Behavior Checklist (CBCL; Achenbach and Rescorla, 2001), an established measure of childhood psychopathology. Clinical cutoff values from the DSM-oriented empirical CBCL ADHD scale were used to establish prevalence. Bivariate and multivariate linear regression analyses were conducted to examine six correlates of ADHD: 1) demographic characteristics (i.e., child age, race, parental education), 2) standardized IQ scores, 3) adaptive-behavioral functioning (Vineland Adaptive Behavior Scale II; Sparrow et al., 2005), 4) psychiatric comorbidities from the DSM-oriented scales shared by the preschool and school age versions of the CBCL (anxiety, oppositional and affective problems T scores), and 6) ASD severity using adjusted ADOS raw scores (Gotham et al., 2006).

Results: In this sample, 15% of children had clinical ADHD, and 18% had sub-clinical ADHD per parent-report. In the bivariate analyses, oppositional (r = .52), anxiety (r = .48) and affective (r = .46) problems were positively correlated with ADHD. Results of the multivariate model demonstrated that all three of these psychiatric comorbidities were independently associated with increased ADHD symptoms (all $p < .01$). Demographic characteristics, IQ, and adaptive functioning were not associated with ADHD symptoms.

Conclusions: Prevalence of parent-reported ADHD symptoms was lower in this sample compared to previously reported estimates, perhaps due to the single informant and normative based assessment utilized in this study. Children with ADHD are likely to present with a more complex psychiatric profile characterized by the presence of comorbid oppositional, anxiety, or affective problems. These data highlight the importance of developing standardized, comprehensive, and multi-informant mental health assessment methods for children with ASD and comorbid ADHD.

158.081 81 Neural Correlates of Face and Eye Gaze Processing Differentiate Children with Autism Spectrum Disorder (ASD) and/or Attention Deficit Hyperactivity Disorder (ADHD).

C. Tye*[1], E. Mercure[2], K. L. Ashwood[1], B. Azadi[1], P. Asherson[1], M. H. Johnson[3], P. F. Bolton[1] and G. McLoughlin[1], (1)*Institute of Psychiatry, Kings College London*, (2)*Institute of Cognitive Neuroscience, University College London*, (3)*Centre for Brain and Cognitive Development, Birkbeck, University of London*

Background: There is considerable clinical and genetic overlap between autism spectrum disorders (ASD) and attention deficit hyperactivity disorder (ADHD). In particular both disorders demonstrate social impairments (Uekermann et al. 2010; Rommelse et al. 2011). In typical development, neurophysiological brain responses differentiate upright and inverted faces, and direct and averted gaze (Farroni et al. 2002; Taylor, Batty & Itier, 2004), and recent work has demonstrated that the gaze effect is only found for upright faces in the right hemisphere (Mercure et al. in prep). While absence or reductions in these effects are consistently found in ASD (McPartland et al. 2004; Senju et al. 2005), the impact of ADHD or co-occurring ADHD in ASD on these effects is unknown. By measuring neurophysiological responses to face stimuli, it is possible to directly capture abnormalities in fast-occurring responses to faces.

Objectives: (1) To investigate the specificity of face processing abnormalities to ASD and (2) to elucidate the neural basis of the common comorbidity between these two disorders.

Methods: Event-related potentials were recorded during presentation of face stimuli in 20 males with ASD, 18 males with ADHD, 28 males with ASD+ADHD and 26 typically developing (TD) males between 8 and 13 years of age. Peak amplitudes of the P1, the N170 and a peak-to-peak difference score between the two components, were entered into separate repeated measures ANOVAs with factors Orientation (Upright, Inverted), Gaze (Direct, Averted) and Montage (Left, Medial, Right, Anterior Midline). Due to developmental changes, the effect of age was analysed both as a covariate and an independent variable (8-10 years vs. 11-13 years).

Results: Across all groups, an interaction between orientation and gaze emerged indicating a gaze effect in upright faces (increased amplitude for averted gaze) and not inverted faces. Children with ASD demonstrated reduced and bilateral neurophysiological responses across all face stimuli compared to typical controls and children with ADHD, who exhibited greater amplitude over the right hemisphere. Children with comorbid ASD+ADHD showed intermediate abnormalities that were not significantly different to neither ASD-only nor ADHD-only participants. Age effects differed between participant groups: all clinical groups demonstrated a more pronounced developmental change in the face inversion effect (reduced amplitude for inverted faces in younger subjects compared to enhanced amplitude for inverted faces in older subjects).

Conclusions: Topographical and amplitude atypicalities in neurophysiological responses to faces are specific to ASD compared to ADHD. Children with ASD+ADHD present as a hybrid of both disorders with deficits equivalent to the addition of each disorder individually. Age has a substantial effect on neurophysiological responses to faces in all clinical groups, suggestive of altered developmental processes. Such findings emphasize the utility of electrophysiological measurement in characterizing this common comorbidity, by highlighting shared and distinct abnormalities to target in genetic research and intervention studies.

158.082 82 Association of Internalising Traits and Autistic Traits in Adolescence in a Community-Based Twin Sample. A. D. Scherff*[1], T. Charman[2] and A. Ronald[1], (1)*Birkbeck College*, (2)*Institute of Education*

Background: Autism spectrum disorders (ASD) show a high degree of comorbidity, with an estimated 70% of individuals with ASD having an additional psychiatric disorder (Simonoff et al. 2008, JAACAP 47: 921-929). Anxiety disorders in particular are among the most commonly co-occurring conditions with ASD with a prevalence of ~40% (van Steensel et al 2011, CCFPR 14:302-317).

Objectives: The current study aimed to estimate the degree to which the overlap between autistic traits and internalising traits in adolescence in the general population is explained by genetic and environmental influences. Further analysis investigated the extent to which internalising traits were associated with specific domains of autistic traits.

Methods: Participants were part of the Twins Early Development Study (TEDS), a UK-based community sample. Parents of 12-14 year old twins completed the emotional symptoms scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman 1997, JCPP 38: 581-586) and the Autism Spectrum Quotient (AQ, Baron-Cohen et al 2006, JADD 36: 343-350). Degrees of covariation between internalising traits and autistic traits (N= 2,005 twin pairs) were assessed using bivariate twin model-fitting, differentiating shared genetic and environmental influences. In a further analysis, exploratory factor analysis was conducted on the AQ. Five subscales descriptive of specific domains of autistic behaviour were derived from the factor analysis: 1) numbers/patterns, 2) social/non-social inflexibility, 3) poor mentalising, 4) solitariness, 5) poor imagination. Overlap between internalising traits and these five subscales of the AQ on genetic and environmental influences was assessed.

Results: The phenotypic correlation between internalising traits and overall autistic traits was $r = 0.32$ ($p<0.001$) and in univariate analyses, both showed moderate heritability (52% and 50%, respectively). Cross-twin-cross-trait correlations were $r_{MZ} = 0.28$ for monozygotic and $r_{DZ} = 0.24$ for dizygotic twins. In an ACE bivariate model genetic and non-shared

environmental correlations were modest (r_g = 0.22, r_e = 0.16), and a high shared environmental correlation was found (r_c = 0.84). Univariate twin model-fitting on the AQ individual factor analysis-based subscales revealed modest heritability for numbers/patterns (33%) and poor imagination (42%) and moderate-to-high heritabilities for social/non-social inflexibility (52%), poor mentalising (69%) and solitariness (78%). In bivariate analyses of internalising traits with each AQ subscale, inflexibility showed the highest amount of shared genetic influences, while all other subscales showed low or non-significant genetic overlap with internalising traits. There was some evidence that shared and non-shared environment explained part of the covariation between each AQ subscale and internalising traits.

Conclusions: These results suggest that both genetic influences and shared environmental influences play a role in the association between autistic traits and internalising traits during adolescence. It is important to consider separately the specific domains of autistic trait-like behaviours in relation to co-occurring internalising traits, and their different aetiologies illustrate the complexity proposed by the fractionable autism triad hypothesis (Happé & Ronald 2008, NR 18:287-304). The present work provides new information on the relationship of internalising traits and autistic traits in early adolescence and particularly about more narrowly defined sets of autistic trait-like behaviours.

158.083 83 Internalizing and Externalizing Behaviors in Children with ASD. C. Manangan, H. N. Liming*, H. Dauterman, B. J. Wilson and K. Reynolds, *Seattle Pacific University*

Background:

Behavioral profiles of children with clinical disorders are frequently utilized in case conceptualization and treatment. Problem behaviors are most commonly understood as falling into either externalizing or internalizing categories. Children with autism spectrum disorder (ASD) commonly present with co-occurring attention deficit/hyperactivity disorder (ADHD) symptoms (Aman & Langworthy, 2000; Ghaziuddin et al, 1998; Lee & Opal, 2006). In comparison to typically developing children, children with ASD-only and children with ADHD-only have increased rates of both internalizing and externalizing behaviors (De Pauw & Mervielde, 2010; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Kuhlthau et al, 2010). However no research has been conducted to compare internalizing and externalizing behavior profiles among children with: a) typical development, b) typical development and ADHD symptoms, c) ASD, and d) ASD and ADHD symptoms.

Objectives:

This study sought to discern manifestations of internalizing and behavioral symptoms in typically developing children (TD), children with ASD, and TD and ASD children with co-occurring ADHD symptoms.

Methods:

Sixty-three children between the ages of 3:0 and 6:11 years old, parents, and teachers participated in this study. Parents completed the Conners' Parent Rating Scale – Revised (Conners, 1997) to assess children's ADHD symptoms. Teachers completed the Behavior Assessment System for Children, Second Edition (BASC-2) to evaluate externalizing and internalizing symptoms. Based on developmental status (ASD vs ADHD) and the presence of clinically significant ADHD symptoms, we created four distinct groups: ASD, ASD + ADHD, TD, and TD + ADHD. These groups were then compared on their symptoms of internalizing and externalizing behaviors.

Results:

A series of one-way analysis of variance (ANOVA) were conducted to examine group differences in externalizing and internalizing symptoms. The overall tests for group difference in depressive symptoms (F = [3, 59] = 19.75, p < .001), aggressive behaviors (F = [3, 59] = 6.60, p < .001), and hyperactivity (F = [3, 59 = 11.89, p < .001), were significant.

Post hoc analyses were conducted to examine pairwise differences via Bonferroni test. Group means for depressive symptoms for children in the ASD + ADHD were significantly greater than group means for children in the TD group (p < .001), TD + ADHD group (p < .001), and the ASD group (p = .03). For aggressive behaviors, group means for the ASD + ADHD group was significantly greater than for the TD group (p

< .001). Hyperactivity mean scores were significantly lower in the TD group than the ASD group (p = .02) and the ASD+ADHD group (p = .003).

Conclusions:

These findings support and extend previous research demonstrating that children with ASD combined with ADHD symptoms demonstrate significant challenges in both internalizing (depressive) and externalizing (aggressive and hyperactive) symptoms. Additionally, children with ASD, with and without ADHD symptoms, demonstrate heightened levels of hyperactivity. These findings contribute to discerning behavioral symptoms associated ASD with and without ADHD symptoms.

158.084 84 The Repetitive Behavior Spectrum: From Autism to Obsessive Compulsive Disorder. R. H. Rice*,

Background:

Repetitive behaviors are commonly observed in clinical settings, yet mental health practitioners still understand very little about them and the role they play in someone's life.

Objectives:

Measure development analyses are outlined for the purpose of determining the psychometric properties of a new assessment tool intended to assist mental health practitioners in understanding what motivates and sustains repetitive behavior in their clients.

Methods:

Participants consisted of 82 total subjects. Of those subjects 70 were male and 12 were female. Diagnostically, 25 were in a group meeting criteria for OCD only, 23 were in a group meeting criteria for an ASD only, and 34 were in a group meeting criteria for both OCD and an ASD. The research site was a clinical setting at a diagnostic and treatment center located in the Northeastern United States.

Measures. The self-developed assessment tool-form 1 was administered and scored by the PI with each subject. This tool is intended to determine whether a particular repetitive behavior (i.e., stereotypy, obsession, compulsion, perseveration, preoccupation) is characterized by one of the possible functional characteristics of repetitive behavior identified for study (i.e., risk-avoiding, pleasure-seeking, soothing, distressing, adaptive, disruptive, metaphoric, concrete, internalized, and/or intrusive).

The self-developed assessment tool- form 2 was provided to the parents or caregivers and primary therapists for each individual in the study. This tool utilized the same items as form 1, but presented in a manner that the individual subject's parents or other caregivers and therapists could easily understand and respond to (e.g., instead of "It makes it difficult to concentrate," the item read: Do you think that this behavior makes it difficult for him/her to concentrate?).

The Yale-Brown Obsessive Compulsive Scale, Adaptive Behavior Assessment System-Second Edition, and Gilliam Autism Rating Scale-Second Edition were also provided to each subject and/or his/her parent or caregiver. For the purposes of this study, it was used to examine patterns of association between the self-developed assessment tool and standard measures of functioning.

Results:

Exploratory factor analyses were conducted separately in data collected from parents, therapists, and individuals using a self-developed repetitive behavior scale. When the structural coefficients from these analyses were compared across the three sources of information, four larger factors emerged demonstrating reasonable consistency across the three types of informants. These assessed: 1) intrusive effects; 2) soothing effects; 3) level of distress, and; 4) pleasure-seeking qualities. Reliability for the new scales was then calculated separately for each source of information revealing high internal consistency as evidenced by Cronbach's alpha scores mostly in the 0.7 and higher range. Validity Analyses were completed, first by examining bi-variate correlations among the new scales and then by examining correlations between the new scales and established measures of functioning.

Conclusions:

A more comprehensive, functional model of repetitive behavior including links with other symptoms would go a long way toward helping mental health professionals better understand the purpose of repetitive behavior and how to better address it.

158.085 85 Reactive/Proactive Aggression, Emotion Regulation, and Empathy in Children with ASD. L. Stockmann[1], L. B. Pouw*[2] and C. Rieffe[2], (1)*Center for Autism*, (2)*Leiden University*

Background: Aggressive behavior has been frequently observed in children with Autism spectrum disorder (Farmer & Aman, 2010). It could be expected that this mainly concerns aggression in response to negative or overwhelming situations, which is (at least partly) caused by impaired emotion regulation skills. Emotion regulation skills are also important concerning empathy. For an adaptive empathic reaction, one needs to be able to regulate the own emotion arousal caused by witnessing another person in pain or upset. It could therefore be expected that impairments in controlling the own level of arousal evoked by witnessing a negative emotion in someone else, will be positively related to reactive aggression.

Objectives: The purpose of the study was to examine the unique contribution of affective and cognitive empathy, and emotion regulation (anger mood) to reactive and proactive aggression in children with an Autism Spectrum Disorder (ASD) and typically developing (TD) children.

Methods: The study included 136 children and young adolescents (68 with ASD, 68 TD, *M*age = 139 months).In order to compare the groups, self-report and parent questionnaires concerning empathy, anger mood, and aggression were used.

Results: The outcomes showed that affective empathy was negatively associated with reactive aggression in de TD group, but positively in the ASD group. However, in the ASD group, the link between affective empathy and reactive aggression was mediated by anger dysregulation. Personal distress was positively and uniquely related to reactive aggression in de TD group, over and above anger dysregulation. Proactive aggression was associated with affective empathy in the ASD group, but not in the TD group. Again, the link between proactive aggression and affective empathy was mediated by anger dysregulation in the ASD group.

Conclusions: These outcomes support previous findings that in TD children, a lack of empathy is related to proactive aggression, suggesting a cold blooded urge to achieve their means. In contrast, emotion dysregulation is related to both reactive and proactive aggression in children with ASD, showing a different origin for these behavioral problems in this clinical group.

158.086 86 Use of On-Body Sensing and Computational Analysis to Automatically Detect Problem Behaviors. A. Rozga*[1], N. Y. Hammerla[2], A. R. Reavis[3], N. A. Call[4] and T. Plötz[1], (1)*Georgia Institute of Technology*, (2)*Newcastle University*, (3)*Marcus Autism Center & Children's Healthcare of Atlanta*, (4)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory University School of Medicine*

Background: Behavior problems such as destructive behaviors, aggression, and self-injury are part of the clinical picture of autism (Hartley et al., 2008), and thus represent the targets of many intervention efforts (Horner et al., 2002). Accurate data on the frequency and intensity of these behaviors is key to understanding why and when they occur and tracking response to treatment. Current approaches to measurement include standardized checklists and direct observation. The former provide quick and cost-effective means of gathering data and are widely used in research settings, but do not capture precise frequencies of behavior. The latter yield rich data regarding the frequency and context of the behavior, but are time-intensive and thus difficult to implement across many settings and longer time scales.

Objectives: To explore the potential for automatic analysis techniques to detect and classify severe problem behaviors using small, body-worn sensors (accelerometers) and computational analysis methods.

Methods: We collected three 2-minute sessions of simulated data with experienced staff from a severe behavior treatment clinic. The staff wore accelerometer sensors on the wrists and ankles while engaging in three classes of problem behaviors: aggression (hits, pushes, kicks directed at another person

present in the room), disruption (throwing objects/furniture, hitting/kicking walls and furniture), and self-injury (hitting self). A researcher reviewed the videos from the sessions and using coding software, marked the onset of each instance of a problem behavior. She further classified each instance according to one of the three main categories (aggression, disruption, self injury) and the limb involved (right vs. left arm and leg).

Results: Data obtained from the sensors included 3-axis accelerometry (energy) and the orientation of the sensor. We applied machine-learning techniques to data from the four sensor streams (right and left ankle and wrist) to automatically: (1) segment events of interest (i.e., identify moments where movement was occurring versus not occurring), and (2) classify each event as falling into one of four categories: *aggression*, *disruption*, *self-injury*, and *other* (not problem behavior related). We then compared the results of the automatic classification against the human-coded data, separately for each limb. For segmentation, the automated method correctly identified 95% of events identified by the human coder. For classification of these events, the automated method differentiated among aggression, disruption, self-injury, and other with an accuracy of 72-74% for events involving the hands, and an accuracy of 94-97% for events involving the legs.

Conclusions: These preliminary results indicate that our automated methods attain high levels of sensitivity in detecting problem behaviors and good accuracy in differentiating among aggression, disruption, self-injury, and movements unrelated to problem behaviors. Our findings highlight the great potential for technology and computational methods to facilitate the gathering of objective, accurate measures of the frequency of problem behaviors in a range of contexts and over larger time scales. Data collection utilizing the accelerometers with children with autism currently undergoing treatment at the clinic is ongoing. The next set of analyses will evaluate the performance of our classification algorithms when applied to data collected from these children.

158.087 87 Examining the Relation Between Sensory Sensitivity and Obsessive-Compulsive Behaviors in Autism Spectrum Disorders As Moderated by Early Language Acquisition. T. W. Soto*[1], L. Wainwright[2], A. S. Carter[2], I. Noens[3], D. L. Pauls[4] and K. D. Tsatsanis[5], (1)*University of Massachusetts, Boston*, (2)*University of Massachusetts Boston*, (3)*Katholieke Universiteit Leuven*, (4)*Massachusetts General Hospital*, (5)*Yale Child Study Center*

Background: Research indicates a link between autism spectrum disorders (ASDs) and obsessive-compulsive behaviors (OCB). Moreover, sensory sensitivity (SS) has been established as a common characteristic in individuals with ASD and potentially in individuals with elevated OCBs. However, there is limited research exploring the relation of SS to OCB in high-functioning individuals with ASD, which is surprising given that both SS and OCB have high prevalence in individuals affected with ASD. A key diagnostic distinction within ASDs is meeting the developmental milestones of language acquisition. Given that a delay in the development of language has shown to be related to impairment in related mechanisms, such as social cognition, it is posited that obsessions and subsequent compulsions would be more pronounced in individuals without a language delay. For this reason, we examined the moderating effect of language acquisition in the relation between SS and OCBs in individuals with high-functioning ASD.

Objectives: 1) To explain the relation between SS and OCBs in high-functioning individuals with ASD. 2) To examine the moderating effect of language acquisition in the relation between SS and OCBs.

Methods: Individuals with high functioning autism (HFA), Asperger's syndrome (AS), and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) (n=129; mean FSIQ=98.46; mean age=13.66; 91.4% male) were assessed in the following domains: Full Scale Intelligence Quotient (FSIQ) as measured by the WISC or WAIS, obsessive-compulsive behaviors as measured by the symptom checklist and ordinal scales of the Yale-Brown Obsessive-Compulsive Scale (TS-OCD), early language acquisition as measured by the ADI-R, and sensory sensitivity as measured by selected items on the ADI-R, ADOS, and TS-OCD interview.

Results: Hierarchical multiple linear regression was used to test the relation between SS and OCBs, controlling for age and FSIQ. Parallel models with obsessions and compulsions as the outcome variables were also tested. Language acquisition was included in models as a moderator of the relation between SS and OCBs. SS and language acquisition each accounted for unique variance in OCBs, $F(4, 125) = 5.02$, $p<.01$, as did their interaction, $F(5, 124) = 4.91$, $p<.001$. When looked at separately, language acquisition moderated the relationship between SS and compulsions, $F(5, 124) = 3.02$, $p<.05$, but not SS and obsessions. The relation between SS and OCBs was significant for individuals with HFA with late language acquisition, but there was no association for those with early language acquisition.

Conclusions: Results suggest that higher levels of SS predict increased rates of OCBs in high-functioning individuals with ASD, and that the magnitude of this relationship is influenced by the presence of early language acquisition. This study provides evidence for further exploration of the role SS and early language acquisition have on the manifestation of ASD related symptom presentation.

158.088 88 Gender Differences in Obsessive and Compulsive Symptomatology Among Children with ASD. V. Livermore-Hardy*[1], D. H. Skuse[2] and W. P. Mandy[3], (1)*Great Ormond Street for Children Hospital NHS Trust*, (2)*Institute of Child Health*, (3)*University College London*

Background:

Gender differences have been found in young children with Autistic Spectrum Disorders (ASDs). Two consistent findings have shown that; ASDs are more common in males than females and females tend to score lower on intelligence tests than males. Research into gender differences in core autistic symptomatology is less consistent when focused on older children and adults. Recent evidence has shown differences with respect to the core autistic symptomatology of older male and female children, which showed that males exhibited greater levels of repetitive stereotypic behaviours than females. There is also some evidence that females with ASD exhibit greater internalising difficulties than males, although the extent and precise nature of this difference is poorly understood. In particular, whilst ASD is a risk factor for developing Obsessive Compulsive Disorder (OCD), little is known about any OCD gender differences in this population.

Objectives:

To investigate whether females with ASDs exhibit higher levels of OCD symptomatology compared to age and IQ equivalent males with ASD.

Methods:

Participants (N = 116, 21 females; aged 3–18 years) received a clinic consensus diagnosis of ASD (based on 3Di and ADOS assessment) at a national clinic for children with high-functioning ASD. All participants were equivalent on age, IQ and symptom severity. All participants were in mainstream school and had fluent language. Male and female participants were compared on parent and self-report OCD symptoms scores. In addition parent and teacher report for internalizing difficulties on the Strengths and Difficulties Questionnaire (SDQ) were available.

Results:

Parents reported that females with ASD exhibited significantly higher levels of OCD symptomatology when compared to males ($p= 0.031$). Using SDQ scores on the emotional subscale both parents and teachers also reported higher levels of internalizing difficulties in females than males. Teachers report of internalizing difficulties was statistically significant ($p=0.03$) and parent report scores were non-significant but displayed a similar trend ($p=0.07$). Linear regression was then used to ascertain whether the significant gender difference in OCD symptomatology remained after controlling for general internalizing difficulties. Females were reported to exhibit clinically significant levels of OCD symptomatology even after controlling for the effects of general internalizing difficulties in females ($p=0.04$).

Conclusions:

In this study, females with ASDs were shown to exhibit significantly higher levels of OCD symptomatology, when compared to males with ASDs. As clinical experience

suggests, females are more likely to display higher levels of internalizing, emotional difficulties than males although this does not fully explain their higher levels of OCD symptomatology. These findings are of research and clinical interest. If females with ASDs are more disposed toward higher levels of OCD symptomatology then clinically, this could be an area for routine assessment of females at the point of an ASD diagnosis. In addition OCD symptoms in females with ASDs could represent the manifestation of repetitive and rigidity behaviours in a more 'cognitive' than behavioural domain than in the male dominated RSB diagnostic subscale. Future ASD gender difference research should therefore distinguish between the cognitive and behavioural manifestations of OCD.

158.089 89 Psychopathology and Impairment in Children with ASD. A. J. Kaat*[1], K. D. Gadow[2] and L. Lecavalier[3], (1)*Nisonger Center*, (2)*State University of New York*, (3)*Ohio State University*

Background: To meet diagnostic criteria for most psychiatric disorders, the DSM-IV-TR requires that a certain number of symptoms be present and cause impairment in social, academic, or occupational functioning. Little research has been done on the relationship between psychiatric symptoms and impairment in children with Autism Spectrum Disorders (ASD). The *Child and Adolescent Symptom Inventory* (CASI-4R), a DSM-IV based symptom checklist, was recently revised to include impairment ratings for several major disorders.

Objectives: The objective of this study was to examine the relationship between psychiatric symptoms and impairment in a large sample of clinically referred children with ASD. Specifically, the objective was to examine how many children screened positive for a disorder based on symptoms only, had significant impairment only, or had both positive screens and impairment. The following disorders were considered: Attention Deficit/Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), Generalized Anxiety Disorder (GAD), Social Phobia, Major Depressive Episode (MDE), and Dysthymia.

Methods: Participants were consecutive referrals to a specialty clinic for autism and developmental disorders who met inclusion criteria for this study. Parents and teachers completed the CASI-4R. A positive screen on the CASI-4R occurs when the rater endorses the DSM-required number of symptoms for a disorder as occurring 'often' or 'very often'. Parent-reported data were available for 104 children (88 boys, 16 girls) and teacher-reported data for 88 children (79 boys, 10 girls) with a mean age of 8.5 years (SD = 1.8) and FSIQ of 86 (SD= 22). Additional socio-demographic variables were also collected. Analyses were conducted on parent and teacher data separately.

Results: Parents and teachers showed low but significant levels of agreement. The correlations between symptom severity scores and impairment scores varied from .49 (for CD) to .83 (for ODD) for parents and from .59 (for ADHD-HI) to .84 (for CD) for teachers. By parent-report, 84 children (81%) were impaired in at least one disorder. For teachers, 76 children (86%) were impaired. Rates of impairment varied significantly across disorders from 20% (for depressive disorders) to 67% (for ADHD). With the exception of parent-reported dysthymia and teacher-reported CD, more children showed impairment than met the symptom count requirements for a disorder. Just because children showed impairment did not mean that they met symptom count requirements. But for parents, children who met symptom count requirements usually also showed impairment. By teacher-report, not all children who met symptom count requirements were impaired.

Conclusions: Many children with ASD present with psychiatric symptoms. Symptoms of other disorders are present and impairing in most children's lives. Of the children who met symptom count requirements, most also met impairment requirements. However, a significant proportion of children failed to reach symptom count requirements, but showed impairment. These subthreshold cases warrant additional evaluation to ensure that all needs are appropriately addressed in treatment.

158.090 90 Behavioral Intervention to Reduce Arousal Improves Compliance and Information Retrieval in Children with ASD. P. R. Zelazo*[1], C. Reid[2], E. Neumark[3], M. Vedenina[4] and J. A. Correa[1], (1)*McGill University*, (2)*Montreal Autism Centre*, (3)*Concordia University*, (4)*Centre for Research in Human Development*

Background:

Young children with autism experience difficulty with social interactions and communication, and have repetitive interests and behaviors. They are non-compliant to adult requests, often hyperactive, frequently display tantrums, avoid eye contact, and have delayed mental development. There is clear evidence that children with ASD also display resistant and non-compliant behaviour to task demands (Carr & Durand, 1985, Carr & Newsom, 1985, Rogers, Zelazo, Mendelson & Rotsztein, 1998). We hypothesized that avoidant/non-compliant behavior and errors in responding to requests for known material result from excessive arousal.

Objectives:

To test this hypothesis, we created a procedure to shape calming behaviors following an avoidant response to a task demand, and predicted both compliance and a correct response to the same task demand that elicited avoidance initially.

Methods:

A before-after design was used in which 30 children were exposed to differing numbers of control and experimental sessions, a total of 190 therapeutic episodes. For the first analysis, 21 children who had one control session and two experimental sessions, selected randomly, served as participants. In experimental sessions, when the child displayed avoidant/non-compliant behaviors to a task demand, the parent initiated a calming procedure in which precise behaviors were rewarded with praise, a one second touch and/or a tiny edible. In the control condition a calming procedure was not implemented when criteria for calming were reached. The exact method of McNemar's test was used to investigate the association between type of session and outcome.

For the second analysis, all episodes were used and all 30 children served as participants. The effect of the type of session and quality of calming (Good, Moderate or Poor) on the probability of a successful outcome (compliance and correct answer), adjusting for age of the child, time elapsed from the previous session and number of previous experimental sessions, was examined using GEE logistic regression.

Results:

For the first data set, Experimental session 1, in which a calming procedure was used following non-compliance to a task demand, elicited more compliance with a correct answer than the control condition in which no calming was used (McNemar's test, $p<0.001$). Similarly, Experimental session 2 elicited more compliance with a correct answer than the control condition (McNemar's test, $p<0.0001$). There was no difference between experimental sessions (McNemar's test, $p=0.18$). For the second data set, a GEE analysis of quality of calming revealed that "Good quality" calming produced more compliance with correct responding than "Poor quality" calming (OR 18.6, 95%CI3.5, 97.8). Moreover, "Moderate quality" calming produced a statistically better outcome than "Poor Quality" calming.

Conclusions:

These results support the hypothesis that the origins of an avoidant, non-compliant response to task demands in children with ASD is arousal that exceeds the child's threshold for tolerance and triggers a biologically programmed stress (HPA Axis flight or fight) response (Zelazo, 2001). This view implies that an immature (Zelazo, 2001) or impaired (Hirstein, Iversen & Ramachandran, 2001; Mehlerk & Purpura, 2008) arousal modulation system that arrests the development of stress tolerance and self-regulation may be a fundamental component of autism.

158.091 91 Stability and Predictors of the Developmental Course From Childhood Into Adolescence of Co-Occurring Psychiatric Disorders in Individuals with ASD. C. Verheij, S. C. Louwerse, J. Van der Ende, F. Verheij, F. C. Verhulst and K. Greaves-Lord*, *Erasmus MC - Sophia's Children's Hospital*

Background: Little is known regarding the developmental course from childhood into adolescence of co-occurring psychiatric disorders in individuals with ASD.

Objectives: The first aim of this study was to longitudinally investigate the prevalence rates of co-occurring disorders

during childhood and adolescence in individuals with ASD. The second aim was to investigate the stability from childhood to adolescence of co-occurring internalizing and externalizing disorders in individuals with ASD. As a third aim, we explored the factors that predict co-occurring disorders in adolescence in individuals with ASD.

Methods: The Diagnostic Interview Schedule for Children (DISC) parental version was assessed to examine co-occurring disorders in individuals with ASD when they were 6-12 years old (T1) and again when they were 12-19 years old (T2). Several factors were explored as putative predictors of outcome at T2.

Results: Parents of 104 individuals took part in the DISC assessment both at T1 and T2. High prevalence rates of co-occurring disorders were found both in childhood (71%) and in adolescence (59%). Children with no co-occurring disorders in childhood were most likely to stay free of co-occurring disorders in adolescence. Children with internalizing as well as externalizing disorders in childhood were most likely to have any kind of co-occurring disorder in adolescence. High levels of socially not tuned behavior, resistance to change and stereotypies during childhood were predictive for the presence of co-occurring disorders in adolescence.

Conclusions: Children with ASD are likely to have co-occurring psychiatric disorders both in childhood and in adolescence. Especially individuals with internalizing as well as externalizing disorders, socially not tuned behavior, resistance to change and stereotypies in childhood are at highest risk for having co-occurring disorders in adolescence. Therefore, these factors have high prognostic relevance and should be evaluated or even treated in childhood.

158.093 93 Internalizing Problems and Emotion Dysregulation In Children with ASD. L. B. Pouw*[1], C. Rieffe[1] and L. Stockmann[2], (1)*Leiden University*, (2)*Center for Autism*

Background: Internalizing problems are common among children with ASD. An important factor in the development of depression and social anxiety in TD children is emotion regulation (Wright et al., 2009). However, based on previous studies (Pouw et al., submitted), we propose that both dysregulation of the own emotions and over-arousal while witnessing others' emotions (empathy) might contribute to internalizing symptoms in children with ASD.

Objectives: With this study, we examined the extent to which different coping strategies and different aspects of empathy contributed to the prediction of internalizing symptoms (social anxiety and depression) in children with and without ASD.

Methods: The study included 136 children and young adolescents (68 with ASD, 68 TD, Mean Age 139 months), who filled out self-report questionnaires about coping strategies (problem solving, seeking social support, externalizing, internalizing, distraction, and trivializing) and empathy (contagion, personal distress, and understanding).

Results: Coping strategies contributed differentially to symptoms of depression and anxiety, but this pattern was equal in both groups. Only distraction and trivializing were negatively related to depression in children with ASD uniquely. However, the aspects of empathy showed quite a distinct pattern between the two groups: contagion (i.e. being emotionally aroused while witnessing another person's distress) contributed to more symptoms of depression and anxiety, but only in children with ASD as predicted.

Conclusions: This study shows that unlike TD children, understanding the emotions of others is not a protective factor in the development of internalizing symptoms in children with ASD. Additionally, distracting themselves from negative events or trivializing the event seem beneficial tactics for children with ASD in the protection of depressive symptoms in particular.

158.094 94 The Impact of the Marital Relationship, Family Environment, and Child Behavior on Maternal Depression. A. S. Weitlauf*[1], A. C. Vehorn[1], S. P. White[1], J. L. Taylor[2] and Z. Warren[1], (1)*Vanderbilt University*, (2)*Vanderbilt Kennedy Center*

Background: Mothers of children with autism report more stress and depression than mothers of typically developing children and children with other developmental disabilities (Griffith et al., 2010; Hamlyn-Wright et al., 2007). Previous studies have found that child behavior problems (Barker et al., 2011; Benson et al., 2011) and child symptom severity

(Ingersoll et al., 2011) may contribute to these high maternal depression rates. Maternal distress can have detrimental effects on both maternal health and the effectiveness of child interventions (Gallagher et al., 2009; Osborne et al., 2008).

Objectives: Our primary aim was to examine demographic, child, and family/relational variables that may contribute to maternal depression maintenance after an autism diagnosis with the ultimate goal of identifying potential targets for intervention.

Methods: Participants included 75 mothers of children who received autism diagnoses an average of 1.4 years earlier as part of a research project at a midsized southern university. Fifty mothers who scored in the clinical depression range at baseline were included in these analyses. Mothers provided self-report information at one time point on current and post-diagnostic depression (Center for Epidemiological Studies – Depression scale; CES-D), demographic variables, dyadic adjustment (Dyadic Adjustment Scale; DAS), child behavior (Child Behavior Checklist; CBCL), and family interactions (Family Environment Scale; FES).

Results: Mothers who reported depression at the time of diagnosis were split into two groups based on current depression status (still depressed vs. resolved). One-way ANOVAs revealed no differences between groups on demographic variables (race, maternal/paternal/child age, income, maternal/paternal education, parent marital status), child variables (age at diagnosis, ADOS severity, Vineland-II scales, IQ), number of interventions, and perceived intervention effectiveness. Differences emerged for dyadic adjustment ($F = 6.634$, $p = .01$), internalizing behaviors ($F = 7.34$, $p < .01$), externalizing behaviors ($F = 7.87$, $p < .01$), and three aspects of the family environment: intellectual/cultural orientation ($F = 4.27$, $p < .05$), cohesion ($F = 7.50$, $p < .01$), and conflict ($F = 5.29$, $p < .05$).

Conclusions: Mothers were more likely to report concerns regarding chronic or recurrent depression following ASD diagnosis in the context of lower family cohesion, poorer relationships with their spouses, fewer cultural enrichment opportunities, and higher family conflict. Both internalizing and externalizing child problem behaviors also related to ongoing depressed mood. Depression maintenance approximately one year after diagnosis was not related to demographic variables, child diagnostic characteristics, the number of supports put into place, or the perceived effectiveness of those supports. Further investigation of the factors that maintain depression after an autism diagnosis may provide more clearly defined targets for intervention that could benefit both mothers and their children.

158.095 95 Early Temperament As a Predictor of Psychopathology in Younger Siblings of Children with Autism. P. A. Rao*[1], R. A. Vasa[2] and R. J. Landa[2], (1)*Center for Autism & Related Disorders*, (2)*Kennedy Krieger Institute*

Background:

According to the National Survey of Children's Health (McPheeters et al., 2011), 5.6% of children with autism spectrum disorder (ASD) have a comorbid psychiatric disorder before the age of 6 years, whereas a striking 48% of children with ASD over the age of 6 years have an additional psychiatric disorder. These data underscore the urgent need for research designed to identify and treat early precursors of psychopathology in children with ASD before the onset of comorbid psychiatric disorders. Younger siblings “at risk” for ASD provide an ideal sample in which to examine early risk factors of emergent psychopathology.

Objectives:

To explore the potential relationship between early temperamental profiles of younger siblings of children with autism and the onset of psychopathology during the early school years.

Methods:

Participants included 74 younger siblings with 36-month outcome diagnoses of ASD (Sibs-ASD; n=21) and no ASD (Sibs-No ASD; n=53) enrolled in a prospective study of child development by age 14 months. Data were collected at two time points. At time 1 (T1; age 30-40 months (mean age = 36; SD = 1.2), parents completed the *Behavioral Style Questionnaire* (BSQ; McDevitt & Carey, 1996). The BSQ yields standard scores for: Activity; Rythmicity; Approach;

Adaptability; Intensity; Mood, Persistence; and Threshold of Response. At time 2 (T2; age 4 to 8 years; mean age = 5.9, SD = 1.3), parents completed the *Behavior Assessment Scale for Children*, *second edition* (BASC-2; Reynolds & Kamphaus, 2004). Multiple regression analyses were conducted for Sibs-ASD and Sibs-No ASD separately, using BSQ standard scores at T1 as predictor variables and BASC-2 standard scores on the Externalizing Behavior and Internalizing Behavior Composite scales at T2 as dependent variables.

Results:

Independent samples t-tests revealed that, at T1, Sibs-ASD scored significantly higher (more impaired) in Adaptability than Sibs-No ASD (t=4.85, *p*=.0001), and Sibs-No ASD scored significantly higher in distractibility (more distractible) than the Sibs-ASD group (t=5.54, *p*=.0001).

Results of the regression analyses for Sibs-ASD showed that Persistence at T1 predicted Externalizing Behaviors at T2, accounting for 28% of the variance [$F(1,20)=7.029$, $p=.016$]. There were no significant predictors of Internalizing Behaviors for the Sibs-ASD group.

For Sibs-NoASD, Activity and Distractibility at T1 predicted Externalizing Behaviors at T2, accounting for 46% of the variance [$F(1,53)=20.916$, $p=.0001$]. Mood at T1 predicted Internalizing Behaviors at T2 in Sibs-NoASD, but accounted for only 13% of the variance [$F(1,53)=7.301$, $p=.009$].

Conclusions:

Findings suggest that developmental psychopathology in children with and without ASD is likely to have different ontogenies. In Sibs-ASD, lack of persistence when faced with difficult tasks was predictive of externalizing symptoms, possibly indicating low tolerance for frustration and poor self-regulatory control. For Sibs-No ASD, elevated levels of activity and distractibility were predictive of T2 externalizing problems. Further research is needed to determine how characteristics of externalizing problems in children with and without ASD differ, and the efficacy of preventative interventions targeting the developmental predictors of these problems.

158.096 96 Disassociation of Maternal Stress in Autism, Fragile X, and Fragile X with Autism. L. M. McCary*, A. Robinson, J. Kellett and J. E. Roberts, *University of South Carolina*

Background: Elevated parenting stress in mothers of children with developmental disabilities has been linked to a range of negative outcomes including increased maladaptive parenting behaviors, greater incidence of maternal psychopathology, failure to engage with services, and less beneficial outcomes for children (Osborne et al., 2008). Though high levels of parenting stress have been reported for mothers across various clinical populations, maternal adaptation has been found to vary significantly according to the nature of a child's disability. Results of efforts to understand the association between certain child characteristics and maternal stress have indicated a strong positive relationship between child problem behaviors and mothers' stress (Hastings, 2003). Fragile X syndrome (FXS) and autism spectrum disorder (ASD) are two developmental disabilities marked by high levels of maladaptive behavior and associated maternal stress. Recent investigations have suggested that child maladaptive behavior may serve as the most salient predictor of maternal stress in both of these populations (Ekas & Whitman, 2010; Johnston et al., 2003). To date, no studies have examined the dissociation of maternal stress across these two groups of mothers whose children often share a number of behavioral characteristics.

Objectives: Due to the significant negative effect of maternal parenting stress on the child and family system, we investigated the relationship between child problem behavior and multiple dimensions of maternal parental stress among 3 high risk maternal groups, those with: a child with idiopathic (non-FXS) autism (IA), a child with FXS only (FXS), and a child diagnosed with FXS and autism (FXSA).

Methods: Participants were 102 biological mothers of sons with FXS (*n*=48), IA (*n*=19), and FXSA (*n*=19). Children were between the ages of 11 months and 14.5 years. Mothers completed the Wechsler Abbreviated Scale of Intelligence (WASI; mean=104), Child Behavior Checklist (CBCL; measure of child problem behavior), and Parenting Stress Index (PSI) as part of a larger study. The PSI yields three scales: Parental

Distress (PD), Parent-Child Dysfunctional Interaction (P-CDI), and Difficult Child (DC). Each subscale served as a dependent variable in this study due to our interest in dimensions of maternal parenting stress.

Results: Three hierarchical regression models were constructed. Covariates (maternal IQ and age) were entered first, followed by group status, then CBCL scores, then the interaction between group and CBCL. In the P-CDI and PD models, child problem behavior significantly predicted parenting stress (β = .601, t = 3.228, p = .002; β= .579, t = 3.103, p = .003, respectively), but this relationship did not vary by group. The overall model for DC was significant (R = .795, R^2 = .632, $F(5,93)$ =31.88, p < .001) in addition to the interaction between CBCL and group (β = 1.326, t = 2.719, p = .008) indicating that maternal parenting stress was lowest for children with FXS when child problem behavior was low.

Conclusions: Findings replicate previous research indicating a significant relationship between child problem behaviors and parenting stress and indicate that there are differences when taking a dimensional approach to stress.

158.097 97 Stress in Parents of Preschoolers Diagnosed with Autism Spectrum Disorder. M. N. Simard*[1], E. Gisel[2], E. Fombonne[3] and M. Couture[4], (1)*CHUQ Research Center*, (2)*McGill University*, (3)*Montreal Children's Hospital*, (4)*Sherbrooke University*

Background: Parents of children diagnosed with autism spectrum disorders (ASD) experience levels of stress significantly higher than parents of children without disabilities. Several factors such as the gender and age of parents, the social support and the parent's perceived self-efficacy, locus of control and coping style, seem to increase the risk for higher level of stress in parents of children diagnosed with ASD. However, apart from the autism severity and the behavior of the child, which child's characteristics contribute to the increase of stress is poorly understood. Recently, it has been suggested that an increase in the degree of the autonomy of the child diagnosed with ASD could act potentially as a protective factor for the family's quality of life and functioning. Moreover, in a pilot study with 35 preschoolers diagnosed with ASD, a significant correlation between the degree of autonomy of children and parental stress was found.

Objectives: To explore which child's characteristics are significant contributors to parental stress in a larger group of families with a preschooler newly diagnosed with ASD.

Methods: A cross sectional design has been used to reach the objective. Data collection was achieved with 61 children aged 3 to 4 years old and newly diagnosed with ASD using the ADI-R and ADOS-G. Other tests administered were the *Merrill-Palmer-Revised* (MP-R) for the cognition, the *Preschool Language Scale 4th edition* (PLS-4) for the language, the *Peabody Developmental Motor Scale-II* (PDMS-2) for the motor component, the *Sensory Profile-Short form* (SSP) for the sensory information processing, the *Child Behavior Checklist* (CBCL) for the behavior, the *Social Responsiveness Scale* (SRS) for the severity of autism, the *Repetitive Behavior Scale* (RBS) for the stereotyped and repetitive behaviors, the *Vineland Adaptive Behavior Scale-II-Daily living* scale (VABS-II-DLS) for the autonomy and the *Parent Stress Index-short form* for the parental stress. With the exception of the VABS-II-DLS, only the total score of each scale was considered in the analysis in order to simplify the presentation of the results.

Results: Pairwise correlations revealed significant association between the high level of total parental stress and the following child's characteristics: difficulties in sensory information processing (r=-0.4671; p=0.0002), behavioral problems (r=0.6571; p<0.0001), higher severity of autism (r=0.5145; p=0.0002), high level of repetitive and stereotyped behaviors (r=0.3935; p=0.0062) and poor daily living skills (r=-0.3451; p=0.0074). After conducting step-wise regression analysis with those variables as predictors of the total parental stress, the best model includes the SSP, the VABS-II-DLS and the CBCL and explains 49% of the variance.

Conclusions: With a prevalence of ASD approaching 1%, there are important costs to society associated with their difficulties which are estimated in terms of billions of dollars. Sensory processing problems, behavioral difficulties and autonomy in daily living skills are domains for which interventions should be elaborated. By improving the child's functioning, this should contribute to help parents cope with their stress following the diagnosis. This would not only impact on the parental stress and the family life, but also it should help lower the costs to society.

158.098 98 Parental Distress in Pursuit of ASD Diagnostic Consultation. S. P. White*, J. A. Davidson, A. G. Nicholson, A. Vehorn, H. Noble, A. S. Weitlauf and Z. Warren, *TRIAD, Vanderbilt Kennedy Center*

Background: Given the numerous challenges involved in raising a child with an autism spectrum disorder (ASD), it is not surprising that parents of children with ASD report higher levels of parenting stress and psychiatric difficulties than do parents of both typically developing children and children with other developmental disabilities. Recent research indicates that parents of young children receiving a diagnosis of ASD report potent symptoms of acute distress following diagnosis (Davis & Carter, 2008; Taylor & Warren, 2011); however, not much is known about parent functioning and distress prior to the child receiving a diagnosis.

Objectives: This poster represents preliminary data from a larger longitudinal study investigating the well-being of parents with concerns related to their child's development, including ASD. The focus is on family functioning while developing concerns, pursuing consultation, and in the immediate aftermath of a diagnosis. Ultimately links to functioning over a more extended timeframe will be explored in order to elucidate factors associated with deleterious distress and resilience in caregivers of young children with ASD.

Methods: Participants were caregivers of families of children between 18 and 39 months of age who endorsed developmental concerns, often including ASD specific concerns, and wanted to participate in a specific psychological evaluation to clarify their child's functioning and diagnostic profile. Parents completed measures of depressive symptoms (Center of Epidemiological Studies-Depression Scale; CES-D) and provided data regarding child functioning (i.e., Achenbach Child Behavior Checklist; CBCL, Modified Checklist for Autism in Toddlers; MCHAT). Children subsequently participated in a direct assessment (Autism Diagnostic Observation Schedule; ADOS, Mullen Scales of Early Learning; MSEL) and families were provided with explicit feedback about their child's profile and performance.

Results: Data was collected on a total 24 parents (18 mothers). When looking at a measure of depression (i.e., CES-D), 50% of mothers (n=9) and 50% of fathers (n=3) endorsed clinically significant levels of depression *prior* to their child being evaluated. Results indicate that symptoms of depression were not related to the child's level of cognitive functioning (i.e., MSEL) or symptom severity (i.e., ADOS). A significant correlation was found between mothers' scores on CES-D and number of items failed on the MCHAT (r =.759, p≤ .001). This relationship was not significant for fathers.

Conclusions: Ideal models of screening, identification, and diagnosis must take into account family functioning prior to and following ASD diagnosis in order to optimally join and engage caregivers in pursuit of the most appropriate services possible for children. Enhanced awareness of pointed distress and the factors associated with such distress prior to diagnosis may provide information to adapt clinical diagnostic best practices for families of children with ASD.

158.099 99 Parental Stress in Families of Children with Autism and Other Developmental Disabilities: Associations with Ethnic Groups and Child-Comorbid Symptoms. M. D. Valicenti-McDermott*, K. Hottinger, K. Lawson, R. M. Seijo, M. Schechtman, L. H. Shulman and S. Shinnar, *Albert Einstein College of Medicine*

Background: Families of children with developmental disorders frequently report higher levels of stress compared to children with typical development. These differences maybe accentuated in an inner city, ethnically diverse population and associated with specific child co-morbid symptoms.

Objectives: To examine level of parental stress in families of children with autism spectrum disorder (ASD), compared to families of children with other developmental disabilities (DD) and to assess the relationship of stress with feeding, gastrointestinal (GI), sleeping and behavioral problems.

Methods: Cross sectional study with structured interview in 50 children with ASD and 50 children with other DD, matched by age/gender. Interview included: Parenting Stress Index, GI

Questionnaire, Child's Sleep Habits Questionnaire and Aberrant Behavior Checklist. Statistical analysis included chi-square, t test, correlations and regression.

Results: Mean age8 +/- 3 yr, 15% White, 44% Hispanic and 24% AfricanAmerican. Parental stress was reported in 51% of the ASD group and 30% of the DD (p=0.04). Children with ASD presented more co-morbid symptoms: GI (66% vs 40%p=0.04), sleeping (78% vs 33%p<0.001) and behavioral problems (78% vs 33%p<0.001). Non Hispanic (52% vs 29%p=0.003) and US-born mothers (51% vs 30%p=0.04) reported more stress. In ASD group stress was related to child's irritability(r=.5 p<0.001), hyperactivity (r=.4p=0.002), lethargy(r=.5 p<0.001), food selectivity (78% vs 35% p=0.007) and GI symptoms (61% vs 25% p=0.04); no association with sleeping problems. In DD group stress was also associated with child's behavioral problems: irritability(r=.5p<0.001), hyperactivity (r=.4p=0.002) and sleep problems (59% vs 15%p=0.003); no association to feeding/GI symptoms. The association between parental stress and irritability persisted after adjusting for child developmental diagnosis, demographics and maternal education (OR1.1 95%CI 1.04-1.2).

Conclusions: Parents of children with ASD reported more stress than parents of children with other DD. In both groups parental stress was related to child's behavioral problems, but in the ASD group it was also related to GI/feeding symptoms and in the DD group to sleeping difficulties. Non Hispanics and US-born mothers reported more stress. Providing more support to parents on behavioral issues may address parental stress in ASD and DD.

158.100 100 Vicarious Futurity, Hope, and Well-Being in Parents of Children with Autism. D. J. Faso*[1], A. R. Neal[2] and C. L. Carlson[3], (1)*University of Texas at Dallas*, (2)*University of Texas*, (3)*The University of Texas*

Background: Parents of children with autism are at risk of experiencing more stress and depression. Trait Hope (tHope) has been shown to buffer some of these deleterious effects (Lloyd & Hastings, 2009). While the broad positivity of tHope appears important to parent functioning, it may overlook the possibility that parent thoughts/feelings about their child may reflect both positive and negative components. Vicarious Futurity (VF) is the Vicarious Hope and Vicarious Despair a parent has for their child's future. Given that VF reflects both positive and negative components, it may more comprehensively reflect the complexity in parents' thoughts/feelings about their child than tHope. Little is known about how VF functions in parents of children with autism aside from findings that suggest that these parents have less Vicarious Hope and more Vicarious Despair for their child's future than parents of typically developing children (Wong & Heriot, 2007).

Objectives: The purpose of this study was to examine potential associations between tHope, VF, autism symptom severity (AutSeverity) and emotional functioning in parents of children with autism. We hypothesized that (1) tHope would correlate with VF, (2) autism symptom severity (AutSeverity) would predict tHope and VF, and (3) tHope and VF would each predict parenting stress, depression, and life satisfaction while controlling for symptom severity.

Methods: Seventy-one parents (53 mothers; 18 fathers) with a child with ASD between the ages of 4-12 participated in an online study. Measures included the Hope Scale, Vicarious Futurity Scale, CES-D, Parenting Stress Index-SF, Gilliam Autism Rating Scale-2, and the Satisfaction with Life Scale.

Results: Correlation analyses indicated that tHope was not significantly correlated with VF (r = .201, *p* =.09). Regression analyses revealed that AutSeverity did not significantly predict tHope (B =-.06, *p* =.60) or VF (B = -.21, *p* =.09). Regression analyses also revealed that tHope significantly predicted higher life satisfaction (B = .380, *p* =.001). and lower depression(B = -.443, *p* =.000), but did not significantly predict parenting stress(B = .141, *p* =.157). VF significantly predicted lower parenting stress(B = -.441, *p* =.000) and higher life satisfaction(B = .233, *p* =.040), but did not significantly predict depression(B = -.144, *p* =.174).

Conclusions: The results suggest that tHope and VF each reflect unique information about parents' thoughts/feelings, and both are important in the prediction of parent functioning. For example, our regression analyses revealed that VF predicted parenting stress and tHope predicted depression,

suggesting that dichotomous parent attitudes about their child's future are crucial when examining how much parenting stress is experienced, and overall hopefulness is important for understanding depression in parents of children with autism. Although these constructs function independently of each other, both VF and tHope are associated with life satisfaction, evidence that these constructs are positive measures for well-being. It is vital to consider the individual and parental aspects of hope in order to fully understand well-being in parents of children with autism. Additionally, child autism severity did not modulate tHope or VF for these parents, and future research should determine what factors contribute to these constructs if not child symptom severity.

158.101 101 Family Functioning and Maternal Depression: A Latent Growth Curve Analysis. A. Zaidman-Zait*[1], P. Mirenda[1], P. Szatmari[2], S. E. Bryson[3], E. Fombonne[4], W. Roberts[5], T. Vaillancourt[6], J. Volden[7], C. Waddell[8], L. Zwaigenbaum[7], S. Georgiades[2], E. Duku[2], A. Thompson[2] and T. Pathways in ASD Study Team[9], (1)*University of British Columbia*, (2)*Offord Centre for Child Studies, McMaster University*, (3)*Dalhousie University/IWK Health Centre*, (4)*McGill University*, (5)*University of Toronto*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*, (9)*McMaster University*

Background: Families of children diagnosed with autism spectrum disorders (ASD) may experience considerable disruptions in family functioning. Elevated levels of depressive symptoms among mothers of children with ASD have been well established (Montes & Halterman, 2007) and are likely to present additional stress to the family system. The simultaneous examination of parental depressive symptoms and family functioning over time would likely yield a more complete understanding of the family system.

Objectives: The purpose of this study was two-fold: 1) to examine the simultaneous trajectories of maternal depression and family functioning over a 3-year period in a large inception cohort of young children with ASD; and, 2) to examine the impact of autism severity, maternal coping strategies, and social support on those trajectories.

Methods: Data were drawn from the Canadian Pathways in ASD study and included 163 children. Data were collected within 4 months of diagnosis (T1; mean age = 36.5 months, SD = 6.6), 24 months later (T2); and when the child was 6 years old (T3). Mothers completed the General Family Functioning subscale of the McMaster Family Assessment Device (Byles, Byrne, Boyle, & Offord, 1988), the Symptom Checklist-90-R (Derogatis, 1994) to assess maternal depression, the Ways of Coping Scales (Folkman & Lazarus,1988) to assess coping strategies, the Social Support Survey (NLSCY, 2008-2009), and the Social Responsiveness Scale (SRS; Constantino & Todd, 2000) to measure ASD severity. Latent growth curve analysis was employed to examine trajectories and predictors. The model employed maximum likelihood estimation with robust standard errors using Mplus Version 6.11.

Results: Tests of model fit revealed a well-fitting model (RMSEA = 0.01; Chi-square = 25.54; p = 0.43). Results indicated significant inter-individual variation around the intercepts of both depression and family functioning. No significant changes were found for either family functioning or mothers' depressive symptoms over time in the group as a whole (Estimate = 0.013, p = 0.85; estimate = -0.02, p = 0.61, respectively). However, results documented a negative covariance between the intercept and the slope of family functioning, implying that families with high levels of family dysfunction at T1 tended to show improved functioning over time, whereas those with better functioning tended to worsen (estimate = -0.05, p = 0.01). In addition, significant covariation was found between family dysfunction and maternal depression at both T1 and over time. Regarding correlates at T1 (intercept), both use of a positive reappraisal coping strategy and social support were associated with lower levels of both family dysfunction and maternal depression. Conversely, an escape avoidance coping strategy was associated with higher levels of both family dysfunction and maternal depression. In addition, a confrontive coping strategy was associated with a higher level of family dysfunction. No significant associations were found with autism severity, as measured by the SRS.

Conclusions: Overall, both depressive symptoms and family functioning were stable over a 3-year period in mothers of young children with ASD. The results emphasize the importance of early intervention that addresses family well-being and that encourages the use of positive coping strategies.

158.102 102 A Family Affair: Linking the Role of Parental Confidence, Siblings, and Emotion Regulation in Children with Autism Spectrum Disorders. N. M. Reyes*[1] and A. Scarpa[2], (1)*Virginia Tech* , (2)*Virginia Tech*

Background: Parental self-efficacy appears to play a role in parental competence and child adjustment in typically developing children (Jones, & Prinz, 2005) and children with autism (Hastings, & Brown). Relationships between children with autism and their siblings have been described as less intimate, prosocial, and nurturing (Kaminsky, & Dewey, 2001). Collectively, previous research suggests that parents' and siblings' interactions with a target child might play a role in his/her adjustment. However, no research has investigated the association among parental confidence, presence of siblings, and emotion regulation in children with autism.

Objectives: This study investigated the whether parental confidence might be linked to (1) children's emotional regulation or (2) the presence of siblings at home.

Methods: Participants consisted of 12 children with ASD (2 females, 10 males) with a mean age of 5.58 (*SD*=.73, range: 4.50-7.00). In order to participate in this study, children were required to have an ASD diagnosis or meet ASD criteria on the Autism Diagnostic Observation Schedule (ADOS). They were attending kindergarten or first grade, were verbal, and able to understand and follow verbal instructions.

Parents reported on how confident they felt in being able to manage their child's anger/anxiety, how confident they felt in their child's ability to manage anger/anxiety, and the number of siblings in the home. Parents also completed both subscales, Emotion Regulation and Negativity/Lability, of the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1998). Finally, Social and communication deficits were examined using the Communication and Social domains of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000, Lord, et al., 1999).

Results: Parental confidence in their child's ability to deal with anger was significantly negatively correlated with the number of siblings in the home, $r(10)=-.502$, $p=.05$). Also, trends were observed for a negative correlation between number of siblings and parental self-confidence to deal with their child's anger, $r(10)=-.41$, $p<.10$), and parental confidence in their child's ability to deal with anxiety, $r(10) = -.393$, $p=.10$). Finally, a trend emerged for a negative correlation between number of siblings in the home and children's Emotion Regulation scores on the ERC, $r(10)=-.420$, $p<.10$). No other significant correlations or trends were observed.

Conclusions: These findings suggest family dynamics may play a role in parental perception of emotion regulation abilities in their child with ASD. Specifically, larger families appear to be associated with decreased confidence in managing the child's anger/anxiety. However, siblings of children with autism tend to show admiration of their siblings and engage in less conflict and competition than their typically developing peers (Kaminsky, & Dewey, 2001). One possible explanation is that even if the total number of interactions is fewer, they might be more emotional intense when they do occur. These interactions might leave parents with a sense of poor self-efficacy in knowing how to help their child to deal with the emotions elicited by negative interactions. Future research should examine the quality and type of interactions between children with ASD and their siblings and whether they are more likely to experience intense negative emotions.

158.103 103 The Nature of Savant Skills in Children with Autism Spectrum Disorders. R. Furlano* and E. A. Kelley, *Queen's University*

Background: Savant syndrome is a rare yet spectacular condition in which someone with a developmental disability has an ability that contrasts the individual's overall handicap (Treffert, 2009). Savant skills have been found to be quite prevalent in people with an autism spectrum disorder (ASD), with a suggested rate of one in ten (Treffert, 2009). Given the high-suggested prevalence of savant skills in individuals with ASD, it is surprising that there is a lack of empirical studies within the field. Research which focuses on savant skills in

individuals with ASD would help not only to uncover the nature of these talents, but would also aid in developing new causal theories for autism and allow researchers to explore the genetic etiologies of ASD.

Objectives: To investigate the nature of savant skills in children with ASD by quantifying more precisely the various types of savant talents. The study examined the relations that IQ, language ability, parental encouragement, social skills, and repetitive and restricted behaviours have with these talents.

Methods: An online parental questionnaire was administered to 22 caregivers with children aged 3-12 years with a current ASD diagnosis. The *Social Communication Questionnaire* (Rutter, Bailey, & Lord, 2003) was used to confirm diagnosis of ASD and to gather a measure of social skills. *The Savant Skills in Children with ASD: Parental Questionnaire,* created for the purpose of this study, was used to gather information on savant skills in children with ASD and also examine IQ, language abilities, parental encouragement, and repetitive and restricted behaviours and preoccupations. The survey was created because as to our knowledge, there are no caregiver questionnaires that quantify and test savant skills. The savant skills included: *math*, *calendar calculation*, *music*, *art*, *memory*, *mechanical*, *language*, *reading and writing*, *fluency for different languages*, and *other*. The talent was considered to be a savant skill if it was *above* the general level of the child and if it was *above* or *well above* that of children of the same age.

Results: The present study found that more than half of the children had a talent, whether it was a savant skill or extraordinary memory, that was both above the general level of the child and above that of children of the same age. Mid-size correlations, approaching significance, were found between the number of savant skills each child possessed and IQ, language abilities and social skills.

Conclusions: Overall, the current study supports the need for future research on the nature of savant skills in individuals with ASD. Future research should focus on creating a more widely accepted classification of savant skills and a tool to measure and assess the different types of talents. It should also use a multi-dimensional approach by pairing parental-report data with experimental observation and attempt to get a larger and more representative sample of individuals with savant syndrome. The findings of the current study, can be used to guide future research on this topic, as the key to understanding savant syndrome may lie in examining it in relation to ASD.

158.104 104 Differential Consequences of Bullying on Internalizing Symptoms in Adolescents with High-Functioning Autism. B. C. Gamber*[1], A. R. Neal-Beevers[1], L. Sperle[2] and A. K. Stefanatos[1], (1)*University of Texas at Austin*, (2)*University of Pittsburgh*

Background: Researchers have documented high prevalence of internalizing symptoms in individuals with HFA relative to controls (Ghaziuddin et al., 1998). Separate studies demonstrated specific social difficulties associated with HFA, such as higher rates of victimization, fewer close relationships, and less perceived social support (Shtayermman, 2007; Bauminger & Kasari, 2000). Yet virtually no studies have examined the relationship between social experiences and internalizing symptoms in autism. In this study, we hypothesized those with HFA to experience lower prosocial behavior, higher peer victimization, and higher internalizing symptoms than TD participants. Moreover, we expected higher peer victimization and lower prosocial behavior to predict higher internalizing symptoms across groups, but that this effect would be stronger for individuals with HFA.

Objectives: This study examines effects of positive and negative social experiences on internalizing symptoms in adolescents with and without HFA.

Methods: Twenty-one TD (19 male, 2 female) and 19 adolescents with ADOS-confirmed HFA (17 male, 2 female), matched on gender and mental age, participated as part of a larger ongoing study. Mental age in months was not significantly different between groups (M_{TD}=191.63, M_{HFA}=198.55). Participants completed the Behavior Assessment System for Children (BASC-2 SRP adolescent or college; Reynolds & Kampaus, 2004), yielding Internalizing Symptoms T-scores. They also completed the Social Experiences Questionnaire (Crick & Bigbee, 1998), yielding

Overt Victimization, Relational Victimization, and Recipient of Prosocial Behavior scores.

Results: Independent t-tests revealed that those with HFA had higher Internalizing ($t(38)=-3.01$, $p<.01$), higher Relational Victimization ($t(36)=-2.40$, $p<.05$), and lower Recipient of Prosocial Behavior scores ($t(36)=2.90$, $p<.01$). Overt Victimization scores approached significance as higher in those with HFA ($t(36)=-1.93$, $p=.06$). Three step-wise linear regressions revealed higher Relational Victimization, higher Overt Victimization, and lower Recipient of Prosocial Behavior scores each predicting higher Internalizing (see Table 1). There was a significant interaction between Overt Victimization and diagnosis; the effect of Overt Victimization as a predictor of Internalizing symptoms was stronger in HFA.

Conclusions: These preliminary results support previous findings of higher peer victimization, higher internalizing symptoms, and lower positive social experiences in individuals with HFA. They also provide new insight into the extent to which internalizing symptoms are predicted by overt and relational victimization in adolescents and young adults with and without HFA. Furthermore, these findings indicate that the relationship between overt victimization and internalizing symptoms like depression is exacerbated for individuals with HFA. Thus, those with HFA are not only at higher risk for being victimized, but may also suffer more severe consequences as a result. These findings warrant further exploration of the potential protective influence of positive social experiences, which we plan to conduct via ongoing data collection.

Table 1.

Regression Analyses

	R Square	Beta	p-value
Internalizing Symptoms	.56		
Diagnosis		.163	.000
Relational Victimization			.176
Diagnosis x Relational Victimization		.747**	.000
		.178	.294
Internalizing Symptoms	.57		
Diagnosis		.226	.000
Overt Victimization		.439*	.064
Diagnosis x Overt Victimization		.363*	.014
			.040
Internalizing Symptoms	.28		
Diagnosis		.230	.001
Recipient of Prosocial Behavior		- .531**	.145
Diagnosis x Recipient of Prosocial Behavior		.176	.001
			.220

*p<.05, **p < .01

158.105 105 Resilience to Bullying Victimization Among Youth with Autism Spectrum Disorders. J. A. Weiss*, M. C. Cappadocia and D. Pepler, *York University*

Background: Children with Autism Spectrum Disorders (ASD) are at risk for experiencing peer victimization (i.e., being bullied), as well as for a range of internalizing and externalizing mental health problems, particularly anxiety. Despite the negative mental health outcomes associated with victimization, however, some children who experience bullying are resilient, and it is important to examine protective factors that can contribute to resilience in children with ASD.

Objectives: The current study assessed the relation among frequency of peer victimization and symptoms of anxiety in children with ASD, and the role of parental positive affect as a moderator of that relation.

Methods: Participants included 227 parents of children diagnosed with ASD. All children were enrolled in elementary, middle, or high school (i.e., grades 1-12) and were 5-21 years of age (83% boys; *M* age = 11.41, *SD* = 3.42). Parents reported the following formal diagnoses for their children: Asperger syndrome (52%), high functioning autism (14%), PDD-NOS (14%), and autism (20%). Parents completed a measure of

parenting affect (Parenting Stress Scale; Bonds, Gondoli, Sturge-Apple & Salem, 2002), child anxiety (Anxiety subscale of the Nisonger Child Behavior Rating Form; Aman, Tasse, Rojahn, & Hammer, 1996), ASD symptomatology (Autism-Spectrum Quotient: Child Version; Auyeung, Baron-Cohen, Wheelwright, & Allison, 2008), and bullying perpetration and victimization via online survey (PREVNet tool; PREVNet Assessment Working Group, 2008).

Results: While the frequency of victimization was predictive of anxiety for all children, it had the greatest impact on children of highly distressed parents, and parental positive affect was found to act as a significant moderator in the process. Regression using simple slopes (i.e., < 1 *SD* below the moderator mean, at the moderator mean, and > 1 *SD* above the moderator mean) indicated that bullying was significant at all three levels of the moderator, such that regardless of the level of the moderator, as the frequency of victimization increases, child anxiety increases. At the same time, at low levels of positive parenting affect, the relationship between victimization and child anxiety is strongest, and at high levels of positive affect, the relationship is at its weakest.

Conclusions: This is the first study to examine variables that may serve to protect children with ASD when they are faced with peer victimization. Consistent with the literature on resilience to bullying victimization in typically developing youth, parent affect may play a role in buffering the negative consequences of bullying. Interventions to assist parents in coping and to address peer victimization are discussed.

158.106 106 The Relationship Between Social Skill Deficits and Comorbidity Among Adolescents with Autism Spectrum Disorder. A. Pulido M.A.*[1], C. White[2], R. Hodges[3] and A. J. Lincoln[4], (1)*Alliant International University* , (2)*Center for Autism Research Evaluation and Service*, (3)*CARES*, (4)*Alliant International University;Center for Autism Research, Evaluation and Service*

Background: Social skills deficits continue to be an impacting characteristic of Autism Spectrum Disorder (ASD) (Woodruff, 2011). Studies indicate adolescents who have a single diagnosis of an anxiety disorder tend to have great deficits in social skills but very little research has examined the social deficits among adolescents with ASD and comorbid diagnosis (Erath, Flanagan, & Bierman 2011). Recent literature indicates seventy percent of adolescents with Autism Spectrum Disorder (ASD) have at least one comorbid diagnosis and have increased symptoms of anxiety and depression (Simonoff et al., 2011). A single diagnosis of ASD may pose its own difficulties for teens with ASD and can further complicate social functioning and treatment when an adolescent receives multiple diagnosis. It is important for clinicians and researchers who are implementing social skills training to consider the effects of comorbid diagnosis and symptoms when treating adolescents with ASD.

Objectives: The purpose of this study is to examine the effects of comorbid diagnosis and increased internalizing symptoms among adolescents with ASD and the impact it places on an adolescents social skills.

Methods: Adolescent participants are part of The Program for the Evaluation and Enrichment of Relations Skills (PEERS) which is a manualized parent-assisted social skills training for teens with Autism Spectrum Disorder conducted by the Center for Autism Research and Evaluation (CARES). Prior to treatment the participants and parents will be completing questionnaires regarding symptoms, current diagnosis and social skills.

Results: Data is currently being collected which examine current diagnosis, internalizing symptoms and social skills. It is hypothesized that adolescents with increased symptoms of anxiety and depression will have the greatest impact in social skills. Additionally, it is predicted that adolescents who have a greater number of comorbid diagnosis will have an increased deficit in social skills when compared to peers who have lower rates of comorbid diagnosis.

Conclusions: Conclusions will be reported when data collection is complete.

158.107 107 Psychosexual Problems in Individuals with ASD: Prevalence, Predictors and Developmental Course. L. P. Dekker*[1], E. van der Vegt[2], S. C. Louwerse[1], N. Tick[2], F. C. Verhulst[1], A. Maras[2] and K. Greaves-Lord[1], (1)*Erasmus MC - Sophia's Children's Hospital*, (2)*Yulius*

Background: Adolescence is marked by many physical, psychological and social changes, including the development of intimate relations and sexuality. A healthy psychosexual development requires a variety of social skills. Important skills are the ability to be sensitive to the signals, needs and boundaries of others. It is precisely these skills that many people with ASD have difficulties with. Since the physical development of individuals with ASD is usually within the normal range, this discrepancy between psychosocial and physical development can be potential risk for difficulties regarding psychosexual development. Despite the fact that these difficulties are highly recognized in clinical practice, until recently, research on this topic has been scarce.

Objectives: In a sample of 142 individuals with ASD, we investigated 1) the prevalence of sexual problem behaviour during childhood, 2) the association between ASD severity and sexual problems during childhood, and 3) whether sexual problems during childhood were predictive of more severe psychosexual problems during adolescence.

Methods: Psychosexual development and potential sexual problems were assessed using the Child Behavior Checklist (CBCL at T1 and T2) and the Teen Transitions Screen (at T2), a newly developed instrument to assess psychosexual development and identify putative problems. Overall ASD severity was assessed during childhood (T1) and adolescence (T2) using the Autism Diagnostic Observation Schedule (ADOS).

Results: The prevalence of sexual problem behavior in children with ASD at T1 was 43% and at T2 30%. No cross-sectional or longitudinal associations between ASD severity and sexual problems were found. Individuals with sexual problems at T1 showed more severe sexual problems at T2 (p=.02).

Conclusions: Sexual problems are prevalent among individuals with ASD in childhood as well as in adolescence. These problems are however not related to the severity of ASD symptoms. Children with sexual problems are at risk for developing more severe sexual problem behavior later in life.

158.108 108 Increased Rates of Gender Identity Issues Among Children and Adolescents with Autism Spectrum Disorders

J. Strang*[1], L. Kenworthy[1], A. Dominska[1], J. L. Sokoloff[1], K. Walsh[1], M. Berl[1], E. Menvielle[1] and G. L. Wallace[2], (1)*Children's National Medical Center*, (2)*NIMH*

Background: Seven case reports have described patients with co-morbid gender identity and autism spectrum disorders (ASDs; e.g., Gallucci et al., 2005; Tateno et al., 2008). A recent study reported high rates of ASDs among children and adolescents referred to a major gender identity clinic in the Netherlands (de Vries et al., 2010). Over-representation of ASDs in gender identity referrals has been discussed by clinicians at several U.S. gender identity clinics (clinical reports by Children's National Medical Center's Gender and Sexuality Development Program, Boston Children's Hospital's Gender Management Service, and Johns Hopkins University Hospital's Sexual Behavior's Unit). To date, reports have originated from gender identity clinics describing ASDs within gender patient referrals. This is the first study to examine rates of gender identity issues among children and adolescents with ASDs.

Objectives: The current study examines rates of parent reported atypical gender behaviors among children and adolescents with ASDs as compared to normative and comparative samples. Given observations of increased rates of ASDs among clients with gender identity issues, we hypothesize that rates of gender issues will be greater among people with ASDs.

Methods: Children and adolescents with ASDs (n=136), typically developing controls (n=166), and a medical comparison group consisting of children and adolescents with epilepsy or neurofibromatosis type I (n=116) participated in the study. Subject data from the non-referred standardization sample of the Child Behavior Checklist (CBCL) (Achenbach & Rescorla, 2001) was used to create an additional comparison group (n=1605). Rates of endorsement of the CBCL gender identity item (item 110), "Wishes to be of opposite sex" are reported as percentage endorsement, and Mann Whitney U tests are used to compare levels of endorsement between groups.

Results: Rate of endorsement of atypical gender behaviors (CBCL Item 110) in children and adolescents with ASDs was more than 7 times greater than in the non-referred comparison sample (CBCL sample) and three times greater than in the medical comparison group. There was no endorsement of gender identity issues in our control group. Percentage endorsement of CBCL Item 110 was 5.1% for the ASD group, 0.7% for the non-referred comparison sample (CBCL sample), 1.7% for the medical comparison group, and 0% for the control group. Mann Whitney U tests showed significantly higher endorsement of gender identity symptoms in the ASD group than the non-referred CBCL comparison sample, U = 104336.00, $p < .001$ as well as the control group, U = 10707.00, $p = .003$.

Conclusions: Findings support the hypothesis of increased rates of atypical gender behaviors or gender identity issues among young people with ASDs compared to non-referred controls. Taken with previous case reports of co-morbid gender identity issues and ASDs and a 2010 study reporting increased rates of ASDs among gender identity referrals, this study indicates the importance of further inquiry into this co-morbidity, including the clinical implications for clients who struggle with both gender and autism-related difficulties.

158.109 109 Sexuality in a Community Based Sample of Adults with Autism Spectrum Disorder. L. L. Gilmour*[1], M. P. Schalomon[2] and V. Smith[1], (1)*University of Alberta*, (2)*Grant MacEwan University*

Background:

There is little research into sexuality among adults with Autism Spectrum Disorders (ASDs), particularly high-functioning individuals living independently in the community. Previous research suggests a relationship between excessive prenatal testosterone and both homosexual and bisexual interests and behaviors as well as ASD (Dörner, 1976; Baron-Cohen, 2002). This relationship is thought to exist because high testosterone levels *in utero* may masculinize the brain (Baron-Cohen, 2002). The prenatal androgen theory suggests that there would be a higher incidence of same-sex oriented behaviours and attitudes and a correspondingly lower incidence of behaviours and attitudes targeting members of the opposite sex among females with ASD. The reverse finding, i.e. a lower rate of homosexuality and higher rate of heterosexuality would be expected among males.

Objectives:

We examined whether the incidence of homosexuality differs between females and males with ASD. We also examined whether the incidence of homosexuality in subjects with ASD differs from that in the general population.

Methods:

An online survey composed of standardized scales was used to compare high-functioning adults with ASD and members of the general population with respect to their sexual interests, sexual behaviors, and sexual orientation. Participants were recruited from undergraduate Psychology students, and via websites, autism organizations, and an Asperger's Syndrome themed blog operated by one of the authors. Univariate ANOVAs were used to compare differences between individuals with ASD and the general population as well as gender differences and interactions of gender and group.

Results:

No significant differences were found in number of sexual partners and frequency of sexual behaviors between the ASD group and the general population group. Compared to the control group, a higher degree of asexuality, bisexuality, and homosexuality, and a lower degree of heterosexuality was found in the ASD group. Females with ASD showed a significantly lower degree of heterosexuality than males with ASD and the results also suggested a higher degree of homosexuality among females with ASD than in female control subjects.

Conclusions:

Unlike lower functioning individuals living in group homes, individuals with ASD living in the community are capable of engaging in sexual behavior and forming romantic relationships, and do so at the same rates as controls. Excessive prenatal testosterone may partially explain the relationship between ASD and increased homosexuality and bisexuality, but it is likely that there are additional biological,

social, and environmental factors that account for the lack of difference between male and female ASD subjects with respect to sexual orientation. Sex education for individuals with ASD should address these similarities and differences and hopefully result in increased self-awareness for individuals with ASD and increased understanding for those who live and work with them.

References

Baron-Cohen, S. (2002). **The extreme male brain theory of autism**. *Trends in Cognitive Sciences, 6,* 248-254.

Dörner, G. (1976). *Hormones and Brain Differentiation.* Amsterdam, Netherlands: Elsevier Scientific Publishing Company.

Core Symptoms Program
159 Core Deficits and Symptoms

159.110 110 Impairments in Real World Executive Function Increase From Childhood to Adolescence in Autism Spectrum Disorders. M. A. Rosenthal*[1], G. L. Wallace[2], R. Lawson[3], M. C. Wills[4], E. Dixon[2], B. Yerys[4], A. Martin[2] and L. Kenworthy[4], (1)*Center for Autism Spectrum Disorders, Children's National Medical Center*, (2)*NIMH*, (3)*Loyola University*, (4)*Children's National Medical Center*

Background: Executive dysfunction is frequently associated with autism spectrum disorders (ASDs) and has been linked to reduced adaptive functioning (Gilotty et al., 2002) and greater autism symptomatology (Kenworthy et al., 2009). Understanding the trajectory of EF development in ASDs can offer key insights into the dynamic nature of the disorder, inform treatment options, and help frame research findings of abnormal neuroanatomical growth (e.g., Courchesne, Campbell, & Solso, 2011; Wallace et al., 2010; Farley et al., 2009). While several studies have investigated developmental trajectories of EF in ASD using lab-based tasks, no study to date has directly measured how these skills change over time in an ecologically-sensitive manner.

Objectives: The current study seeks to extend prior work by evaluating age-related changes in everyday EF during childhood and adolescence in a large cohort of children with ASDs. We hypothesize that children with ASD will show divergence in EF skills over time compared to normative samples as indicated by increasingly impaired scores on the Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000) subscales.

Methods: 260 children with an ASD but without Intellectual Disability participated in the study. Subjects were divided into four groups based on age (5-7; 8-10; 11-13; and 14-18 year olds), consistent with the age subdivisions described in the original BRIEF factor analysis paper. The four age groups did not differ in IQ, sex or autism severity ratings. A mixed-model ANOVA was run to investigate differences in BRIEF subdomains across age groups.

Results: Analyses revealed a significant interaction effect of BRIEF subdomain by age group ($p=.015$). After post-hoc false discovery rate adjustment, significant age effects (i.e., worsening scores with increasing age) for the Initiate ($p<.001$), Working Memory ($p=.011$), and Organization of Materials ($p=.016$) subscales, and a trend toward significance for the Shift subscale ($p=.038$), were found.

Conclusions: Findings generally confirmed the hypothesis that older children with ASD would show greater EF problems compared to the normative sample than younger children with ASD. Specifically, despite being equated for IQ, sex, and ASD symptoms, the older children had more impaired scores on most subdomains in the Metacognitive Index of the BRIEF. Findings support a general worsening, or divergence from the normative sample, in metacognitive abilities in children with ASD as they age, and have important implications for the challenges faced by high functioning adolescents and young adults with ASD as they attempt to enter mainstream work and social environments.

159.111 111 Factors Related to the Development of Bilingual Vocabularies in Young Children with Autism Spectrum Disorders. C. Hambly*[1], C. Roux[2], M. J. Cecyre[1], J. Noseworthy[1] and E. Fombonne[1], (1)*Montreal Children's Hospital*, (2)*University of Quebec in Montreal*

Background: Two studies (Hambly & Fombonne, 2011; Leadbitter, Hudry, & the Preschool Autism Communication

Trial consortium, 2009) have found that children with Autism Spectrum Disorders (ASD) do not experience additional language delays when exposed to two languages. A third study has shown that the language of bilingual children with ASDs is not delayed compared to matched monolinguals with ASD (Petersen, Marinova-Todd, & Mirenda, 2011). The factors associated with becoming bilingual during early childhood have never been studied in children with ASDs.

Objectives: Identify factors related to the development of bilingual language in young children with ASDs.

Methods: 33 children (mean age=60 months) with ASD, bilingual exposure history, and a minimum vocabulary size of 50 words in their dominant spoken language (L1) were studied using parent report data. 10 children had no words in a second language (NO-B). The remaining 23 children were divided using the median L2 vocabulary size (69 words) on the MacArthur-Bates Communication Development Inventories (MBCDI, various languages) to assign children to the low vs. high bilingual vocabulary groups: 11 children had L2 vocabularies from 2-69 words (LOW-B) and 12 children had 70 or more words (HIGH-B). The three groups were compared using one-way Analysis of Variance to look for differences in exposure history, dominant language abilities, social abilities, and family demographics. Differences with a *p* value of <.10 were explored further with post-hoc testing. The correlations between L2 vocabulary and key factors were explored in the 23 children with bilingual vocabularies to look for relationships between exposure and language variables and L2 vocabulary size.

Results: Recent exposure history (*p*=.09) was significantly different only between the LOW-B (6% L2 exposure) and the HIGH-B (27% L2 exposure) groups (*p*=.04). Statistically significant differences were also present on language measures: HIGH-B scores were higher than both the LOW-B and NO-B scores on the Vineland Adaptive Behavior Scale-II (VABS-II) Expressive score (*p*=.01) and the MBCDI (*p*=.01). Data from the 23 bilingual vocabulary users showed strong correlations between higher L2 vocabularies and 1) less exposure to L1 (*r*= -.83, *p*=.000), 2) higher VABS-II Expressive score (*r*=.60, *p*=.005), and 3) less-impaired Social Responsiveness Scale scores (*r*= -.46, *p*=.031).

Conclusions: High levels of current L2 exposure (e.g., >25% exposure to an L2) combined with more advanced L1 language (e.g., large L1 vocabularies and expressive language scores in the high average range) are likely factors in the development of larger bilingual vocabularies. It is not clear from this data why some children with large amounts of exposure did not develop L2 vocabularies, but it is possible that differences in the type or quality of exposure (e.g., L2 at home vs. at daycare/school, the presence or absence of indirect L2 exposure in the home) or in the approach to teaching an L2 could explain why some children start acquiring small bilingual vocabularies while others do not.

159.112 112 Associations of IQ and Autistic Symptomology with Functioning in Young Adults with ASD: Self- and Parent Report. S. K. Kapp*[1], A. Gantman[2] and E. Laugeson[2], (1)*University of California, Los Angeles*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

Despite positive overlap between ASD and intellectual disability (Ronald & Hoekstra, 2011) and social anxiety (Cath et al., 2008; Tyson & Cruess, in press; White, Bray, & Ollendick, in press), self- and parent reports have related higher IQ and lower ASD symptomology to lower self-reported self-concept and higher distress within the ASD population (Capps, Sigman, & Yirmiya, 1995; Mazurek & Kanne, 2010; Sterling et al., 2008; Vickerstaff et al., 2007).

Objectives:

The study's purposes are to test associations between (1) IQ and (2) ASD symptoms with measures of social and psychosocial functioning in young adults with ASD.

Methods:

Data draw from the baseline data of young adults (*N* = 34, *M* IQ – Verbal = 96.47) ages 18 to 24 with ASD from *PEERS for Young Adults,* an evidence-based social skills program for high-functioning adults with ASD. In Study 1, Pearson's correlations were performed between the young adults'IQ scores on the KBIT-2 (Kaufman & Kaufman, 2005) and several measures inlcuding the AQ (Baron-Cohen et al., 2001), DAS

(Glickman & La Greca, 2004), DERS (Gratz & Roemer, 2004), EQ (Baron-Cohen & Wheelwright, 2004), FQ (Baron-Cohen & Wheelwright, 2003), SAS (La Greca & Lopez, 1998), SELSA (DiTamasso & Spinner, 1993), SSI (Riggio, 1986), and SSRS (Gresham & Elliot, 1990) filled out by young adults (YA), and the AQ, EQ, SAS, SQ (Baron-Cohen et al., 2003), SRS (Constantino et al., 2003), SSRS, and VABS-2 (Sparrow, Cicchetti, & Balla, 2005) completed by parents (P). In Study 2, Pearson's correlations were separately performed between the AQ-YA and AQ-P and the DAS, DERS, SAS-P, SAS-YA, SELSA, and SSRS – Problem Behaviors.

Results:

Subscale correlations are not reported here of measures in which the total score correlated. In Study 1, the KBIT–2 Verbal was inversely related to the DERS ($r = -.407$, $p<.05$); FQ ($r = -.457$, $p<.01$); and SSI ($p = -.405$, $p<.05$). No relationship was found between KBIT-2 Nonverbal and other measures. In Study 2, the AQ-YA positively correlated with the DAS ($r = .560$, $p<.01$); SAS-YA ($r = .477$, $p<.01$); and the SAS-P ($r = .545$, $p<.01$). The AQ-P correlated positively with DAS – Group ($r = .547$, $p<.01$); SAS-A-General ($r = .420$, $p<.05$); SAS-P ($r = .407$, $p<.05$); and SSRS–P-PB –SS ($r = .413$, $p<.05$).

Conclusions:

These results suggest that effective interventions to treat ASD symptomology may ameliorate anxiety symptomology, or vice versa. In Study 1, young adults with ASD with higher verbal IQ reported better emotion regulation abilities but lower friendship quality and social skills, which might suggest higher self-awareness. Conversely, the young adults' IQ scores did not significantly relate to parent report on any measures, suggesting stigmatizing effects of pedantic knowledge about perseverative interests or – paradoxically – of appearing odd rather than disabled. This study extends previous evidence that neither verbal nor nonverbal IQ consistently predict outcomes in adults with ASD, but without ID (Howlin et al., 2004). In Study 2, according to both self- and parent report, young adults with higher ASD symptomology had higher internalizing psychopathology, in contrast to previous studies.

159.113 113 Community Service Providers' Views and Experiences Regarding Bilingualism and Autism. K. Hudry* and L. Pamment, *Olga Tennison Autism Research Centre*

Background: Historically, early bilingual exposure has been thought to be confusing for typically-developing children at the early stages of language development and detrimental for children with developmental delays/disorders. However, substantial evidence now demonstrates that functional bilingualism does indeed develop in early childhood, and that it poses no additional developmental disadvantage for children with conditions such as Down syndrome or Specific Language Impairment. Until very recently, no research has specifically considered the effects of bilingualism on the development of children with Autism Spectrum Disorders (ASD). In the absence of such dedicated research, it remains highly likely that service providers working in multicultural communities are being approached by bilingual parents of children with ASD diagnoses, seeking advice around their language-use choices.

Objectives: This study sought to explore the current views held by community service providers working with individuals with ASDs and their families, around the topic of bilingualism and autism. In the absence of any published evidence base around this topic at the time of data collection, we were interested to determine the extent to which the issue of bilingualism and autism is of relevance to professionals from varying backgrounds, working within families with ASD in a multicultural society.

Methods: We have conducted interviews with community service providers working with individuals with ASD/their families, from various professional backgrounds. Recruitment was through targeted advertising across a range of service-provision centres relevant to ASD, in and around Melbourne, Australia. Semi-structured telephone interviews were undertaken with individual participants by a trained research assistant. Through use of a standard semi-structured interview protocol, we elicited individuals' views on bilingualism and autism and descriptions of experiences arising around this topic within their professional practice. General personal and professional information was also collected and the interviews were audio-recorded to permit later review.

Results: Interview data-collection is ongoing at the time of this submission. To date, individuals from such service provision backgrounds as psychology, speech pathology, general education, and specialist early intervention have participated, and their contributions have confirmed our expectation that bilingual families are indeed seeking advice on language-use choices for their young child with an ASD. Following the completion of data collection, qualitative thematic analysis will be undertaken to explore the types of consultation sought from service providers by bilingual families, the practices undertaken by these professionals in attempting to address the individuals' needs, and the broader opinions held by professionals around this issue. Quantitative analyses will allow us to further evaluate the extent to which opinions/practices might vary as a function of service providers' different professional and/or personal backgrounds.

Conclusions: At this exciting time when the establishment of an evidence-base around bilingualism and autism is beginning to appear in the scientific literature, it is useful to explore the existing opinions held and practices employed by community service providers. Such knowledge will facilitate forthcoming attempts to disseminate evidence-based practice to those who are working directly with families seeking advice around language-use choices for children with ASD.

159.114 114 Stability and Validity of a New Vocal Complexity Measure. P. J. Yoder*[1], D. K. Oller[2], J. A. Richards[3], S. Gray[4] and J. Gilkerson[3], (1)*Vanderbilt University*, (2)*University of Memphis*, (3)*LENA Foundation*, (4)*self-employed*

Background:

Some children with autism spectrum disorders (ASD) may not produce speech because of speech-motor deficits, which may in turn produce atypical or developmentally young vocalization (Rogers & Pennington, 1991). In response to challenges in measuring these deficits in children with ASD, some scientists measure the complexity of non-word and word vocalizations as a proxy for speech-motor (dis)ability. Most methods of analyzing vocalizations involve either perceptually-guided spectral analysis or behavioral coding of recorded interactions (Singh & Singh, 2008; Paul, et al, 2011). These are extremely time-consuming procedures, and consequently brief vocal samples (e.g., 10 minutes), are analyzed resulting in relatively unstable estimates of vocal complexity (Yoder & Symons, 2010). Day-long (12 hours) samples of child vocalizations through small digital audio recorders and fully automatic computer analysis can now be used to derive a vocal age equivalency score (Oller et al., 2010). The across-occasion stability and association of this index with expressive language in children with ASD and children with typical development has not yet been tested.

Objectives:

To determine how many day-long sessions are required to derive a stable vocal age equivalency score in (a) children with autism spectrum disorders (ASD), and (b) children who are typically developing (TD).

To determine the extent to which the vocal age equivalency score is associated with expressive language in children with ASD and children who are TD.

Methods:

Forty-two children with ASD and 30 children who were TD wore a small digital recorder (LENA) for three days (occasions) within a 5-day period (i.e., 72 participants x 12 hours x 3 samples = 2592 hours of recording). Generalizability and decision studies were conducted on each participant group to determine how many sessions' data would need to be averaged to estimate vocal age equivalency with an intraclass correlation coefficient (ICC) greater than .80 (our criterion for "across-occasion stability). Within 5 days of the vocal recordings, each child's parent completed the expressive subscale of the Child Development Inventory (CDI-EL) and the Language Development Survey (LDS). The age equivalency and raw scores were derived from the CDI-EL and LSD, respectively.

Results:

In both groups, only one day-long session was necessary to derive a stable estimate of vocal age equivalency (ICC for children with ASD = .86; ICC for children with TD = .86). The vocal age equivalency from only the first recorded session was correlated with the CDI-EL and LDS at r = .70 and .75 in the

ASD sample, respectively and at .73 and .68 in the TD sample, respectively.

Conclusions:

The validity of a measure cannot exceed the square root of its reliability (Nunnally, 1978). If the vocal age equivalency score is a measure of vocal complexity, it should correlate with expressive language (Cronbach & Meehl, 1955). To put the .68 - .75 correlations with expressive language in perspective, other measures of vocal complexity (e.g., consonant inventory, canonical babbling ratio) concurrently correlate with expressive language between .38 and .65 in ASD or at-risk-for-ASD participant samples.

159.115 115 Reduced Preference for Social Rewards in Toddlers with Autism: Relations with Symptoms and Treatment Response. K. Sullivan*[1], J. Munson[1] and G. Dawson[2], (1)*University of Washington*, (2)*Autism Speaks, UNC Chapel Hill*

Background: Research indicates that Autism Spectrum Disorder (ASD) is associated with reduced sensitivity to social rewards. Children with ASD vary in terms of their degree of preference for social versus nonsocial rewards, and it is expected that variations in such preferences might correlate with symptom severity, especially social impairments. Furthermore, given that early intervention utilizes social rewards to motivate learning and skill acquisition, variation in social reward preference might predict rate of skill acquisition and outcome in early intervention research.

Objectives: The purpose of the current study is to assess, via parent questionnaire, preferences for social versus nonsocial rewards in toddlers with ASD, and assess the relations between variation in such preferences and symptom severity and response to early intervention.

Methods: The current sample consists of 48 children diagnosed with ASD (*M* CA = 23.5 months; *SD* = 4.9, range 18 to 30 months; 37 M, 11F) who participated in a randomized clinical trial of early intensive behavioral intervention, based on the Early Start Denver Model (ESDM). Participants met diagnostic criteria for Autistic Disorder or Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) as measured by the ADI-R and ADOS-WPS as well as DSM-IV criteria by an experienced clinician. At baseline, parents completed a 201-item reinforcer questionnaire (RQ) to assess their children's preference for a wide range of social and nonsocial reward stimuli. The questionnaire used a Likert scale, with scale values ranging from 0 (*not rewarding*) to 4 (*extremely rewarding*). Additionally, parent reports of adaptive behavior and observational measures of joint attention, social orienting, and symptom severity were collected. To examine the relationship between items endorsed on the RQ and participant characteristics, the items from the RQ were sorted into four categories (social, nonsocial activities, tangibles, and edibles) and correlation analyses were conducted.

Results: According to parent report, young children with ASD are more likely to prefer nonsocial, as compared to social, reward stimuli. Nonsocial activities, such as riding in the car, playing with glue, listening music, or lining up objects, were most frequently endorsed, followed by edible stimuli. Children who showed the greatest preference for nonsocial stimuli, as compared to social stimuli, showed more significant impairments in social orienting skills, whereas those children with greater preferences for social stimuli had significantly better social orienting skills. Further analysis will examine the relationship between RQ categories and additional child characteristics, including response to early behavioral intervention after 2 years.

Conclusions: This is the first report, to our knowledge, to assess the relation between variations in social reward preference and degree of autism symptom severity. Results show that young children with ASD tend to prefer nonsocial as compared to social stimuli, and that variation in their degree of preference for social stimuli is correlated with symptom severity, as reflected in social orienting, joint attention, and other domains. Future analyses will explore whether variation in preference for social rewards moderates response to early behavioral intervention. Knowledge of children's preference for social versus nonsocial stimuli can be useful in designing individualized strategies for intervention.

159.116 116 Social Functioning in Individuals with a History of Autism Spectrum Disorders Who Have Achieved Optimal Outcomes. A. Orinstein*[1], E. Troyb[1], K. E.

Tyson[1], M. Helt[1], M. A. Rosenthal[2], J. Suh[1], L. O'Connell[3], M. Barton[1], I. M. Eigsti[1], E. A. Kelley[3], L. Naigles[1], M. C. Stevens[4], R. T. Schultz[5] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Children's National Medical Center, Center for Autism Spectrum Disorders*, (3)*Queen's University*, (4)*Institute of Living, Hartford Hospital / Yale University*, (5)*Children's Hospital of Philadelphia*

Background: A study is currently following children and adolescents who have a history of autism spectrum disorder (ASD), but who no longer meet diagnostic criteria for the disorder. These individuals have achieved social and language skills within the average range for their ages and receive little or no school support. Several recent studies suggest that this small subset of children, once diagnosed with ASD, achieve an "optimal outcome (OO)" (Sutera et al., 2007, Kelley et al., 2010, and Helt et al., 2008).

Objectives: Despite no longer meeting diagnostic criteria for an ASD, OO individuals may exhibit subtle deficits in the social domain. This study examines social functioning by assessing autism symptomatology and adaptive skills in a group of OO individuals.

Methods: The Autism Diagnostic Observation Schedule (ADOS) was conducted with 32 OO individuals (*M*(age)=12.9), 33 individuals with high-functioning autism (HFA) (*M*(age)=13.4), and 25 typically developing (TD) peers (*M*(age)=13.9). Parents of participants completed the Vineland Adaptive Behavior Scales (Vineland) interview. The groups were matched on age, sex and nonverbal IQ; however, the groups differed significantly on verbal IQ (*M*(OO)=112.7, *M*(HFA)=103.0, *M*(TD)=112.1, $p<.05$).

Results: Higher scores on the ADOS indicate more abnormal behavior. There was a statistically significant difference between the groups on the ADOS social algorithm total, $F(2, 87)=127$, $p<.001$. The mean ADOS social algorithm total for the HFA group (*M*=7.00) was significantly greater than the OO (*M*=1.41) and TD groups (*M*=0.32), which were also significantly different from each other. However, the OO group mean was still well below the ADOS ASD cutoff of 4. Exploratory *t*-tests were conducted to determine if the OO and TD groups differed on specific ADOS social items. Of the 11 ADOS social items, only 3 differed significantly between the OO and TD groups. There was a significant difference in scores (*M*(OO)=0.25, *M*(TD)=0.040, $p=.020$), and frequency of behavioral abnormality ($\chi^2(1,57)=4.65$, $p=.031$) for facial expressions directed to others. When the OO and TD groups were compared on insight into the nature of social relationships, there was a significant difference in scores (*M*(OO)=0.41, *M*(TD)=0.080, $p=.010$), and the difference in frequency of abnormality approached significance ($\chi^2(1,57)=5.77$, $p=.056$). Quality of rapport was significantly poorer in the OO than TD group, both in terms of mean difference (*M*(OO)=0.31, *M*(TD)=0.080, $p=.024$) and frequency of abnormality ($\chi^2(1,57)=4.56$, $p=.033$). The HFA group had higher group means and greater frequency of abnormality than the OO group on all three of these items. On the Socialization domain of the Vineland, the OO group (*M*=102) was not significantly different from the TD group (*M*=102), and both groups scored better than the HFA group (*M*=77.6; $F(2,86)=47.4$, $p<.001$).

Conclusions: These results suggest that, relative to TD peers, OO individuals did not demonstrate deficits in social adaptive functioning skills and were well below ASD cutoff on the social domain of the ADOS. However, some OO individuals continue to exhibit subtle residual deficits in specific aspects of social functioning, which indicate that these skills may be the most complex within the social domain.

159.117 117 Language Profiles of Boys with Idiopathic Autism or Fragile X Syndrome: A Cross-Disorder Comparison.

A. McDuffie*[1], S. T. Kover[2], R. J. Hagerman[3] and L. Abbeduto[1], (1)*MIND Institute University of California Davis*, (2)*University of Wisconsin, Madison Waisman Center*, (3)*U.C. Davis MIND Institute*

Background:

Fragile X syndrome (FXS) is the leading inherited cause of intellectual disability. A majority of males with FXS also display symptoms of autism (e.g., poor eye contact, repetitive behaviors, social anxiety). Language represents a core area of impairment in both autism and FXS. Directly comparing profiles of abilities in specific language domains for boys with autism and boys with FXS can help to clarify whether cognitive

impairments and symptoms of autism differentially affect language in these two neurodevelopmental disorders.

Objectives:

1. Are there between-disorder differences in receptive and expressive vocabulary and grammar?
2. Does autism severity predict receptive and expressive language performance?

Methods:

Participants were boys with autism (n = 29; Mean = 7.84 years) and FXS (n = 34; Mean = 7.44 years), 4- to 10-years of age, who participated in a longitudinal study examining word learning. Nonverbal IQ scores ranged from 38 - 80. Participants with autism had significantly higher nonverbal IQs than participants with FXS, with mean IQs of 63 and 58, respectively. Growth scores from the Leiter-R Brief IQ were used as the metric of nonverbal cognition in all analyses. Autism symptom severity was calculated from the ADOS. Severity scores ranged from 5-10 (M = 8.21) for participants with autism and 2-10 (M = 6.47) for participants with FX. This difference was significant. The Peabody Picture Vocabulary Test-4 and Expressive Vocabulary Test-2 provided measures of vocabulary. The Test for Reception of Grammar-2 and the Sentence Completion subtest of the Comprehensive Assessment of Spoken Language provided measures of grammar. Raw scores from the language tests were used as dependent measures in all analyses.

Results:

After controlling for age and nonverbal cognition, the groups differed significantly in receptive and expressive vocabulary and receptive grammar; boys with FXS outperformed those with autism on all three measures. Nonverbal cognition was a significant covariate in each analysis; CA was not. There was a significant and negative bivariate correlation between autism severity and nonverbal cognition for boys with FXS, r(34) = -.44, p < .009, but not for boys with autism.

Regression analyses revealed that nonverbal cognition and diagnostic group were significant and unique predictors of receptive and expressive vocabulary. Nonverbal cognition was a unique predictor of receptive and expressive grammar. Autism severity failed to reach significance as a unique predictor for any language domain. For receptive grammar, there was a significant interaction between Group and Autism Severity; higher severity scores were more strongly related to grammatical understanding for children with autism, R^2 change = .05, t = 2.23, p<.03, two-tailed.

Conclusions:

Boys with FXS experience less severe language impairment than boys with autism after controlling for level of intellectual impairment. Although challenges in the social uses of language are well documented, current findings suggest that boys with autism also have especially severe impairments in acquiring the conceptual and structural aspects of language. The negative association between autism severity and nonverbal cognition for boys with FXS suggests that severity scores may represent a different construct in FXS than in idiopathic autism.

159.118 118 Directed Vocalizations and Smiles Can Differ As Early As At 6 Month of Age. P. A. Filipek*[1], K. M. Johns[1], M. M. Abdullah[2], K. L. Pham[3], P. L. Horner[4] and J. T. Phan[3], (1)*UT Health Sciences Center at Houston*, (2)*University of California, Irvine*, (3)*For OC Kids Neurodevelopmental Center*, (4)*California State University, Los Angeles*

Background:

Typical infants are innately social, demonstrating direct eye contact as early as in the delivery room. Socially directed vocalizations emerge by age ~12 weeks in the form of reciprocal cooing “conversations,” and consonant babbling by age ~6 months. Although most infant sibling studies report no or minimal abnormalities until after age 9-12 months, clinical experience, along with parental report, strongly suggest differences as early as at age 3-6 months. We previously reported the sensitivity of the *Rossetti Infant-Toddler Language Scale to* measure differences in social communication at ages 3 and 6 months. We now report additional differences in social interactions presenting by age 6 months.

Objectives:

To examine whether 6-month-old infants later classified with ASD differed from those later classified as NonSpectrum (NS) in the amount of social interactions when face-to-face with an unfamiliar adult using a Still Face (SF) paradigm.

Methods:

Twenty-seven infants were enrolled between birth and age 2 months (13 males, 63% Caucasian); they were followed at 2-6months with videotaped social interactions and psychometric instruments, and 9-12+months with the *Mullen Scales of Early Learning* (MSEL) and the *ADOS-Toddler Module* (ADOS-T).

At age 6 months, infant-researcher interactions were videotaped with a fiberoptic eyeglass camera while the infant was seated in a car seat, during spontaneous infant-directed "motherese" paradigms, performed pre- (90sec) and post- (90sec) a Still Face (SF) maneuver (30sec).

Once the infants achieved a chronological age of 12 months, a mental age of 12 months measured by the *Mullen Scale of Early Learning*, and independent ambulation, they were assessed with the ADOS-T for ASD classification.

Videotapes were coded by blind research assistants using Noldus Observer™ software for the following social interaction behaviors: Direct eye contact; Smiles: directed vs. undirected; and Vocalizations: directed vs. undirected, positive vs. negative. The Observer™ calculated: a) Proportion of total time, b) Mean duration in seconds, and c) Rate per minute.

Results:

There were no differences between the ASD and NS infants on MSEL scores at 2 or 6 months of age. Eleven of the 27 infants met cutoff criteria for an ASD using the ADOS-T, 4 male and 7 female.

Compared to NS infants at 6 months of age, infants classified with ASD demonstrated:

- a significantly lower rate ($p < 0.03$)and proportion ($p < 0.04$) of directed vocalizations throughout the entire Paradigm, particularly during the SF ($p < 0.02$) and Post-SF ($p < 0.03$) periods;
- a significantly briefer mean duration of directed smiles before the SF ($p < 0.002$); however, the durations during and Post- SF were similar to NS infants.

Conclusions:

These data demonstrate further evidence that deficits in social interaction can be measured as early as at 6 months in at least some infants who are at risk for being diagnosed with an ASD in toddlerhood. This finding lends further support to the ongoing search for easily quantifiable measures which can be used as an early infant screening tool. Study limitations include a socio-economically advantaged sample, a relatively small sample size, and early classification of ASD with ADOS-T rather than ADOS Module 1 or 2.

159.119 119 Delayed Reversal Learning in Autism. T. Newton*, W. Ernst, P. D. Chamberlain and M. South, *Brigham Young University*

Background: Up to 70% of individuals diagnosed with autism spectrum disorders (ASD) also experience severe, debilitating symptoms of anxiety (Lopata et al., 2010; Reaven, 2010). Anxiety-inducing situations for ASD individuals include changes to the environment or daily routines. Difficulties responding to such changes may lead to consequences for ASD children, their families and communities. Understanding the mechanisms that lead to such difficulties may improve the specificity of treatment for these symptoms. We adapted a reversal learning paradigm used in healthy adults (Schiller et al., 2008) to study older children and adolescents diagnosed with ASD, in order to improve understanding of connections between ventromedial prefrontal cortex (VMPFC) and the amygdala regarding the acquisition and maintenance of fear. To our knowledge this is the first such reversal study in ASD.

Objectives: In the context of frequent severe anxiety in autism, including core symptoms of insistence on sameness, we sought to identify underlying differences in fear learning and a later switch in the learned contingencies, in ASD and a matched control group.

Methods: Participants viewed a series of a yellow or blue square presented on the monitor in pseudorandom order. During the Acquisition stage, Color A coterminates on 1/3 of trials with a burst of air directed at the participant's neck. After 30 total trials of 4 seconds each (12 trials of Color B, 12 of Color A with no reinforcement, and 6 reinforced trials), the task is reversed so that Color B, instead of Color A, may be accompanied by the puff of air. Disposable electrodes are used to collect skin conductance response (SCR) for the duration of the experiment.

Results: Participants (typical CON *n*=30; ASD *n*=30) matched for age (range 11-16 years) and IQ (range 80-135). Both groups showed robust fear learning during Early and Late Acquisition phases, measured as the difference between SCR response to Color A and Color B. During Early Reversal, the ASD group did not differentiate between Color A and B, unlike the CON group who showed the expected greater response to the new threat stimulus. The ASD group finally made the switch during the Late Reversal phase.

Conclusions: Delayed reversal learning in the ASD group suggests possible disruption in the circuit linking the amygdala and ventromedial prefrontal cortex (VMPFC). The emotional responses found in the amygdala are unable to make the connection to the VMPFC and back again, as necessary for reversal learning. The inability to switch efficiently may underlie symptoms of anxiety in autism including insistence on sameness. Future research will focus on fMRI studies to further observe brain regions used during this reversal task. Present SCR results suggest that difficulty dealing with changes in ASD may occur at a fundamental, early processing level. We also discuss the viability of using the air puff device as a safe but effective aversive unconditioned stimulus.

159.120 120 ADOS Severity Scores Predict Performance on a Classic Measure of Intentional Understanding in Preschoolers on the Spectrum. J. Pandey[1], J. Parish-Morris*[2], K. Hirsh-Pasek[3], R. M. Golinkoff[4], R. Pulverman[5], R. T. Schultz[1] and S. Paterson[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*, (3)*Temple University*, (4)*University of Delaware*, (5)*Delaware State University*

Background: ADOS severity scores are designed to assess the extent to which children are impacted by the primary deficits of autism. Unlike previous ADOS scoring metrics, these severity scores are based on the revised algorithm (Gotham et al., 2007), including repetitive and restricted behaviors as well as impairments in social interaction and communication, thereby capturing the comprehensive clinical picture more accurately. The present research asked whether this new measure of autistic symptom severity could predict naturalistic play, imitative, and helping behaviors, as measured by performance on a modified version of a classic behavioral reenactment task (Meltzoff, 1995; Parish-Morris et al., 2007).

Objectives: Determine whether ADOS severity scores predict children's performance in a behavioral reenactment paradigm. We hypothesized that ADOS severity scores would significantly predict performance in the *non-canonical* condition of the task because success in this condition required attention to the intentional cues of the experimenter. Performance in the *canonical* condition could be solved based on prior knowledge of typical toy use and thus would not be predicted by severity scores.

Methods: Twenty-three children (19 male) were diagnosed with an ASD using the ADOS, the ADI-R, and expert clinical judgment. Children ranged in age from 3-6 years (mean: 60.77 months, SD=11.69), with an average full-scale IQ of 87.09 (SD=25.49). The severity scores for our sample ranged from 1-10, indicating a good spread, with a mean score of 7 (SD=2.45). In the behavioral reenactment paradigm, children observed an experimenter repeatedly try (and fail) to perform actions that either coincided with canonical toy use (e.g., stack a ring on a post) or conflicted with canonical toy use (e.g., put a train in a pot instead of on the available track). Children were asked, "Can you do it for me?" The first action children performed on each set of objects was scored "1" if it completed the experimenter's intended action, and "0" if it did not (4 sets in all).

Results: Two linear regression analyses were conducted, one predicting average performance on the *canonical* set and one predicting performance on the *non-canonical* set. In each regression, sex, IQ, and chronological age were controlled in Step 1. ADOS severity scores were added in Step 2. In the

canonical condition, ADOS severity scores did not account for a significant amount of variance in performance (R^2 change = .05, *F* change = 1.74, *p* = ns). In the *non-canonical* condition, ADOS severity scores significantly predicted children's responses (R^2 change = .20, *F* change = 8.27, $p < .01$), with the complete model accounting for a full 57% of variance in task performance.

Conclusions: ADOS severity scores predicted performance on a task requiring an understanding of the intentional cues, but not performance on a task that could be solved based only on prior experience with toys. This suggests that ADOS severity scores are a potentially useful metric for predicting live-action play behaviors in children with ASD, and are sensitive to intention understanding in this population, even after controlling for such powerful predictors as IQ.

159.121 121 Identifying Pragmatic Language Skills Difficulties in School-Aged Boys with Autism Spectrum Disorder (ASD). C. Koning*[1] and J. Volden[2], (1)*Glenrose Rehabilitation Hospital*, (2)*University of Alberta*

Background:

For children with ASD who have structural language skills within normal limits, pragmatic communication difficulties remain a persistent and pervasive impairment (Landa, 2000; Tager-Flusberg, 2004). Few studies have examined pragmatic language ability by considering both parent perspectives and behavioural observation within a relatively homogenous group of children with ASD. Volden and Phillips (2010) compared two standardized pragmatic assessments: the Children's Communication Checklist-2 (CCC-2; Bishop, 2003, 2006), a parent-report instrument, and the Test of Pragmatic Language (TOPL; Phelps-Terasaki & Phelps-Gunn, 1992), a child observation measure, on their ability to identify pragmatic communication impairment in high-functioning children and youth with ASD. They found that the CCC-2 identified pragmatic impairment in more children than the TOPL. Since then, the Test of Pragmatic Language-Version 2 (TOPL-2; Phelps-Terasaki & Phelps-Gunn, 2007) has become available. The present study compared the CCC-2 and the revised TOPL-2 on their ability to identify pragmatic impairment in a cognitively and linguistically able group.

Objectives:

To compare the CCC-2 with the TOPL-2 on the ability to identify pragmatic language difficulties in children with ASD whose cognitive and receptive language skills are in the average range.

Methods:

Fifteen boys aged 10-12, diagnosed with ASD based on ADOS results and DSM-IV criteria, met inclusion criteria of cognitive and receptive language ability in the average range. Parents completed the CCC-2; participants were administered the Clinical Evaluation of Language Fundamentals-4 (CELF-4), and the TOPL-2.

Results:

As expected, despite receptive language skills in the average range on the CELF-4, participants demonstrated difficulties in pragmatic skills on both the CCC-2 and the TOPL-2. Similar to the results reported in Volden and Phillips (2010), the parent-report CCC-2identifiedmore participants(13/15) as having pragmatic impairment whereas the TOPL-2 identified pragmatic deficits in only 8/15 participants. In addition, a bivariate linear regression analysis indicated that CELF-4CoreLanguage standard score significantly predicted the TOPL-2 standard score (Beta = .726, F(1,13)=14.452, p=.002) accounting for 53% of the variance. A bivariate linear regression with CELF-4 Core Language standard score as the independent variable and CCC-2 General Communication Composite standard score as the dependent variable was not significant (Beta=.268, F(1,13)=1.006, p=.334, n.s.)

Conclusions:

This comparison of the CCC-2 and the TOPL-2 supports previous findings suggesting that the CCC-2 is a more sensitive instrument for identifying pragmatic language impairment in children with ASD whose structural language skills and IQ were in the average range. In addition, these results suggest that the TOPL-2 is more reliant on structural language competence than the CCC-2.

159.122 122 Social Orienting in Children with ASD. D. Kamara*[1], E. J. H. Jones[1], C. Rubery[1], S. Corrigan[1], J. N. Greenson[2], K. Toth[2], S. J. Webb[2] and G. Dawson[3], (1)*Seattle Children's Research Institute*, (2)*University of Washington*, (3)*Autism Speaks, UNC Chapel Hill*

Background: Children with ASD exhibit impairments in joint attention (e.g. Dawson et al., 2004; Mundy et al., 1986; Toth et al., 2006). Joint attention is thought to contribute to the development of language skills and social proficiency in children (e.g. Carpenter et al., 1998; Sigman & Ruskin, 1999) and can also help to distinguish young children with ASD from those without ASD (e.g. Dawson et al., 2004). Identifying precursors to joint attention impairments may suggest novel targets for intervention. In the Orient Task (Dawson et al., 2004), 3- to 4-year-old children with ASD oriented less than controls to both social and non-social stimuli, with a greater difference found for social stimuli. Children's social orienting behavior was positively related to their joint attention skills.

Objectives: In Experiment 1, we used a similar task as Dawson et al. (2004) to examine social and non-social orienting in a younger cohort. In Experiment 2, we removed the underlying social component of the original task. In the original Orient Task, all orienting stimuli were delivered by an experimenter, which adds a social component to both the social and non-social stimuli. To examine the effects of removing this social component, we delivered all stimuli through speakers.

Methods: Participants in Experiment 1 were 18- to 30-month-old toddlers with ASD, developmental delay (DD), or typical development (TD). Diagnosis of ASD was based on the ADOS, DSM-IV criteria, the ADI-T, and expert clinical judgment. Social and non-social prompts were delivered by an experimenter, while the child played with a toy. During the task, the experimenter also provided bids for joint attention (gaze or point). Participants in Experiment 2 were 2- to 4-year-old children with ASD or TD. All orienting cues were delivered from wall-mounted speakers. Head and/or eye turns toward the location of the stimuli were counted as orienting.

Results: In Experiment 1, toddlers with ASD were significantly less likely to orient to social and non-social cues than toddlers with TD or DD. This difference was greater for social cues, replicating Dawson et al (2004). Toddlers with ASD were also less likely to respond to joint attention bids; social orienting was correlated with joint attention in children with ASD and TD. Data collection is ongoing for Experiment 2. Preliminary results suggest that children with TD orient to the stimuli at a comparable rate to previous findings. Additional analyses will compare rates of orienting in children with ASD to TD children.

Conclusions: Social and non-social orienting deficits were apparent in 18- to 30-month-old toddlers with ASD. Social orienting behavior was related to joint attention, suggesting that orienting deficits may contribute to impaired joint attention skills in autism. We also aimed to strengthen our methodology by eliminating all social elements to the non-social stimuli. Preliminary data suggest that method of delivery of social and non-social stimuli does not alter rates of orienting in TD children.

159.123 123 Vocabulary Composition in Toddlers with ASD: The Longitudinal Development of a Productive Verb Lexicon. C. Gilman[1], J. Parish-Morris*[2], D. A. Fein[3] and L. Naigles[3], (1)*Center for Autism Research, Children's Hospital of Philadelphia*, (2)*University of Pennsylvania*, (3)*University of Connecticut*

Background: Research suggests that verbs are harder for typically developing children (TD) to learn than nouns, perhaps because their referents are often less perceptually available than words for concrete objects (Gentner, 1982). One theory suggests that the reduced perceptual availability of verbs necessitates increased support from social and grammatical cues, which may put children with less access to social cues at a disadvantage (Maguire et al., 2006). Indeed, experimental research suggests that children with autism spectrum disorders (ASD) have relatively intact noun learning abilities (Swensen et al., 2007); moreover, parental report measures indicate that they use proportionately fewer verbs (Parish-Morris et al., 2009). However, because children with ASD appear to *learn* verbs via some typical strategies (Naigles et al., 2011), the differences in verb vocabulary may result from children with ASD not *using* verbs as flexibly and comprehensively as TD children. The current study seeks to

distinguish these accounts by examining children's noun and verb use in naturalistic conversations.

Objectives: Plot a longitudinal trajectory of growth in 2 lexical categories (nouns and verbs) over two years, investigating whether the lexicons of children with ASD have fewer verbs than TD children, and whether this discrepancy *increases* over time.

Methods: Seventeen toddlers with ASD (mean age=32.86 months) were matched to 18 TD toddlers (mean age=20.60 months) on Expressive and Receptive Language abilities at Visit 1 of 6. The language produced by parents and children during six 30-minute unstructured home-based play sessions (4 months apart) was recorded and transcribed in CHAT format.

Results: Preliminary analyses revealed that both groups had proportionately fewer verbs than nouns in their early productive lexicons (Bornstein et al., 2004). The proportion of verbs and nouns used by children at each visit was calculated by dividing the number of category tokens by the total number of words spoken. Independent-samples t-tests conducted at each time point revealed that although the TD group used a significantly smaller proportion of **verbs** than the ASD group at Visit 1, $t(32)=-2.10$, $p=.04$, rapid growth in the TD group reversed this pattern at Visits 3, 5, and 6, when they used a significantly larger proportion of verbs than the ASD group, *(ps*<.05 at Visits 3 and 6, $p=.06$ at Visit 5). In contrast, TD children used a larger proportion of **nouns** in their conversation at Visits 2 and 3 (*ps*<.05) than did children in the ASD group. Paired-samples t-tests conducted within-groups revealed that the proportion of nouns in the vocabularies of children with ASD did not change between Visits, whereas the proportion of nouns used by the TD group decreased from Visit 2 to Visit 3 ($p=.009$), from Visit 3 to Visit 4 ($p=.06$), and from Visit 5 to Visit 6 ($p=.03$).

Conclusions: This study demonstrates that toddlers with ASD produce proportionately fewer verb tokens than TD control children at multiple time points, during naturalistic interactions. Future analyses will use growth curves to characterize developmental trends in the vocabulary of each group, and explore *how* the verb usage of children with ASD differs from TD.

159.124 124 Neglecting the Eyes and It's CASCADE EFFECT On Joint Attention Abilities In CHILDREN with ASDs. R. Fadda*[1], S. Congiu[2], F. Musante[2], G. S. Doneddu[2] and A. Salvago[2], (1)*University of Cagliari*, (2)*Center for Pervasive Developmental Disorders, AOB*

Background: In our previous study (Fadda, Doneddu, Striano, Chessa, Salvago, Frigo, Liberati, 2010), we found quantitative differences in the way children with ASD process static eye-gaze direction: They demonstrated fewer fixations to the eyes region compared to controls but equal fixation to the gaze target (GT). These results indicated that children with ASD might be successful in locating the referent of the gaze due to an atypical pattern of visual attention, involving over-exploration of the visual-field. However, in this previous study, we used static pictures of an adult looking toward an object and therefore we might have underestimated children's ability to focus on the eyes. Moreover, we did not explore to what extent the reduced focus to the eyes prevents children to develop the ability to produce visual patterns of Joint Attention (JA) when observing complex social scenes.

Objectives: In this study, we aimed to investigate: 1) the ability to follow a dynamic referential looking in children with ASDs; 2) whether children with ASDs who are able to follow a dynamic referential looking produce visual pattern of JA when exploring a complex social scene.

Methods: We compared 20 children with ASDs (mean chronological age: 102 mths; sd=32,201), 18 autistics, mean non verbal IQ (Leiter-R)= 64 (sd=17.589), mean verbal IQ (PVT)=69,79 (sd=11,128), with a group of TD controls (10 males) in the preschool years (mean age=59 months; sd=8.44). Children were tested twice with the Tobii T60 Eye Tracker. In the first test, they observed a video in which an actor looked laterally towards one of two identical objects depicted on eye level next to her face. We measured the number of fixations on two specific areas of interest: eyes and gaze target (GT). The second video showed an adult and a child sitting at a table, one in front of the other. The adult poured some juice into two glasses, put some sugar into one glass and asked the child: "Which one is for you?". We counted the number of JA visual patterns (adult-object-child) produced by children during the observation of the scene.

Results: The results showed that ASD children looked less to the eyes compared to controls (mean FC ASD=7,79, sd=3,824; mean FC TD=10,40, sd=3,992; t=2,084; df=37; p<0.05). However, they were as accurate as controls in locating the GT. Children with ASDs showed also a reduced visual pattern of JA when exploring the social scene (mean JA ASD= 2,42, sd=1,121; mean JA TD=5,05, sd=2,03; t=4,953, df=37, p<0.05).

Conclusions: These results confirmed the findings in our previous study (Fadda et al., 2010), namely that children with ASDs are able to locate a referential target even though they focus less on the eyes. This is true even when the referential gaze is dynamic (gaze shifting) so the eyes motion might better capture the observers' attention. Neglecting the eyes seems to have a negative cascading effect on visual patterns of JA attention in children with ASD, confirming that focus on relevant social cues is pivotal for social development.

159.125 125 EXPLORING MORAL Judgment In High Functioning AUTISM: The ROLE of Emphaty and THEORY of MIND. G. S. Doneddu*[1], R. Fadda[2], L. Ferretti[1], G. Saba[1], F. Casano[1] and G. Macchiavello[1], (1)*Center for Pervasive Developmental Disorders, AOB*, (2)*University of Cagliari*

Background: People usually rely to mentalistic motivations in order to define moral judgments (MJ) about agents behaviors. While unintentional behaviours are usually explained merely in terms of mechanical causal factors, intentional actions are interpreted considering not merely the intention that precedes the behaviour but also the beliefs that support it – that is the fact that the agent knows that his/her behavior might cause harmful or negative effects to others (Knobe, 2005). However the effect of perceived beliefs and intentions in MJ is not so linear, because sometimes the emotional reactions elicited by morally based behaviours can distort Theory of Mind (ToM) judgments (Malle, 1999). Despite the centrality of emotion and cognition in moral judgment, little experimental work has been done to study the actual role of empathy and mentalizing abilities in motivating moral judgment. One way to distinguish the role of cognitive and emotional factors in predicting moral decision might be to compare the behavior of Autism Spectrum Disorders (ASDs) and Normally Developing (NDs) individuals in moral judgment tasks, where both outcomes concern and intention-detection are relevant. While NDs acquire the ability to "mentalize" quite early in their childhood, subjects affected by ASDs show difficulties in understanding others mental states and emotions (Baron-Cohen, 1995).

Objectives: Analyze the role of empathy and ToM on MJ, comparing NDs with High Functioning Autistic kids (HF-Aut).

Methods: We tested 22 HF-Aut (all males; aver. chron. age=15 yrs; DS=3; aver. IQ=84; DS=10) and 41 NDs (all males; aver.chron.age=10; yrs; DS=9 mths) for MJ with a classical Piagetian task, for ToM with a second order False Belief task and for Empathy with the Cambridge Empathy Quotient (Baron-Cohen et al., 2004). Two versions of a story similar to the classical Piagetian tasks were used to assess the children's moral judgment. While in one version the character intentionally acted unfair and he/she caused a modest material damage, in the other version the character acted fair but, for an error, he/she caused a great material damage. The children had to "morally" judge the behavior of the characters, on the basis of what they think could be more relevant (intentions vs material consequences). The second order false belief task was the "Ice-cream task" (Perner & Wimmer, 1985), that requires the ability to represent one character's false belief about what another character thinks about the world.

Results: All HF-Aut were significantly lower than NDs in empathy scores (HF-Aut EQ=32.4; DS=8 - NDs EQ=42,82; DS=7.52; t=4,97; df=49; p=0.000). The 55% of them who passed the false belief task did not differ from NDs in MJ (U=135; p>0.05). The HF-Aut who lacked of ToM abilities expressed more morale judgments on the basis of "morally appropriate behavior" rules than NDs (U=85; p=0.05).

Conclusions: Atypical pattern of MJ in children with HF-Aut was related with intact ToM abilities but not with empathy, indicating the essential role of cognitive processes in MJ. Furthermore, a lack of intention-detection was involved in perseverant negative moral judgments concerning actions that broke "morally appropriate behavior" rules.

159.126 126 Prelinguistic Predictors of Language in Young Children with Autism Spectrum Disorders. C. C. Wu*[1],

C. H. Chiang[2] and Y. M. Hou[3], (1)*Kaohsiung Medical University*, (2)*National Chengchi University*, (3)*Chia-Yi Chritian Hospitial*

Background: Previous researches have shown that early language ability is related to better long-term outcomes and adaptive function in children with autism spectrum disorders (ASD). However, most of children ASD appear delays and impairments in language development. It is an important issue to explore predictors of language in young children with ASD. A few prelinguistic were suggested that they could enhance development of language in children with ASD. However, there was no longitudinal research to investigate prelinguistic predictors of language in young children with ASD under 36-months-old.

Objectives: The purpose of the longitudinal study was to examine prelinguistic predictors of language in young children ASD less than 36 months. We also further investigated which variable was the unique contribution to language development in the ASD population.

Methods: The participants were thirty six 29-months-old (range = 24-36 months) children with ASD, including 28 cases of typical autism and 8 cases of atypical autism. The prelinguistic skills were measured at 29 months old and language outcome were assessed at 29 months and 48 months. A T-STAT, modified form from the STAT (Stone, et al., 2000, 2004), was used to measure the prelinguistic skills, including initiating joint attention, responding joint attention, object imitation, manual imitation, and doll-directed play. Besides, the verbal abilities were assessed by Mullen Scales of Early Learning (MSEL, Mullen, 1995).

Results: Language at 29 months, all of receptive language, expressive language and overall language were concurrent correlated with object imitation and doll-directed play. The receptive language was marginal correlated with responding joint attention. Significant concurrent predictor of receptive language and overall language was object imitation. Language at 48 months, the expressive language is longitudinal related to object imitation, manual imitation, and doll-directed play. And, the receptive language was marginal correlated with object imitation and responding joint attention. In addition, the overall language was also marginal correlated with object imitation. Significant longitudinal predictor of expressive language was object imitation.

Conclusions: Results of this current longitudinal study demonstrated that object imitation skill was the stronger predictors for receptive language and overall language at 29 months and for expressive language at 48 month in young children with ASD. The current results replicated previous findings and supported that children with ASD acquire language rely on object imitation. Although the object imitation could enhance language development, it is not enough to learn appropriate language use. Overuse of imitation without initiating joint attention causes a lack of intentional reference. This is a reason why children with ASD show atypical features of language usage. The current findings have important implications for early intervention in children with ASD.

159.127 127 Differences in Reaching and Object Exploration Skills Between Infants At Risk for Autism and Typically Developing Infants in the First 15 Months of Life. G. Ju*, M. Kaur, A. C. Harris, S. Srinivasan and A. Bhat, *University of Connecticut*

Background:

Infants begin to grasp objects at around 6 months of age and continue to explore various object properties based on shape, size, and texture. These fine motor skills lay a foundation for cognitive skills such as object knowledge as well as social communication skills such as hand gestures. Infants at risk for autism (AU sibs) also present with fine motor delays (Landa et al., 2005) which may in turn affect their object exploration skills.

Objectives:

In the present study, we examined the differences in object exploration skills between AU sibs and typically developing (TD) infants and correlated them to infants' future social and motor outcomes. In addition, we examined how caregiver feedback influences object exploration skills (Bourgeois et al., 2005) in AU sibs and TD infants.

Methods:

12 TD infants and 12 AU sibs were observed at 6, 9, 12, and 15 months of age with developmental follow-up and autism screening conducted at 18 and 24 months. Infants were seated upright in a booster seat and were offered three different objects – a long rattle, a circular solid rattle, and a circular soft koosh ball. In the spontaneous conditions, infants were allowed to spontaneously explore each object. In the social conditions, an adult tester showed the infant the property of each object (i.e.; vertical shaking of the long rattle, horizontal shaking of the solid ball, and fingering of the koosh ball) and additional opportunities for object exploration were provided. Videotaped data will be coded for percent duration of oral, visual, and haptic exploration. Rates of demonstrated actions and task-appropriate grasping patterns, for example, power or pincer grips, one-handed vs. two-handed grasps, and rates of transfers will also be coded.

Results:

Our preliminary analyses suggest that AU sibs will show increased visual exploration, reduced grasping and bimanual use, and fewer appropriate motor responses to caregiver-provided demonstrations as compared to TD infants. In addition, AU sibs with poor social outcomes at 18 or 24 months will show greater fine motor impairments and poor use of caregiver feedback during object exploration as compared to the AU sibs with typical outcomes.

Conclusions:

TD infants demonstrated increased fine motor control and increased ability to shape their actions based on caregiver feedback across 6 to 15 months of age. In contrast, AU sibs' impairments in fine motor control and lack of social attention may have contributed to their poor object exploration skills. Overall, spontaneous versus social conditions of object exploration may be an effective context to assess the atypical fine motor and visual attention patterns of infants at risk for autism and may provide a window for early diagnosis of future autism-related motor and social impairments.

159.128 128 Validation of a Japanese Version of the Vineland Adaptive Behavior Scales, Second Edition: Comparison Between ASD, ADHD, and Intellectual Disability. H. Ito*[1], M. Ohnishi[2], S. Ohtake[1], F. Someki[1] and M. Tsujii[3], (1)*Hamamatsu University School of Medicine*, (2)*Fukui University*, (3)*Chukyo University*

Background: Currently, a comprehensive adaptive behavior scale that assists in making a decision on the necessary level of support for individuals with disabilities is not available in Japan. The unavailability of adaptive behavior scales has led to an underestimation of the needs related to the adaptive functioning of individuals with disabilities, particularly those who exhibit a significant discrepancy between their cognitive ability and adaptive functioning (i.e., those who exhibit higher IQ but have deficits in adaptive functioning). The Vineland Adaptive Behavior Scales, Second Edition (VABS-II; Sparrow, Cicchetti, & Balla, 2005) is one of the most widely used adaptive behavior scales in the US and other countries, and it is used for not only identifying individuals with cognitive disabilities but also for assessing needs of individuals with autism spectrum disorders (ASD) and other developmental disabilities. We started a standardizing process of the Japanese version of the VABS-II.

Objectives: As a part of the validation analysis, this study aimed to compare the scale scores of the Japanese version of the VABS-II among three groups: the ASD group, the attention deficit hyperactivity disorder (ADHD) group, and the intellectual disability (ID) group.

Methods: The participants of the ASD group (n = 132), the ADHD group (n = 21), and the ID group (n = 52) received a diagnosis on the basis of the DSM-IV criteria by experienced psychiatrists belonging to medical and educational facilities in 28 areas throughout Japan. We administered the Japanese version of the VABS-II to parents, caregivers, or adult family members of the participants.

Results: With regard to the adaptive behavior domains, the ID group showed the lowest scores in all subdomains. The ASD groups showed lower scores than the ADHD group, especially in the Communication and Socialization domains. In the context of the maladaptive behavior domains, the differences between the three groups were smaller than those in the adaptive behavior subscales. In particular, in the external problem subscale, the ADHD group showed a higher mean

score than the other two groups, although it was not statistically significant.

Conclusions: We found that the Japanese version of the VABS-II is quite useful for evaluating the actual adaptive functioning of individuals with developmental and intellectual disabilities.

159.129 129 Spoken Language Abilities in Adults with High-Functioning Autism. S. Kuo*[1], M. L. McEntee[1], L. Bosley[1], E. Lacey[1], M. A. Andrejczuk[1], A. Cooper[1] and B. Gordon[2], (1)*The Johns Hopkins University School of Medicine*, (2)*The Johns Hopkins University*

Background: Most comprehensive studies of language abilities in high-functioning individuals with autism (HFA) have been focused on early development through adolescence, and very few on the adult high-functioning population. As a result, the pattern of abilities and disabilities of this group is not as well characterized.

Objectives: To obtain a comprehensive spoken language profile of adult HFA using a standardized language assessment with good validity and reliability, CASL

Methods: Five HFA (diagnosis of autism confirmed by ADI-R and ADOS, ages 19-40) were administered the complete CASL and the results were scored according to the manual. In order to provide a common frame of reference for comparing core, index, and standard scores for our participants who are older than the normative age limit set for CASL (21;11), individuals aged 22 or older at the time of assessment were normed to age group 21;11. Cognitive function data were also collected using tasks such as Block Design (BD) and Rey Complex Figure Test (RCFT) to measured weak central coherence, which is a core deficit in autistic individuals across many domains.

Results: Analysis of CASL's category index scores revealed the lexical/semantic index score to be consistently the highest index score compared to other areas of language (syntactic, supralinguistic, and pragmatic). There is a significant difference between lexical/semantic and supralinguistic, which measures higher-level language processing. Within the supralinguistic subtests, the most consistent deficit in our HFA participants was the ability to explain non-literal language (subtest: Non-literal Language). The abilities to derive meaning from context (subtest: Meaning from Context) and from prior knowledge (subtest: Inference), and to provide two different interpretations of an ambiguous sentence (subtest: Ambiguous Sentences) also tended to be below normal range. The participants exhibited a weakness in BD and a severe impairment in the copy portion of the RCFT, characterized by a preference for using a local rather than global strategy.

Conclusions: 1) Preliminary data suggest that CASL is a sensitive battery for capturing the typical language strengths and deficits in HFA even beyond its normative age range. 2) The overall language profile seen in these participants thus far is consistent with the literature on HFA in that lexical/semantic was an area of strength, syntactic ability was relatively intact, and deficits were shown in higher-level language processing and pragmatics. Difficulties observed on CASL subtests (Meaning from Context and Inference) are consistent with weak central coherence theory, which is also supported by participants' performance on the RCFT. Further analysis and testing is needed to examine in detail the relationship between cognitive function and language processing tasks, to explain individual differences in performance in adult HFA.

159.130 130 Motor Functioning and Language Development in Preschool Children with Autism. A. Hellendoorn*[1], P. P. Leseman[1], L. Wijnroks[1], C. Dietz[2], J. K. Buitelaar[3] and E. Van Daalen[4], (1)*Utrecht University*, (2)*Altrecht Institute for Mental Health Care*, (3)*Radboud University*, (4)*University Medical Centre Utrecht*

Background: Although delays and deficits in language development are diagnostic criteria for Autism Spectrum Disorder (ASD), little is known about the pre-clinical signs related to these deficits. Various researchers have noted delays and deficits in the motor skills of young children with ASD, little attention has been paid however to the role of motor development in the acquisition of language in children with ASD. From an embodied cognition perspective it is proposed that motor functioning and language development are related, and that exploratory behavior and visuospatial cognition are possible mediators of this relationship. This perspective may be fruitful to study the language acquisition in ASD.

Objectives: The objectives of this study were to examine whether (1) early motor functioning can predict later receptive and expressive language development in children with ASD and children at risk for ASD, (2) the relationship between motor functioning and language is mediated by exploration and visuospatial cognition, (3) the relationship between motor functioning and language is moderated by severity of autism.

Methods: Longitudinal relations between early finemotor functioning and language in the fourth year of life were examined in two groups of preschool children: 50 with ASD, confirmed by ADI-R and the ADOS-G, and 120 at high risk for developing ASD. The high risk children failed 3 or more items on the Early Screening of Autistic Traits (ESAT) but had no ASD at the moment of assessment. Motor functioning, visuospatial cognition and language abilities were assessed with the Mullen Scales of Early Learning (MSEL). An observation coding scheme was applied to score several aspects of exploration.

Results: Finemotor functioning predicted language in the ASD and the high risk group. This relationship was mediated by visuospatial cognition in both groups and by exploration in the ASD group. Severity of autism moderated the strength of some of the relations with stronger effects in the ASD group compared to the high risk group.

Conclusions: Early motor functioning, exploration, and visuospatial cognition appear to be predictors of later language development in children with autism. These findings are in support of the embodied cognition theory. The current study emphasizes the importance of motor assessment for children with ASD and the need for clinicians to consider cognition in general, and language specifically as emergent from multiple interacting systems. Future longitudinal studies are needed to examine the developmental trajectories of ASD and the interrelations between different domains of functioning.

159.131 131 The Regression of Language Skills in Preschool Children with Autism Spectrum Disorder. B. Backes*, R. B. Zanon, R. G. Endres, M. A. Meimes and C. A. Bosa, *Federal University of Rio Grande do Sul*

Background: The Autism Spectrum Disorder (ASD) is characterized by the presence of severe impairment of social interaction and communication as well as by the presence of repetitive and stereotyped behaviors. In recent years, it has increased the interest of researchers for occurrence of language regression, in some cases of ASD, with negative outcomes on other areas of development. In general, language regression is understood as a significant or permanent loss of newly acquired words, in the first years of life, and it may be associated with epilepsy and genetic factors. The lost of skills may be an early indicator of autistic traits because apparently it tends to be characteristic, although not universal, of children with ASD.

Objectives: This study aimed to investigate retrospectively the occurrence of language regression in a sample of Caucasian preschool children diagnosed with Autistic Disorder or Pervasive Developmental Disorder Not Otherwise Specified. In particular, it was investigated: a) the percentage of children who regressed; b) the mean age of onset of regression; c) the level of regression before the loss; e) the possible co-occurrence with epilepsy and f) the co-occurrence of loss of skills in other developmental areas (motor, self-care, play and sociability).

Methods: A database of 150 preschool children diagnosed with ASD, who were treated at the Cincinnati Children's Medical Center in Ohio, between 2008 and 2009 was used. Regression was investigated based on items 11 to 28 of the Autism Diagnostic Interview – Revised (ADI-R).

Results: Of the 150 children 33 met the criteria for participation in this study (age, race, diagnostic, and ADI-R complete measures). Of these, 18.2% had regression of oral language skills, with a mean age of onset of loss of 25 months. Regarding the level of language before the regression, 83.3% of children used at least five words spontaneously and communicatively, and 33.3% lost communicative intention. In addition, 66.6% of children who had language regression also showed lost of social interaction skills. None children had epilepsy.

Conclusions: These results about the percentage of ASD children who had language regression, the mean age of onset

and also the loss of social skills corroborate previous findings. On the other hand, there was no co-occurrence with epilepsy. These results are discussed in the light of sociopragmatic theory.

159.132 132 Speech Delays and Early Social Communication and Symbolic Functioning in Toddlers with and without Autism. S. Shumway*[1], A. Thurm[2], C. Marti[2], L. Joseph[2], L. Rothschild[2], L. B. Swineford[3] and D. Luckenbaugh[2], (1)*University of Utah*, (2)*National Institute of Mental Health*, (3)*Florida State University Autism Institute*

Background: Prelinguistic communication skills such as joint attention, gesture use, and shared positive affect distinguish autism spectrum disorders (ASD) from typical development and nonspectrum developmental delays (DD) in the first few years of life (e.g., Osterling et al., 2002; Wetherby et al., 2004) and predict later language development (e.g., Mundy et al., 1990; Wetherby et al., 2007). In addition, early language functioning is one of the strongest predictors of outcome in ASD (Luyster et al., 2007; Billstedt et al., 2007). Understanding how early expressive speech/language skills relate to social communication skills in children with ASD will expand knowledge of the key factors related to ASD development.

Objectives: The purpose of this study was to examine the concurrent relationship between early expressive speech/language and social communication, expressive speech/language, and symbolic functioning, the three measured components of the Communication and Symbolic Behavior Scales Developmental Profile Behavior Sample (Wetherby & Prizant, 2002) - in a sample of young children evaluated for ASD or DD.

Methods: The Behavior Sample (BS), a face-to-face evaluation of the child interacting with a parent and clinician, was completed with 55 children evaluated for ASD or other DD. Following a research evaluation, 31 children were diagnosed with ASD (mean age=31.7 months, SD=5.2) and 24 comprised a nonspectrum group (mean age=26.0 months, SD=5.8). BS raw scores were computed for the Social (emotion and eye gaze, communication, gestures), Speech (sounds, words), and Symbolic (understanding, play) composites. We examined these composites in relation to parent reports of expressive language, including number of words produced (from the MacArthur-Bates Communicative Development Inventories; Fenson et al., 1993) and age of first words (from the Toddler ADI-R; Lord et al., 2004).

Results: Preliminary findings revealed that 45% (14/31) of children with ASD and 67% (16/24) of children in the nonspectrum group were reported to use words when assessed on the Toddler ADI-R. Using age-matched groups, significant large correlations (spearman's rho) were found between number of words produced and Social and Speech in children with ASD, with a nonsignificant moderate correlation between words produced and Symbolic. In the nonspectrum group, number of words produced was significantly correlated with Speech, but not Social or Symbolic. Results of Cox Regression survival analyses revealed that the children with ASD attained first words significantly later than children in the nonspectrum group (p=.015). In ASD, age of first words was significantly related to Social (p=.015) and Speech (p=.000), but not Symbolic (p=.097). In the nonspectrum group, age of first words was not significantly related to Social (p=.278), Speech (p=.063), or Symbolic (p=.173).

Conclusions: Preliminary results indicate that social communication skills in a sample of young children with ASD are strongly related to expressive speech/language both in terms of age of first words and current words produced. It is possible that language and social deficits may be more interdependent in young children with ASD but become more independent with age. Further analysis of larger samples and of different ages will be important in clarifying the relationship between language and other deficits in ASD.

159.134 134 Differential Predictors of Social Behavior with Unfamiliar Adults Versus Peers in Higher Functioning Children with Autism. L. Usher* and H. A. Henderson, *University of Miami*

Background: There is a wide range of variability in the severity of social deficits displayed by higher functioning individuals with autism. Syndrome specific and non-syndrome specific individual differences may predict variability in the severity of social deficits.

Objectives: The aim of the current study was twofold: 1) To examine the correlation between Autism Diagnostic Observation Schedule (ADOS) Social-Communication combined scores and an observational measure of social and communication skills obtained through a peer interaction task. 2) To examine and compare the syndrome specific and non-syndrome specific individual difference factors that predict performance on ADOS and during a peer interaction.

Methods: Twenty-nine higher functioning individuals with autism, ages 9 to 17, participated in two laboratory visits, an interaction with an unfamiliar age-, gender-, and IQ-matched typically developing peer and an individual assessment. The dyad was given five minutes during which they were instructed to get to know each other. Eye contact, appropriateness of conversation/interaction, and conversational efficacy were coded from video recordings using 7-point Likert scales. A composite score of *Peer Competence* was obtained by standardizing and summing scores on the three behavioral codes. In a separate visit, an ADOS was administered to each individual. Of interest was the combined Social-Communication score. Syndrome specific factors (verbal IQ and theory of mind) were assessed using the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) Verbal Comprehension Index (VCI) and the Reading the Mind in the Eyes Test. Non-syndrome specific factors of inhibitory control and social anxiety were assessed with Early Adolescence Temperament Questionnaire (EATQ-R) self- and parent reports and Social Anxiety Scale for Children (SASC) self-report.

Results: Preliminary correlational analyses revealed a strong negative correlation between ADOS Social-Communication and Peer Competence, r (27) = -.55, p = .002, such that higher social-communicative deficit on the ADOS corresponded to lower observed competence during the peer interaction. Despite this strong correlation between the independent indices of social skills, correlations revealed different sets of syndrome specific and non-syndrome specific predictors of behaviors in the ADOS versus peer interactions.

WISC-IV VCI was significantly associated with Peer Competence, r (27) = .40, p = .031, and approached significance for the ADOS, r (27) = -.34, p = .071. However, Eyes Test, r (25) = .385, p = .047, self-reported Inhibitory Control, r (25) = .41, p = .034, and Fear of Negative Evaluation scores, r (27) = -.365, p = .052, predicted Peer Competence but not ADOS social-communication scores.

Conclusions: The ADOS is commonly used as the primary instrument for assessing the severity of current symptoms in individuals with autism. The results of the current study suggest that supplementing assessments with in vivo observations of peer interactions provide an effective way to capture variation in children's implementation of social skills. Higher order cognitive skills including theory of mind and aspects of emotional reactivity (social anxiety) and self-regulation may be particularly important in peer contexts where interactions are highly dynamic and potentially demanding especially during late childhood and adolescence.

159.135 135 A Look At the Input: Relationships Between Parental Speech and Child Vocabulary in Autism and Typical Development. J. Bang* and A. Nadig, *McGill University*

Background: There is extreme variability in vocabulary acquisition among children with autism spectrum disorders (ASD). While some children display clear delays, others achieve age-appropriate vocabularies (Luyster et al., 2007). Given less reliance on social input for language development, children with ASD may rely more on associative word learning mechanisms to acquire their vocabularies. This hypothesis has yet to be directly tested. Research with typically-developing children (TYP) demonstrates that variation in the statistics of parental speech influences child vocabulary; for example, word frequency (number of times a word is spoken; Goodman et al., 2008) and density of co-occurrence (number of different words with which a particular word co-occurs; Hills et al., 2010), are associated with the age of acquisition of those words. Few studies have explored how parental input influences children with ASD, nor in non-English languages.

Objectives: This study investigates the relationship between linguistic properties of parental speech input, specifically word types, word tokens, lexical diversity, MLU, word frequency (WF), density of co-occurrence (DCo), and child vocabulary. Based on studies that found no differences in parental input

between parents of children with ASD and parents of TYP children (Siller & Sigman, 2002), we predict no differences between groups for measures of parental input. Consistent with studies of the influence on child vocabulary (Swensen et al., 2007), we hypothesize that in both groups, higher WF and DCo will predict a greater proportion of children having acquired those words. We also detail important cross-linguistic data in French and English.

Methods: The child-directed speech of 44 parents was investigated (ASD and TYP parent-child dyads n =22) Children were matched on receptive language ability. Dyads were from English-speaking (En; n = 13 per diagnostic group) or French-speaking (Fr; n = 9 per diagnostic group) families. Parents engaged in a 10-minute parent-child interaction with a standardized toy set. Child vocabulary was measured six months before and after the interaction using the MacArthur-Bates Communicative Developmental Inventories. Interactions were transcribed using CHAT (MacWhinney, 2000). Measures of word types, word tokens, lexical diversity, MLU, and WF were obtained in CLAN (MacWhinney, 2000). DCo will be calculated in R.

Results: Preliminary analyses of a sample of 14 ASD dyads and 14 TYP dyads (8 En and 6 Fr per group) show no significant differences between diagnostic groups for the parental speech properties of word types, word tokens, lexical diversity, and MLU. Analysis of DCo is in progress. Once all transcriptions are complete, logistic regressions will be used to examine the influence of WF and DCo on individual children's acquisition of a particular word.

Conclusions: This is the first study to compare multiple properties of parental speech between parents of children with ASD and parents of TYP children and examine their influence on child vocabulary. As early intervention for children with ASD increasingly recruits parent involvement, understanding what input factors can be modified to create an optimal environment is important for language development. Understanding how children with ASD acquire words will allow intervention programs to better target language outcomes.

159.136 136 Comprehension of Head Nodding and Head Shaking Gestures in Early Childhood. M. Fusaro*, G. S. Young and S. J. Rogers, *UC Davis M.I.N.D. Institute*

Background:

Impairments in responding to joint attention (RJA) bids are more useful for diagnosing Autism Spectrum Disorders (ASD) through childhood than they are later in development (Mundy, Sullivan, & Mastergeorge, 2009). However, RJA is typically tested only by examining responsiveness to gaze and point direction and to one's name being called. Impairments processing more complex social cues may continue to differentiate typically developing children and those with autism later in development. By age four, typically developing children can use head nodding and head shaking gestures to identify correct label-object pairings (Fusaro & Harris, 2008). The current study examines receptivity to head nodding and head shaking gestures among preschoolers with ASD and typically developing controls, in a novel adjective-learning paradigm.

Objectives:

This experiment examines preschoolers' use of head gestures to learn adjective-object pairings. We test the prediction that preschoolers with ASD will show less systematic gesture comprehension than typically developing children.

Methods:

To date, participants include 15 typically developing preschoolers (11 boys and 4 girls; M = 48.5 months; Range = 41-55 months) and 14 with ASD (10 boys and 4 girls; M = 49.1 months; Range = 42-55 months). Each child responded to eight trials presented via video on a Tobii eye tracking monitor. For each trial, an actress sat behind two pictures of an object, which differed in one salient characteristic (e.g., a book pictured in an upright and an inverted position). The actress stated "Look at these books. One of these is the [inverted book]. Let's find the [inverted] one." She then looked at each picture, indicated one by putting her hand on it, and either nodded or shook her head. Thus, the indicated object was the target in head nodding trials, and the non-target in headshake

trials. The actress then prompted a response “Now you find the [inverted book], point to it.”

Results:

Gesture scores equal the number of trials in which the child identified the correct target (max = 4 for head nods; max = 4 for head shakes). A Mixed ANOVA was calculated with group (ASD, Typical) as the between-subjects variable and gesture type (nod, shake) as the within-subjects variable. This analysis revealed a significant main effect of diagnostic group ((F, 1, 27) = 4.65, p = .04). No other main effects or interactions were detected. Collapsing across gesture type, two-tailed t-tests confirmed that scores for typically developing children were above chance (2.0) level (*M* = 2.92, *SD* = .93; *t* = 3.80, *p* = .002), whereas scores among children with ASD did not differ significantly from chance (*M* = 2.25, *SD* = .71, *t* = 1.32, *p* > .10).

Conclusions:

As predicted, children with ASD are less systematic in their use of head nodding and head shaking gestures to make adjective-object pairings. Difficulties on this task may reflect diminished attention to the gesture or ineffective attention shifting between the gesturer and the targets. Ongoing eye-tracking analyses will allow us to test these hypotheses.

159.137 137 Early Developmental Patterns of Receptive and Expressive Language in Children with ASD. M. Matthews*[1], C. E. Venker[1], E. Haebig[2] and S. Ellis Weismer[2], (1)*Waisman Center, University of Wisconsin-Madison*, (2)*University of Wisconsin-Madison*

Background: One area of continued debate within autism research is whether patterns of language acquisition in autism differ qualitatively from those seen in typical development. Research has shown that children with ASD have relatively more severe impairments in receptive than expressive language early in life (see Volden and colleagues, 2011 for review), but little is known about how this atypical receptive-expressive profile may change during development.

Objectives: To determine whether the atypical receptive-expressive profile persists from toddlerhood through the preschool years, to identify the factors that predict the extent of the atypical profile, and to quantify the impact that the early atypical profile has on later language outcomes.

Methods: Participants were a large sample of young children with ASD in a longitudinal study (n = 122 at Time 1). An experienced examiner made diagnoses integrating results from the ADOS, ADI-R, and clinical expertise. Autism severity scores were calculated per Gotham and colleagues (2009). Comprehensive evaluations completed at each visit (ages 2½, 3½ and 5½) included the Preschool Language Scale-4, Mullen, and at 5½, Peabody Picture Vocabulary Test-4. Discrepancy scores were calculated for each child by subtracting PLS-4 receptive from expressive age equivalent scores (see Volden et al., 2011).

Results: Descriptively, the percentage of children with relatively higher expressive than receptive skills decreased across development from 81.1% (99/122) at 2½, to 67.6% (75/111) at 3½, to 45.1% (41/91) at 5½. A series of t-tests indicated that on average, expressive language age equivalents were higher than receptive age equivalents at 2½ (t =-9.9, p< .001) and 3½ (t=-4.1, p<.001), but not at 5½ (t =-1.1, p=.26). Using multiple linear regression, we examined predictors (maternal education, nonverbal cognition, and autism severity) of discrepancy scores from 2½ to 3½. Autism severity (t=2.110, p=.038) and nonverbal mental age (t =-3.206, p=.002) at 2½ were predictive of discrepancy scores at 3½ (R^2 =0.217, F(3, 91) = 8.387, p<.001). Finally, in a simple linear regression, the discrepancy scores at 2½ did not predict language outcomes at age 5½ on the PLS-4 or PPVT (ps>.3), but the discrepancy scores at 3½ did predict language outcomes at age 5½ on the PLS-4 (R^2=0.20, F(1,90) = 22.610, p<.001) and PPVT-4 (R^2=0.20, F(1,81) = 19.699, p<.001).

Conclusions: Our finding that receptive language lags behind expressive language in young children with ASD at age 2½ and 3½ confirms the results of previous studies. By age 5½, however, there was no group difference in receptive and expressive age equivalent scores, which more closely mirrors patterns in typical development and is consistent with previous findings in older preschool and school-age children

(Kjelgaard & Tager-Flusberg, 2001). Higher autism severity and lower nonverbal mental age at age 2½ were related to higher discrepancy scores one year later. We also found that greater discrepancy scores at 3½ were predictive of worse language outcomes two years later, indicating the impact of the atypical profile on language development over time. Future studies should examine the extent of intervention or developmental effects on changes in the receptive-expressive profile.

159.138 138 Gender Trends in the Friend Preference and Social Acceptance of Girls and Boys with Autism. M. Dean* and C. Kasari, *University of California, Los Angeles*

Background: Typically developing boys and girls prefer same-sex peer groups, however it is unclear if children with autism (ASD) follow the same trends. Results from previous studies indicated that children with ASD generally had fewer friends than typical classmates (Chamberlain, Kasari, & Rotherman-Fuller, 2007). Prior examinations of inclusion classrooms suggested that children with ASD tend to nominate same-sex friends (Rotherman-Fuller, 2010). However, since fewer girls were represented in research samples, less is known about their experiences. Therefore, this research sought to explore the influence of gender research on the social experiences of girls and boys with ASD.

Objectives: The purpose of this study is to examine the gender trends in the social lives of elementary boys and girls with ASD and to boys and girls without ASD.

Methods: The Friendships Survey (Cairns & Cairns, 1994) was used to examine the social relationships and friend preferences of children with ASD compared to their typical classmates. Peer nomination data was collected from 28 elementary school general education classrooms in Los Angeles. The children with ASD (n=30; Girls=15, Boys=15) had their diagnosis confirmed by the Autism Diagnostic Observation Schedule (ADOS), had average or above average intelligence (IQ>70; confirmed by the Stanford Binet-5) and were educated in general education classroom for a minimum of 80 percent of the school day. Girls and boys with ASD were matched by IQ, age, and school district. The control sample consisted of 15 typical girls and 15 typical boys who were selected because they were same-gender classmates of a student with ASD. Gender (Girl/Boy) x Disability (with or without ASD) comparisons were used to identify gender trends in nomination and acceptance scores.

Results: Girls and boys with and without ASD were significantly more likely to nominate same-sex classmates as friends, and to receive nominations from same-sex classmates. Both girls and boys with ASD received significantly fewer friend nominations than the same-gender control group F (1,56)= 10.01, $p < .003$, $\eta_p^{2=}.163$, and were significantly less likely to be reported by their classmates as belonging to a group F (1, 46) = 8.12, $p < .007$, $\eta_p^2 = .150$. A gender x disability interaction effect indicated that classmates generally perceived boys with ASD to be more isolated than girls with ASD F (1,46) = 4.13, $p < .048$, $\eta_p^2 = .082$. There was a significant negative main effect of autism on "cluster centrality scores" F (1, 56)= 4.77, $p < .033$, $\eta_p^2 = .078$ suggesting that the friendship bonds were less salient in children with ASD than typical controls.

Conclusions: Following the trends of typical populations, the children with ASD were significantly more likely nominate and receive nominations from same-gender classmates. However, typical girls generally have more friends than typical boys, and typical boys have more salient relationships. Both girls and boys with ASD received significantly fewer friend nominations, and had weaker bonds than typical control groups. Therefore, the sex-differences in the way typical boys and girls socialize (Macoby, 1998), make girls and boys with ASD face different social challenges.

159.139 139 Parent-Child Shared Storybook Reading for Children with Autism Spectrum Disorders: A Comparison with Typical Development and Relationships with Child Language. S. C. Smith* and A. Nadig, *McGill University*

Background:

Parent-child interactions play an important role in typically-developing children (TYP)'s language development (Huttenlocher et al., 2010). This has also been found for children with autism spectrum disorders (ASD) (Siller &

Sigman, 2002, 2008). Parents of TYP children and parents of children with ASD have been found to be similar in terms of the language input they provide to their children during general daily activities (Warren et al., 2010). Extending these findings to the context of reading, for TYP children, amount of exposure to shared storybook reading predicts vocabulary (Deckner et al., 2006; Fletcher et al., 2008). However, parents vary the styles in which read to their children (Hammett et al., 2003). Adding meaningful dialogue to reading activities predicts expressive vocabulary growth beyond simply reading (Whitehurst et al., 1988). Specifically, parent utterances that promote reflection on language are pertinent for child vocabulary development (Deckner et al., 2006; Fletcher et al., 2008).

Objectives:

This study examined a novel question: similarities and differences in language input provided to children during shared storybook reading by parents of children with ASD and parents of TYP children. Secondly, we investigated if parent input variables are related to child vocabulary in each group.

Methods:

Parent-child dyads including twenty-five typically-developing toddlers and fifteen children with ASD participated. During the first and third visits of a three-part longitudinal study, parents filled out the *MacArthur-Bates Communicative Developmental Inventories (MCDI)* (Fenson et al., 2007). During the second visit dyads were videotaped while reading the same storybook and the interaction was transcribed. Parent utterances were analyzed for linguistic variables (MLU and lexical diversity) and coded into three categories according to input added: reading, non-language-related and language-related, with the last category subdivided as labeling, responses to child, and elaborative utterances.

Results:

Group differences in parent language input were analyzed and correlations were calculated between parent language variables and child vocabulary. Similarities: There were no significant group differences in the number of reading utterances, non-language-related utterances, or in lexical diversity. Differences: Parents of TYP children labeled more, had more responses to child, used more elaborative utterances and had longer MLUs. For TYP children, initial vocabulary was negatively correlated with parents' labeling and elaborative utterances 6 months later. For the ASD group, there were no significant correlations. Analysis of relationships between parent language and final child vocabulary will be available by May 2012.

Conclusions:

Parents of children with ASD and parents of TYP children differ in some aspects of their language during shared storybook reading. Specifically, parents of TYP children add more language-related utterances to the activity, perhaps because their children were more interested in these asides. In the TYP group parents were influenced by their child's earlier vocabulary; they produced fewer language-related utterances for higher child vocabulary, suggesting that elaborations may have been used to facilitate language development in children with less language. However, no such relationship was found for parents of children with ASD.

159.140 140 Early Vocal Development in Infants At Risk of Autism: Prosody and Social Interaction. G. Ramsay*, K. Muench and A. Klin, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Prosodic deficits in autism, including monotonic or exaggerated patterns of intonation, have been recognized since the earliest descriptions of the syndrome, but the onset, development, and origin of atypical intonation patterns have never been properly determined. In early infancy, the fundamental frequency contour of the infant's voice, although initially reflexive, is known to be shaped by prenatal experience of the language environment, loses those properties during the first year of life as volitional control is gained, then converges gradually on native language patterns again in response to engagement with the social world. Conversely, mothers shape their intonation patterns to attract infant attention, specifically by exaggerating changes in fundamental frequency, and infants are sensitive to such changes in intonation. Thus, the development of intonational exchanges throughout childhood may provide a useful index of social attunement between infant and caregiver and its potential derailment in autism.

Objectives: The goal of this study is to track the development of intonation in the first two years of life in infants at risk of autism, concurrently with the development of vocal interaction between infant and caregiver, in order to detect the earliest manifestation of any disruption of prosody, and test the hypothesis that the disruption of expressive prosody in infants with ASD is associated with an earlier derailment of mechanisms of social engagement.

Methods: As part of an ongoing study, we recruited 4 low-risk infants, with no family history of autism, and 4 high-risk infants, with older siblings already diagnosed with autism. Using a miniature digital audio recording device (LENA Foundation) sent out to families in the mail and worn by each child all day, we made day-long audio recordings of each child's language environment at monthly intervals from 2 months onwards. Using automatic speech recognition technology, we extracted and labeled sequences of utterances containing interactions between infant and caregiver, and calculated the fundamental frequency contour, utterance duration, and relative timing between utterances for all of our labeled segments. Using Functional Data Analysis to time-align all fundamental frequency contour shapes for infant and caregiver at each monthly time point, we were able to quantify developmental changes in intonation and also the timing statistics describing vocal interactions.

Results: Consistent with previous studies, all of our infants showed evidence of a development in intonation and vocal turn-taking over the first 12 months, with higher mean F0 and greater F0 variability in our high-risk sample, as well as a reduction in F0 modulation relative to controls. In at least one of our high-risk infants, this was preceded by reduced vocal interaction.

Conclusions: Preliminary results suggest that prosodic deficits in ASD may begin within the first year of life, preceded by atypical patterns of social vocal engagement.

159.141 141 Pronoun Comprehension As a Window Into Pragmatic Processing in ASD. R. Nappa*, N. Hahn and J. Snedeker, *Harvard University*

Background:

Autism spectrum disorders (ASDs) are characterized by impairments in communication. Even children with age-appropriate syntactic and lexical abilities seem to have difficulty using language communicatively (i.e. pragmatics) [1]. While pronoun production is well-studied in ASD[2,3], little is known about pronoun comprehension – a well-understood pragmatic task in psycholinguistics.

Objectives:

We investigate where pragmatics breaks down in autism, and the cognitive skills associated with pragmatic tasks. We examine where pronoun comprehension is impaired in highly-verbal children with autism. To the extent that pronoun resolution depends on linguistic heuristics, we might expect it to be unimpaired in these individuals (like scalar implicature)[4]. To the extent that it involves social perspective-taking or inhibitory control, we might expect otherwise.

Methods:

ASD children (mean age≈7, mean syntax score >100) and controls matched on linguistic abilities heard pronouns across different environments with increasingly complex contextual contributions. Participants answered a pronoun resolution question after hearing a story like those below. As pronoun resolution got more difficult, participants had to: 1) rely only on features (e.g. understand that “he” must refer to a singular male entity), 2) keep track of parallel sentences with the pronoun either in the subject (she) or object (her) position, 3) build a discourse representation (know who’s focused) and maintain it over a longer discourse, 4) determine who’s focused in a discourse when it conflicts with recent mention, 5) use thematic-role mapping in parallel sentences – pronouns in the subject position refer to the first-mentioned character, pronouns in the object position refer to the second-mentioned, 6) use contrastive stress.

1) Emily is in the park with Jacob. She wants to go on the swings.

2) Sheila visited Marky and she/Frankie called Frankie/her.

3) Emily and Hannah are in the park. Emily is playing on the swings. [It's a nice day outside. The sun is shining overhead.] She loves playing in the park.

4) Emily is in the park with Hannah. She wants to go on the swings.

5) Sheila visited Ellie and she/Frankie called Frankie/her.

6) Sheila visited Ellie and SHE/Frankie called Frankie/HER.

Results:

As difficulty increased, results showed: 1) both groups at ceiling, 2) both groups above chance at both pronoun positions, no significant difference between groups , 3) both groups above chance, no significant difference between groups, 4) TD children demonstrating the expected result[5] (>80% first-mentioned responses),ASD children only marginally different from chance (<60% first-mentioned responses), 5) TD children choose the first-mentioned character significantly more with a subject pronoun (she) than with a object pronoun (her), ASD kids are at chance at both, 6) TD children demonstrate sensitivity to contrastive stress in the subject pronoun condition (she and SHE) but not in the object condition,ASD kids show no sensitivity to contrastive stress.

Conclusions:

Thus, several features of pronoun resolution are unimpaired in ASD. However, as integration across types of information (e.g. discourse status and recency) is required, ASD children struggle to successfully arrive at preferred interpretations. Roles for cognitive and general language abilities in these results will be discussed.

159.142 142 Executive Functioning and Responsiveness to Joint Attention in Autism. K. Dela Cruz[1], K. Gillespie-Lynch*[2], N. Le[1], T. Hutman[3] and S. P. Johnson[1], (1)*University of California, Los Angeles*, (2)*UCLA*, (3)*UCLA Center for Autism Research and Treatment*

Background:

While reduced responsiveness to joint attention (RJA) is often observed among young children with autism (Mundy, Sigman, & Kasari, 1994; Rozga et al., 2010), executive functioning impairments are often not observed until later in development (Ozonoff et al., 1991; Yerys et al., 2007). Executive functioning impairments evident by 5.5 years of age are not apparent between 3 and 4 years of age (Dawson et al., 1998; 2002). Although RJA impairments may emerge before executive functioning difficulties in autism, RJA is concurrently associated with behavioral measures of executive functioning even among young children with autism (Dawson et al., 2002). Relations between RJA and behavioral measures of dorsolateral (McEvoy et al., 1993) and ventromedial (Dawson et al., 2002) executive functioning have been observed in autism. Parental report of executive functioning deficits may capture a wider range of behaviors than a behavioral assessment in the lab (see Gilotty et al., 2002 for a discussion of this issue).

Objectives:

1. Assess relations between a parent questionnaire measure of executive functioning and RJA.

Methods:

Fifteen 3 to 7 year old autistic children participated in this study. Control participants are currently being recruited. The RJA component of the Early Social Communication Scales (ESCS) was administered. Parents completed the Behavior Rating Inventory of Executive Functioning-Preschool Version (BRIEF).

Results:

RJA was associated with the inhibit (p = .045), shift (p =.036), and plan (p=.014) subscales of the BRIEF. RJA was not associated with the emotional control and working memory subscales (p>.05).

Conclusions: This study demonstrates the utility of a parent questionnaire for assessing relations between RJA and executive functioning. Interestingly, given the theory that ventromedial aspects of executive functioning, which are believed to be important for emotional learning, are related to RJA in autism, the emotional control subscale of the BRIEF was unrelated to RJA in the current study. Atypically

developing control group will allow us to determine if relations between parent report measures of executive functioning and RJA are specific to children with autism.

Core Symptoms Program
160 Core Deficits and Symptoms II

160.143 143 Exploring Relationships Between Anxiety Symptoms and Repetitive Behaviors in Children with Autism Spectrum Disorders. I. Giserman*, L. Berry, C. M. Puleo, M. C. Souders, A. Bennett, J. S. Miller and J. D. Herrington, *Children's Hospital of Philadelphia*

Background: Repetitive behaviors, a core deficit of autism spectrum disorders (ASD), are often interfering and problematic in the daily lives of individuals with ASD. At present, we know little about the etiology of these behaviors or the extent to which they may be governed by endogenous processes (e.g., cognition, affect). Hutt and Hutt (1965) hypothesized that repetitive behaviors may serve to regulate arousal level: upwards for hypo-aroused individuals and downwards for individuals with elevated anxiety levels (potentially as a means of self-soothing or distraction). Others (Baron-Cohen, 1989; Carruthers, 1996) have posited separate models wherein social anxiety triggers repetitive behaviors in individuals with ASD. However, the exact nature of the relationship between anxiety symptoms and repetitive behaviors in children with ASD remains unclear.

Objectives: This study tests the hypothesis that repetitive behaviors are related to anxiety symptoms in individuals with ASD by examining data from two parent-report measures: the Repetitive Behavior Scale-Revised (RBS-R) and the Screen for Child Anxiety Related Emotional Disorders (SCARED).

Methods: Data are presented on 20 participants between the ages of 6 and 16 years (90% male; mean age=10.1 years, mean IQ=99.1; range: 47-158) diagnosed with ASD using gold standard diagnostic measures (ADOS, ADI-R) and expert clinical judgment; assessment of intellectual functioning was also completed via the Differential Ability Scales Second Edition. Analyses consisted of general linear model-based comparisons of anxiety symptoms and repetitive behaviors, and post-hoc analyses including IQ. Data collection is ongoing.

Results: When controlling for IQ, preliminary results indicate that the Self-Injurious Behavior subscale on the RBS-R is significantly correlated with the SCARED overall score ($r=.58$, $p<.05$), Panic Disorder subscale ($r=.53$, $p<.05$), and Separation Anxiety Disorder subscale ($r=.63$, $p< .01$). Interestingly, preliminary analyses show no significant relationships between the Social Anxiety Disorder subscale on the SCARED and any of the RBS-R subscales.

Relationships between IQ and both anxiety symptoms and repetitive behaviors are observed, such that overall IQ is significantly related to both the Generalized Anxiety Disorder subscale on the SCARED ($r=.56$, $p<.05$) and the Stereotyped Behavior subscale on the RBS-R ($r=-.53$, $p<.05$). Further mediation analyses will be conducted with a larger sample.

Conclusions: Preliminary results suggest that self-injurious behavior may represent a maladaptive coping mechanism for anxiety in individuals with ASD. If this finding holds, it opens up potential avenues for the treatment of repetitive behaviors (particularly self-injury) that focus on anxiety management. Recent studies indicate that behavioral strategies can mitigate anxiety symptoms in ASD (Wood et al. 2009); it is therefore worth exploring whether behavioral strategies for anxiety could also lead to decreases in repetitive behaviors. Additionally, results raise the possibility that higher intellectual functioning in children with ASD may serve as a potential risk factor for generalized worry, and a potential protective factor for stereotyped behaviors. Future studies in this area will refine our understanding of the precise relationship between anxiety and repetitive behaviors in ASD, and expand our knowledge of the role of behavioral strategies in reducing both of these symptoms.

160.144 144 Adult-Supported Intention-Reading in Children with High-Functioning Autism Spectrum Disorders. K. J. Greenslade* and T. E. Coggins, *University of Washington*

Background:

Children with autism demonstrate joint attention (JA) and mindreading deficits (Baron-Cohen et al., 1985; Wetherby et

al., 2004). The confluence of JA and mindreading is intention-reading: the ability to identify what communicative partners are attending to (referential intention) and why (social intention) (Tomasello, 2008). Intention-reading is fundamental to everyday interactions, making it a potentially powerful indicator of social-communication impairments in children with autism.

In everyday social interactions, adults typically manipulate common ground (i.e., knowledge and information shared by communicative partners), which supports/ "scaffolds" children's performance. Scaffolding is arguably required to assess how young children perform in dynamic social exchanges, rather than what they know about social interactions as measured by a static, standardized test. The purpose of this poster is to evaluate the effectiveness of scaffolding in supporting intention-reading in children with high-functioning autism spectrum disorders (CHFASD).

Objectives:

I. To examine scaffolding in CHFASD:

1. Is scaffolding effective in eliciting improved intention-reading responses from CHFASD?
2. Are more scaffolds required to elicit improved responses in younger as compared to older children?

II. To compare scaffolding in CHFASD and children with typical development (CTD) :

1. Do CTD demonstrate better scaffolded intention-reading performance than CHFASD?
2. Are more scaffolds required to elicit improved responses in CHFASD than CTD?

Methods:

Six children, aged 6;5 to 7;7 (years; months) with an autism spectrum disorder and age-appropriate language and cognition, individually participated in an art activity with the experimenter. The art activity created common ground, which the child used to read the experimenter's intentions. The experimental task's nine *opportunities* were interspersed throughout the art activity, each posing two questions: "What did I look at?" (targeting referential intentions), and "What am I thinking?" (targeting social intentions). In each opportunity, the experimenter used JA to communicate one social function: (1) requesting, (2) informing, or (3) sharing emotions. Each function was targeted three times. When participants did not provide complete responses, the experimenter provided verbal and nonverbal prompts to elicit additional information.

Each opportunity was transcribed and coded for the number and nature (verbal/nonverbal) of experimenter scaffolds and informativeness of child responses. Both participants' unprompted and scaffolded responses were coded, and performance was compared. Similar procedures were used to analyze scaffolds and child responses for CTD in the same age range, who previously participated in the same task (Greenslade & Coggins, 2011). Amount of scaffolding and scaffolded performance were compared across groups.

Results:

1. Scaffolded responses of CHFASD were more informative than unprompted responses.
2. Younger CHFASD required more scaffolds to provide improved responses than older CHFASD.
3. There was no difference between the scaffolded performance of CTD and CHFASD.
4. Overall, more scaffolds were not required to elicit improved responses in CHFASD than CTD. However, younger CHFASD required more scaffolds than CTD.

Conclusions:

These results support the effectiveness of scaffolding in improving intention-reading in CHFASD. Future research will refine the present task and scaffolding procedures. If construct validity is confirmed, this measure may prove useful in identifying social-communication impairments in CHFASD.

160.145 145 The Female Profile of Autism: An Examination of Friendships. A. M. Head*[1], J. A. McGillivray[2], J. A. Manjiviona[3], T. Attwood[4] and M. A. Stokes[2], (1)*Deakin Univeristy*, (2)*Deakin University*, (3)*The University of Melbourne*, (4)*Griffith University*

Background: Research has indicated that there are as many as four times the numbers of males diagnosed with High Functioning Autism (HFA) than females. The growing body of research which focuses on girls with HFA questions the assumption of gender invariance in HFA. Clinical observations suggest that HFA girls superficially demonstrate better social and emotional skills than boys with HFA and this may camouflage other diagnostic features. This in turn, may explain the under diagnosis of girls with HFA.

Objectives: This study aims to explore the skewed gender distribution observed within this population and determine whether sociability and emotionality are camouflaging HFA girls from diagnosis.

Methods: Seventy-five 10-16 year old boys and girls (HFA girls: 18, TD girls: 25, HFA boys: 15, TD boys: 17) were interviewed (using the Friendship Questionnaire (FQ)). High scores on the FQ indicate that the child experiences close, empathetic and supportive relationships. One parent of each child also completed the FQ about their child to assess differences in perception of the quality and quantity of friendships.

Results: Independent of diagnosis, girls were found to have higher empathy than boys. Further, irrespective of their gender, HFA children demonstrated lower empathetic relationships compared to TD children. Also, the effect of HFA did not depend upon gender, meaning that both genders had a similar reduction in empathetic relationships which was associated with a diagnosis of HFA. Interestingly, while the interaction between gender and diagnosis was not significant, TD girls and HFA girls also did not demonstrate any differences between empathy scores; however, HFA girls and TD boys displayed the same degree of empathetic relationships.

Conclusions: As HFA girls scored on empathy at similar levels to TD girls, and TD boys and HFA girls demonstrated no differences between their scores, HFA girls appear to function at the level of TD boys, or even some TD girls. Despite their diagnosis of HFA, they appear to function at normal levels with respect to empathy, and thus may be camouflaged. It is only when assessment went beyond this superficial level that differences in HFA girls became apparent, and they are seen to function more like HFA boys.

Unsuspecting clinicians, or those with unwarranted assumptions about diagnostic characteristics, may thus conclude inaccurately that the female child was not autistic. Girls with indications that they may be autistic must be carefully assessed, and the clinician should not assume that because they may demonstrate a TD male friendship style, that they are not autistic.

160.147 147 Characterizing Language Development in Infants At Risk for Language Impairment. K. Downing*[1] and V. Vogel-Farley[2], (1)*Boston University*, (2)*Children's Hospital Boston*

Background: The heritability of autism and language impairments has been well documented with evidence that siblings of a child with autism often show a broader autism phenotype marked by language delays and impairments (La Couteur et al., 1996). Retrospective parent report found concerns regarding language were among their first signs of the presence of autism (De Giacomo & Fombonne, 1998). Investigations of language in at-risk populations by Landa and colleagues (2006) show that language trajectories slow for high-risk infants with significant differences emerging at 14 months on the Mullen Scales of Early Learning (MSEL). However, this study did not look at the crucial time between 6 and 14 months when these differences might emerge or assess language using other measures.

Objectives: The aim of the current study was to evaluate the use of a combination of language measures to characterize the trajectory of early language development of at-risk infants.

Methods: The current analysis included 39 infants that reached the age of 36 months in an ongoing Infant Sibling Project (Children's Hospital Boston/Boston University). In order to evaluate the developmental trajectories of language, infants were split into three groups based upon their risk status (defined as having an older sibling with/without ASD or language delay) and their performance on language measures at 36-months (low-risk control infants (LRC), high-risk positive (HRp), and high-risk negative (HRn)). Infants in the HRp group met at least one of the following criteria: above the

cut-off on the CDI-III developed by Skarakis-Doyle, Campbell, & Dempsey, 2009; or scored less than or equal to one standard deviation below the mean on receptive or expressive language on the MSEL; or were above the ASD cut off on the communication domain of the Autism Diagnostic Observation Schedule (ADOS). HRn infants had an affected sibling but did not meet any of the criteria that defined the HRp group. LRC infants did not have an affected sibling and did not meet the criteria for HRp.

Results: Because of limited sample sizes, preliminary analyses focused solely on MSEL scores at ages that had the largest number of participants. Up to 20 additional infants will soon complete the study and will be added to these analyses. Multivariate ANOVAs showed significant group differences ($F(2,29)= 3.947$, $p <.05$) of verbal developmental quotients when looking at infants at 12 months and 24 months, with HRp infants (n=12; M=97.09, SD=11.80) performing significantly poorer than HRn (n=9; M=105.12, SD=13.19) and LRC infants (n=11; M=104.97, SD=9.11). Group means at other ages showed poorer scores for the HRp infants, however, these differences were not significant which may be because of small sample sizes at these ages.

Conclusions: Based upon our preliminary analyses, our data suggest that language scores for the HRp infants begin to diverge as early as 12-months on the MSEL. Impaired MSEL scores for at-risk infants suggest that there are early language deficits present that affect language abilities at 36 months.

160.148 148 Gestures As Facilitators for Word Learning in Children with ASD: The Role of Social Intent and Attentional Cues. K. E. Patrick*[1], F. Hurewitz[1] and A. E. Booth[2], (1)*Drexel University*, (2)*Northwestern University*

Background:

As Typically Developing (TD) children begin to follow joint attention, they become avid word learners (Baldwin, 1992). These developments are influenced by an emerging appreciation of gestures as cues to referential intent of speakers (Booth et al, 2008). Children with Autism Spectrum Disorders (ASD) show deficits in both joint attention and word-learning abilities. Research suggests that ASD children may err in learning labels because they focus on objects they are attending to during labeling rather than objects of speaker intent (Hennon, 2002). However, it is not clear which cues to speakers' intent children with ASD are capable of using or whether their word-learning strategies are similar to TD children's.

Objectives:

We investigated the roles of social referencing and attentional cues as facilitators for word learning in children with ASD, and sought to reveal qualitative differences in word-learning strategies and eye gaze patterns of ASD children relative to those of TD children.

Methods:

Twenty-five children with ASD and matched controls participated in a within-subjects design word-learning task. For each trial, the experimenter paired an object-directed label with one of four levels of gestural support (gaze, point, touch, or manipulation). Children's eye-gaze patterns during training and word-mapping accuracy were recorded.

Results:

Children were stratified into younger (2- 6) and older (6-10) groups. Older ASD children and matched controls performed near ceiling on the comprehension test. The younger ASD group performed worse than matches in all conditions and particularly poorly in the gaze condition (10% correct) relative to other conditions (57% correct). For ASD children in the gaze condition, those who word-mapped accurately were more likely to look at the object during labeling (64%) than those who did not (39%). In the other conditions, accurate word-mapping trials did not differ in looks to the object of intent (59%) from incorrect trials (66%). These data indicate that ASD children may understand the referential intent of the speaker and use this information to learn new words when a manual gesture is used. However, when labeling is paired with gaze alone, ASD children rely heavily on their own attentional focus to learn new labels. Further analyses will compare the eye gaze patterns of ASD and control group participants.

Conclusions:

Young children with ASD showed impaired abilities to utilize eye gaze as a signal of referential intent during object labeling. Interestingly, older children were able to learn the object labels using only gaze, indicating that maturity or interventions may help children with ASD develop word-learning strategies. ASD children who learned object labels appeared to do so on the basis of some understanding of gestures as cues to referential intent, except perhaps in the gaze condition, in which attention to the target at the time of labeling was a particularly strong predictor of successful learning. Results suggest that younger children with ASD may be unable to effectively use eye gaze as a cue to referential intent in the service of learning new words, and thus resort to less effective strategies when faced with this insufficient cue alone.

160.149 149 Parents of Children with ASD Scaffold Novel Word Learning. A. M. Gonzalez Barrero* and A. Nadig, *McGill University*

Background: Language development in children with autism spectrum disorders (ASD) is extremely heterogeneous, making the process of word learning important to study (Luyster et al., 2007). Although parental communicative behaviors are known to influence their child's communication (Siller & Sigman, 2002), few studies have investigated parental labeling in ASD. Given that parents are children's first and main source of language input at early ages, investigating parental labeling in naturalistic settings can provide insights into the underpinnings of lexical acquisition in children with ASD.

Objectives: This study examines the behaviors of parents of children with ASD and parents of typically developing (TYP) children while teaching novel object labels to their child. More specifically, we focus on two domains: first, whether or not parents spontaneously provide additional content during labeling episodes; that is, if in addition to the object label parents add information about its function, physical attributes, or the category it belongs to. Second, whether or not parents in both groups spontaneously test the oral production or the comprehension of the label.

Methods: Forty-six children (23 with ASD and 23 TYP) with an age range from 14 to 74 months at Time 1, and their parents, participated in this study. Families had English or French as a dominant language (30 English, 16 French). At Time 1, child language was assessed with the Mullen Scales of Early Learning and groups were matched on receptive language ability. Six months later, at Time 2, parent-child dyads engaged in a naturalistic task in which parents were asked to introduce two novel objects to their children using labels we provided. Interactions were videotaped and coded for parents' use of additional content and testing behaviors that accompanied the labeling episodes.

Results: The proportion of parents who provided additional content did not differ between groups, $p = .10$. Likewise, the type of content that parents used followed the same pattern across groups: the intended function of the object was provided most often, followed by the superordinate category of the object and then by the physical attributes of the object. A significant group difference was found only in the production of superordinate category information, $p = .008$, with parents of TYP children using this more often. Secondly, the same proportion of parents (0.74) in both groups performed some type of testing of the acquisition of the label. Production of the label was tested most frequently, at a similar rate across groups, $p = .53$.

Conclusions: Both parents of children with ASD and parents of TYP children spontaneously enhanced novel object labeling episodes through the provision of additional content about the object and by testing their child's learning of the novel label. The difference in the use of category information between groups should be explored in future research. Overall, these results support the implementation of parent-based interventions for children with ASD (Kasari et al., 2010; Prelock et al., 2011), given the aptitude parents demonstrated in introducing their child to novel words.

160.150 150 Communication Spontaneity in Infants At High and Low Risk for ASD. S. L. Alvarez*, A. M. Estes, J. E. Elgin, B. LeBlanc and A. D. Rosenberg, *University of Washington*

Background: Pre-symbolic communication (e.g., gestures, vocalizations) provides the foundation for later language

acquisition in a well-established developmental progression. Longitudinal studies demonstrate infants at high risk for ASD often show deficits in pre-symbolic and symbolic communication. One aspect of pre-symbolic communication receiving limited attention is communication spontaneity (CS), which refers to the level of support required to initiate communication. CS can range from very low (dependent on adult cues) to very high (based on individual, internal motivation). Clinical reports suggest CS is a challenge for many children with ASD. However, there is very little research examining CS in children with pre-symbolic communication or the relationship between CS and other developmental constructs. Studies of CS in infants at high risk for ASD are needed to investigate whether this aspect of communication is diminished in at-risk infants and whether CS may be related to early social-communication difficulties.

Objectives: We will describe a new measure of CS and examine CS in a cohort of 12-month-old infants with an older sibling with ASD (HR) and with typically developing older siblings (low-risk, LR). We aim to examine the relationships between CS and four domains of development: 1) language ability, 2) social-communication 3) social skills, and 4) adaptive skills. We will also compare 5) CS levels in the HR versus LR groups.

Methods: Participants are part of a larger, multi-site, longitudinal study of development in at-risk infants (IBIS ACE Network). We examined a subsample of HR (n=43) and LR (n=21) 12-month-old infants from the University of Washington site. The Communication Symbolic Behavior Scales (CSBS:DP) was used to measure social-communication. To measure CS, videos of the CSBS:DP were blindly coded using a newly-developed coding system capturing the level of cuing required for a child to initiate communication acts. Language outcomes were measured by the Mullen Scales of Early Learning. Adaptive skills were measured by the Vineland Adaptive Behavior Scales.

Results: Preliminary analyses indicate CS is positively associated with: 1) language ability on the Mullen Expressive Language (r=.439, p<.01) and Receptive Language (r=.319, p<.01) scales, and the Vineland Communication Composite (r=.492, p<.01), 2) social-communication on the CSBS Social Communication Scores (r=.437, p<.01), 3) social skills on the Vineland Social Composite (r=.357, p<.01), and 4) adaptive skills on the Vineland Adaptive Behavior Composite (r=.527, p<.01). 5) No significant difference between level of CS in HR vs. LR infants was found.

Conclusions: Results indicate that higher levels of CS are related to higher language, social-communication, social and adaptive scores at 12 months. However, preliminary data suggests differences in CS in HR and LR infants may not be present at 12 months. Future analyses are needed to investigate the relation of CS to development at 24 months and whether early variations in CS are related to later-emerging ASD symptoms in infants at high risk for ASD. In addition to standardized measures of expressive and receptive language, the level of spontaneity with which children functionally apply these language skills may be an important consideration for early assessment and intervention in ASD.

160.151 151 Initial Psychometric Properties of the Autism Impact Measure (AIM): A New Tool for Treatment Outcome Measurement. S. M. Kanne*[1], M. O. Mazurek[2], D. Sikora[3], B. J. Bellando[4], B. H. Freedman[5], B. L. Handen[6], T. Katz[7], E. Leuthe[8], M. M. Powell[1], J. Vickstrom[9], L. Walters[10] and Z. Warren[11], (1)*Baylor College of Medicine*, (2)*University of Missouri*, (3)*Oregon Health & Science University*, (4)*University of Arkansas for Medical Sciences*, (5)*Kennedy Krieger Institute*, (6)*University of Pittsburgh School of Medicine*, (7)*University of Colorado*, (8)*JFK Partners – University of Colorado Denver*, (9)*Vanderbilt Kennedy Center*, (10)*Arkansas Children's Hospital Research Institute*, (11)*Vanderbilt University*

Background:

Although ASD treatment-outcome research is increasing at a rapid pace, there remains a need for psychometrically sound measurement tools that are sensitive to change in these core symptom areas. The Autism Impact Measure (AIM) was developed to assess change in clinically relevant features of core ASD symptoms. The AIM assesses frequency of symptom occurrence using a 2-week recall period, enabling measurement of incremental change over short periods of time. In addition, the AIM assesses the functional impact of

ASD symptoms, allowing for identification of symptoms that are associated with the greatest functional impairment. The measure includes 41 parent-rated items, each requiring two corresponding 5-point ratings (frequency and impact). This two-pronged approach has the potential to inform both treatment outcome research and clinical practice.

Objectives:

The purpose of the current study was to examine the psychometric properties of the AIM using a large, well-defined, and nationally representative sample of children with ASD.

Methods:

The AIM was administered to 390 children (ages 2-16) with ASD across 8 sites participating in the Autism Treatment Network. All participants met DSM-IV criteria for ASD, and met or exceeded clinical cut-off for diagnosis on the Autism Diagnostic Observation Scale (ADOS). For a subset of participants (n=70), the AIM was re-administered within 3 weeks following initial administration to establish test-retest reliability. For another subset of participants (n=65), ratings were obtained from two caregivers to establish inter-rater reliability for the measure across reporters. Construct validity was investigated by examining the strength of association between AIM scores and scores on other scales that purport to measure similar constructs (i.e., Vineland-II, Social Communication Questionnaire [SCQ]).

Results:

Initial item reliability estimates were very strong, with Cronbach's alpha of .96 for the entire scale, .90 for the Frequency scale, and .95 for the Impact scale. Test-retest reliability was strong for both the Frequency scale (r=.84) and Impact scale (r=.82). Inter-rater reliability was moderately strong for both the Frequency scale (r=.66) and the Impact scale (r=.62). A subsample of participants (n=66) completing both the SCQ and AIM indicate strong evidence for construct validity, with scores on the SCQ significantly correlated with both Frequency (r = .60, $p < 0.001$) and Impact (r = .53, $p < 0.001$) scores. Both the Frequency and Impact scales were significantly correlated with the Vineland Adaptive Behavior Composite score (r = -.37, $p < 0.001$ and r = -.23, $p < 0.001$).

Conclusions:

These results provide evidence that the AIM shows promising psychometric properties, with excellent internal consistency, test-retest reliability, inter-rater reliability, and relations to measures of related constructs. Next steps include continued examination of structural and construct validity, development of interpretable and valid subscale and summary scores, and examination of the AIM's sensitivity to change in core symptoms following treatment.

We acknowledge the members of the Autism Treatment Network (ATN) for use of the data and the families who participated in the Registry. The ATN is funded by Autism Speaks and a cooperative agreement (UA3 MC 11054) from HRSA to the Massachusetts General Hospital.

160.152 152 Characterizing the Language Phenotype in Adults with ASD and Its Relationship with Daily Living Skills. A. Sterling* and M. M. Seltzer, *Waisman Center, University of Wisconsin-Madison*

Background: Past research has focused primarily on the language phenotype in children with ASD, with only minimal work on language in adults. In particular few studies have examined multiple methods of assessing language (e.g., language sample vs. parent report). Additionally, there is a lack of research on the impact of the language phenotype on daily living skills in adults with ASD.

Objectives: The primary aim of the present study was to characterize the language abilities of adults with ASD, using an interview-style language sample as well as parent report, and to examine the relationship between these variables and daily living skills.

Methods: We tested a sub-set of adults with ASD drawn from a larger study. An interview-style language sample and IQ test (Wide Range Intelligence Test; Glutting, Adams, & Sheslow, 2000) were completed with 85 adults with ASD, mean age = 26 years, mean IQ = 87. However, of the 85 individuals only 18 provided enough language within the language sample for a meaningful analysis. Of these 18 individuals, the majority were males (72%), with an average age of 25 years. The general IQ was quite high, although there was a broad range in this small

sample (*M* = 134.39, *SD* = 216.49); verbal IQs were on average 51 points lower (*M* = 83.28, *SD* = 18.92). Parents reported on their son or daughter's daily living skills using the Waisman Activities of Daily Living (W-ADL) Scale, and completed the Vineland Screener (Sparrow, Carter, & Cicchetti, 1993).

Interviews were transcribed using standard language transcription procedures, and analyzed using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2000). Transcripts were analyzed for standard language measures including number of utterances, number of words, grammatical complexity, and measures of dysfluencies (e.g., repetitive speech, incomplete sentences).

Results: The adults who were able to complete the interviews demonstrated complex, and appropriate language abilities with few word and utterance level errors. However, they had a significant number of language dysfluencies, including repetitions (e.g., I went to *went to* the store yesterday), and revisions (e.g., *The girl, I mean* the man left). The language measures were not related to gender, age or IQ. The dysfluency measures were significantly related to the scores from the Vineland Screener, (e.g., a negative relationship between one of the measures of dysfluency (i.e., revisions) and the daily living standard score, *r* = -.56*, and social skills, *r* = -.52*). However, the language measures were not significantly related to the W-ADL scores.

Conclusions: The adults with ASD in this sample who were able to complete the language sample task were using complex language, marked by frequent dysfluencies. This was not related to overall cognitive abilities, but was in fact associated with daily living and social skills. Understanding the nature of the adult language phenotype and its impact on daily life will help guide practitioners in their treatment of language disorders in children and adolescents.

160.153 153 Correlates of Early Imitation Recognition in Preschoolers with ASD. N. I. Berger* and B. Ingersoll, *Michigan State University*

Background: In typically developing children, implicit imitation recognition has been demonstrated early in life such that infants look longer and smile more at adults who are imitative. A developmental shift around 1 year is thought to occur during which children develop the ability to apply intention to others, and also begin to reliably exhibit behaviors associated with explicit imitation recognition (e.g. testing behaviors). Limited work has been conducted to date examining implicit and explicit imitation recognition skills in children with ASD.

Objectives: This exploratory study sought to examine the relationship between implicit and explicit imitation recognition (IR) and existing measures of joint attention and imitation in children with ASD.

Methods: Subjects were 30 preschoolers with autism who were systematically imitated during the course of a naturalistic imitation task. Measures assessing ASD symptomology, cognitive abilities, language skills, and joint attention were also completed for each child. Partial correlations, controlling for length of imitative period, between frequency of IR behaviors and our standardized assessments were conducted.

Results: Preliminary results suggest that frequency of children's explicit IR behaviors is negatively correlated with ASD symptomatology, and positively correlated with scores on a measure of unstructured imitation. Implicit IR skills were positively correlated with measures of joint attention initiations.

Conclusions: Explicit recognition of being imitated is related to the ability to spontaneously imitate others as well as severity of autistic symptoms. Implicit recognition of being imitated is related to initiation of joint attention, owing perhaps to overlap in behaviors captured by the two measures (gaze to adult).

160.154 154 The Social Awareness Knowledge (SAKT) Test: An Interactive Test to Detect Autism Spectrum Disorders (ASD) in Toddlers. R. Choueiri*[1], S. Mangan[2], E. Stern[1] and S. Wagner[3], (1)*Floating Hospital for Children*, (2)*Claremont graduate University*, (3)*Behavior Development and Educational Services*

Background: Interactive tools may trigger atypical behaviors, leading to enhanced early identification and improved outcome of ASD.

Objectives: We created the Social Awareness Knowledge Test (SAKT) to evaluate and screen for skills delayed in

toddlers with ASD. We present here preliminary data on the performance of the SAKT in affected toddlers. We are reviewing complete data in December 2011.

Methods: The 9 testlets of the SAK detect social communication skills delayed in toddlers with ASD: joint attention; response to name; reaction to emotions and human agency. Each testlet is coded from 0-4 (typical to atypical) from which a total score is generated. Administration and scoring take 10 minutes. A 4-session, 90-minute training module was developed and pilot tested with a multidisciplinary team in our specialty clinic. The training module consisted of observation, scoring of videos of SAKT assessments, and group discussion of scoring results. The initial 7 testlets (version A) were expanded to 9 testlets (version B) for improved precision. In parallel, the SAK was piloted in a toddler autism evaluation project that follows progress every 6 months. The SAKT and the Autism Diagnostic Observation Schedule (ADOS)-Module 1 were administered at 2 visits by the same examiner; these were videotaped to be scored by an independent reviewer. We calculated correlation coefficients using Spearman s rho statistic of total scores from both versions of the SAKT with the ADOS. (See table)

Results: Forty-three toddlers were tested: 37 boys and 6 girls, aged 16 to 32 months (mean: 25.2 months). Ethnicity: 45.23% Hispanic or mixed Hispanic and Caucasian; 52.3% Caucasian; 2.38% African American. Masshealth was the primary insurance in 76.2%. Both versions of the SAKT were significantly correlated with the ADOS.

Conclusions: We present promising preliminary data on the validation of a 10-minute interactive test to detect ASD in toddlers, following a short and easy training.

SAKT Correlations with the ADOS-1

	SAKT A	SAKT B
Visit 1	N= 25	N= 18
	r=0.55; p<0.001	r=0.70; p=0.001
Visit 2	N= 3	N=13
		r=0.87; p<0.001

160.155 155 The Speech-Gesture Link and Trajectory of Language Development Among Young Children At Risk for Autism. K. Sheperd*[1] and R. J. Landa[2], (1)*Johns Hopkins School of Medicine*, (2)*Kennedy Krieger Institute*

Background:

Expressive behavior is multi-modal from early in life (Yale et al., 2003). Gestures and vocal production become more coordinated over time, but little is known about the developmental origins of the speech-geture link (Iverson, 2010). Gestures provide a means for children to communicate meaning beyond their lexical abilities (Ozcaliskan et al., 2005). However, many children with ASD demonstrate motor difficulties which may impede gesture development and are associated with language delays (Stone & Yoder, 2001).

Objectives:

1. Determine gesture inventory produced by children with and without autism.
2. Examine patterns of gesture use and associations with language development using parent report and clinical measures.

Methods:

Participants were 231 sibs-A (57.1% male) assessed at 14, 18, 24, and 36 months. Outcome diagnoses were assigned at 36 months. Children were classified as ASD (n = 68), non-ASD delay (n = 63), or non-ASD (n = 106).

Parents completed the *MacArthur-Bates Communicative Development Inventories:* Words & Gestures version at 14 months and Words & Sentences version at 18, and 24 months. The trajectory of vocabulary development was assessed using the total number of words produced at each assessment.

Clinicians administered the *Mullen Scales of Early Learning* at 14, 18, and 24 months. The Receptive (RL) and Expressive language (EL) age equivalents were used.

Results:

Gesture Use at 14 Months. Across all types of gestures, the non-ASD group produced more gestures than the ASD or Non-

ASD Delay groups (all $p < .01$). The ASD and Non-ASD Delay groups did not differ from each other. The number of gestures produced was also associated with Mullen RL and EL, and CDI words produced at 14, 18, and 24 months (all $p < .01$).

Trajectory of Language Development. Hierarchical linear modeling demonstrated quadratic growth in parent-reported vocabulary development, expressive and receptive language within each of the groups. Further, on all language measures, the ASD group showed a divergent pattern from both the non-ASD Delay and non-ASD groups. The non-ASD Delay group became more similar to the non-ASD group over time.

Total number of gestures at 14 months was associated with greater gains from 14-24 months in words produced on the CDI for the non-ASD group only ($t(215) = 2.20$, $p < .05$). On the Mullen, total gesture use at 14 months was associated with gains in receptive and expressive language trajectories from 14-24 months for both the non-ASD (RL: $t(215) = 2.08$, $p < .01$; EL: $t(215) = 2.94$, $p < .01$) and non-ASD delay groups (RL: $t(215) = 2.68$, $p < .01$; EL: $t(215) = 3.18$ $p < .01$).

Conclusions:

These data corroborate previous reports that children with ASD demonstrate fewer gestures early in life (Landa et al., 2007). Early gesture use was not related to language trajectories for children ASD. The speech-gesture link requires integration of multiple systems, particularly motor and vocal. Children with ASD may have more difficulty integrating these systems, which may limit the communicative quality of early gestures and diminish the potential for early gesture use to promote language development.

160.156 156 Factors Associated with Empathic Behavior in Children and Adolescents with High-Functioning ASD. A. M. Scheeren*[1], P. C. Mundy[2], H. M. Koot[1], L. Mous[1] and S. Begeer[1], (1)*VU University*, (2)*UC Davis*

Background:

A lack of empathy is emphasized in diagnostic guidelines and clinical observations of autism spectrum disorder (ASD). Yet, given the high degree of clinical heterogeneity in ASD (e.g., Jones & Klin, 2009; Mundy, 2007), the expression of empathy may be affected by multiple factors. Therefore, we addressed possible reasons why some youths with ASD do not show empathic responses while others do.

Objectives:

This is the first large-scale study to explore associations of social cognition, executive functioning, temperament, and co-morbid problem behaviors with empathic behavior of high-functioning children and adolescents with ASD (HFASD).

Methods:

Participants with HFASD (6-18 years) were classified as 'empathic' (n=45) when both direct observations and parent reports confirmed their empathic responsiveness to others' emotions. Participants who were not rated empathic during the direct observation and/or by their parents were classified as 'non-empathic' (n=80). Children completed an advanced Theory of Mind test (ToM), while parents completed the Social Responsiveness Scale (SRS), the Behavior Rating Inventory of Executive Function (BRIEF), the Disruptive Behavior Disorders scale (DBD), the Wing Subgroups Questionnaire (WSQ), and the Emotionality Activity Sociability temperament survey (EAS).

Results:

MANOVAs with group (empathic vs. non-empathic) and age (below vs. above 13 years) as factors showed that the empathic group had significantly fewer symptoms of conduct disorder than the non-empathic group ($F(1, 125) = 4.68$, $p < .05$). Other main effects of group were not found. The younger age group showed more executive functioning problems ($F(1,125) = 3.51$, $p = .06$), activity (WSQ: $F(1,125) = 7.41$, $p < .01$; DBD: $F(1,125) = 6.19$, $p < .05$), emotionality ($F(1,125) = 14.40$, $p < .001$), and poorer social cognition than the older age group (ToM: $F(1,125) = 6.46$, $p = .01$; SRS social cognition: $F(1,125) = 7.97$, $p < .01$). Furthermore, group x age analyses demonstrated that empathic children had more executive functioning problems and hyperactivity symptoms than empathic adolescents (BRIEF: $F(1,45) = 5.07$, $p < .05$; DBD hyperactivity: $F(1,45) = 12.90$, $p = .001$) and non-empathic children (BRIEF: $F(1,52) = 4.40$, $p < .05$; DBD hyperactivity: $F(1,52) = 11.67$, $p = .001$). Empathic adolescents were rated by their parents as having fewer social motivation problems

when compared to non-empathic adolescents (SRS social motivation: $F(1,73) = 6.06$, $p < .05$; EAS sociability: $F(1,73) = 7.22$, $p < .01$).

Conclusions:

Differences in social cognition do not explain the observed differences in empathic behavior in children and adolescents with HFASD. However, problems in executive functioning such as inhibition problems seem to be particularly evident in young empathic children with HFASD. The findings stress the importance of age in empathic behavior. Children's empathic responses may be produced by a general drive to be active, whereas adolescents' empathic responses are associated with social motivation. Hence, instead of empathy being a general deficit in ASD, individual social and non-social factors are associated with the expression of empathy in children and adolescents with HFASD.

160.157 157 Deconstructing the Play Impairment in Autism: An Analysis of Interdependent Variables. C. E. Harrop*, R. Emsley, J. Green and P. Consortium, *University of Manchester*

Background: Play impairments in autism have been observed for over three decades and are central to its definition and manifestation; previous research has found symbolic impairments (Baron-Cohen, 1987), deficits under certain conditions (Jarrold et al, 1996) and play in its entirety affected (Libby et al, 1998). It is also still far from clarified whether play in children with autism is delayed or displayed differently to typically development inconsistent definitions, mixed control samples and limited longitudinal research make conclusions difficult. Defining this impairment is also reliant upon the analysis of interdependent variables, often ignored by pre-existing studies, therefore possibly leading to misleading findings. Due to the over-reliance of traditional statistics in the field, which assume play behaviours are independent, and a reliance on cross sectional methods, the play impairment in autism remains unclear.

Objectives: This study sought to clarify the play impairment in autism through a short-term longitudinal study. The study explored differences relative to neurotypical controls cross-sectionally whilst mapping development over time. A novel statistical technique was utilised, outlined previously by Pennington et al (2009), to overcome the interdependence of the play variables.

Methods: Play behaviours (coded using Noldus Observer) in preschool children with autism (n = 49) were compared over three timepoints within 13 months to typically developing children matched on gender and non-verbal development (n = 44). Definitions were based on previous research, however the definition of symbolic play was tightened and functional play was divided into simple and advanced behaviours. The statistical method entailed testing differences in proportions of play behaviours between the two samples with the non-significant behaviours then merged to form a reference category. The remaining significant behaviours were then transformed by log ratio to the reference category to ensure each 'level' of play was on the same scale, independent and normally distributed and subsequent analysis performed using the transformed variables.

Results: At all timepoints, children with autism demonstrated more simple exploratory play and less advanced functional play. Only at time three did a difference emerge in symbolic play. Autism symptoms did predict differences in simple play behaviours but failed to predict more advanced behaviours despite the group differences found. Play development between time one and two was slower in children with autism but reflected that of typical development. Between time two and three, development slowed and a reduction in symbolic play was evident.

Conclusions: By utilizing a new statistical technique, this study sheds new light on the presumed symbolic-specific impairment in autism. Symbolic play impairments were not evident until the final timepoint and were still accompanied by heightened simple play and reduced functional play, mirroring the findings of Jarrold et al (1996) and Williams et al (2001). The apparent loss of symbolic skill has been reported anecdotally by caregivers and shown here empirically. Autism symptomatology also failed to shed light on the differences found, despite the presence of group differences. The findings do not support the notion of a symbolic-specific impairment and lend themselves to an overall delay in play development compared to neurotypical progression.

160.158 158 Assessing Receptive Vocabulary Knowledge in Individuals with Autism Using Implicit Measures. I. Gangopadhyay*[1], L. Bosley[1], K. Ledoux[1] and B. Gordon[2], (1)*The Johns Hopkins University School of Medicine*, (2)*The Johns Hopkins University*

Background: Many individuals affected by autism fail to develop useful speech, and some never learn to express themselves in any functional way. An important question about nonverbal individuals with autism is whether their lack of expressive ability is necessarily accompanied by an equally severe deficit in receptive language. Little research has addressed this question because of the difficulty of testing low-functioning participants and the insensitivity of most behavioral methodologies. We have previously used eye movements (EMs), pupillary dilation (PD), and event-related potentials (ERPs) as measures of receptive vocabulary knowledge in normal adults and normally developing children, in whom self-report and behavioral accuracy served as measures of comparison. Here, we use the same measures to assess receptive vocabulary knowledge in high-functioning and low-functioning individuals with autism.

Objectives: We hypothesize that eye movements, pupillary dilation, and the N400 component of ERPs could provide evidence of single-word comprehension in nonverbal individuals with autism, even in the absence of a behavioral response. We expect that eye movements will be faster to and fixate longer on pictures of known words, pupillary dilations will be greater when identifying unknown words, and an N400 congruency effect will be observed for known words, but not for unknown words.

Methods: Participants included lower-functioning, low-verbal individuals with autism and higher-functioning individuals with autism. For the lower-functioning participants, caregivers completed checklists used to determine words expected to be known receptively by the participants; unknown stimuli were drawn from a pool of items developed for other subject populations. Participants completed a) a forced choice recognition task (EM and PD), where four pictures were presented on a computer screen, along with an auditory token that named one of the pictured objects; and b) a congruity task (ERP), where single pictures were shown on the computer screen, accompanied by an auditory token that did or did not match the name of the pictured item.

Results: Individuals with autism showed similar trends to that observed previously in normal adults and normally developing children for all three measures. The eye movements of both high- and low-functioning individuals seemed to be faster and more accurate to the named picture in the known condition. Changes in pupillary dilation also tended to be greater in the unknown condition for both groups. For the low-functioning individuals tested to date, the amplitude of the N400 appeared to be greater in the incongruous condition, but only for known words. This difference, to the extent that it was observed at all, tended to be smaller in higher-functioning individuals with autism.

Conclusions: The three measures (EM, PD, ERP) differentiated known from unknown words, but in potentially different ways for the two participant groups. Differences among the high- and low-functioning autism participants may reflect different developmental language trajectories among these participants. Importantly, our implicit measures may prove to be useful measures of single-word comprehension in otherwise “nonverbal,” low-functioning individuals with autism, a group whose language abilities have been difficult to assess.

160.159 159 Beyond Pointing: Gesture Profiles in the First Year Differentiate Infants with ASD, Language Delays, and Typical Development. C. C. Clements*[1], J. Garzarek[2], S. Macari[2], D. Campbell[2] and K. Chawarska[2], (1)*Massachusetts General Hospital*, (2)*Yale University School of Medicine*

Background: Given the high recurrence rates of autism spectrum disorder (ASD) among siblings (Ozonoff et al., 2011), it has become increasingly important to identify high-risk infants who have the greatest likelihood of developing ASD as early as possible. A deficit in pointing has been identified as an indicator of ASD in the second year (Baron-Cohen et al., 1996; Wetherby et al., 2004), but little is known about other specific gestures in infants with ASD.

Objectives: To investigate the development of five gestures (showing, giving, protodeclarative pointing, waving, and raising arms to be picked up) at 9 and 12 months in infants at high

and low risk for ASD and to examine whether proficiency in individual gestures can predict diagnostic classification at 24 months.

Methods: Parents of 79 infants (48 high-risk, 31 low-risk) completed the MacArthur Communication Development Inventories for their infants at 9 and 12 months. Infants were deemed proficient in specific gestures if parents reported that they used them 'often.' At 24 months, infants were classified as likely having ASD, exhibiting language or mild social-communication delays (LAN), or developing typically (high-risk TD and low-risk TD).

Results: At 9 months, the only gesture that infants used frequently was raising arms to be picked up, but there were no between-group differences. At 12 months, the sole gesture that differentiated ASD infants from all the other infants was showing: infants with ASD exhibited the lowest levels of showing compared to LAN ($\chi^2(1,36)=4.21$, $p< .05$), high-risk TD ($\chi^2(1,26)=3.78$, $p =.05$) and low-risk TD ($\chi^2(1,45)=7.11$, $p<.01$). Waving ($\chi^2(1,45)=5.60$, $p <.05$) and protodeclarative pointing ($\chi^2(1,45)=9.74$, $p<.01$) were impaired in ASD versus low-risk TD infants but were similar in ASD, LAN, and high-risk TD infants. Proficiency in giving and raising arms to be picked up was similar across all four groups.

In a binary logistic regression, showing emerged as the strongest predictor of an ASD diagnosis at 24 months of all five gestures (showing: b=-1.77, p < .01). Given that an infant was proficient in showing at 12 months, the odds were nearly 6 times greater of belonging to one of the control groups than to the ASD group.

Conclusions: Consistent with other studies (Mitchell et al., 2006), our results show that infants who later develop ASD show deficits in the development of gestures in the first year. While showing, pointing, and waving were impaired in the ASD group, pointing and waving were also impaired in the LAN and high-risk TD groups. Only deficits in showing were specific to the infants with ASD; infants who showed frequently at 12 months were nearly 6 times more likely to be in a non-ASD group than in the ASD group at 24 months. Our findings suggest that individual gestures are strong candidates for inclusion in parent-report screening instruments. While previous studies often collapsed gestures into a composite score, our results indicate that, given varying trends across specific gestures, a summary score might obscure group differences. More research is needed to further explore developmental profiles of individual gestures in ASD.

160.160 160 A Second Look At Imitation: Imitative Errors in Children with Autism Spectrum Disorders. M. Sevlever*[1], J. M. Gillis[1], R. E. Mattson[1] and R. G. Romanczyk[2], (1)*Auburn University*, (2)*State University of N.Y. at Binghamton*

Background: Although imitation appears to be an innate and effortless ability for typical individuals, children with autism spectrum disorders (ASD) are often severely impaired in this capacity (Rogers & Williams, 2006; Williams, Whiten, & Singh, 2004). Despite documented impairment, research suggests children with ASD demonstrate effective imitative skills under certain conditions (Ingersoll, 2008; Ingersoll, Schreibman, Tran, 2008; Hobson & Lee, 1999; Want & Harris, 1998). These findings have led to a recent focus on imitative *errors*. Thus, rather than assessing whether a child passes or fails an imitative tasks, researchers are beginning to attend to the unique ways in which individuals with ASD imitate. However, error analyses are relatively new and only two known studies have aimed to specifically assess imitative errors (Rogers, Young, Cook, Giolzetti, & Ozonoff, 2010; Vanvuchelen, Roeyers, & Weerdt, 2007).

Objectives: This study assessed the prevalence of imitative errors across three types of imitative tasks (i.e., object, facial-object, and facial tasks) in children with ASD and a typically developing control group. In addition, this study aimed to assess the impact of autism severity and verbal IQ on the frequency of imitative errors.

Methods: Thirty-one children with ASD and eighteen typically developing children completed an imitation battery comprised of three types of imitative tasks. Trained observers used a behavioral coding system to assess the prevalence of six error types (i.e., the need for multiple attempts, spatial errors, failure to attend, mirroring, non-compliance, and no-response). Multilevel modeling (MLM) was used to examine differences in error rates across groups and task types.

Results: The overall frequency of errors across tasks was significantly greater for the ASD group (p <.05). Furthermore, the error rates of typically developing children did not differ significantly from zero in any of the error by task combinations (e.g., multiple attempt errors in the facial task). Children with ASD made significantly more errors across each outcome as compared to the typically developing group, except for non-compliance errors in the object and object-facial tasks. As predicted by previous research, the facial task posed the most difficulty for the ASD group, with higher levels of errors in this task as compared to other tasks (p <.05).

Conclusions: The findings in this study expand on previous error analyses by assessing error rates in two new task types: object-facial tasks and facial tasks. Furthermore, the results of this study appear to support an ASD specific imitation deficit, as ASD status, rather than IQ predicted error frequency. Although it is difficult to compare the results of the present study with other error analyses conducted (due to differences in tasks and methodology), these findings appear to support the notion that individuals with ASD emit an atypical level of imitative errors.

160.161 161 Nonverbal Referential Communication and Language in Infants At High Risk for ASD. C. J. Grantz*[1], L. V. Ibanez[2], D. N. Gangi[1], W. L. Stone[3], Z. Warren[4] and D. S. Messinger[1], (1)*University of Miami*, (2)*University of Washington Autism Center*, (3)*University of Washington*, (4)*TRIAD, Vanderbilt Kennedy Center*

Background: Nonverbal referential communication (NVRC) consists of social prompts to a partner regarding an object or event, i.e. initiating joint attention (IJA) and initiating behavioral requests (IBR). Infants at high risk for an autism spectrum disorder (ASD) may exhibit atypical NVRC development, yet there are few validated measures of NVRC, and their associations with concurrent measures of language have not been well documented.

Objectives: Determine the stability of measures of NVRC between 6, 9, and 12 months, and the associations of NVRC with a measure of verbal communication.

Methods: High-risk (n=72; older sibling with ASD) and low-risk (n=52; no siblings with ASD) infants were observed at 6, 9, and 12 months. The Early Social Communication Scales (ESCS) and the Play-based Assessment of Referential Communication (PARC) measured nonverbal referential communication via IJA and IBR. The Mullen Scales of Early Learning (MSEL) yielded Receptive (RL) and Expressive (EL) language T-scores at 12 months.

Results: There was a non-significant trend for high-risk infants to demonstrate less IBR during the ESCS, t(65)= -1.85, p=.07, and lower EL on the MSEL, t(115.16)= -1.89, p=.07, at 12 months.

For high-risk infants, IJA during the ESCS was stable between 6 and 9 months, r(26)=.47, p<.03, and between 9 and 12 months, r(17)=.77, p<.01. For low-risk infants, IJA during the ESCS was stable only between 9 and 12 months, r(19)=.70, p<.01. IJA during the PARC did not show significant stability for high- or low-risk infants. IBR during the ESCS and the PARC did not show significant stability from 6 to 12 months for either group.

IBR levels between the ESCS and the PARC were associated at 12 months for both high-risk, r(30)=.44, p<.03, and low-risk infants, r(29)=.59, p<.01, while 12 month IJA was not significantly associated between measures for either group.

For high-risk infants, 12 month IBR (mean of z-scored ESCS and PARC IBR) was associated with 12 month MSEL language (mean RL and EL), r(30)=.45, p<.02. 12 month IJA (mean of z-scored ESCS and PARC IJA) was associated at trend levels with 12 month MSEL language, r(30)=.34, p=.07. Neither 12 month IBR, r(29)=.00, p=1.00, nor 12 month IJA, r(29)=.10, p=.59, were associated with 12 month MSEL language for low-risk infants.

Conclusions: IJA during the ESCS was stable between 6 and 12 months for high-risk infants, but was not associated with IJA in the PARC. At 12 months, IBR on the ESCS and the PARC were associated for both high- and low-risk infants, providing cross-validation of the measurement of 12 month IBR. This prompted the creation of a composite measure of 12 month IBR, which was associated with early language in high-risk but

not low-risk infants. The associations between NVRC and language at 12 months suggest a potential unitary communication construct of early NVRC and verbal language in high-risk infants. We are continuing to follow these high-risk infants in order to understand whether their early communication abilities predict later language and ASD symptomatology.

160.162 162 Identifying Features of ASD Language Impairment in Narrative Retellings. E. T. Prud'hommeaux*, B. Roark, L. M. Black and J. van Santen, *Oregon Health & Science University*

Background: It has yet to be established whether the language difficulties observed in some children with ASD are indicative of a developmental language disorder (DLD) or are characteristic of a distinct subtype of ASD. In this research, we employ a novel method of analyzing the results of a widely used neurocognitive assessment tool, the NEPSY Narrative Memory subtest, in order to distinguish the language features associated with DLD from those associated with ASD. In this test, a subject listens to a story and then retells the story to the examiner. The retelling is scored by counting the number of predetermined "story elements" it contains. Although these scores correlate strongly with measures of language ability in children, this procedure ignores much of the linguistic information contained in a child's retelling. The scoring method proposed here attempts to leverage that information for differential diagnosis.

Objectives: To determine whether an alternative method of scoring narrative retellings can reveal differences in language impairment between children with DLD and children with ASD who meet criteria for a language disorder.

Methods: A battery of language and neurocognitive assessment tests were administered to 74 children ages 4-8 with ASD (N=34), DLD (N=17), or typical development (N=23). The ASD group was further divided into two groups according to whether the subjects met the criteria for DLD (ASD+DLD N=21, ASD-DLD N=13). The NEPSY Narrative Memory subtest was administered to each child. The story retellings elicited in the free recall portion of the test were transcribed and scored in two ways. In the standard method, each retelling was scored according to the published guidelines in which the child earns two points for every recalled story element. In the alignment method, each retelling was aligned to the original narrative by matching the words in one to the same or similar words in the other. For instance, the word "Jim" in the original story might align with "the boy" or "he" in a retelling. The score is the percentage of words in a retelling that could not be aligned to any matching word in the original narrative.

Results: (1) Under the standard scoring method, there was no significant difference between the DLD and ASD+DLD groups. There were significant differences between the TD and ASD-DLD groups and the DLD and ASD+DLD groups. (2) Under the alignment scoring method, the DLD group had a significantly smaller percentage of unaligned words than the ASD+DLD group. In addition, there was no significant difference between the DLD group and the ASD-DLD group.

Conclusions: We observed that many of the ASD children included off-topic content in their retellings, while the DLD children tended to report the facts of the story, albeit with great difficulty and without the required story elements. Our novel method for scoring the NEPSY Narrative Memory subtest seems to reveal these kinds of differences, offering utility for distinguishing DLD from ASD-related language impairment. Future work will focus on generating alignments automatically using existing computerized techniques and exploring other features extracted from these aligments.

160.163 163 Responsive Parental Behaviour Predicts Joint Engagement in Toddlers with Autism Spectrum Disorder (ASD). S. Y. Patterson*[1], L. Elder[2], A. Gulsrud[3] and C. Kasari[4], (1)*University of California Los Angeles*, (2)*University of Washington*, (3)*UCLA*, (4)*University of California, Los Angeles*

Background: Parental responsivity is characterized by a constellation of behaviours including joint attention, contingent responding, emotional-affective support and language input (Warren & Brady, 2007). A positive association has been demonstrated between children's language learning and parental responsive behaviour (Siller & Sigman, 2008). For children with autism spectrum disorders (ASDs) who display fundamental challenges in joint engagement and language, it is particularly important to understand the interaction

characteristics that best facilitate increased social communication learning opportunities.

Objectives: The current study provides a unique examination of the association between parental responsivity and both a broad measure of children's social behaviour (Child Behaviour Rating Scale (CBRS): Mahoney & Wheeden, 1999) and careful parceling of a hierarchy of engagement states including exclusive attention to objects and joint engagement with another person and a shared referent (Adamson, Bakeman & Deckner, 2004). The following questions were addressed: 1) is parental responsivity during parent-child play predictive of supported joint engagement? and 2) is responsivity associated with a broader measure of children's social behavior, the CBRS?

Methods: Eighty-five toddlers (mean age: 31 months) diagnosed with ASD and their primary caregivers (n=73 mothers; n=8 fathers, n=1 grandparent) who were participating in a larger intervention study were included. Children ranged in developmental level (MSEL score mean= 68.16 (SD= 20.41)). Ten minute videotaped parent-child interactions collected at baseline were coded for general social behaviour (CBRS), specific engagement states (adapted from Adamson et al., 2004) and parental responsivity (Mahoney et al., 1998).

Results: Overall, mean parental responsivity was 2.66 (SD=1.13). On average, children entered into supported joint engagement 12.69 times (SD=5.8) for 18.71 seconds(s) (SD=15.20) and object engagement 22.08 times (SD=5.28) for 50.98s (SD=29.79). Responsivity was a unique predictor of the frequency (ß=.316, t= 2.98, p < .01) and longest duration (ß =.226, t=2.08, p < .05) of supported joint engagement in child initiated activities after controlling for children's developmental level (MSEL score). Responsivity also predicted decreased duration of object engagement in parent initiated activities (ß =-.317, t(84)=-2.99, p <.01). Alongside developmental level, responsivity also predicted frequency (ß=.293, t(84)=3.33, p <.01) and longest duration of (ß=.171, t(84)=2.04, p <.05) symbol infused supported joint engagement. Further, predictive associations between responsivity and both the CBRS attention (ß =.351, t=3.47, p <.01) and initiation subscales (ß =.276, t=2.84, p <.01) were found.

Conclusions: Findings confirm the study hypotheses that parental responsivity uniquely predicts increased child joint engagement indicating that responsivity is important across the spectrum of skills presented by toddlers with ASD. Careful delineation of object focused versus joint engagement demonstrates that responsivity is predictive of supported joint states that are associated with language learning. As such, parents who demonstrate a responsive interaction style may increase successes in facilitating child engagement. Thus, responsivity may be an important initial target in parent-mediated interventions in order to facilitate engagement and increase learning opportunities during interaction. Yet, given the small durations of joint engagement, future research needs to investigate whether responsiveness alone is enough to increase toddlers' joint engagement and language, or if other strategies are required.

160.164 164 Structural Equation Modeling to Measure Well-Being and Its Association with Autism Symptoms. B. Harrison*[1] and T. Smith[2], (1)*University of Rochester*, (2)*University of Rochester Medical Center*

Background:
A measure of overall well-being in children with autism has not yet been devised, and little is known about how well-being might relate to autism severity. Previous studies show an inverse relationship between the severity of autism symptoms and adaptive functioning (Paul, Loomis, & Chawarska, 2011), but this relationship has typically been quantified as a correlation between one composite from the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1989) and a summary score from the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Balla, 2005). This approach excludes other measures of well-being (e.g., ratings of quality of life and behavioral or emotional regulation) and the restricted, repetitive behavior domain. It also does not take into account the planned revisions to the Diagnostic and Statistical Manual of Mental Disorders to include sensory sensitivity symptoms in the restricted, repetitive behavior domain.

Objectives:
This study examined well-being and its relationship to autism symptoms by using multiple assessments to derive latent

variables for both constructs and generating a structural equation model of associations among these variables.

Methods:
Data collected as part of the Autism Treatment Network at the University of Rochester Medical Center were analyzed for 147 children ($M = 7.15 \pm 2.7$ years; 123 males). Autism symptom severity was operationalized as a latent construct comprised of the communication, social, and stereotyped behavior and restricted interests total scores from both the ADOS and the Autism Diagnostic Interview-Revised (ADI-R). Well-being was operationalized as a latent construct with VABS adaptive behavior composite, total problem score from the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001), and psychosocial total score from the Pediatric Quality of Life Inventory (PedsQL; Varni, Seid, & Rode, 1999). Sensory symptoms were quantified by using the total score from the short form of the Sensory Profile (Dunn, 1999). Analyses were conducted with AMOS (Arbuckle, 2010) to generate measurement and structural models for this dataset.

Results:
In the measurement model that best fit this data, (1) autism symptom severity was represented by all three ADOS total scores and only the social interaction score from the ADI-R and (2) CBCL and PedsQL represented the latent construct of well-being. This model fit the data very well χ^2 (12) = 16.69, p = .162, RSMEA = .052. A structural equation model tested the predictive value of autism and sensory symptoms and revealed that sensory symptoms (β = -.692), but not autism symptoms (β = -.006), significantly predicted well-being.

Conclusions:
This study suggests that well-being in children with autism may be conceptualized as a latent variable comprised of behavior regulation and quality of life and may be predicted by sensory symptoms. While autism symptoms were not significantly associated with well-being in this study, it should be noted that Ray-Subramanian, Huai, and Weismer (2011) found that the relationship between autism symptoms and AF was non-significant after controlling for age and IQ. This study highlights the importance of utilizing additional assessments to model the relationship between autism symptoms and well-being, as both are multi-dimensional constructs.

160.165 165 Screening Children with Autism Spectrum Disorders (ASD) Using the Japanese Version of the Strengths and Difficulties Questionnaire (J-SDQ). S. Ohtake*[1], F. Someki[1], H. Ito[1], M. Ohnishi[2] and M. Tsujii[3], (1)*Hamamatsu University School of Medicine*, (2)*Fukui University*, (3)*Chukyo University*

Background: The Japanese version of the Strengths and Difficulties Questionnaire (J-SDQ) is a brief measure of behavioral and emotional problems in children and adolescents rated by parents. The J-SDQ has 25 items and can be allocated to five subscales of five items each: the Emotional Symptoms subscale, the Conduct Problems subscale, the Hyperactivity-Inattention subscale, the Peer Problems subscale, and the Prosocial Behavior subscale.

Objectives: This study included one main research question and two additional research questions. The main research question was: "Does the J-SDQ have sufficient power to discriminate children with Autism Spectrum Disorders (ASD) from those who are typically developing?" The additional research questions were: (a) What is the impact of cognitive function (i.e., IQ) on a power of discriminating children with ASD from those who are typically developing? and (b) What is the impact of age on a power of discrimination?

Methods: Participants were 180 children with ASD and 6,586 typically developing children in elementary and middle schools (i.e., 1st to 9th grade). All the J-SDQ scores were compared between the two groups by five subscales, and powers of discrimination were calculated by receiver operating characteristic (ROC) analyses. For (a) the first additional question, children whose IQ was below 70 was excluded from the analysis because more children with ASD usually function significantly lower than normally developing children, which might result in higher spurious discrimination power. For (b) the second research question, analysis was conducted with additional data of individuals who were over 17-year-old to examine the effect of age on the discrimination power.

Results: For the main research question, the Peer Problems subscale exhibited a significant and the largest discrimination power. Among five subcategory scores, there was a significant

differences between the ASD group and the typically developing group in the area of the Peer Problems only. Furthermore, for the first and second additional questions, there were no effects of cognitive function and age on powers of discriminating children with ASD from typically developing peers.

Conclusions: The efficiency of the Peer Problems subscale of the J-SDQ, which consist of only five items, to screen children with ASD among those who are typically developing was supported.

160.166 166 Evaluation of Classroom Performance in Students with Autism Spectrum Disorder. N. Sparapani*[1], L. Morgan[2] and A. M. Wetherby[1], (1)*Florida State University Autism Institute*, (2)*Florida State University*

Background: Emotional regulation is the capacity to modulate behavior in response to the physical and social environment and is critical for academic persistence and independence (Connor, et al., 2010; Acock, & Morrison 2006; Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006). Students entering the classroom better able to self-regulate are more prepared and available for learning, and research in typically developing students has shown that successful self-regulatory abilities predict positive academic outcomes (Connor et al., 2010; Ponitz & McClelland, 2009; McClelland, Acock, Morrison, 2006). Currently, there is limited research on emotional regulation and other variables contributing to academic outcomes and classroom performance in students with Autism Spectrum Disorder (ASD). **Objectives:** The purpose of this study was to 1) describe emotional regulation, productivity, and independence in the classroom in a sample of students diagnosed with ASD, and 2) evaluate the concurrent relationships among these classroom variables and standardized measures of adaptive behavior and vocabulary. **Methods**: Participants were recruited from the Classroom SCERTS Intervention Project, a longitudinal public school-based intervention study for students with ASD in Kindergarten through second grade. Participants were diagnosed with ASD (n = 107) at the beginning of the school year and completed an evaluation battery including standardized measures of adaptive functioning and vocabulary. Additionally, teachers were given a series of questionnaires including the *Child Behavior Checklist* (CBCL). Observational data for this study consisted of a fifteen minute video sample across varying classroom activities, coded using the Noldus Observer® Video-Pro Software. **Results:** Preliminary analyses were conducted on a subset of 48 students of the total collected data. During the 15-minute sample, students spent time in a well-regulated state (M = 12:35, SD = 02:46), productive state (M = 07:18, SD = 03:20), and independent state (M = 03:49, SD = 03:35). A moderate, positive relationship was found between time spent in a well-regulated state and time spent in a productive state, r = 417, p < .003. Analyses revealed positive relationships among the *Vineland Adaptive Behavior Scale* (VABS) Adaptive Functioning Composite and time spent in a well-regulated r = .292, p < .044 and independent state r = .406, p < .004, as well as moderate, positive relationships among the VABS Social Composite and time spent in a productive r = .400, p < .005 and independent state r = .370, p < .010. Analyses also revealed moderate, positive relationships among the CBCL Adaptive Functioning Composite and time spent in a well-regulated r = .402, p < .005 and productive state r = .416, p < .003. **Conclusions:** While students spent a large proportion of time in a well-regulated state, less than half of the time was spent in productive and independent states. The concurrent relationships among these classroom variables and standardized measures provide validation of a unique school-based measure for evaluating classroom performance for students with ASD. These preliminary results contribute to and expand on current research on indicators of academic success while providing insight for evaluating and planning effective programming for students with ASD in the classroom.

160.167 167 Exploring the Impact of Vygotsky in Pre-School Autism. C. E. Harrop*, J. Green and P. Consortium, *University of Manchester*

Background: Vygotsky's theory of development has implications for learning and development in autism. With the emphasis on social learning and the role of others, Vygotsky's social-constructivist theory emphasises the collaborative social context in development. However, Vygotsky's theory has not been applied within the context of autism.

Objectives: An exploration of the influence of caregiver play on child play, both concurrently and over time, was conducted to test the applicability of Vygotsky's notion of a Zone of Proximal Development (ZPD).

Methods: 93 caregiver-child dyads were recruited; 49 of the children had a diagnosis of core autism. The remaining children were matched to the children with autism based on gender and non-verbal development. The children were aged between one and five at time one. Dyads were seen three times within 13 months (T1, T2, T3). Caregiver and child play were coded continuously from ten minutes of free play. Six levels of child play were coded; simple exploratory, cause and effect, game and bubble, simple functional, advanced functional and symbolic. The same levels were coded in the caregiver with an additional category of facilitating. A novel statistical technique, based on that of Pennington et al (2009), was used to account for the interdependency between the play variables whilst controlling for chronological age and SES.

Results: Between group differences were explored in children with and without autism. At T2 the differences found in game and bubble play (heightened in the autism sample) were predicted by caregiver play of this kind at both T1 and T2. Simple exploratory play differences (heightened in the autism group) were not predicted by any caregiver play behaviours. At both T2 and T3, caregiver advanced functional play (in combination with child language) predicted advanced functional play differences in the child (heightened in typical development). Concurrent caregiver play (combined with child variables) predicted child symbolic play differences at T3 (heightened in typical development).

Reduction in exploratory play over time was seen in both autism and typically developing group. This reduction was not related to any caregiver variables. Increase in advanced functional play over time in both groups was related to the amount of advanced functional play shown by the caregiver at the previous timepoint. Reduction of symbolic play in Autism from T2- T3 was predicted solely by the amount of symbolic play shown by caregivers at T2 – in inverse fashion.

Conclusions: Different results here are compatible with both Piaget's and Vygotsky's theory of play; with support for dyadic notions of a ZPD in more advanced forms of play but also children as 'lone scientists' for simple forms of play. Caregiver play that was too complex produced an inverse effect on child development in this area, indicating a sensory overload and mirroring previous findings in typically developing children (Tamis-LeMonda and Bornstein, 1994). 'Game and bubble' play in autism were highly reliant on caregiver input. The results indicate a complex interplay between child play, caregiver play and developmental variables and important implications for the role of caregivers in play and interventions.

160.168 168 Age of First Words Predicts Cognitive Ability and Adaptive Skills in Children with ASD. J. Mayo*[1], C. Chlebowski[2], D. A. Fein[1] and I. M. Eigsti[1], (1)*University of Connecticut*, (2)*University of Connecticut*

Background:

Children with ASD generally achieve language milestones, particularly expressive language milestones, later than children with typical development. Early reports of ASD identified age of language acquisition as an important indicator of positive prognosis; specifically, language by age 5-6 years was described as an important discriminator of higher versus lower functioning in ASD. In recent years, children have been diagnosed with ASD at younger ages, which allows for an earlier investigation of the relationship between language acquisition and later development.

Objectives:

The current study examines the relationship between early language acquisition and later functioning in children with ASD by examining how the age of a child's first word predicts later cognitive ability, adaptive behavior, and ASD severity.

Methods:

The sample consisted of 119 children with ASD who were ascertained by screening positive on the M-CHAT at age two. The sample was primarily male (83.2%) and White (82.4%). Children ranged in age at the time of the evaluation from 45 - 72 months, with a mean age of 52.2 months (SD = 6.1). Cognitive ability and adaptive skills were assessed using the Mullen Scales of Early Learning (MSEL) and the Vineland Adaptive Behavior Scales (VABS); parents recalled the age of

their child's first words during standard administration of the ADI-R.

Results:

Children were grouped based on the age by which they produced meaningful first words (i.e., 18, 24, 30, 36 months). T-tests indicated that, for all significant results, children producing meaningful words by a given age performed significantly better on measures of cognition (MSEL) and adaptive skills (VABS) than the group of children who remained non-verbal at that benchmark. This difference was present as early as 18 months; as the age of comparison increased, more comparisons yielded significant results, and effect sizes became larger. All comparisons were significant by 24 months, with medium effect sizes or larger, indicating that achieving first words by 24 months is a powerful prognostic indicator. Investigation of the age of first words using ANOVA and subsequent post hoc analyses indicated that first words by 24 months was associated with significantly better performance on MSEL language domains, VABS Communication and Social domains, and CARS total score when directly compared to children who achieved their first words by 30 months or later. The exceptions to these findings were ADOS severity score and DSM-IV total symptoms, which were similar in verbal versus non-verbal children at each comparison point.

Conclusions:

In summary, the current study of 119 children with ASD suggests that the age at which children speak their first words is strongly associated with better outcomes later in childhood. Children with first words by 24 months had higher cognitive ability and better adaptive skills than children who did not reach this milestone until later in life. Identifying that acquisition of first words by 24 months is associated with a more positive prognosis will help parents and professionals prioritize treatment goals, and supports arguments against a "wait and see" approach to language delay, especially in the presence of any ASD symptoms.

160.169 169 Characteristics of Toddlers Screening False Positive on the Modified Checklist for Autism in Toddlers (M-CHAT). S. D. Tomchek*[1], L. L. Sears[1] and C. G. Sears[2], (1)*University of Louisville*, (2)*Goshen College*

Background: Early identification of young children with autism creates opportunity for early intervention to improve outcome. Autism screening instruments have been shown to be useful in identifying children needing further evaluation for autism, but use of these instruments has also led to concern about the frequency of false positives that occur as part of the process. False positives can create unnecessary stress for parents and lead to expensive and time consuming diagnostic evaluations.

Objectives: This study sought to identify characteristics of young children identified as at risk for autism, based on screening with the Modified Checklist for Autism in Toddlers (M-CHAT), but who were later found to not have an autism spectrum disorder based on a multidisciplinary evaluation. Recognition of characteristics unique to this false positive group may be useful for improving the ability of screening instruments to distinguish young children with autism from those children with developmental delays and behavior problems but not autism.

Methods: Retrospective data from a state-wide early intervention program was analyzed comparing characteristics of children (ages 16 to 35 months) who screened positive for autism on the M-CHAT, but did not meet criteria for an autism spectrum disorder (N=122), to those with a positive screen and confirmed diagnosis of autism (N=69).

Results: Children who turned out to not have an autism spectrum disorder despite screening positive had better fine motor skills and fewer feeding problems than children with confirmed autism. Those with a false positive screen did not differ from those confirmed to have autism in measures of cognitive ability, adaptive behavior, or language skills.

Conclusions: Consideration of feeding issues and fine motor skills in the screening for autism, in conjunction with social communication skills currently included in the M-CHAT, may improve screening for autism in young children by reducing false positives. This improvement in screening will benefit parents by reducing stress associated with a positive screen for autism and by reducing costs and time associated with diagnostic evaluations.

160.170 170 The Relationship of Motor Skills & Social Skills in Young Children with Autism. M. I. MacDonald*,

Background:

Autism spectrum disorder (ASD) is characterized by deficits in social communication skills and repetitive or stereotyped behaviors. In the youngest children with ASD, delays in the attainment of infant motor milestones are frequently reported. In addition to these early delays, many children with ASD also demonstrate deficits in gait patterns, postural control, and in the performance of gross and fine motor skills. Although these motor deficits have been documented in very young children with ASD, greater focus and developmental awareness has been placed on social communicative skills, including the necessity of improving social communicative skills through early intervention. However, very little effort has been made to understand how the delays in motor skills impact later movement performance, which may impact socially relevant activities or opportunities. Although the relationship between the motor and social domains has recently been acknowledged, there is a very limited understanding of how these domains interact, especially in young children with ASD.

Objectives:

The objective of this study is to better understand the relationship between social skills and motor skills in young children with ASD using standardized assessments.

Methods:

10 young children with ASD were recruited for this study as a part of an early intervention project. All participants in this study were children between the ages of 2- 5 years with a confirmatory diagnosis of ASD or pervasive developmental disorder- not otherwise specified (PDD-NOS) as indicated by standardized algorithms established from the Autism Diagnostic Observational Schedule (ADOS). All participants were also administered the Peabody Developmental Motor Scales 2nd ed., the Mullen Scales of Early Learning, and the Vineland Adaptive Behavior Scales 2nd ed. A linear regression model used motor skills to examine the relationship to social skills, based on standardized assessments.

Results: Significant relationships were found between motor skills and social skills while controlling for age and non-verbal problem solving (as based on the visual receptive organization subscale of the Mullen, a scale within the Mullen Scales of Early Learning). Findings indicated that locomotor skills were predictive of social skills ($p < 0.05$) and relationship trends were evident between object manipulative skills and social skills and object manipulative skills and calibrated autism severity.

Conclusions:

The results of this study show there are important relationships between the motor skills and social communicative skills in young children with ASD. Early intervention is a priority for young children with autism in practice and research. This study is not meant to negate the importance of social communicative early intervention for young children with autism. However, it appears that the motor development of young children with autism needs to be considered a priority as well.

160.171 171 Asperger Syndrome in Adults: Evidence for the Validity of Contemporary Screens. B. M. Stoesz*[1], J. Montgomery[1], L. Hellsten[2], K. Stoddart[3], L. J. Burke[4] and M. A. Stokes[5], (1)*University of Manitoba*, (2)*University of Saskatchewan*, (3)*Redpath Centre*, (4)*The Redpath Centre*, (5)*Deakin University*

Background: Knowledge of Asperger Syndrome (AS) in children has increased substantially in recent years; yet, information on diagnosis in adults is limited. Adult assessment may be difficult for various reasons: early developmental history may be unobtainable; co-existing conditions may be present; and/or experienced and knowledgeable clinicians may be unavailable. Tests to assist in diagnosing adult AS exist, but they have limitations: (1) many tests were created for use with children; (2) information on reliability and validity of test scores are often unavailable; and (3) test developers do not always obtain independent confirmation that their participants actually have AS. Thus, the usefulness of tests for identifying AS in adults remains questionable and may result in inaccurate diagnoses.

Objectives: Given the above, the goals for our current study were to augment the existing information for several tests of adult AS to determine: (1) how well these instruments discriminate between groups of people with autism spectrum disorders (ASD) (discriminant validity); (2) if the instruments are strongly related to other tests for AS/ASD (convergent validity); and (3) if the instruments differ from tests of other conditions (divergent validity). Further, we examined the accuracy of AS diagnoses when instruments are used individually or in combination.

Methods: In a pilot study, we recruited adults (aged 18+ years) with AS and IQ-, gender-, and age-matched controls in each of three groups – high functioning autism (HFA), attention deficit hyperactivity disorder (ADHD), and typically developing. These groups were chosen to evaluate the sensitivity of existing measures for discriminating between similar (HFA), overlapping (ADHD), and distinct (typically developing) groups. All clinical participants were diagnosed by a clinician prior to their participation and had a verbal IQ ≥ 85. Participants completed various AS screening/diagnostic measures [e.g., Krug Asperger Disorder Index (KADI); Gilliam Asperger's Disorder Scale (GADS); The Adult Asperger Assessment (AAA); Asperger Syndrome Diagnostic Interview (ASDI); and Ritvo Austim Asperger Diagnostic Scale- Revised (RAADS-R)] and other tests included to measure convergent and divergent validity.

Results: Findings are preliminary, however, they do indicate that some instruments are better at correctly identifying and discriminating amongst subgroups and that combining selected instruments improves classification rates.

Conclusions: Families and individuals affected by a late diagnosis of AS experience frustrations and difficulties. Many clinicians feel inadequately prepared to assess adults on the spectrum, as resources for late diagnosis are limited. Thus, it is essential that clinicians feel competent to address the unique diagnostic needs of adults suspected of having AS. The results from our study provide a step towards improving this situation at a clinical level, and we anticipate that this will likewise positively impact individuals and families by enabling accurate diagnosis and, thus, access to appropriate supports and treatment. Our findings are essential to informing understanding of AS in adults and improving clinical assessment and diagnosis of AS.

160.172 172 Divergence of Object Play Trajectories Between High-Risk Infant Siblings and Low-Risk Controls Occurs Between 15 and 18 Months of Age. T. P. Nguyen*[1], L. V. Ibanez[2], M. Fong[3], D. S. Messinger[4], C. J. Grantz[4], Z. Warren[5] and W. L. Stone[6], (1)*San Francisco State University*, (2)*University of Washington Autism Center*, (3)*University of Washington Autism Center CHDD*, (4)*University of Miami*, (5)*Vanderbilt University*, (6)*University of Washington*

Background: Assessment of object play behaviors in early childhood can have important implications for screening of autism spectrum disorder (ASD) and for predicting social and communicative competence of children with ASD in later life (Stone et al., 2008; Ozonoff et al., 2008; Bruckner and Yoder, 2007; Lewis, 2003). While unusual characteristics of object play in children with autism before the age of two have been reported via parent reports and analysis of family home videos, confirmation of diagnosis typically does not occur until age 3 or older. Currently, it has been estimated that almost 20% of the infant siblings of children on the spectrum (High-Risk sibs) develop an ASD (Ozonoff et al., 2011). Thus, studying this population could provide profound insights on the developmental trajectory of ASD during the first two years of life.

Objectives: This study compares object play behaviors in High-Risk sibs and the infant siblings of typically developing children (COMP-sibs) from 9 months through 18 months of age.

Methods: Object play was examined longitudinally in high-risk sibs (*n*= 9) and COMP-sibs (*n*= 9) at 9, 12, 15, and 18 months of age. Infants and their caregivers participated in the Play-based Assessment of Referential Communication (PARC) task in which the infant is seated across from his/her caregiver and is surrounded by 9 different types of toys. During the 6 minutes of the PARC, infants and their caregivers engage in a play session in which caregivers are instructed not to initiate or prompt interaction/play with their child (i.e. vocalizing or smiling) unless the child initiates first. Using an adapted version of the Developmental Play Assessment (DPA; Yoder,

2007), differentiated and undifferentiated play behaviors were coded. *Differentiated play* refers to object-specific actions that were identified for each toy a priori. *Undifferentiated play* refers to actions that are indiscriminant and can be used with any toy regardless of its physical properties (e.g., mouthing, banging, or visual inspection). Four variables were coded during play: rate per minute of differentiated and undifferentiated play actions; number of different actions of toys; and number of different toys used.

Results: From 9 months through 15 months, there were no group differences in number of differentiated play actions or number of toys used. At 18 months of age, High-Risk sibs (*M*= 1.23, *SD*=1.08) showed a lower rate of differentiated play actions than COMP-sibs (*M*= 3.28, *SD*=1.55), *p* =.03. High-Risk sibs (*M*= 2.60, *SD*=1.52) engaged in fewer distinct differentiated play actions than COMP-sibs (*M*=5.86, *SD*=2.48), *p*=.03. High-Risk sibs (*M*= 2.00, *SD*=1.00) tended to play with fewer toys than COMP-sibs (*M*= 3.43, *SD*=1.40), *p* = .08. There were no group differences on undifferentiated play.

Conclusions: Differences in differentiated object play between High-Risk sibs and COMP-sibs emerge by 18 months, as reflected by High-Risk sibs demonstrating fewer overall differentiated play actions, fewer distinct actions, and engaging with fewer toys than COMP-sibs. The implications of this group difference in developmental trajectory will be examined in a larger sample with reference to development of social communicative competencies and diagnostic outcomes.

160.174 174 Potential Gender Differences in Older Children and Adolescents with Autism Spectrum Disorder. A. M. Schmidt*, M. A. Winter-Messiers and T. Oswald, *University of Oregon*

Background:

A limited number of studies have examined gender differences within Autism Spectrum Disorder (ASD). Research indicates that girls compared to boys within the ASD population are more impaired in social competence, communication, cognitive abilities, and demonstrate more anxious or depressed affect (Hartley & Sikora, 2009; Carter et al., 2007; Holtman, et al, 2007), although some studies have found no significant differences (McLennan, 2003). The majority of these studies have focused on either toddlerhood/preschool or spanned a large age range. Adolescence is a crucial developmental stage requiring further examination in the ASD population because of great advances in social and cognitive abilities that have been found to be impaired in ASD. Additionally, adolescent gender differences in depression have been found in a typically developing (TD) population (Nolen-Hoeksema & Girgus, 1993), but investigation in the ASD population is scarce.

Objectives:

The current study examined gender differences across multiple domains, including social abilities, communication, and depression in higher functioning individuals during late childhood and adolescence.

Methods:

Participants consisted of older children and adolescents ranging from 10.1 to 17.8 (*M*=14.94, *SD*=1.85) years. Theory of Mind (ToM) was assessed using Happé's strange stories (Happé et al., 1994), and the Erickson Flanker Task (Eriksen & Schultz, 1979) measured inhibitory control. Verbal and non-verbal abilities were measured using the Kaufman Brief Intelligence Test-Second Edition (KBIT-2) (Kaufman & Kaufman, 1990) and autistic traits were measured using the Autism-Spectrum Quotient - Adolescent Version (AQ; Baron-Cohen et al., 2006).

Results:

To examine group and gender differences in depression, we used a univariate analyses of variance (ANOVA) with group (TD vs. ASD) and gender (Male vs. Female) as fixed factors, and depression as the dependent variable. This analysis revealed a main effect of group, $F(1,68) = 6.40$, $p = .01$, such that the ASD group (*M*= 15.95, *SE*= 1.40) scored significantly higher on depression than the TD group (*M*= 11.11, *SE*= 1.31). In addition, we found a marginally significant gender by group interaction, $F(1,68)= 3.45$, $p= .07$, with ASD males (*M*= 17.40, *SE*= 1.85) scoring highest , then ASD females (M= 14.50, SE= 2.15), followed by TD females (*M*=13.21, *SE*=

1.85), and with TD males (*M*= 9.00, *SE*= 1.85) scoring the lowest.

Regarding ToM, an ANOVA revealed a main effect of group, $F(1,63) = 4.95$, $p=.03$, such that the ASD group (M =11.41, SE= 0.40) scored significantly worse on the ToM task than the TD group (M =12.65, SE= 0.38).

A two-way MANOVA with group and gender as the fixed factors, and the five AQ subscales as the dependent variables revealed a significant multivariate main effect of gender, Wilks' $\Lambda = .35$, $F(5,66)= 24.48$, $p < .001$. Univariate tests indicated a significant effect of all five subscales ($p< .01$), such that the ASD group showed greater impairments than the TD group.

Conclusions:

The ASD group showed more autistic traits and depression, as well as worse ToM than the TD group. Further, a gender by group interaction suggested that ASD males have greater depressive symptoms than TD males.

160.175 175 Theory of Mind and IQ in High Ability Youth with An ASD. A. Berns* and S. Assouline, *The University of Iowa*

Background: Theory of mind has been found to be impaired in most high functioning youth with an autism spectrum disorder (ASD). Some research suggests theory of mind is not impaired in most high functioning adults with an ASD, however they still have social difficulties. Research indicates the development of theory of mind, both first-order (emotional/mental self-awareness) and second-order (understanding of other's emotional/mental states), to be facilitated by language acquisition in children. It is not clear what other factors may be influencing sophisticated theory of mind in high functioning youth and adolescents with an ASD (i.e., age, IQ, executive functioning). Investigation of theory of mind, including emotional self-awareness, empathy, and social insight in high ability youth with an ASD may provide valuable information regarding the relationship between theory of mind and IQ.

Objectives: This research provides some information regarding the relationship between IQ and theory of mind in high ability youth with an ASD. The study encourages further investigation of sophisticated theory of mind development and related factors in individuals with an ASD, with clinical implications for the design of successful social skills interventions.

Methods: Forty-two youth with high ability (defined as having an IQ verbal, nonverbal, or full scale standard score of >120) and an ASD (Autistic Disorder, Asperger's Syndrome, Pervasive Developmental Disorder – Not Otherwise Specified; PDD-NOS) had measures gathered from the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) or Wechsler Adult Intelligence Scale – Third Edition (WAIS-III), as well as measures from the Autism Diagnostic Observation Schedule (ADOS) , as part of a Belin-Blank Center Javits Grant and from private clients evaluated at the Belin-Blank Center's Assessment and Counseling Clinic. Clinician rated ADOS codes of theory of mind (empathy, insight into social relationships, and emotional self-awareness) were analyzed with IQ Indices to determine correlations between ADOS theory of mind codes and IQ Indices (i.e., Verbal Comprehension Index, Perceptual Reasoning Index, Processing Speed Index, and Working Memory Index).

Results: Nonparametric Spearman rank order correlation coefficients were calculated of WISC-IV/WAIS-III Indices and ADOS codes. Results revealed Verbal Comprehension Index scores were positively correlated with the ADOS code of insight into social relationships ($r_s = - .411$, $p = .007$), and had trends towards significance with ADOS codes of emotional self-awareness ($r_s = - .674$, $p = .067$), and empathy ($r_s = - .270$, $p = .084$). Conversely, Perceptual Reasoning Index scores were negatively correlated with ADOS codes of emotional self-awareness ($r_s = .730$, $p = .040$) and empathy ($r_s = .428$, $p = .005$).

Conclusions: High verbal ability is associated with sophisticated theory of mind abilities in youth with an ASD. Language acquisition facilitates theory of mind development in children and may facilitate sophisticated theory of mind development in high ability youth with an ASD. Further research is needed to better understand the relationship between language abilities and sophisticated theory of mind abilities in high functioning persons with an ASD.

160.176 176 The Psychometric Evaluation of the Theory of Mind Inventory. T. L. Hutchins*, *University of Vermont*

Background: Despite the tremendous activity in the field and developments in Theory of Mind (ToM) assessment procedures, the measurement of ToM has traditionally been associated with several challenges. These include a lack of content and social validity, ceiling effects when mentalizing is relatively good, and a variety of situational, motivational, cognitive, and linguistic factors that often complicate the administration of tests that rely on direct measures of child performance (Hutchins et al. 2008). In addition, while several ToM tests have been developed to assess the social cognition of individuals with HFA and Asperger Syndrome, there are no measures currently in existence that are appropriate for the measurement of ToM among those the most severe disabilities. Thus, children with ASD who are nonverbal or have limited language skills are commonly excluded from research protocols.

Objectives: The purpose of this study was to assess the psychometric properties of a new parent-informant measure of ToM: one that would be appropriate for younger and older children and those who vary widely in their cognitive and linguistic profiles.

Methods: Two cross-sectional studies examined the psychometric properties of the Theory of Mind Inventory (ToMI). In Study One, 135 caregivers completed the ToMI for children (ages 3 through 17) with autism spectrum disorder (ASD). In Study Two, data were collected for 124 typically developing children (2 through 12 years).

Results: Findings revealed excellent test–retest reliability and internal consistency for both samples ($r = .86$, $p < 01$ for both samples). A number of other measures (e.g., receptive vocabulary, a test of ToM performance using direct assessment) provided evidence of convergent validity ($p < .05$). A contrasting-groups method of construct validation also revealed between group differences where 1) higher ToMI scores were obtained for typically developing children compared to children with ASD ($p < .05$), and 2) ToMI scores were positively correlated with child age in the typically developing sample ($r = .72$, $p < .05$). Finally, a Principle Components Analysis revealed three subscales related to the complexity of ToM understanding. These appeared to reflect a general developmental progression seen in typically developing children. These were termed: early, basic, and advanced skills.

Conclusions: The ToMI performed well in all examinations of reliability and validity in both typically developing children and individuals with ASD. The advantages of the ToMI

over traditional ToM assessment procedures include the fact that responses are not scored on a dichotomous pass/fail basis but rather in terms of continuum of confidence that a child possesses a ToM understanding. A range of scores can be obtained which are construed as interval in nature and can be submitted appropriately to the most powerful statistical procedures. In addition, the ToMI is quick and easy to administer and it is not complicated by situational factors and child motivation, linguistic, or cognitive performance factors. Finally, the automated scoring and norms are now available for the ToMI.

Core Symptoms Program

161 Core Deficits and Symptoms III

161.177 177 Comparing Early Language Development in Monolingual- and Bilingual- Exposed Children with Autism Spectrum Disorders. P. Mirenda*[1], K. Ohashi[2], J. Petersen[3], S. Marinova-Todd[1], C. Hambly[4], E. Fombonne[4], P. Szatmari[5], S. E. Bryson[6], W. Roberts[7], I. M. Smith[6], T. Vaillancourt[8], J. Volden[9], L. Zwaigenbaum[9], S. Georgiades[5] and A. Thompson[5], (1)*University of British Columbia*, (2)*ABA Learning Centre*, (3)*Down Syndrome Research Foundation*, (4)*McGill University*, (5)*Offord Centre for Child Studies, McMaster University*, (6)*Dalhousie University/IWK Health Centre*, (7)*The Hospital for Sick Children*, (8)*University of Ottawa*, (9)*University of Alberta*

Background: Until recently, only a few unpublished studies have examined the effects of exposure to more than one language in children with autism spectrum disorder (ASD) (e.g., Hambly & Fombonne, 2009; Leadbitter et al., 2009; Kremer-Sadlik, 2005; Yu, 2007). Perhaps because of this lack of research, bilingual families of children with ASD often

decide to speak only one language to their child at home, or are advised to do so by a professional (Jordaan, 2008; Thordardottir, Weismer, & Smith, 1997). This practice stems from the belief that bilingual exposure will "overload" an already-impaired language system and will thus have a negative impact on overall language development. However, imposing a non-native language on a family can create social distance between family members and a child with a disability. In addition, many parents who speak a non-native language are not fluent themselves in that language, and thus provide models that are grammatically incorrect (Jacobson & Cairns, 2008). The end result is that parents who switch to speaking a non-native language to their child with ASD may adversely affect the child's language development by talking less and by providing less accurate language models. Research in this area is needed in order to better understand the impact of bilingual exposure on children in this vulnerable population.

Objectives: Two studies were conducted to compare aspects of early language development in young children with ASD who were raised in monolingual and bilingual home environments in Canada.

Methods: In the first, exploratory study, lexical comprehension and production and overall language scores were compared in 14 English–Chinese bilingual and 14 English monolingual children with ASD (ages 43-73 months) who were matched by chronological age. In the second study, language scores were compared for 20 recently-diagnosed bilingual-exposed children with ASD and 40 monolingual-exposed children with ASD (ages 24-52 months). The two groups, which were matched with regard to chronological age and nonverbal IQ score, were compared with regard to the severity of children's autism-related communication impairment, age of first words, and age of first phrases; receptive vocabulary scores; receptive and expressive language scores; and functional communication scores.

Results: Results of both studies indicated no statistically significant differences between the bilingual and monolingual groups on any of the language measures. Effect sizes (partial η^2) were ≤.04 for all analyses. When the two languages of bilingual participants were compared in Study 1, no significant differences were found for either production vocabulary size or vocabulary comprehension scores.

Conclusions: There is no evidence that early bilingual exposure adds an additional burden to the developing language system of young children with ASD. This is positive news for the growing number of families in which more than one language is spoken and who may believe (or may be told) that they should restrict the use of their home language in order to simplify language input.

161.178 178 The Autism Quotient Has Concurrent Validity with the Social Responsiveness Scale. K. Armstrong* and G. Iarocci, *Simon Fraser University*

Background: The Autism Quotient (AQ; Baron-Cohen et al., 2001) is a continuous, quantitative measure of traits associated with autism. It is often used as a tool to measure autism symptoms and screening for the disorder in research. The Social Responsiveness Scale (SRS; Constantine & Gruber, 2005) is another brief measure which can be used to measure autism symptoms, particularly in the social domain, and has well-established reliability and validity (Brooker & Starling, 2011).

Objectives: To examine the concurrent validity of the AQ using another common screening measure of autism: the SRS.

Methods: Participants with autism (n=30) were administered the AQ and the SRS. A correlation analyses was conducted to determine whether the AQ and SRS were related. A further correlation analysis employing the use of the Bonferroni correction was conducted to determine whether any specific AQ symptom domains were related to the SRS.

Results: The first analysis indicated a significant correlation between SRS and AQ scores (r=.61, p=.00). The second analysis revealed that the social domain was the only AQ domain found to be significantly related to the SRS (r=.63, p=.00).

Conclusions: This study provides evidence that the AQ-Social domain is measuring the same construct as the SRS, supporting its validity. More importantly, this study provides evidence for concurrent validity of the AQ with the SRS, an already well-validated screening tool for autism.

161.179 179 Responding to Joint Attention Requests From Virtual and Non-Virtual Social Partners. B. Lambert*[1], A. Gutierrez[1], W. Mattson[1], J. Artigas[1], O. Martinez[1], M. Kimijima[1], J. Cassell[2], J. Cohn[3] and D. S. Messinger[1], (1)*University of Miami*, (2)*Northwestern University*, (3)*University of Pittsburgh*

Background: Responding to joint attention (RJA) refers to following a partner's referential cues (e.g., gaze shift, head turn, pointing) by shifting gaze from the partner to the indicated object or event. Impairments in RJA have been observed in interactive and video protocols among children with autism spectrum disorders (ASDs) and are linked to delays in language development. However, little is known about how children with ASD respond to referential cues provided by different kinds of partners.

Objectives: Determine differences in RJA in response to virtual and non-virtual characters in video stimuli among children with ASD and typically developing (TD) controls.

Methods: The sample consisted of 16 TD (11 male) and 13 ASD (10 male) children from 36.8- 81.9 months of age. For the TD group, mean chronological (CA) was 55.5 months (SD=9.9) and mental age (MA) was 61.2 months (SD=7.1). For the ASD group, mean CA was 66.6 months (SD=13.4) and MA was 62.7 months (SD=15.5). Group differences in MA were not significant, p=.73.

Participants were seated in front of an LCD monitor mounted with a Tobii X50 eye tracker and presented a 14-minute video. Gaze shifts were recorded during 2 two-minute sequences featuring first a non-virtual (actual) boy and then a virtual (animated) boy using an identical audio track. In both sequences, the boy faced the child and performed a series of RJA presses (vocalizations, head turns, pointing) to direct the child's attention to a SpongeBob cartoon on a TV to the child's right.

Results: Children with ASD demonstrated fewer gaze shifts (M=1.01, SE=.12) from the boy to SpongeBob than TD children (M=1.53, SE=.11), $F(1, 170)=9.95$, $p < .01$, $\eta_p^2=.06$. Children with ASD also demonstrated fewer gaze shifts from SpongeBob back to the boy (M=0.80, SE=.11) than TD children (M=1.33, SE=.10), $F(1, 170)=12.45$, $p < .001$, $\eta_p^2=.07$. There was no effect of type of boy (actual vs. virtual) and no interaction between boy and status, ps>.25. Children in the ASD group had a lower proportion of tracked frames (M=.56, SD=.33) than children in the TD group (M=.70, SD=.30), $F(1, 398)=19.68$, $p < .001$, $\eta_p^2=.05$. Analyses controlling for proportion of tracked frames (number of gaze shift per minute of tracked frames) yielded no significant main or interaction effects.

Conclusions: Children with ASD engaged in fewer instances of RJA (boy to SpongeBob) shifts and fewer instances of shifting gaze back from SpongeBob to the boy. However, children with ASD also contributed a lower proportion of tracked frames to analysis than TD children presumably because they spent less time gazing at the monitor. No deficits in gaze shifting were evident when controlling for the proportion of frames for which eye tracking data was available. There were also no differences in how ASD and TD children responded to cues from the virtual versus non-virtual social partners. Difficulties with RJA among children with ASD may be partially a function of difficulties attending to the partner who is directing their attention.

161.180 180 The Influence of Social-Communicative Skills on the General Development of Toddlers with Autism Spectrum Disorder (ASD). L. Verhaeghe*, M. Dereu, P. Warreyn and H. Roeyers, *Ghent University*

Background:

The early social-communicative skills *imitation, joint attention,* and *pretend play* are considered to be pivotal skills in the development in children with autism spectrum disorder (ASD). Children with ASD exhibit significant deficits in the development of these three skills. Previous research indicated that these skills are important precursors of later language, social competence, and general development.

Objectives:

The first goal of this research was to determine which specific aspects of the three social-communicative skills differ in children with and without a clinical diagnosis of ASD, recruited from a group of children with a positive screen for ASD at a younger age. Secondly, this study wanted to reveal which of

these aspects correlate with general development simultaneously and one year later.

Methods:

In this study, the three social-communicative skills were investigated in a group of 3-year-olds with (*n*=13) and without (false positives; *n*=24) a clinical diagnosis of ASD. Imitation was examined using the Preschool Imitation Praxis Scale (PIPS; Vanvuchelen, 2009). Joint attention skills were measured with the Early Social Communication Scales (ESCS; Mundy et al., 2003), and pretend play was assessed using the Test of Pretend Play (ToPP; Lewis & Boucher, 1997). The general development of all children was examined at the ages of 3 and 4, using the Mullen Scales of Early Learning (MSEL; Mullen, 1995).

Results:

Adopting a multivariate analysis of variance, significant group differences were found for the variables *pretend play, bodily and procedural imitation,* and *response to joint attention*. Positive correlations were observed between the Early Learning Composite score of the Mullen measured at age 3 and age 4 and the social-communicative skills *response to joint attention, response to behavioural request*, *pretend play, bodily and procedural imitation*. Hierarchical analyses with these results revealed that procedural imitation, measured at age 3, significantly predicts the Early Learning Composite measured at age 4. Further, these hierarchical analyses brought to light that the group differences based on clinical diagnosis disappeared when other variables were added to the model. In order to investigate whether this effect is mediated by the effect of the other variables, mediation analyses were executed. For this analyses, bootstrapping methods were used (Preacher & Hayes, 2008). Results revealed that the effect of the variable 'having a clinical diagnosis ASD' is mediated by *pretend play* and *procedural imitation*.

Conclusions:

This study confirmed previous results concerning differences in the development of the three social-communicative skills between children with and without ASD. Significant differences were observed for the skills *pretend play, bodily and procedural imitation,* and *response to joint attention*. However, certain aspects of the three social-communicative skills do not differ between children with ASD and false positives. Moreover, differences in general development between children with ASD and false positives can be explained by a different development of procedural imitation and pretend play.

161.181 181 Critical Evaluation of Commonly Used Assessments of Theory of Mind Abilities. K. V. O'Connor*, J. P. Stichter and M. Herzog, *University of Missouri*

Background:

Individuals with High Functioning Autism (HFA) and Asperger Syndrome (AS) are characterized by deficits in social competence. Many of the social difficulties observed in HFA/AS are related to deficits in social perspective taking. However, researchers have postulated that assessments commonly used to evaluate social perspective taking (Theory of Mind; ToM) do not effectively evaluate these abilities and are confounded by other variables (e.g., language ability). There is a paucity of research examining the efficacy of measures evaluating ToM abilities and as a means to monitor progress; therefore leading many to question the validity of these assessment tools. It is essential that the field critically examine commonly used measures to identify intervention efficacy.

Objectives:

This study examined the performance of elementary aged children (both HFA/AS and typically developing peers) on common assessments of ToM in order to evaluate the relationship between social perspective taking abilities, cognitive abilities (e.g., IQ, reading skills). This study also evaluated the utility of commonly used ToM assessments to monitor progress in the area of social perspective taking within the context of a social competency intervention.

Methods:

19 children, ages 6-10 participated in this study (10 HFA/AS, 9 typically developing). HFA/AS students were enrolled in the Social Competency Intervention for Elementary students (SCI-

E; Stichter, et al., 2011). Standardized assessments were administered pre/post intervention to evaluate the impact of SCI-E on: Social Behavior, Theory of Mind, Executive Function and Emotion Recognition. Within this battery are common measures of ToM: false belief tasks and social vignettes (Strange Stories, Faux Pas). Additionally a parent rating, Theory of Mind Inventory (ToMi) was utilized. Measures of IQ and reading ability were conducted to analyze possible relationships with ToM scores. Within initial analyses the pre-assessment ToM scores of the 10 children with HFA/AS was compared to 9 typically developing children. Following the SCI-E intervention, outcome measures for participants with HFA/AS were analyzed to interpret intervention effectiveness.

Results:

The results indicated that 65% of the variance in ToM scores were associated with other variables (p<.01), IQ approximately 40% of the variance (p<.001) and reading recall 24% of the variance (p<.01). When the participant groups were analyzed separately only the HFA/AS group had significant results with 60% of the variance in their ToM abilities associated with their recall reading assessments (p<.001). Results of intervention efficacy for students with HFA/AS identified that the common measures of ToM did not demonstrate any post intervention changes, although the majority of other measures did, including the ToMi.

Conclusions:

Over half of the variance associated with ToM performance for participants with HFA/AS was related to reading recall abilities. These results indicate that ToM assessments may be in actuality evaluating working memory instead of interpreting social situations. The results also provide indications that the commonly used ToM assessments may be confounded by the large emphasis on reading abilities and requirements to retain verbal information and may not be sensitive to intervention change. The results support that the field needs to identify and utilize measures that more effectively evaluate ToM abilities.

161.182 182 Predictive Utility of CBCL Subscale Scores on Autism Diagnoses in Preschool Aged Children. S. E. Hoffenberg and S. E. Crossett*, *Marcus Autism Center: Children's Healthcare of Atlanta*

Background:

The Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000) is a parent-report measure used to assess for a range of social, emotional, and behavioral disorders. The measure includes the Pervasive Developmental Problems (PDD) and Withdrawn Symptoms DSM-oriented scales, which have been suggested by some to be appropriate for the diagnosis of Autism Spectrum Disorders (ASD) in children (Pandolfi, Magyar, & Dill, 2009). However, others have indicated that the CBCL is not sensitive enough to identify ASD in young children (Kanne, Abbacchi, Constantino, 2009). However, to date, no research has examined whether caregivers' ratings on the CBCL are predictive of a child's final diagnosis of an ASD.

Objectives:

The goal of the current study was to determine the clinical utility of the CBCL in diagnostic evaluations of preschool-aged children with possible ASD. More specifically, this study evaluated whether the PDD and Withdrawn scales were predictive of the final diagnosis given to the child.

Methods:

The present study was composed of 172 clinically-referred children between 25 and 71 months of age (M=47.1 months, SD= 12.52). All children were referred for psychological assessment to rule out an ASD. Evaluations were completed between November 1, 2010 and November 1, 2011 and all data were collected via retrospective record review. Clinical assessments typically included a parent interview, assessment of cognitive and adaptive abilities, ASD assessment using the Autism Diagnostic Observation Schedule, Revised, and completion of parent-report measures, including the CBCL.

Children were divided into two groups based on whether or not they received an ASD diagnosis, which included Autistic Disorder, Pervasive Developmental Disorder, NOS, and Asperger's Disorder. Data were analyzed using multiple linear regression, with diagnosis as the criterion variable and CBCL subscales (i.e., scores on the PDD and Withdrawn subscales) as the predictor variables.

Results:

Of the 172 children included in the study, 62% were given an ASD diagnosis. The results indicated that the PDD scale scores (b = 0.09, $t(170)$ = 1.17, p = 0.24) were not predictive of an ASD diagnosis. The PDD scale had a sensitivity of 0.65, but a specificity of only 0.42 in this sample. In contrast, scores on the Withdrawn subscale were predictive of a final ASD diagnosis (b = 0.18, $t(170)$ = 2.41, $p < .05$). The sensitivity of the Withdrawn scale in this sample was 0.61, while the specificity was 0.55.

Conclusions:

Data from the current study suggests that the PDD subscale of the CBCL is not a valid predictor of ASD diagnoses in clinically referred preschool-aged children; however, the Withdrawn subscale shows some promise in differentiating children with an ASD from children without an ASD. Clinicians are cautioned against using this data outside of a comprehensive assessment to determine diagnoses.

Future research should examine the diagnostic utility of the other CBCL subscales, in addition to the possibility of gender and ethnic group differences. Examination of caregiver-teacher report forms as well as other more specific ASD parent report forms may also provide informative findings.

161.183 183 Psychotropic Medication Use in Children Before Autism Spectrum Diagnosis Is Made. I. Bukelis*[1], A. N. Harris[2], S. E. O'Kelley[3], K. Guest[1], M. W. Gower[1] and F. J. Biasini[1], (1)*University of Alabama at Birmingham*, (2)*The University of Alabama at Birmingham*, (3)*UAB Civitan-Sparks Clinics*

Background: It has been reported that about 45% of individuals with ASD take psychotropic medications (Aman at al., 2003 and Langworthy-Lam et al., 2002), and there is also evidence that many children are prescribed these medications even before they receive ASD diagnosis. Very little is known about the specific types of medications individuals with ASD are getting before they receive a formal ASD diagnosis, and given the significant implications of these medications, this is an important area to explore. Based on Alabama Medicaid data, more than 50% of individuals less than 5 years of age who were prescribed atypical antipsychotics did not have FDA approved diagnosis (Littlejohn, 2011).

Objectives: To determine prevalence and type of psychotropic medication use in a tertiary care clinic sample of children before formal ASD diagnosis was made.

Methods: Thirty-one children (ages 2.0 - 13.0 years) with ASD received diagnostic and intellectual evaluations at an interdisciplinary clinic. Records regarding psychotropic medication use prior to formal ASD diagnosis were reviewed for each participant.

Results: Of the 31 participants, 51% met criteria for PDD-NOS, 23 % met criteria for Asperger syndrome, and 26% met criteria for autism based evaluations utilizing the ADOS, ADI-R, and clinical opinion. Eighty percent of the sample was male and 48% was white non-Hispanic. Mean FSIQ for participants was 80.6 (range 52-118). Of our sample, 38.7% were taking psychotropic medications prior to diagnostic evaluation and of these, 19.3 % had already tried more than one class of psychotropic medications before the formal ASD diagnosis was given. Twenty-nine percent tried stimulants and 16% of participants had tried atypical antipsychotics.

Conclusions: Preliminary results suggest that a large subgroup of individuals with ASD seek treatment before receiving a comprehensive ASD evaluation and diagnosis, and often this treatment is in the form of psychotropic medications. In the current sample, stimulants and atypical antipsychotics were the most common medications used in individuals with ASD prior to evaluation. Further investigation of this phenomenon in a larger sample based on racial disparities, severity of ASD, and its implications to ASD treatments in general is suggested. Review of clinical files is ongoing, and it is anticipated that this dataset will include 100 individuals by May 2012. Further, we anticipate including individuals who were evaluated but did not receive ASD diagnosis as a comparison group to explore possible differences in these groups regarding types or prevalence of medication use. The insights gained from these investigations will extend the understanding of treatment of ASD leading to recommendations concerning medical management of ASD in certain populations.

161.184 184 Pronounced Lateral Glances in Children with ASDs and Parents Perception of Social Abilities in Daily

Life. M. Foscoliano*[1], R. Fadda[2], G. S. Doneddu[1], P. M. Peruzzi[1], F. Casano[1] and G. Frigo[1], (1)*AOB*, (2)*University of Cagliari*

Background: Due to the growing interest in lateral glances as possible distinctive signs of ASDs (Mottron et al., 2007), in a previous study (Doneddu, Foscoliano, Frigo, Peruzzi, Casano, Congiu & Fadda, 2011) we explored the relationship between the frequency of lateral glances (LG), defined as the tendency of some individuals with Autism Spectrum Disorders (ASDs) to look at the objects out of the corner of the eyes (Filipek et al.,1999), with symptoms severity and cognitive abilities. The results showed that LG were an index of symptoms severity, since children with ASDs with higher frequencies of LG were higher in ADOS total scores. However, to what extent pronounced LG really marks a specific autistic phenotype was not addressed, since all the children considered in the previous study were selected because they showed LG to some extent.

Objectives: The aim of this study was to extend our previous findings, comparing the characteristics of children with ASD who show LG to a group of children with ASD who don't show LG. In particular, we explored the severity of impairments in social and play abilities, the presence of stereotyped behaviour, the level of adaptive and cognitive functioning.

Methods: We compared three groups of children with ASD's: one group of 10 (9 males, aged between 29 and 58 months, mean chronological age=43; sd=7.688) characterized by high frequency lateral glances (HLG), a second group of 11 (9 males, aged between 41 and 67 months, mean chronological age=48; sd=8.522) characterized by low frequency lateral glances (LLG) and a third group of 17 (14 males, aged between 24 and 64 months, mean chronological age=41; sd=11.252) with no lateral glances (noLG). All children were videotaped during twenty minutes of free play. The lateral glances (LG), defined as lateral movements of the eyes pupils in the corner of the eyes, were quantified by means of a coding system specifically constructed by the authors. Than we compared the three groups for symptoms severity, assessed with the ADOS, non-verbal IQ, measured with the Leiter-R scale or Bayley Scales III, and adaptive behaviours measured with Vineland Adaptive Behavior Scales, between the two groups.

Results: The results showed significantly lower scores in adaptive behaviours as measured by Vineland Total Scale (F 2;31 = 3.904; p=0.031) and in Vineland Socialization (F 2;31 = 5.618; p=0.008) and in ADOS play (F 2;34 =3,631; p=0,038), but not in the other dimensions. These results indicated that children with HLG are perceived by their parents as less social in everyday life and less competence in adaptive behaviours.

Conclusions: As in our previous study (Doneddu et al., 2011), an high frequence of lateral glances seems not to be neither a sign of mental retardation nor a cue of stereotypic behavior classically coded in ASDs. However, parents find these children less competent both in social and in adaptive abilities in daily life. More studies are necessary to develop practical tools that might incorporate lateral glances in screening protocols to be used by paediatricians and parents.

161.185 185 Coding Joint Engagement Live in School-Based Research: Reliability and Psychometric Considerations. J. R. Dykstra*, B. Boyd, L. R. Watson, C. McCarty, G. T. Baranek and E. Crais, *University of North Carolina at Chapel Hill*

Background: Active engagement has been noted to be a critical component of many interventions for children with autism (NRC, 2001). Therefore, it is important to have tools to measure engagement in a variety of intervention environments. Previous engagement tools used with children with disabilities have focused on on-task behavior or academic engagement (McWilliam et al., 1985; Kishida et al., 2008) or used video coding of joint engagement (Adamson et al., 2009; Kasari et al., 2010). The Advancing Social-communication and Play (ASAP) study needed a tool to measure joint engagement, but methodological restraints required in-vivo coding in school settings. Live coding of behavior requires careful training and monitoring of coders to attain and maintain acceptable reliability. Further, there are multiple ways to estimate reliability for observational measurement of behavior including point-by-point agreement and intraclass correlations (Yoder & Symons, 2010).

Objectives: To describe the joint engagement coding scheme we adapted for live classroom coding, to examine and discuss the process of measuring and attaining reliability, and to examine the psychometric characteristics of the coding system.

Methods: The joint engagement video coding manual (Adamson et al., 1998) was adapted for live, school-based coding of six engagement states: unengaged, onlooking, object only, person only, supported joint engagement, and coordinated joint engagement. In addition, the coding system was adapted to include 2 qualitative ratings, codes for each activity, and recording the numbers of adults and peers present. Coders were trained in the joint engagement coding and practiced coding using a combination of live and video coding. The research team used both percent point-by-point agreement and total proportions for engagement categories to monitor reliability.Once trained, coders conducted three 5-minute observations of joint engagement for 24 preschool students with autism during typical classroom activities. The reliability coder collected data on sixteen (22%) of the 5-minute segments. Data from additional participants in elementary classrooms will be collected in the coming months.

Results: Participants exhibited a range of joint engagement levels, with coordinated joint engagement ranging from 0 to .74. Overall percent agreement for point-by-point agreement ranged from .49 to .98 with a mean of .77. With a 3-second radius window for error, corrected percent agreement ranged from .50 to .99 with a mean of .83. Kappa values, however, ranged from .07 to .80, with a mean of .53. The correlation between corrected percent agreement and kappa estimates was .741 (p=.001). Intraclass correlation coefficients (ICCs) were calculated between primary and reliability coders for the proportion of time spent in each engagement category. The ICCs ranged from .33 to .98, with an average of .83. Psychometric characteristics will be analyzed to examine patterns across participants and activities.

Conclusions: The joint engagement coding produced a wide range of scores for the participants, and was feasible to reliably measure engagement in classroom settings. However, there are challenges in determining what metrics to use to assess reliability, and whether different metrics should be used for training versus actual coding.

161.186 186 Motor Behaviors and Associations with Later Consonant Inventory in Nonverbal Children with ASD.

E. Patten*[1], L. R. Watson[2] and P. J. Yoder[3], (1)*UNC Greensboro*, (2)*University of North Carolina at Chapel Hill*, (3)*Vanderbilt University*

Background: Motor impairments are often present in individuals with ASDs and can appear early, even before core features are identifiable (e.g., Bryson et al., 2007, Minshew et al., 2004). Further, some specific motor impairments are related to core features. Regarding communication, poorer imitation skills are negatively associated with severity of more severely impaired social and communicative skills (Dawson & Adams, 1984; Zachor et al., 2010) and oromotor skills are concurrently and longitudinally associated with speech intelligibility (Gernsbacher et al., 2008).

In typical children and children with developmental delay, consonant production during prelinguistic development predicts later developing oral communication (e.g., Stoel-Gammon, 1989; McCathren et al., 1999). At nine months, consonant inventory differentiates infants who are at high-risk and low-risk for developing ASD (Paul et al., 2011). Although many children with ASDs develop oral communication, roughly 30% remain nonverbal into their school years (Lord et al., 2006), and failure to develop oral communication drastically impacts nearly all aspects of life.

Objectives: 1. To determine associations between (a) manual motor imitation, (b) basic oromotor skills (i.e., eating), and (c) oromotor imitation. 2. To determine the extent to which early motor variables predict later consonant inventory in young nonverbal children with ASD.

Methods: This study is part of a larger research project aimed at determining factors that influence the development of useful language in children with ASDs. Participants have a diagnosis of an ASD and are assessed five times at four-month intervals. All children are nonverbal at Time 1 (T1) as determined by the production of five or fewer words during all T1 assessments combined. Available T1 and Time 3 (T3) motor and consonant inventory data were used for this study. T1 *N*=50,

CA: *M*=35.9, *SD*=7.8. Time 3 (T3) *N*=32, *CA*: *M*=44.7, *SD*=7.5. Motor variables at T1 & T3 were: (a) Motor Imitation Scale (MIS), assessing manual motor skills (Stone et al., 1997), (b) oromotor imitation, and (c) eating. Consonant inventory scores were drawn from the Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002).

Results: (1) Associations between motor behaviors: significant associations were present between basic oromotor skills and oromotor imitation, and between oromotor imitation and manual motor imitation. (2) Associations between early motor behaviors and later consonant inventory: linear regression analysis revealed that oromotor imitation was a highly significant predictor of consonant inventory eight months later (β= .53, *p*=.006). Manual motor imitation approached significance (*p*=.051) and eating was not significant in predicting consonant inventory.

Conclusions: Both manual motor imitation and eating skills are associated with oromotor imitation but only oromotor imitation significantly predicts later consonant inventory. Therefore, oral motor imitation is potentially a more important skill to address in early language interventions. Oromotor imitation may be tapping basic motor skills, praxis and perhaps attention and sensory responsiveness, but further research is needed to understand the extent to which each factor is present.

161.187 187 Empathic Behavior in Children and Adolescents with High-Functioning ASD. A. M. Scheeren*[1], P. C. Mundy[2], H. M. Koot[1], L. Mous[1] and S. Begeer[1], (1)*VU University*, (2)*UC Davis*

Background:

Autism has been described as an empathy disorder. A lack of empathy is emphasized in diagnostic guidelines and clinical observations of autism spectrum disorder (ASD). Yet, surprisingly few studies have directly looked at the empathic behavior of children with ASD during real life interactions. The few studies that did, suggest a reduced attention to and concern for others' emotions in children with ASD compared to controls (e.g. Sigman, Kasari, Kwon, & Yirmiya, 1992). It is unclear whether these findings can be generalized to the behavior of school-aged children and adolescents with ASD but normal intelligence (high-functioning ASD; HFASD).

Objectives:

This is the first large-scale study to systematically and directly examine the empathic behavior of children and adolescents with HFASD and typically developing (TD) peers.

Methods:

We compared the empathic behavior of 203 school-aged children and adolescents with HFASD and 65 TD peers (6-18 years) using: (1) direct observations of participants' responses to affective states (happiness, sadness, and pain) displayed by an adult interviewer, and (2) parent reports of their child's anticipated responses in comparable situations. All responses were coded by independent coders into five response categories (kappa's ranging from .68 to 1.00). An empathic response was defined as a relevant verbal response including an empathic reference to the other's emotional state (e.g., 'Are you all right?').

Results:

A k-means cluster analysis on the five response categories was performed to create different clusters of participants with homogeneous response patterns, including a cluster of participants that responded mostly empathically. Independent of group status, significantly more participants of 13 years or older (36%) were assigned to the empathic cluster based on their directly observed behavior compared to participants younger than 13 years (16%) ($\chi^2(3) = 11.40$, $p = .01$). Surprisingly, an equal proportion of participants from the HFASD and TD group (29% in HFASD vs. 26% in TD) were assigned to the empathic cluster based on their responses to the interviewer's affective states ($\chi^2(3) = 1.92$, $p > .10$). When based on parent reports, significantly fewer children with HFASD were classified in the empathic response cluster (35%) than children with a typical development (67%) ($\chi^2(3) = 18.56$, $p < .001$).

Conclusions:

The findings suggest empathic behavior continues to develop throughout adolescence, both in typically developing children and children with HFASD. Importantly, children and adolescents with HFASD appear equally (in)capable as typically developing peers to respond empathically during a standardized observation, but are less likely to give empathic responses according to parents. Hence, a child's (lack of) empathic behavior during a social interaction with an unknown adult does not indicate or refute an ASD diagnosis. However, a marked absence of empathic responses as observed by parents appears to point to an atypical, and possibly autistic, development.

161.188 188 Sibling Relationships and Social Skills in Adolescents with and without ASD. B. Caplan*[1], C. Neece[2] and B. Baker[1], (1)*University of California, Los Angeles*, (2)*Loma Linda University*

Background: Social difficulties have been suggested to be a key area of impairment for children with autism spectrum disorders (ASD) due to their association with both affective and cognitive deficits (Fein et. al. 1986). Research on the influence of the sibling relationship on social skills has generally focused on children with typical development (TD); for example, older siblings who display warmth may promote more prosocial behavior in younger siblings (Garcia et. al., 2000). The little research that been done on sibling relationships in families of children with ASD has mainly focused on outcomes for the typically developing sibling (Zomick, 2010). Since siblings can provide a medium for social practice, it may be especially important to look at these sibling relationships in terms of outcomes for ASD individuals.

Objectives: The aim of the present study is to investigate differences in the sibling relationship for adolescents with and without ASD and to examine the relationship between sibling warmth and social skills in adolescents with and without ASD.

Methods: Participants were 13 year-olds sampled from a study of adolescent development. Information on sibling relationships was collected from family members of adolescents with TD (parents: *n*=72; siblings: *n*=33) and ASD (parents: *n*=14; siblings: *n*=17) using the Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985). Adolescents' social skills were measured using mother report on the Social Skills Rating Form (SSRS; Greshman & Elliot; 1990).

Results: Adolescents with ASD demonstrated poorer social skills (*M*=84.7) than adolescents with TD (*M*=103.7; *t*=3.65, *p*=.00), while no significant differences in sibling warmth were reported by either siblings or mothers. According to mother report, sibling warmth correlated with social skills in adolescents with TD (*r*=.26, *p*=.03) but not in adolescents with ASD. Sibling reports of warmth did not correlate with social skills in adolescents with TD, but correlated negatively at a trend level in adolescents with ASD (*r*=-.47, *p*=.060).

Conclusions: Despite receiving lower ratings of social skills, adolescents with ASD tend to have comparable ratings of sibling warmth as compared to adolescents with TD. This could be due to positive rater biases in families of adolescents with ASD, or due to the possibility that the social skills utilized for peer interactions may not be as necessary for maintaining a warm sibling relationship. While sibling warmth positively correlated with social skills in adolescents with TD (according to mother report), the opposite was found for adolescents with ASD (according to sibling report). This may mean that for adolescents with ASD, warm social interactions with siblings do not provide social practice that can generalize to peer relationships. It is also possible that the social avoidance or rejection that results from poor social skills may lead the individuals with ASD to rely on their sibling for positive social interactions, which may promote opportunities to display warmth.

161.189 189 Does Social Shyness Predict Autism in High Risk Preschoolers with FXS? A Longitudinal Examination of Behavioral and Biomarkers of Autism. M. Mounts*[1], B. Tonnsen[1], K. Rizzo[1], A. Ingram[1], D. Hatton[2] and J. E. Roberts[1], (1)*University of South Carolina*, (2)*Vanderbilt University*

Background: Approximately 40-60% of children with fragile X syndrome (FXS) also meet DSM IV criteria for an autism spectrum disorder (ASD), and up to 90% display autistic symptoms. Distinguishing the precursors, emergence, and presentation of autism in children with comorbid FXS and autism ("FXS+ASD") may inform the neuobiological and behavioral underpinnings of autism in FXS and other clinical

and non-clinical samples. Although social symptoms are among the most striking features of both FXS and ASD, no studies have prospectively examined behavioral and biomarkers of social approach to predict autism in FXS. Observational and physiological data have suggested atypical patterns of social response in children with FXS+ASD, warranting further examination of whether subtle behavioral and biomarkers of autism can be detected in infants and young children using laboratory-based paradigms.

Objectives: The present study prospectively examined the relationship between autism outcomes and both behavioral and physiological indicators of social shyness during a laboratory paradigm in young children with FXS and TD controls.

Methods: Participants include 51 males with FXS and 33 typically developing (TD) controls, each observed between 2-4 times between ages 10 and 76 months (totaling 189 assessments). We used the stranger approach episode of the Laboratory Temperament Assessment Battery (Lab-TAB) to elicit behavioral and physiological markers of social shyness and anxiety. Outcomes included the Childhood Autism Rating Scale (CARS) and Child Behavior Checklist (CBCL) withdrawn and DSM-Anxiety subscales. We used multilevel modeling to examine the effects of genetic status, autism outcomes, and anxiety outcomes on mean levels and change in facial fear, distress vocalizations and escape behaviors. We also examined partial correlations among CARS scores and physiological data (vagal tone – VT; interbeat interval – IBI; cortisol) from a subset of our sample (n=32, 53 assessments).

Results: Behavioral variables were screened for normality, transformed as needed, and standardized. The first set of MLM analyses included all FXS and TD participants (n=84, 189 observations). The FXS group demonstrated a curvilinear pattern of escape behaviors, with increased intensity at younger ages and decreased intensity at older ages; as well as less decreased distress vocalizations over time. Within the FXS group, lower escape behaviors predicted more severe autistic outcomes, and more intense distress vocalizations predicted increased withdrawal and anxiety outcomes. Lower VT correlated with more severe autistic outcomes in the FXS group. This relationship was not present in the TD group; instead, lower VT correlated with higher escape behaviors during several phases.

Conclusions: Our results are consistent with findings that social interactions differentiate children with FXS+ASD and FXS-only (Kaufmann et al., 2004). Consistent with similar studies using parent report, several approach behaviors predicted anxiety outcomes. However, autism outcomes were also related to several predictors, including lower escape behaviors and vagal tone during the approach paradigm. These results suggest that children with FXS who later demonstrate severe autistic outcomes may be distinguished by early biobehavioral patterns of social approach. These findings may inform early detection of autism in high risk samples and differential diagnosis of autism and anxiety symptoms in children with neurodevelopmental disorders.

161.190 190 The Influence of Social Communicative Abilities on Language Development in Children At Risk for Autism Spectrum Disorder: A Prospective Longitudinal Study. M. Dereu*, H. Roeyers, P. Warreyn and R. Raymaekers, *Ghent University*

Background: Delayed language development is commonly found in young children with autism spectrum disorders (ASDs). The slower acquisition of spoken words is often what first prompts parents to consult a primary health care professional. Concerns about the language development of their child are amongst the most frequently reported parental concerns during the first years of life. Next to its role in the recognition of ASD, early language ability is also related to long-term outcomes for children with ASD. With the recent emphasis on early intervention for young children with ASD to optimize their outcome, language development can be the subject of these intervention programs. In addition, a better understanding of factors that underlie, facilitate, and predict language acquisition in ASD would allow for the refinement of targeted early interventions. Preverbal social communicative skills that have been associated with language development in both typically developing children and in children with ASD are: imitation, joint attention, and pretend play.

Objectives: The current study investigated the influence of preverbal social communicative abilities on language

development between 2 and 4 years in 39 children at risk for ASD, recruited from a screening study in day-care centres.

Methods: Of the 39 children in this study, 13 children were diagnosed with ASD. The remaining 26 children screened false positive for ASD. Data were collected at three time points, when children were on average 27, 37, and 49 months old. Language development was assessed at each time point with the Receptive Language and Expressive Language subscales of the Mullen Scales of Early Learning (Mullen, 1995). Social communicative abilities were once assessed, at the intermediate time point. Imitation was examined using the Preschool Imitation Praxis Scale (PIPS; Vanvuchelen, 2009), joint attention skills were measured with the Early Social Communication Scales (ESCS; Mundy et al., 2003), and pretend play was assessed using the Test of Pretend Play (ToPP; Lewis & Boucher, 1997).

Results: Conditional latent growth curve modeling showed that children with ASD had a smaller growth rate for their receptive language development between the ages of 2 and 4 compared to non-ASD cases. Children with ASD also had a marginally significantly lower age equivalent for expressive language at age 2. Whereas pretend play was most closely related to concurrent measures of receptive language ability, the individual differences in growth rates for both receptive and expressive language were most strongly associated with procedural imitation and the ratio score of higher level behaviours to total amount of initiations of joint attention.

Conclusions: Within an at-risk group, children with ASD were significantly different from non-ASD children in their growth rate for receptive language between the ages of 2 and 4. Since especially imitation and joint attention skills were related to growth rates of language development, enhancing these skills might be an important element of early intervention programs to promote communicative competence in young children at risk for ASD, whether or not they receive a diagnosis of ASD later on.

161.191 191 Accounting for Social Skills Deficits in Adolescents with ASD, Intellectual Disability, and Typical Development. R. W. Ellingsen*[1], J. Blacher[2] and E. Laugeson[3], (1)*University of California, Los Angeles*, (2)*University of California*, (3)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background: Poor social skills in adolescence may lead to a range of problems including delinquency, poor academic performance, and mental health problems. While social deficits are known to be significantly impairing for adolescents with Autism Spectrum Disorders (ASD) and Intellectual Disabilities (ID), no known research has yet to compare differences in social functioning among these groups and adolescents with typical development (TD).

Objectives: The first objective of this study is to compare the social skills of early adolescents with ASD, ID, and TD. The second objective of this study is to compare predictors of social skills across symptom groups. Possible predictors include inattention, externalizing behavior, and anxiety.

Methods: Parent ratings of social behavior from the Social Skills Rating System (Gresham & Elliott, 1990) were compared across symptom groups for adolescents with ASD (n=46), ID (n=41) and TD (n=90). Data were analyzed from UCLA's Collaborative Family Study, a longitudinal study of children with and without intellectual disability and their families, and the UCLA PEERS Program, an evidence-based social skills intervention for adolescents. Predictors of social functioning (anxiety, externalizing behavior, and inattention) were also examined.

Results: Data were analyzed by one-way ANOVAs. Results demonstrate several significant differences between groups in overall social functioning on the SSRS and its subscales. In general, adolescents with ID and TD tend to score higher on social functioning than adolescents with ASD. Adolescents with TD had higher overall social functioning and higher levels of assertion, responsibility, and self-control as compared to adolescents with ASD and ID (p<.001). In the area of problem behaviors, however, both adolescents with ID and TD were reported to have significantly fewer problems than adolescents with ASD (p<.001). The subscales of cooperation, internalizing, and externalizing also showed a trend for higher functioning among adolescents with ID and TD as compared to adolescents with ASD. Analyses of the predictor variables suggest significant differences between the groups in

inattention, externalizing behavior and anxiety (p<.01). Higher inattention, externalizing behavior, and anxiety predict lower social functioning across symptom groups. However, anxiety does not predict social functioning over and above diagnosis. Externalizing behavior and inattention continue to predict social functioning over and above diagnosis (p<.05).

Conclusions: Results suggest that adolescents with TD exhibit better social functioning overall than adolescents with ASD and ID. However, when behavior problems are considered, the TD and ID groups are functioning better than adolescents with ASD. This suggests a possible behavioral regulation deficit in adolescents with ASD that may have a lesser effect for adolescents with ID. Further commonalities and differences across disabilities will be discussed. Recommendations for how these findings might inform future interventions will be highlighted.

161.192 192 Parental Concerns: Consistency Across Question Format and Relationship to Child Performance. B. Brooks, K. Casagrande* and D. L. Robins, *Georgia State University*

Background:

Parental concerns are important to consider when screening children for developmental delays. Studies show that regardless of differences in socioeconomic status and education, parents of children who are diagnosed with a developmental delay expressed early concerns about their child's development. Understanding differences in parents' responses, as well as the accuracy of their concerns compared to the child's performance can enhance the effectiveness of early screening and evaluation procedures.

Objectives:

Parental concerns may vary across questionnaires, depending on the way in which concerns are elicited, e.g., domain-specific questions or broad questions about overall concerns. It is predicted that parents will endorse concerns in more domains of development when asked directly than when asked broadly. It is also predicted that the nature of parental concerns will not accurately predict their child's performance or diagnosis.

Methods :

Participants completed a diagnostic evaluation after screening positive on the Modified Checklist for Autism in Toddlers (M-CHAT; n=63). Parents also completed the Parents' Evaluation of Developmental Status (PEDS) questionnaire at a routine 18- or 24-month check up and a history questionnaire (Hx) before their evaluation. After the evaluation, 32 children were diagnosed with ASD, 28 children were diagnosed with another developmental delay or clinical concern, and 3 children were typically developing. Typically developing children were excluded from analyses.

The PEDS consists of 10 items that ask about concerns in specific domains including: global/cognitive, expressive (EL) and receptive language (RL), fine (FM) and gross motor (GM), behavioral, social-emotional (SE), self-help, school, and other. Parents also reported concerns about their child's development on two broad questions on the Hx. Answers from PEDS and Hx were coded according to whether a parent expressed concerns in each domain. Children's skills were assessed using direct testing (Mullen Scales of Early Learning; Autism Diagnostic Observation Schedule).

Results:

Parents were significantly more likely to express concerns about their child's development when given the domain specific format (PEDS: M=4.32, SD=2.21) versus broad format (Hx: M=2.58, SD=1.29; $t(59)$=6.279, p <.001). Parents of children with ASD did not report more concerns than parents of children with non-ASD developmental delay (PEDS: $F(58)$=.232, p=.632; Hx: $F(58)$=.004, p=.949), but they were significantly less likely to report gross motor concerns ($\chi^2(1)$=7.037, p=.008). Parents were most likely to remain consistent in their concerns about expressive language (80%) and global development (86.7%) when compared to other domains (53.3-75%). Children whose parents endorsed concerns about their development in specific domains were not likely to perform lower on testing than children of parents without concerns (EL: $t(27)$=-.623, p=.538; RL: $t(52)$=.213, p=.828; FM: $t(58)$=1.059, p=.294; GM: $t(51)$=-1.808, p=.076; SE: $t(46)$=-1.18, p=.244).

Conclusions :

To obtain accurate report of parental concerns, domain-specific questions will elicit more responses. Parent report is an essential component to clinical evaluation; however, their concerns may not predict the child's actual performance on standardized testing. This may be related to parents' understanding of normative development.

161.193 193 Perceptions of Peer Rejection Among Adolescents with ASD: Comparing Adolescent, Parent, and Teacher Reports. A. R. Dillon*[1], S. Bates[2] and E. Laugeson[2], (1)*Pacific Graduate School of Psychology*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

Adolescents with Autism Spectrum Disorders (ASD) often lack the ability to perceive their social deficits accurately, and due to their poor social skills and limited understanding of social cues, it is difficult to discern whether adolescents with ASD recognize peer rejection when it is directed toward them. Consequently, there is often a discrepancy between how teens with ASD perceive their peer relationships and experiences of peer rejection and how others perceive them (Kasari & Rotheram-Fuller, 2007). According to the National Center for Educational Statistics, 28% of adolescents reported being the victims of bullying within a six-month period. This number nearly doubles for adolescents with special needs. Houndoumadi and Pateraki (2001) found that parents of victims may be more aware of bullying rates as victim participants noted that they told their parents about these incidents 42.4% more frequently than their teachers. While much of the current research examines perceptions of peer rejection amongst peers, teachers and self, studies rarely include parent perceptions of adolescent peer rejection.

Objectives:

This study seeks to examine the relationship between adolescent self-perception of peer rejection among teens with ASD in comparison to parent and teacher perceptions. Correlations between adolescent, parent and teacher perceptions of peer rejection on two standardized measures were investigated.

Methods:

79 adolescents with ASD ranging from 11-18 years of age (M = 13.79; SD = 1.69), 91 parents, and 27 teachers participated in the study. Participants completed the Social Skills Improvement Scale (SSIS; Gresham & Elliot, 2008) and the Olweus Bullying Questionnaire (OBQ; Olweus, 1996). Findings from the SSIS Bullying Subscale and a specific question from the OBQ that directly inquires about how many times the adolescent has been bullied were examined to assess perceptions of peer rejection.

Results:

Pearson correlations were conducted to determine whether correlations exist between adolescent self-perceived peer rejection, and parent and teacher perceptions of adolescents' peer rejection. Results were significantly correlated on the SSIS Bullying Subscale and OBQ bullying question for the adolescent and parent (r = .268; p < .05; r = .670; p < .01, respectively). Parent and teacher perceptions were also significantly correlated on the OBQ question that inquires how many times the participant had been bullied (r= .482; p <.05).

Conclusions:

Results reveal that adolescents with ASD and their parents are in agreement with how they perceive the adolescent's level of peer rejection on the SSIS and OBQ; however, parents and teachers were only in agreement on the degree to which the adolescents experienced peer rejection on the OBQ, but not the SSIS. Differences in parent and teacher perceptions of bullying may be due to teacher's reduced contact with students throughout the school day, as is typical in middle and high school. Thus, teachers may be less aware of bullying occurrences since these interactions may take place out of their sight. This study highlights the need for better communication between parents, teachers, and teens with regard to issues of bullying and peer rejection among adolescents with ASD.

161.194 194 Syntactic Comprehension in Boys with Autism Spectrum Disorders: Evidence From Specific Constructions. S. T. Kover*[1], E. Haebig[1], A. Oakes[2], A. McDuffie[3], R. J. Hagerman[4] and L. Abbeduto[3], (1)*University of Wisconsin-Madison*, (2)*University of California, Davis*, (3)*MIND Institute University of California Davis*, (4)*U.C. Davis MIND Institute*

Background: Previous research suggests that receptive language and syntactic ability might be particularly impaired in children with autism spectrum disorders (ASD; Eigsti et al. 2007, Ellis Weismer et al., 2010). However, most studies have relied on broad summary measures that fail to distinguish specific language forms, making it difficult to speculate about mechanisms of language learning that might be impaired.

Objectives: We examined comprehension of three specific syntactic constructions and analyzed the nature of the errors that occurred. Based on evidence that reversible forms might be uniquely challenging (Oakes et al., 2011), we assessed reversible locatives and reversible subject-verb-object (SVO), as well as simple sentences, the latter serving as a baseline. We distinguished between purely syntactic errors of the word order type and errors that included semantic components. Through a comparison of boys with ASD to typically developing boys, we sought to establish the extent of delay in comprehension of these constructions and the processing mechanisms that underlie that delay.

Methods: Boys with ASD (n = 45; ages 4 – 10 years) had ADOS severity scores that ranged from 4 to 10 (M = 7.89, SD = 1.64) and nonverbal Leiter-R (Roid & Miller, 1997) Brief IQ scores from 40 to 117 (M = 77.62, SD = 19.51). Typically developing boys (n = 57, ages 2 – 5 years) did not differ on Peabody Picture Vocabulary Test-4 (Dunn & Dunn, 2007) growth scores from the boys with ASD, $t(100) = .48$, $p = .634$. Boys with ASD had higher Leiter-R growth scores, $t(100) = 3.98$, $p < .001$, which were statistically controlled in all analyses. Comprehension was assessed with the Test for Reception of Grammar-2 (Bishop, 2003), in which each construction is tested with four items.

Results: For each of the three constructions of interest, we examined group, receptive vocabulary, and nonverbal cognition as predictors of comprehension (i.e., items correct). For simple sentences, the effect of group was not significant. For locatives and SVO, boys with ASD scored lower than typically developing boys, ps < .049, one-tailed. Receptive vocabulary was a positive predictor in each regression and nonverbal cognition predicted simple and locative sentence comprehension. For locative and SVO sentences, boys with ASD committed more semantic errors, $F(1, 98) = 4.91$, $p = .029$, but not more word order errors, $F(1,98) = .78$, $p = .379$, than the typically developing boys, controlling for receptive vocabulary and nonverbal cognition.

Conclusions: Boys with ASD demonstrated specific weaknesses in comprehension of reversible constructions, including locatives and SVO, after controlling for receptive vocabulary and nonverbal cognition. These results are in line with previous research that suggests that children with ASD might employ immature strategies for comprehension of syntactically demanding constructions (Tager-Flusberg, 1981). The failure to capitalize on semantic information to support syntactic comprehension, resulting in high rates of semantic errors that were avoided by typically developing children, suggests that semantic impairments contribute to syntactic processing difficulties, a conclusion also supported by the regression analyses.

161.195 195 The Relationship Between Motor and Language Abilities in Autism Spectrum Disorders. A. N. Harris*[1], M. K. McCalla[2], S. E. O'Kelley[3] and K. Guest[2], (1)*The University of Alabama at Birmingham*, (2)*University of Alabama at Birmingham*, (3)*UAB Civitan-Sparks Clinics*

Background:

A core diagnostic criterion of Autism Spectrum Disorders (ASD), and the first symptom usually noticed by parents, is a deficit in or difficulty with language. Previous studies report mixed results on the possible relationship between motor and language issues within children with ASD. Specifically, Kim (2008) studied children with ASD and found no correlation between crawling and later language usage nor was babbling associated with gross or fine motor development. However, Luyster, Kadlec, Carter, and Tager-Flusberg (2008) found the use of gestures to be a significant predictor of receptive language. Also, the use of gestures and imitation significantly

predicted expressive language. This current study is an extension of a previous study, now utilizing a doubled sample size and additional variables of interest, including the children's age at language evaluation and cognitive scores.

Objectives:

To examine the receptive and expressive language profiles in children with and without ASD

To determine the relationship between language abilities and fine motor abilities in children with and without ASD

Methods:

Children are referred to an interdisciplinary tertiary clinic to be evaluated for ASD as well as other developmental disabilities. Children who received the PLS-3 or PLS-4 (a language abilities assessment instrument) and the PDMS-2 (a motor abilities assessment instrument) were included in the analyses. There were $N = 43$ children in the ASD group and $N = 42$ children in the non-ASD group.

Results:

Preliminary analyses suggest that expressive language ($M = 61.07$) surpasses receptive language ($M = 57.26$) in children with ASD, $t(41) = 2.55$, $p < .05$. This was not true for the non-ASD group (p = ns). Furthermore, fine motor abilities were predictive of expressive language in ASD, $F(4, 27) = 4.61$, $p < .01$, $\beta = .46$ and of receptive language in ASD, $F(4, 28) = 3.05$, $p < .05$, $\beta = .49$. Again, this predictive relationship was not present in the non-ASD group (both p's = ns). Also, there was no significant difference between the ASD group and the non-ASD group concerning age at language evaluation, gender, ethnicity, or cognitive scores (all p's = ns).

Conclusions:

These results have potential to greatly impact the identification and treatment of children with ASD. This language and motor profile seems to be unique to children with ASD and is not seen in our comparison group. It should be noted that our comparison group was comprised entirely of children who were suspected of ASD (but ultimately did not meet diagnostic criteria), and many of which were ultimately diagnosed with another developmental disorders. However, even these children did not display this language profile. Furthermore, fine motor skills were only predictive of receptive language and of expressive language in our ASD group. Thus, the relationship between motor and language abilities also seems to be unique to ASD. If this result is replicated, then future research regarding treatment considerations follow. Specifically, it should be examined whether fine motor interventions can lead to improvements in language abilities in children with ASD.

161.196 196 Differences in Object Sharing and Locomotor Skills Between Infants At Risk for Autism and Typically Developing Infants in the First 15 Months of Life. E. Cha*, S. Srinivasan, M. Kaur and A. Bhat, *University of Connecticut*

Background:

Older infants engage in triadic joint attention episodes to share their object play with caregivers (Bakeman & Adamson, 1984). During object sharing episodes infants move in different ways to express their intent to share by turning heads to look at caregivers, pointing to or showing objects, reaching out to or vocalizing to caregivers, or a combination of these behaviors. These socially-oriented actions are encompassed by the term, "initiation of joint attention" and lay a foundation for future social, communication, and cognitive development. Recent evidence suggests that advancements in locomotor skills could facilitate a child's object sharing or joint attention bids (Karasik et al., 2011). Children with Autism Spectrum Disorders (ASDs).show impairments in both initiating and responding to joint attention bids by the second year of life. However, early socially-oriented motor behaviors may also be reduced in young infants at risk for ASDs (i.e.; infant siblings of children with ASDs or AU sibs).

Objectives:

In the present study, we will compare object sharing behaviors between AU sibs and typically developing (TD) infants. In addition, we will assess the influence caregiver interactions on the object sharing skills of both groups of infants.

Methods:

12 AU sibs and 12 TD infants were observed during an object sharing task at 9, 12, and 15 months with developmental follow-up and autism screening at 18 and 24 months. During each visit we collected video data for 14 minutes wherein infants were seated near multiple small toys. In the spontaneous condition (7 minutes), the caregivers were asked to be quiet and wait for the child to initiate a social interaction. In this condition, the caregiver did not ask the child for toys. In the social condition (7 minutes), the caregiver initiated a clean-up activity wherein she showed the bag and said, "Let's put the toys away". She would point to each object and ask for the toy. Dependent variables included rates of object sharing bids including looks, reaches, and/or vocalizations as well as stationary or moving bids. In addition, we grouped infants by locomotor status (novice or experienced crawlers or walkers).

Results:

Based on our preliminary data, rates of object sharing bids in the social context were greater than the spontaneous context and may interact with a child's motor skill level for both groups. Specifically, children with advanced locomotor skills will show greater rates and variety of object sharing behaviors. AU sibs with poor social outcomes had lower rates of object sharing bids, specifically in the spontaneous condition, as compared to infants without poor social outcomes.

Conclusions:

Our results suggest that socially-oriented motor behaviors such as object sharing may provide an early marker for future risk of ASDs within the first year of life. Moreover, early fine motor and gross motor delays may contribute to the social, nonverbal communication delays found in infants at risk for ASDs. Therefore, it would be important to diagnose and treat these early delays in infants at high-risk for ASDs such as infant siblings of children with ASDs.

161.197 197 Usability & Likability of the Virtual Environment for Social Information Processing (VESIP TM) for Children with and without Autism Spectrum Disorders. N. M. Russo-Ponsaran*[1], C. McKown[1], J. Johnson[1], A. Allen[1] and K. Knudsen[2], (1)*Rush University Medical Center*, (2)*Soar Technology, Inc.*

Background:

There is a well-articulated theoretical model for understanding social information processing (SIP; Crick & Dodge 1994, 1996). Most SIP assessments are vignette-based interviews that require significant training to administer and score. It is unclear how well interviews *about* social problems approximate the experience of *being in the midst* of a social problem. To advance science and practice, we are developing the Virtual Environment for Social Information Processing (VESIP™), a computerized simulation in which children adopt the role of an avatar and use a game controller to navigate challenging social situations and engage in real-time social decision-making.

Objectives:

First, we tested the usability and feasibility of our prototype in typically-developing (TD) children and children with autism spectrum disorders (ASD). Our second objective was to show initial evidence that the VESIP™ is sensitive to diagnostic differences. Our overarching goal is to create a user-friendly, scientifically sound, and automated system for SIP skill assessment.

Methods:

20 children (10=ASD, 10=TD; ages 8-14 years) participated. ASD diagnoses were confirmed through parent interview and administration of the ADOS.

During the VESIP™, the child assumed the role of a character and navigated the social situation in an animated scene using a game controller. The prototype ambiguous provocation situation involved a child being bumped by another child. Using the controller, children selected (1) an emotional response, (2) actions to engage at first insult versus after thinking about it, (3) how well one is able to carrying out solutions, and (4) intent of the provocateur. As selections were made, avatars acted accordingly. Afterwards, children rated the usability and likability of the VESIP™, reported general impressions (e.g., likes and dislikes), and described the tool in their own words (demonstrating task comprehension). Children also completed some interview questions that paralleled key decision points in VESIP™.

Results:

On a scale of 1-5 (1=very easy, 5=very hard), children with and without ASD rated the the instructions as being very easy to understand (ASD mean=1.2, TD mean=1.7) and the tool as being very easy to use (ASD mean=1.3, TD mean=1.5). Again on a scale of 1-5 (1=very fun, 5=no fun), children rated the tool as being moderately enjoyable (both groups, mean=3). Eighty-seven percent of responses on the computerized assessment matched responses to the same interview questions. Group differences were most evident in the following ways: (1) 50% of TD children chose pro-social and competent goals, compared to no children with ASD, (2) children with ASD were less likely to elect to have an adult intervene; and (3) children with ASD tended to report less confidence in their ability to carry out a solution to the problem.

Conclusions:

This pilot study data supports the usability and likeability of the VESIP™ and its sensitivity to diagnostic differences. We are further developing the tool by incorporating child feedback and adding other challenging social situations. We expect this tool to (1) allow for more efficient SIP assessment, (2) have greater ecological validity over other tools, and (3) identify specific SIP steps for remediation with targeted interventions.

161.198 198 Autism Symptom Severity As Moderator of IQ and Language Development Among Children with Delayed Phrase Speech and Autism Spectrum Disorder. P. Mathy*[1], E. L. Wodka[2] and L. Kalb[2], (1)*Kennedy Kreiger Institute*, (2)*Kennedy Krieger Institute*

Background: Understanding barriers to language development continues to be a research focus in children with ASD. Prospective longitudinal studies have found non-verbal cognitive ability at age 2, early joint attention, autism symptom severity, and vocal/motor imitation skills to be significant predictors of language outcomes in children with ASD up to age 9. Further research is needed to better understand the relationship between these and other variables on the emergence of functional communication in children with severe language delays.

Objectives: To examine: a) the rate at which children acquire phrase speech at or after age 4; b) differences between those children who do and do not gain language despite initial delay; and c) if the relationship between IQ and delayed language development is moderated by autism symptom severity.

Methods: Data came from the Autism Treatment Network (ATN) registry, a multi-site collaboration among 17 autism centers in the US and Canada. All children have a diagnosis of ASD, confirmed by the Autism Diagnostic Schedule (ADOS) and DSM-IV-TR criteria. From this repository, a total of 183 children met the following criteria for this study: a) 8 years or older (M = 10.7 y, SD = 2.3 y) and b) absence of phrase speech by age 4 years. Bivariate analyses were performed to examine demographic, cognitive, adaptive, behavioral, psychiatric, and autism symptom differences between children who developed phrase speech at or after 4 years of age and those who did not. Multivariate logistic regression analyses were used to examine if autism symptom severity moderated the relationship between IQ and the likelihood of late onset language development.

Results: A total of 112 (61%) children developed phrase speech between 4 and 8 years, while 71 (39%) had not developed phrased speech by age 8 years or older. For those who went on to develop language, age at phrase speech onset ranged from 4 to 10 years (M = 4.7 y; SD=1.02 y). Bivariate analyses revealed that lower autism symptoms (ADOS) as well as higher nonverbal IQ and adaptive scores were associated with later language attainment (all $p < .001$). Mean-centered autism symptom severity and IQ scores, as well the interaction between the two, were significant in the multivariate logistic model (all $p < .05$).

Conclusions: Novel to the literature, this study found the relationship between nonverbal intelligence and the development of phrase speech, despite language delay prior to 4 years of age, is moderated by autism symptoms. This further supports the importance of evaluating and considering nonverbal skills in developing interventions and setting goals for language development; however, given the moderating relationship of autism-related behaviors, additional intervention goals targeting such interfering behaviors may provide additional benefit to language-driven intervention.

This research was conducted as part of the Autism Speaks ATN. Further support came from a cooperative agreement (UA3 MC 11054) from the U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Research Program, to the Massachusetts General Hospital. The views expressed in this publication do not necessarily reflect the views of Autism Speaks, Inc.

161.199 199 Parentsxperception of the First Symptoms of Autism Spectrum Disorder: A Retrospective Study. R. B. Zanon*, B. Backes, R. G. Endres, R. G. Gowert and C. A. Bosa, *Federal University of Rio Grande do Sul*

Background: The first symptoms of Autistic Spectrum Disorder (ASD) must appear before the child's third anniversary. Early abnormalities in social development are the best predictors of the ASD diagnosis. However, speech delay rather than social difficulties, seems to mobilize parents for seeking assistance. This fact ensures the importance of both research and dissemination of pre-linguistic markers of ASD.

Objectives: To investigate the type of first symptom that concerned caregivers of children with ASD and the child's age at the time.

Methods: A database of 150 preschool children diagnosed with ASD, who were treated at the Cincinnati Children's Medical Center in Ohio, between 2008 and 2009 was used. All children sampled were caucasian, with ASD diagnosis according to Autism Diagnostic Interview-Revised (ADI-R) and with complete date on investigated measures. The introductory part of ADI-R was used as instrument. The data were analyzed using descriptive statistics. Quantitative content analysis of parental reports was conducted to verify the nature of the first symptoms in the three areas impaired by ASD.

Results: Thirty two children met the inclusion criteria for participating in the study. The total average age when the parents noticed the first symptoms in development was 17.31 months. Almost half of the parents identified abnormalities in language development (44.73%, n=17) followed by social behavior (23.69%, n=9) and repetitive and stereotyped behavior (13.15%, n=5). When examining both the developmental area and the correspondent mean age, the results showed that social impairments were the first to be observed by the caregivers (mean age: 10.77 months), followed by stereotyped behaviors (mean age: 17.6 months) and the symptoms in language development (mean age: 17.94 months). Regarding the language development, speech delay was the most frequent symptom reported by parents (63%, n=12). Concerning the social area, problems in social interaction were identified by most parents (57%, n=8), including anxiety and/or avoidance of contact with other people, followed by problems in look/smile quality (29%, n=4). Finally, there was early concern about the repetitive quality of children´s play, such as object rotation and rigid classification (37%, n=2).

Conclusions: The results corroborate findings of other studies, highlighting the importance of social deficits in the ASD early identification. Only a few parents noticed impairments in the social area when the child was as young as nine months old, a period that represents a substantial advance in the sociocomunicative development due to the emergence of joint attention (JA). It is pointed out that gestures such as pointing, showing/giving tend to be subte in very young children and may be missed by most parents.

161.200 200 Differences in Emotional Self-Regulation within ASD, ADHD and Typically Developing Populations. A. T. Dovi*, E. Allain, C. M. Brewton and G. T. Schanding, *University of Houston*

Background: Deficits in emotional self-regulation (i.e., the ability to control one's emotions), is characterized by the inability to control physiological processes typically triggered by strong emotional experiences (Spencer et al., 2011). Previous research suggests that individuals with Autism Spectrum Disorders (ASD) often lack motor planning and flexibility skills whereas individuals with Attention Deficit/Hyperactivity Disorder (ADHD) suffer from inhibition impairment (Sinzig et al., 2008). While past research recognizes these specific deficits as potential emotional self-regulation difficulties, research comparing the potential differences in emotional self-regulation between ASD, ADHD, and typically developing populations is lacking. Furthermore, research indicates that child factors, such as age, gender, and

IQ influence the development of emotional self-regulation (Althoff et al., 2010). Therefore, the current study will aim to investigate the impact these factors may have on the emotional self-regulation of children across all three groups.

Objectives: The current study aims to investigate: (a) potential differences in emotional self-regulation between ASD, ADHD, and typically developing populations and (b) the possible influence that gender, IQ, and age may have on emotional self-regulation of children in all three populations.

Methods: Participants will include children with ASD and ADHD from the Simons Simplex Collection (SSC), which contains children ages 4 to 18 years old. Children with ASD have received clinical diagnoses through administrations of the *Autism Diagnostic Interview – Revised (*ADI-R; Rutter, et al,. 2009) and the *Autism Diagnostic Observation Schedule* (ADOS; Lord, et al., 2000). The SSC also includes data on typically developing siblings of the children with ASD. From the sibling population, a subset of children with ADHD diagnoses and a subset of siblings without ADHD, who are otherwise typically developing, will be pulled for analyses. Emotional self-regulation will be measured by the *Child Behavior Checklist* (CBCL; Achenbach, 1991) Post-Traumatic Stress Problems domain (PTSP; Althoff et al., 2010), Cognitive ability (i.e., verbal, non-verbal, and full-scale IQ) will be assessed through either the: (a) *Differential Ability Scales – Second Edition* (DAS-II; Elliott, 2007), (b) *Mullen Scales of Early Learning* (Mullen; 1995), (c) the *Wechsler Intelligence Scale for Children* (WISC-IV; Wechsler, 2003), or the (d) *Wechsler Abbreviated Scale of Intelligence* (WASI; Wechsler, 1999). Demographic information on all three groups will include age, gender, and race/ethnicity.

Results: An ANCOVA will be run to assess the differences in the emotional self-regulation of participants between the groups of youth with ASD, ADHD and those who are typically developing.

Conclusions: Findings from the current study may further knowledge regarding emotional self-regulation patterns across different populations. Such knowledge may contribute to the early identification of emotional self-regulation problems and may help determine the degree a child's need for intervention.

161.201 201 Predictors of Initial Language Level and Rates of Language Growth in Young Children with ASD. S. Ellis-Weismer*[1], C. E. Venker[2], H. Sindberg[1] and C. E. Ray-Subramanian[2], (1)*University of Wisconsin-Madison*, (2)*Waisman Center, University of Wisconsin-Madison*

Background:

There has been considerable interest in identifying predictors of language outcomes in young children with ASD (e.g., Bopp & Mirenda, 2011; Charman et al., 2003, 2005; Paul et al., 2008; Thurm et al., 2007). Prior investigations have typically involved relatively small samples or not included consideration of growth trajectories across time. Examination of a large, well-defined sample of young children at successive developmental levels is needed to provide a clearer understanding of predictors of language development over time in children with ASD. In addition to addressing this need, the current study is the first to investigate the role of calibrated ADOS severity scores as a potential predictor of language outcomes.

Objectives:

The goal of this study was to examine predictors of early language comprehension and expressive language abilities in toddlers with ASD and predictors of rates of language growth over time.

Methods:

One hundred twenty-one children with ASD participated in a longitudinal investigation of language development. Mean age at each assessment was approximately 2 ½ (Visit 1), 3 ½ (Visit 2), 4 ½ (Visit 3), and 5 ½ years (Visit 4). Autism spectrum diagnoses were determined using comprehensive evaluations including the ADI-R and ADOS/ADOS-T. Language abilities were measured by the Auditory Comprehension (AC) and Expressive Communication (EC) subscales of the Preschool Language Scale (PLS-4). Predictors included nonverbal cognition (Bayley-III), socialization (Vineland Adaptive Behavior Scales, VABS), maternal education as an index of SES, and calibrated ADOS severity scores (Gotham et al., 2009).

Results:

A random slope and intercept model using Hierarchical Linear Modeling was fit to PLS-AC and PLS-EC standard scores across 2 ½ -5 ½ years. When considered individually, cognition, socialization, and maternal education were each significant positive predictors and ADOS severity was a significant negative predictor of both intercept and slope. Entering all four significant predictors into the model at once revealed that the 2 ½ year PLS-AC score (intercept) was primarily predicted by nonverbal cognition ($p<.001$), whereas the 2 ½ year PLS-EC score was predicted by nonverbal cognition and socialization ($ps<.001$). ADOS severity at 2 ½ years was a significant negative predictor of change across the three-year time span (slope) for PLS-AC ($p=.004$) and PLS-EC ($p<.001$). Additionally, nonverbal cognition at 2 ½ years was a positive predictor of PLS-EC growth over time ($p<.001$).

Conclusions:

Nonverbal cognition was a robust predictor of language comprehension and expressive language level at 2 ½ years for toddlers with ASD, such that toddlers with higher nonverbal cognitive abilities performed better on language measures. Initial expressive language level was also positively predicted by socialization skills. Higher degrees of autism severity at 2 ½ years were predictive of slower rates of language growth across three years for both comprehension and production and higher nonverbal cognition was predictive of faster rates of expressive language development.

161.202 202 Parental Recognition of Early Signs of ASD in Venezuelan Children. C. Montiel-Nava*[1], M. A. Soto[2], M. Marín[2], Z. Gonzalez[1], J. A. Chacin[1] and J. Pena[1], (1)*La Universidad del Zulia*, (2)*Universidad Rafael Urdaneta*

Background:

It has been suggested that parents of children with ASD notice abnormalities during the first 2 years of life. Most common concerns are related to language and speech delays, as well as lack of social responses. It is of relevance to explore how consistent early signs of ASD and parental recognition are among countries.

Objectives:

The current study provides data on the age of diagnosis of ASD, on the first concerns according to parents report, and also on the age of onset of those symptoms.

Methods: 106 children between 2 and 7 years of age((mean age 4.55 years) underwent a comprehensive evaluation as part of an epidemiological study of autism in Venezuelan children. The assessment protocol included the Raven progressive matrices test, and the Autism Diagnostic Observation Scales–G, Parents were interviewed with the Vineland Adaptive Behaviors Scales Expanded and Autism Diagnostic Interview-Revised (ADI-R) . Information regarding the age of parental recognition, as well as the description of the first signs was ascertained using the ADI-R.

Results:

38% of parents reported that the first concerns were present before the first birthday, while 58.4% by 18 months; with a mean age for first concerns of 17 months. Those first concerns were related mainly to delays in speech and language (49.4%), lack of response to name and environment (52.8), restricted interest and stereotyped behaviors (28.1%), other behaviors and medical problems (53.9%), and loss of skills (7.9%). When comparing children with autism and children with PDD-NOS, we found that speech delays and abnormalities in social interaction were more frequent in children with autism than in those with PDD but did not reach statistical significance. On the contrary, restriction of interests/stereotyped behaviors and medical problems were significantly more prevalent in the autistic children($p=0.05$). Loss of skills, particularly loss of speech, was present only in the autistic group. Although the mean age of first concerns was 17 months, the mean age at diagnosis was 53 months.

Conclusions:

Results of this study suggest that parents are aware of abnormal or atypical behaviors in their children during the first year of life, which does not differ from reports in other parts of the world. Consistent with previous reports, there is a wide gap between recognition of first signs and the final diagnosis, which might be affected by cultural factors related to

availability of services, and the impact of having a child with developmental delays. In Latin cultures, behavior problems are usually attributed to poor parenting skills, so parents might take longer to reach for professional help. The symptoms that triggered parents´ recognition were mostly related to language and speech delay, and lack of response to name and environmental delays which have been the pattern described in studies carried in other countries. These results have clinical implications for screening, diagnosis, and intervention. Health authorities from Venezuela and from other Latin-America countries must develop public health policies to correctly identity and diagnose ASD children, and clinicians must actively search for them to provide the best-available treatment.

161.203 203 How Do the Functions of Restricted and Repetitive Behaviors Vary with Developmental Level in Children with ASD?. J. Lidstone*[1], M. Uljarevic[2], S. R. Leekam[1], H. Kanaris[3], A. M. McKigney[4], J. Mullis[5] and R. Paradice[6], (1)*Cardiff University*, (2)*School of Psychology, Cardiff University*, (3)*St. Cadocs Hospital*, (4)*St Cadoc's Hospital*, (5)*Cardiff & Vale University Health Board*, (6)*St David's Hospital*

Background: The Motivation Assessment Scale (Durand & Crimmins, 1992) is a caregiver questionnaire designed to identify the functions of target behaviors. Joosten et al. (2009) modified the MAS for use in relation to repetitive behaviors in children with ASD, and shed light on how the functions of repetitive behaviors in children with ASD differ from the functions of repetitive behaviors in children with developmental delay. The functions addressed by the scale, as conceptualised by Joosten et al., are *Intrinsic* (controlling sensory feedback; responding to anxiety), and *Extrinsic* (gaining attention; escaping [from demands]; gaining tangible reward). Little is known about how the functions of repetitive behavior vary by developmental level.

Objectives: Building on Joosten et al.'s group comparison, we sought to investigate the extent to which the functions of repetitive and restricted behaviors (RRBs) vary with developmental level in children with ASD, extending this analysis to both lower-level (repetitive motor and sensory behaviors) and higher-level (insistence on sameness) behaviors.

Methods: Telephone interviews were conducted with parents of 2- to 17-year-olds with clinical diagnoses of ASD. As part of the telephone interview, each participant completed one modified-MAS for each of their child's most frequent RRBs, with frequency measured by the Repetitive Behaviours Questionnaire-2. The mean scores for intrinsic and extrinsic function were used for analysis—firstly, averaging across all RRBs, and, secondly, averaging for lower-level and higher-level behaviors separately. Expressive language level was used to index developmental level. This was assessed during the telephone interview using items adapted from the Diagnostic Interview for Social and Communication Disorders (Wing et al., 2002), and the resulting 7-point scale ranged from 0 (no speech or meaningful vocalisations) to 6 (uses past, present and future tenses and complex sentences).

Results: Preliminary analysis of data from 27 participants indicates a positive relation between developmental level and extrinsic function, $r(26) = .41$, $p < .05$. This remained even when lower-order RRBs alone were considered, $r(18) = .48$, $p < .05$. Multiple regression with the three extrinsic subscales predicting developmental level showed that *escaping* was related to developmental level ($\beta = .48$) but *gaining attention* and *gaining tangible reward* were not (βs -.01 and .02 respectively). Intrinsic function was heavily endorsed in relation to children of all developmental levels and was unrelated to developmental level, $r(26) = .19$, ns.

Conclusions: These data suggest that the functions of repetitive behaviours are more diverse in children with higher developmental level, with extrinsic function assuming greater importance than in children with lower developmental level. Specifically, a new function of *escaping* emerges with increasing developmental level.

161.204 204 Superior Auditory Memory in Young Children with ASD? Results From a Non-Word Repetition Task and Relationships with Vocabulary. A. K. Mulligan* and A. Nadig, *McGill University*

Background: While vocabulary development is generally delayed in children with autism spectrum disorders (ASD),

some do achieve age-appropriate vocabularies. Additionally, recent studies have reported that individuals with ASD display enhanced performance on auditory processing tasks (*e.g.*, Bonnel et al., 2003) and moreover, demonstrate enhanced learning of the sound structure of novel words (Norbury et al., 2010). We test the hypothesis that children with ASD have superior auditory memory abilities compared to typically-developing peers (TYP), and that they utilize these abilities to build their early vocabularies.

Objectives: First, we assessed auditory memory using a non-word repetition task, the Syllable Repetition Task (SRT) (Shriberg et al., 2009). We also examined the type of sound substitution errors made in order to identify the role that auditory encoding skills had in SRT performance, independent of auditory memory abilities. Substitutions which changed the manner of articulation (*e.g.*, [t] to [m]) were interpreted as a failure to encode auditory information. Substitutions that preserved the manner of articulation (*e.g.*, [t] to [d]) were interpreted as evidence for partial encoding of the target sound and a functional auditory encoding system (Shriberg et al., 2009). Second, we examined relationships between auditory memory and receptive language ability. We answered the following research questions:

1a. Do participants with ASD perform better than TYP participants on the SRT, specifically on the longest stimuli?

1b. Do participants with ASD produce fewer manner change errors than TYP participants, reflecting better auditory encoding abilities?

2a. Is there a correlation between concurrent receptive language and SRT scores?

2b. Is earlier receptive language predictive of later SRT performance?

Methods: To date, twenty-eight TYP and ten ASD participants between the ages of 2-7 years have been tested. By April 2012 thirty-one TYP and fifteen ASD participants will be included in the study sample. Receptive language was assessed at two time points, approximately one year apart, using the Mullen Scales of Early Learning. The groups did not differ in their receptive language abilities at Time 1. At Time 2 the SRT was administered. SRT responses were scored and errors were coded from video.

Results: Preliminary analyses revealed:

1a. No significant differences between ASD and TYP groups in overall SRT scores, but a trend for the ASD group to achieve higher scores on the longest stimuli.

1b. Both groups produced manner change errors approximately half of the time, with no significant difference between groups.

2a. Significant correlations between concurrent receptive language and SRT scores in both groups.

2b. Significant correlations between earlier receptive language and SRT scores in both groups.

Conclusions: In the current sample, children with ASD did not demonstrate superior auditory memory ability as assessed by performance on the SRT. However, the trend observed may prove significant once additional participants are included. Groups did not differ in their proportion of manner change errors, suggesting similarities in auditory encoding. Previous receptive language ability was predictive of later SRT scores in both groups, indicating that receptive language knowledge may similarly support auditory memory and, by extension, word learning in ASD.

161.205 205 Repetitive Behaviors and Executive Functions in Children with High Functioning Autism Spectrum Disorders. K. Jitlina*, A. McCrimmon, A. A. Altomare and R. L. Matchullis, *University of Calgary*

Background: Repetitive, restricted and stereotyped types of behavior are a core feature of Autism Spectrum Disorders (ASDs) and are necessary for their diagnosis. Previous research has reported a distinct profile of executive functions in a group of young adults with a subset of High Functioning ASDs, and specifically in non-verbally mediated cognitive flexibility. The relationship between executive functions and repetitive behaviors has previously been examined in adults with ASDs, but has not distinguished between verbally and non-verbally mediated cognitive flexibility or looked at the relationship in children on the high-functioning end of the

spectrum. It has been suggested that both impairment in executive functions and the presence of repetitive behaviors contributes to the social interaction deficits seen in this population.

Objectives: The current study examines the relationship between cognitive flexibility and repetitive, stereotyped behavior patterns in children with high-functioning ASDs to explore the underlying cause of the poor social interaction skills that are so debilitating to individuals with this disorder.

Methods: Participants included 25 children ages 8-12 with Asperger Syndrome, High-Functioning Autism, or Pervasive-Developmental Disorder Not-Otherwise-Specified, whose diagnosis was based on the Autism Diagnostic Instrument-Revised (ADI-R) and 25 age- and gender-matched typically developing controls. Participants with scores lower than 85 on the Verbal and Performance IQ on the Wechsler Abbreviated Scale of Intelligence were excluded. Cognitive flexibility was assessed using the Trail-making, Verbal Fluency, and Design Fluency tasks of the Delis-Kaplan Executive Function System (D-KEFS) whereas repetitive behaviors were evaluated using the ADI-R and the Yale Special Interests Survey (YSIS).

Results: Bivariate correlations revealed no statistically significant associations between circumscribed interests or repetitive behavior and performance-based measures of verbally or non-verbally mediated cognitive flexibility of the D-KEFS.

Conclusions: Preliminary findings suggest that there is no significant relationship between cognitive flexibility and areas of repetitive behaviors based on a small sample of children with high-functioning ASDs. This finding is in contrast to the positive relationship previously observed in adults with ASDs who ranged in cognitive functioning. The current findings may be a result of variations in methodology, a more limited range of cognitive functioning, or the younger developmental stage of the current sample group. Future investigations should aim to clarify this relationship in children across the entirety of the spectrum.

161.206 206 Mentalizing Knowledge of the Self Versus Others: Distinct Clinical Predictors of Social Maladjustment in Children with Higher Functioning Autism. D. C. Coman*[1], N. K. Coman[1], N. E. Zahka[2], C. Hileman[3] and H. A. Henderson[1], (1)*University of Miami*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*MIND Institute, UC Davis*

Background: Prior research has documented that self-referenced processing enhances word memory in comparison to other semantic forms of word processing in neurotypical individuals; a phenomenon coined as the self-referenced memory (SRM) effect (Symons & Johnson, 1997). However, individuals with autism fail to exhibit this enhanced recognition memory for self-referenced words. For example, Henderson et al. (2009) reported that higher functioning children with autism (HFA) failed to show the standard SRM effect and instead showed comparable recognition of self- and other-processed words. Additionally, better self-referenced processing was inversely related to social symptom severity. This ability to mentalize self-knowledge is an integral component of social cognition, and its impairment in autism may be distinct from theory of mind (ToM) abilities, or the ability to mentalize about others (Hobson et al., 2006). Although both skills are necessary for the development of an understanding of the relations between self and others, impairments in these distinct aspects of mentalizing may lead to different social maladjustments.

Objectives: This study investigated both SRM performance and ToM, as two distinct constructs, and their relations to self-reported social maladjustment in HFA children.

Methods: Participants were 94 HFA children (IQ > 70) aged 8 to 16, with a clinically confirmed diagnosis. A SRM task was completed in which they read a list of words and decided whether the word described them (self-condition), a fictional character, or contained a certain number of letters. They then identified familiar words from a longer list. Participants also completed *The Children's Eyes Task* and the *Behavior Assessment System for Children, 2nd-Edition*. Independent variables were recognition performance for words in the self-condition (d' self) and total scores on the eyes task.

Results: Bivariate analyses indicated that SRM and ToM were correlated, $r = .34$, $p < .05$. Controlling for verbal IQ, age, and symptom severity, results of regression analyses indicated that

d' self, but not ToM, predicted self-reported School Problems, $R^2 = 0.44$, adjusted $R^2 = 0.13$, $F(5, 57) = 2.78$, $p < .05$, $\beta = -.28$, $t(57) = -2.05$, $p < .05$. Similarly, d' self predicted Internalizing Problems, $R^2 = 0.40$, adjusted $R^2 = 0.16$, $F(5, 56) = 2.14$, $p = .07$, $\beta = -.33$, $t(56) = -2.28$, $p < .05$, but ToM did not. In contrast, Personal Adjustment was predicted by ToM, $R^2 = 0.44$, adjusted $R^2 = 0.13$, $F(5, 57) = 2.54$, $p < .05$, $\beta = -.48$, $t(57) = -3.12$, $p < .01$, but not d' self.

Conclusions: This study provides support that self-processing and ToM are distinct indices of mentalizing that may impact specific aspects of social adjustment in HFA children. SRM may uniquely predict school problems because poor self-awareness may impede social learning within the complexity of a school setting. Personal adjustment, particularly during late childhood and adolescence, may be particularly dependent upon the ability to understand others' intentions and emotions, which were assessed in the Eyes task. Results will be discussed in the context of theories of self- and other-processing as they relate to social learning and development.

161.207 207 Exploring the Relationship Between Communication Skills and Sleep Problems in Autism Spectrum Disorders. M. K. McCalla*, A. N. Harris, E. H. Sheridan, K. Guest and S. E. O'Kelley, *The University of Alabama at Birmingham*

Background: Children with Autism Spectrum Disorders (ASD) and other developmental disabilities commonly experience sleep problems, primarily consisting of difficulty initiating and maintaining sleep. Previous research has demonstrated that sleep problems in children with ASD often impact daytime functioning (e.g., attention, drowsiness, social skills and behavior problems) (Sheldon, 2001, Stores, 2001). In typically developing children sleep deprivation has been shown to impact verbal abilities; however, few studies have examined the relationship between sleep problems and communication in children with ASD (Schreck, Mulick, & Smith, 2004).

Objectives: The purpose of this study is to investigate the relationship between communication skills and sleep problems in children diagnosed with ASD and children diagnosed with non-ASD impairments (i.e., language delays and developmental delays).

Methods: The current sample consists of 51 children (ages 2-7, $M = 4.16$ years, $SD = 1.32$ years) who received a comprehensive, interdisciplinary ASD evaluation using the ADOS and the ADI-R. Additionally, each child's expressive and receptive language abilities were assessed using the Preschool Language Scale (PLS) and sleep habits were assessed through caregiver report. The ASD group consists of 8 children with sleep problems and 23 children without sleep problems. The clinical comparison group consists of 7 children with sleep problems and 14 children without sleep problems. Data collection is ongoing and it is anticipated that there will be at least 20 children with sleep difficulties in both groups in the coming year.

Results: Preliminary analyses indicate that in the ASD group, children who had sleep problems obtained lower receptive language scores ($M = 56.02$, $SD = 10.92$) than those who did not have sleep problems ($M = 63.33$, $SD = 10.70$). In contrast, when examining expressive language abilities, children with sleep problems ($M = 73.67$, $SD = 18.76$) and those without sleep problems ($M = 71.30$, $SD = 15.94$) obtained similar scores. No group differences in communication skills based on sleep problems have been found in the clinical comparison group. Further investigation is planned, including utilizing ADOS severity scores as a covariate.

Conclusions: A better understanding of the relationship between sleep problems and language abilities may have important implications for understanding one of the core deficits of ASD. Additionally, these data provide support for the idea that treating sleep problems in individuals with ASD may improve daytime functioning.

161.208 208 Constructs of Social Communication in ASD Measures, Categorized by the Who's International Classification of Functioning, Disability and Health (ICF). M. J. Cooley Hidecker*[1], B. M. Di Rezze[2], B. Ross[3], H. Hawthorn[1], N. Galla[1] and T. Allen[1], (1)*University of Central Arkansas*, (2)*McMaster University*, (3)*University of Houston*

Background: The ICF provides a standard framework to describe health state in terms of functioning. Over the last decade, researchers have established standard rules to map health and clinical outcome measures onto the ICF to

contribute to outcome research. This can assist with defining the construct(s) of functioning that underlie a measure and are thought to be meaningful. Such information can be valuable in selecting appropriate measures for intervention and for understanding common characteristics of how measures are conceptually related. 'Social communication' is evaluated in various ways in ASD, but is unclear how this construct relates to a child's overall functioning. If we can identify common characteristics across measures of social communication in ASD, we will be able to provide a better picture of what defines social communication functioning for children with ASD.

Objectives: (i) To describe how to link measures of social communication used for preschool children with ASD to the ICF child and youth version (ICF-CY). (ii) To apply established ICF 'linking rules' to prominent social communication measures in ASD in order to identify common characteristics across these measures.

Methods: Measures of social communication in preschool children with ASD were identified from a scoping review of the literature, including the Autism Diagnostic Interview-Revised (ADI-R), Autism Diagnostic Observation Schedule (ADOS), Communication and Symbolic Behavior Scales, Early Social Communication Scales, and the Social Communication Questionnaire. These measures and their manuals (when available) were accessed and underwent a qualitative content analysis procedure to examine the meaning of each item and response option. Applying published "ICF Linking Rules", these measures were linked to the ICF-CY by pairs of investigators who independently undertook this systematic linking process. Inconsistencies in item linking with ICF-CY codes were discussed by team members to reach consensus. The team consisted of Speech-Language Pathology and Occupational Therapy investigators with expertise in the ICF and ASD. Frequency counts for each ICF-CY chapter level (1 to 3) were examined to understand common social communication constructs across measures.

Results: Linking items at the ICF-CY chapter level showed good interrater reliability, but linking to second and third levels was challenging. Common trends were evident in terms of ICF-CY codes across measures. Chapters most frequently linked with social communication were (in ranked order): Communication; Learning and Applying Knowledge; and Interpersonal Interactions and Relationships. Several unspecified item codes were identified across measures, indicating that codes on the ICF were not always available to map on some characteristics of social communication in ASD.

Conclusions: Core constructs across social communication measures mapped onto 'Communication' but not as prominently on 'Interpersonal Interactions and Relationships'. Common gaps were observed across measures whereby not all characteristics of social communication in ASD were specified by the ICF-CY. We identified areas and gaps in the construct of social communication that are important to our understanding of functioning in preschool children with ASDs.

Invited Educational Symposium Program
162 Rethinking Interventions and Implementation Strategies for Under-Resourced Areas

Chairs: C. Kasari[1] D. S. Mandell[2] (1)*UCLA*, (2)*University of Pennsylvania School of Medicine*

A growing body of research provides exciting evidence for the efficacy of both targeted and comprehensive interventions for children with autism. Relatively few of these interventions have made their way into community practice, however, and when they do, outcomes rarely approximate what is observed in university-based research settings. This implementation challenge is exacerbated among many underserved communities, for whom "research" is a loaded term. Translation of research findings into community settings is particularly difficult in school settings, in which educators and administrators may doubt the applicability of research practices to the unique aspects of settings or system resources. To overcome such barriers, having a dialogue with schools, parents, and community members around best practices is essential for the next phase of "translation" of research on behavioral treatments for individuals with ASD. This dialogue is especially important for communities that are most likely to struggle to provide access to services, with lesser capacity to implement evidence based practice, especially involving individuals under-represented in most extant ASD intervention studies. This symposium will address these issues

and present a series of innovative studies with the overarching goal of enriching intervention research with concepts and strategies from implementation science.

162.001 Parent Mediated Interventions: What Works, What Doesn't?. C. E. Lord*, *Weill Cornell Medical College*

162.002 Interventions for Social Impairment at School: Rethinking Implementation. J. J. Locke*, *University of Pennsylvania*

162.003 Implementation Strategies In Schools: What We Have Learned From Teachers. A. C. Stahmer*[1], J. Suhrheinrich[2], S. R. Reed[1] and L. Schreibman[1], (1)*University of California, San Diego*, (2)*Rady Children's Hospital, San Diego*

There have been recent calls for more multi-directional knowledge exchange involving active collaboration and partnership between researchers and the community stakeholders they are trying to assist at all stages of the research to practice transfer process (Addis, 2002; Beutler, Williams, Wakefield, & Entwistle, 1995; Wells & Miranda, 2006). Yet, there have been few examples of how to elicit information from stakeholders and utilize findings to improve implementation. We will present an example of adaptation of an evidence-based intervention for use in school settings in which teacher input was used to guide researchers in adaptation studies and procedures.

162.004 Lessons From the Field: How Challenges From Effectiveness and Implementation Trials Can Inform Intervention and Study Design. D. S. Mandell*, *University of Pennsylvania Perelman School of Medicine*

This session presents the latest and, in some ways, most cutting edge research on improve quality of care for children with autism in community settings. The results from these studies suggest that developing and studying strategies to move efficacious interventions into communities so that they are effective and sustain, especially in traditionally under-resourced areas, will require new approaches to intervention development and field testing. In the current presentation, these issues are examined from the perspectives of community-based participatory research, implementation science, behavioral economics, and academic public partnerships. We argue that 1) interventions must be developed and tested in partnership with the community organizations whom we hope ultimately will use them; 2) interventions must be paired down to their absolutely essential active mechanisms, which will require more rigorous dismantling designs; 3) the strategy for successful implementation must be developed hand-in-hand with the intervention, and must address practitioner and organization-level factors; 4) strategies for measuring intervention fidelity must be flexible, comprehensive, and based on highly specific behaviors or intervention components of interest; and 5) treatment-as-usual comparison conditions are increasingly unethical, not practical and potentially unscientific, requiring new designs that focus more on comparative effectiveness.

Invited Educational Symposium Program
163 Methodologic Challenges In Risk Factor Epidemiology: Advancing the State of Research
Chair: B. K. Lee *Drexel University School of Public Health*

In recent years, epidemiologic studies have implicated a number of potential prenatal and perinatal risk factors in the etiology of autism. Unfortunately, challenges inherent in observational risk factor study designs, such as confounding, measurement error, and selection bias, can limit causal inference from epidemiologic studies of autism etiology. In this educational symposium, speakers will review the state of epidemiology research regarding four different prenatal risk factor domains noting the major methodological challenges specific to each domain and highlighting at least one specific technique that can be used to overcome these challenges.

163.001 Parental Age. C. J. Newschaffer*, *Drexel University School of Public Health*

Dr. Newschaffer will discuss studying paternal and maternal age associations with risk of autism, and analytical challenges such as confounding, effect modification, and effect specificity.

163.002 Perinatal and NEONATAL RISK FACTORS for AUTISM: LESSONS and Challenges of Meta-ANALYSIS. S. L. Buka*, *Brown University*

Context: The etiology of autism is unknown, although perinatal and neonatal exposures have been the focus of epidemiologic research for over 40 years.

Objective: To provide a comprehensive review and meta-analysis of the association between perinatal and neonatal factors and autism risk; further, to discuss the heterogeneous evidence regarding obstetric suboptimality and autism, and share recommendations to improve methodological rigor.

Data Sources and study selection: PubMed, Embase, and PsycInfo databases were searched for studies that examined the association between perinatal and neonatal factors and autism through March, 2007. Forty studies were eligible for the meta-analysis.

Data extraction: For each exposure, a summary effect estimate was calculated using a random effects model. Heterogeneity in effect estimates across studies was examined and, if found, a meta-regression was conducted to identify measured methodological factors that could explain between-study variability

Results: Over 60 perinatal and neonatal factors have been examined. Factors associated with autism risk in the meta-analysis were abnormal presentation, umbilical cord complications, fetal distress, birth injury/trauma, multiple birth, maternal hemorrhage, summer birth, low birthweight, small for gestational age, congenital malformation, low 5-minute Apgar score, feeding difficulties, meconium aspiration, neonatal anemia, ABO or Rh incompatibility, and hyperbilirubinemia. Factors not associated with autism risk included anesthesia, assisted vaginal delivery, post-term birth, high birthweight, and head circumference.

Conclusions: There is insufficient evidence to implicate any one perinatal or neonatal factor in autism aetiology, although there is some evidence to suggest that exposure to a broad class of conditions reflecting general compromises to perinatal and neonatal health may increase the risk. Methodological variations were likely sources of heterogeneity of risk factor effects across studies

163.003 Environmental Pollutants. I. Burstyn*, *Drexel University School of Public Health*

Dr. Burstyn will discuss the epidemiological literature on the role of maternal smoking of tobacco products in autism etiology. Using this subject as a motivating example, Dr. Burstyn will focus on challenges of environmental bio-marker research and exposure assessment. Technique highlighted: instrument validation and Bayesian methods to correct for exposure misclassification.

163.004 Maternal Prescription Drug Use. L. A. Croen*, *Kaiser Permanente Division of Research*

Dr. Croen will comment on recent research implicating certain classes of maternalprescription drugs in the etiology of ASD, and challenges such as confounding by indication anddose assessment. Technique highlighted: Matching and sample restriction for confounding byindication.

Brain Imaging: fMRI-Social Cognition and Emotion Perception Program

164 Brain Imaging: fMRI-Social Cognition and Emotion Perception

Chair: M. Solomon *Department of Psychiatry, MIND Institute, Imaging Research Center*

164.001 Brain Responses to Anthropomorphism and Perception of Actions in Autism. C. Doss*, L. Libero, D. Bala, M. Bellare and R. K. Kana, *University of Alabama at Birmingham*

Background: Anthropomorphism or the attribution of human characteristics (motivation, intention, and emotion) to non-human agents has been associated with the activation of mentalizing areas such as the posterior superior temporal sulcus (pSTS), the medial prefrontal cortex, and the anterior cingulate cortex (Chaminade et al., 2007). Individuals with autism have demonstrated difficulty in social attribution along with reduced activity in mentalizing regions (Kana et al., 2009). In addition, individuals with autism also showed diminished response to biological motion in regions like the pSTS (Pelphrey et al., 2005) as compared to typically developing peers. The present study examined brain responses associated with anthropomorphism and mentalizing in

autism. Using stimuli that elicit different levels of anthropomorphism, we expect that human social motion will elicit more activation in mentalizing brain areas in controls than non-human motion, while participants with autism will have altered brain response for socially meaningful motion.

Objectives: The purpose of this fMRI study was to investigate the role of pSTS and other mentalizing regions in motion processing in the context of anthropomorphism.

Methods: fMRI data were acquired from 5 high-functioning adults with autism and 6 typically developing controls (data collection in progress) while they viewed short animations of pairs of shapes (triangles) and stick figure characters engaged in random and socially meaningful movements. The average length of an animation was about 10 seconds. The participants' task was to view the animations and judge whether the characters' motion was social (intentional/goal-directed) or random. The stimuli were presented in an event-related design and data were acquired on a Siemens 3T scanner and analyzed using SPM8.

Results: The main results are as follows: 1) This study elicited strong responses in bilateral pSTS to movements of shapes and stick figures in both groups of participants; and 2) While observing social movement from shapes to stick figure characters, the control participants recruited a set of frontal regions, including the inferior frontal gyrus. However, the frontal activation was absent in participants with autism and their response was restricted to more posterior brain regions, like the extrastriate body area and the temporoparietal junction.

Conclusions: Our results support previous findings of the role of the pSTS and the prefrontal cortex for anthropomorphism (Chaminade et al., 2007). Inferior frontal cortex in control participants seems to play a vital role as the anthropomorphism increased from shapes to humans, a trend not seen in autism. These findings underscore the role of the pSTS in biological motion, with the inferior frontal area more specific to human social motion. We did not find differential activation in our autism participants between social shape and social human movements. This suggests that anthropomorphism may not be a key factor in the way participants with autism process these movements. This is potentially significant for people with autism in real life social interactions.

164.002 Diminished Superior Temporal Sulcus Response to Communicative Intent in Children with ASD. A. Martin*[1], A. C. Voos[1], A. Vouloumanos[2], K. A. Pelphrey[1] and M. D. Kaiser[1], (1)*Yale University*, (2)*New York University*

Background: Processing others' goals and intentions is critical for engaging in and understanding communicative interactions. The neural mechanisms for processing communicative intent are not well known, and may be disrupted in children with autism spectrum disorder (ASD) who show deficits in social and communicative abilities. The posterior superior temporal sulcus (pSTS) is one brain region that has been implicated in intention understanding. Specifically, Vander Wyk and colleagues (2009) reported that the pSTS responds to unexpected or incongruent actions (i.e., when an actor reacts negatively to an object and then reaches for it). The pSTS seems to be involved in encoding goals or intentions rather than simply responding to unexpected events, since it responds more to failed actions than successful actions (Shultz et al., 2010). Researchers have reported pSTS dysfunction in ASD using a variety of tasks including biological motion perception (Kaiser et al., 2010).

Objectives: We adapted a paradigm from infant research to examine the neural mechanisms supporting the assessment of communicative intent and evaluation of communicative interaction outcomes in typically developing (TD) adults, and children with and without ASD.

Methods: During a functional magnetic resonance imaging scan, groups of TD adults, TD children, and children with ASD viewed a series of 10-second videos. In each video, an actor reached for one of two unfamiliar objects to show a preference for that object (Target object). In the next scene, the actor's arms were blocked from reaching the objects and a new actor was present who had full access to the objects. The first actor looked at the second and said a nonsense word, and the second actor picked up the Target or Non-target object and extended it toward the first actor.

Infants who saw similar events looked longer (suggesting surprise) when the second actor handed over the Non-target rather than the Target object (Martin, Onishi, & Vouloumanos, under review). We hypothesized that TD participants, but not those with ASD, would exhibit a differential pSTS response to successful (Target) and unsuccessful (Non-target) communicative interactions.

Results: Since we were interested in whether the pSTS responds to a mismatch between communicative intentions and outcomes in the same way as it responds to a mismatch between an individual's intentions and subsequent behavior, we used a pSTS region of interest in our analysis (Vander Wyk et al., 2009). Preliminary results suggest that TD adults and children exhibit a greater pSTS response to Non-target than Target outcomes, while children with ASD do not.

Conclusions: Children with ASD seem to exhibit disruptions in brain mechanisms for processing intentions and outcomes in communicative interactions. In particular, the current findings highlight dysfunction in the pSTS in autism, which may contribute to or reflect some of the core social deficits of the disorder. Here we have focused on a pSTS ROI approach but whole brain contrasts will be implemented with larger samples. In addition, further work will investigate the behavioral responses (e.g. eyetracking) of children with ASD to communicative scenarios to further illuminate the nature of the processing differences.

164.003 Lack of Neural Specialization for Speech in Children with Autism Spectrum Disorder. R. H. Bennett*[1], S. Shultz[1] and K. A. Pelphrey[2], (1)*Yale University*, (2)*Yale University School of Medicine*

Background: fMRI studies have demonstrated abnormal cortical processing of social auditory stimuli in adults with Autism Spectrum Disorder (ASD). Specifically, a voice-selective region in the superior temporal sulcus/superior temporal gyrus (STS/STG) is hypoactive to voiced sounds in adults with ASD, suggesting deficit in processing human voiced versus non-voiced sounds. However, research from our laboratory suggests that this STS/STG region is most sensitive to human voiced sounds that are communicative (e.g. speech), rather than being equally sensitive to all voiced sounds. This raises the possibility that reduced STS/STG activity in response to voiced versus non-voiced sounds observed in adults with ASD may be driven by altered response to particular categories of voiced sounds, rather than all voiced sounds.

Objectives: **(**1) Investigate whether children with ASD show hypoactivation in STS/STG in response to voiced versus non-voiced sounds, and (2) Investigate whether children with ASD and typically-developing (TD) children differ in response to different categories of human voiced sounds.

Methods: Data was collected from 38 participants (18 ASD) matched on age, gender, and verbal IQ. Participants heard both voiced and non-voiced sounds while in the fMRI scanner. There were 3 categories of voiced sounds: non-native human speech, human communicative vocalizations (e.g. laughing), and human non-communicative vocalizations (e.g. coughing). Non-vocal stimuli consisted of human non-communicative non-vocal sounds (e.g. walking). Each condition was presented for 20 seconds, 5 times in a block design.

Results: We performed a 2 x 2 whole-brain ANCOVA analysis to identify regions exhibiting significant Condition (voiced versus non-voiced) x Group (TD versus ASD) interaction ($q<0.001$, $k>36$). No significant voxels were observed. A more liberal threshold ($p<0.05$, $k>12$), revealed a group difference to voiced versus non-voiced sound in solely anterior insula. To determine whether the groups responded differently to different human voiced sounds we did an ROI analysis, with the ROI functionally defined as bilateral STS/STG that responded to voiced versus non-voiced human sounds in both TD and ASD children ($q<0.001$ and $k>36$). A repeated measures ANOVA with sounds as a within-subject factor and diagnosis as a between-subject factor was conducted on beta values from the bilateral STS/STG ROI. There was a significant group x sound interaction in both hemispheres (right: $F(2,35) = 3.089$, $p<0.05$; left: $F(2,35) = 3.821$, $p<0.026$). Follow-up analyses showed a main effect of sound for TD children (TD: $F(1,20) = 7.873$, $p<0.001$; ASD:$F(1,16) = 0.972$, $p<0.389$) but not for ASD children. Paired-samples t-tests revealed that TD children's STS/STG responded more robustly to speech than to both

non-speech voiced categories bilaterally (Right: $t(20) = 5.538$, $p<0.000$; Left: $t(20) = 4.878$, $p<0.0001$).

Conclusions: Our results didn't support previous findings that individuals with ASD show hypoactivation in the STS/STG to voiced versus non-voiced human sounds. However, we found between-group differences in response to different categories of human voiced sounds within this voice-sensitive region. Specifically, the TD children differentiated between three voiced conditions, responding most strongly to speech, unlike the ASD group.

164.004 Disrupted Neural Response to Affective Touch in ASD. M. D. Kaiser*[1], A. C. Voos[1], R. H. Bennett[1], I. Gordon[1], F. McGlone[2] and K. A. Pelphrey[1], (1)*Yale University*, (2)*Liverpool John Moores University*

Background: Social, or affective, touch plays a critical role in early development and interpersonal interactions throughout the lifespan. A special class of nerve fibers, C-tactile afferents, which are present only in hairy skin, has been found to respond to such slow, gentle touch. We recently identified a network of brain regions involved in processing affective touch targeting C-tactile afferents in typical adults, including the posterior superior temporal sulcus (pSTS) and insular cortex. These key nodes of the 'social brain' have been shown to be disrupted in Autism Spectrum Disorder (ASD) in a variety of social perception paradigms. This is the first neuroimaging study to examine tactile social perception in ASD. Given the importance of touch in early socio-emotional development, and known sensory issues in ASD, it is important to examine brain mechanism for processing affective touch in individuals with this neurodevelopmental disorder.

Objectives: Using functional magnetic resonance imaging (fMRI), we sought to characterize the brain mechanisms for processing C-tactile targeted affective touch in typically developing (TD) children and those with ASD.

Methods: Thirty-eight children with and without ASD (matched on age and IQ) participated in the study. During a 10-minute fMRI scan, participants received continuous brushing to the Arm or Palm in a block design procedure. There were 2 runs of each condition, including 8 repetitions of 6-second blocks of touch followed by 12 seconds of rest (no touch). Tactile stimuli were slow strokes (8cm/s) with a 7cm wide brush administered by a trained experimenter.

Results: We implemented a region of interest (ROI) analysis, using bilateral insula and right pSTS ROIs. First, we examined the differential response to Arm (CT-targeted) and Palm (non-CT) touch in three bilateral insula regions. The groups showed a significantly different response to Arm vs. Palm touch in the dorsal anterior insula. Unlike those with ASD, TD children showed a greater response to the Arm relative to Palm in this region. The groups did not differ in their posterior or ventral anterior insular responses. In the right pSTS, there was a trend toward a group difference in the response to Arm vs. Palm touch.

Conclusions: The current fMRI study indicates that children with ASD have disrupted neural mechanisms for processing affective touch (targeting C-tactile afferents). Notably, TD and ASD groups revealed comparable activity in response to gentle touch in the posterior insula, a region involved in processing primary sensory input. However, the groups differed in the dorsal anterior insular response. This region has been shown to be important for interpreting affective aspects of somatosensory/interoceptive information, influencing decision-making and behavior. Similarly, children with ASD exhibited a dampened response to affective touch in the pSTS, a region involved in a variety of social perception tasks, including the visual perception of biological motion. These findings raise questions regarding the developmental trajectory of disrupted brain mechanisms for processing affective touch. We will discuss implications of our results for early diagnosis and intervention.

164.005 Lack of Embodiment of Action Words in the Autistic Brain. R. L. Moseley*[1], B. Mohr[2], A. K. Ludlow[2], M. V. Lombardo[3], S. Baron-Cohen[3] and F. Pulvermüller[4], (1)*MRC Cognition and Brain Sciences Unit*, (2)*Anglia Ruskin University*, (3)*Autism Research Centre, University of Cambridge*, (4)*Free University of Berlin*

Background:

Atypical organisation of the semantic system in autism spectrum conditions (ASC) is implied by previous research (Harris et al, 2006) but remains understudied. In typical

individuals, word meaning is embodied in sensorimotor systems related to experiencing that concept in the world. Action-related words (e.g. “kick”) activate frontocentral “mirror” motor systems in a somatotopic fashion reflecting their semantic relationship with the effectors, and visual object-related words (e.g. “cat”) activate occipitotemporal visual-processing areas. In ASC, a different learning style and atypical neural connections might give rise to substantially different neural organisation of action- and object-related words. We predicted there would be atypical representation of action words in ASC due to atypical connections in the pathway connecting temporal to frontocentral cortices and, most importantly, atypical mirror neuron functioning in the networks of multimodal, sensorimotor circuits typically involved in representing action words (Pulvermuller & Fadiga, 2010).

Objectives:

To investigate the functional organisation of conceptual knowledge in ASC, focusing on action- and object-related words.

Methods:

Event-related fMRI was employed to investigate activity evoked by passive reading of well-matched action and object words in 18 subjects with an ASC (all previously diagnosed using gold-standard instruments) and 18 controls matched for age and IQ, both groups equally balanced for gender. In order to investigate the behavioural correlates of activity, participants completed a speeded semantic decision task several weeks after scanning.

Results:

Alongside a general reduction in word-related inferior frontal and precentral activity in ASC, striking differences in the representation of action words appeared: action words evoked robust motor activity in controls but not in ASC subjects. A regions of interest analysis confirmed this group difference in the motor system ($f(1, 34) = 5.280$, $p < .03$), which was specific to action words; activity to object words overlapped substantially between groups in both frontal and temporal cortices. Semantic judgements revealed an interaction of word category and group, indicating that autistic subjects were significantly slower in the processing of action words ($F(1, 30) = 4.291$, $p < .05$). A significant correlation showed that motor system activation was associated with faster reaction times to action words ($r = .509$, $p < .01$).

Conclusions:

The normal embodiment of action word meaning in the motor system was absent in ASC, though other words did not show this difference. A correlation between activity in motor cortex and the speed of processing showed that as activation decreased, people with autism were slower to process action words, indicating the functional importance of the motor system in processing action words. Lack of activity in the frontocentral motor systems and slowness of semantic decisions in ASC suggests deficits in embodied motor cognition at the action-semantic level. Our results indicate that conceptual-semantic knowledge differs substantially between ASC and typical controls as predicted by the mirror neuron theory of ASC, which links the sociolinguistic and mindreading deficits of autism to the robustly-reported inactivity of mirror systems replicated in the present study.

164.006 fMRI of Emotion Regulation in Autism. G. S. Dichter*[1], J. A. Richey[2], C. Damiano[1], M. Smoski[3], N. J. Sasson[4], E. Hanna[5], A. Sabatino[1] and J. W. Bodfish[1], (1)*University of North Carolina*, (2)*Virginia Tech*, (3)*Duke University Medical Center*, (4)*University of Texas at Dallas*, (5)*UNC-Chapel Hill*

Background: Outside of autism, individuals with a range of psychiatric and childhood-onset disorders can learn to change their emotional responses to affective stimuli by “cognitive reappraisal” - the effortful alteration of emotional responses. Cognitive reappraisal improves subjective experience as well as neural activation in key social-affective brain regions. This approach has revealed neuroplasticity in disorders previously thought to be "hard-wired" as emotionally dysregulated. Despite clear evidence that autism is characterized by poor modulation of emotional responses to social-affective information, no research to date has examined the neuroplasticity of brain responses to social-affective information in autism.

Objectives: To examine changes in brain activation due to cognitive reappraisal while viewing social stimuli (i.e., pictures of faces) as well as stimuli related to circumscribes interests in adults with autism with fMRI.

Methods: Fifteen high-functioning adults with autism and fifteen matched neurotypical control adults enrolled. Participants first completed a 30-60 minute one-on-one, structured cognitive reappraisal training session with visual supports. During this training session, participants learned how to increase or decrease their emotional responses to pictures of faces and of objects. After confirmation of adequate comprehension of the cognitive reappraisal training sessions, participants completed a 90-min fMRI scan session with eye-tracking. The fMRI task involved first looking at pictures of faces or objects for 10 seconds. During the first 4 seconds, participants viewed the images without instruction. Next, an auditory prompt indicated whether participants were to increase or decrease their emotional response or leave their emotional response unchanged. Following the scan session, participants viewed the same images again, this time outside of the scanner, and rated the images on the dimensions of valence and arousal both before and after cognitive reappraisal instructions.

Results: Analysis of subjective ratings revealed that cognitive reappraisal modulated subjective responses to both categories of stimuli in both groups. Analysis of eyetracking data revealed no group differences in the proportion of time spent looking at the stimuli for any stimulus or regulation condition. Initial analyses of fMRI patterns in the autism group suggest that cognitive reappraisal resulted in hypothesized changes in prefrontal and limbic brain activation patterns. Additionally, groups differed in activation of amygdala and ventrolateral prefrontal responses when instructed to decrease positive emotional responses to images related to circumscribed interests and differed in nucleus accumbens and ventrolateral prefrontal cortex responses when instructed to increase positive emotional responses to images of faces.

Conclusions: Results indicate that individuals with high-functioning autism are able to learn and implement simple cognitive strategies to consciously modulate their emotional responses to social-affective stimuli. However, the autism group showed evidence of differential activation during cognitive reappraisal in key social-affective brain regions. This initial study suggests the potential for biobehavioral interventions to impact subjective experience and neurobiological responses to emotional challenges in individuals with autism. An improved understanding of brain systems mediating emotion regulation in autism will be important for the generation of better etiologic models of emotion dysregulation in this disorder.

164.007 Oxytocin Receptor Gene (OXTR) Impacts Salience Network Connectivity in Children with and without ASD.

L. Hernandez*[1], J. D. Rudie[1], D. Beck-Pancer[1], E. M. Kilroy[2], D. H. Geschwind[1], S. Y. Bookheimer[1] and M. Dapretto[1], (1)*University of California, Los Angeles*, (2)*Brain Mapping Center, University of California, Los Angeles*

Background: Converging evidence suggests that common genetic variations in a number of Autism Spectrum Disorder (ASD) risk genes impact brain circuitry in individuals with ASD as well as neurotypical controls (e.g., Scott-Van Zeeland 2010). A single nucleotide polymorphism (SNP; rs53576) located in the oxytocin receptor gene (*OXTR*) has been linked to increased genetic risk for ASD (Wertmer 2009, Wu 2005), as well as with reductions in both grey matter volume and neural activity in components of the "salience network" in neurotypical adults (Tost 2010). The salience network plays an important role in the identification of the most homeostatically relevant stimuli, which includes socio-emotional processing (Seeley 2007). In particular, the right anterior insula is a critical hub of this network and altered activity and connectivity in this region has been implicated in autism (Uddin & Menon 2009).

Objectives: Despite research showing associations between *OXTR*, ASD genetic risk, and abnormalities in the salience network, no studies have examined how the presence of one or more *OXTR* risk alleles may impact functional connectivity in ASD. Here we sought to investigate how a common variant in *OXTR* (rs53576) may impact resting-state functional connectivity (rs-fcMRI) in typically developing children (TD) and children with ASD using the right anterior insula as a seed region. Given that additional SNPs in OXTR have been linked to ASD, we further examined how the presence of multiple

OXTR risk alleles in other loci relate to social functioning in children and adolescents with ASD.

Methods: DNA was extracted from saliva samples and genotyped for rs53576 as well as 5 other oxytocin SNPs previously associated with ASD. rs-fcMRI scans were acquired in 70 children and adolescents (36 ASD, 34 TD). Data were analyzed using a seed-based approach. After standard preprocessing, average timeseries were extracted from the right anterior insula for each subject and then correlated with activity across all other voxels in the brain. Individual correlation maps were combined at the group level and compared between oxytocin genotype groups stratified by diagnostic status.

Results: The rs53576 "A" risk allele was associated with decreased connectivity between the right anterior inslua and the right inferior frontal gyrus, bilateral amygdalae, and medial prefrontal cortex; reduced connectivity was most pronounced in individuals with ASD. Furthermore, social and communication phenotypes in the ASD group correlated with number of risk alleles for 6 *OXTR* SNPs (rs53576, rs237897, rs1042778, rs2254298, rs2268943, rs2268494), such that increased number of risk alleles were associated with higher scores on the ADOS social and communication subscales, and overall ASD symptom severity.

Conclusions: Our results show that a common variant in *OXTR* is associated with decreased functional connectivity between regions underlying social and emotional processing in ASD, and that multiple *OXTR* SNP risk alleles are associated with greater severity of ASD symptoms. These findings highlight a mechanism for how genetic risk might predispose to ASD and suggest that the use of an imaging-genetics approach combining multiple risk loci may help to further clarify the relationship between brain function and behavioral phenotypes in ASD.

164.008 Oxytocin's Impact on Social Cognitive Brain Function in Youth with ASD. I. Gordon*[1], R. H. Bennett[1], B. C. vander Wyk[2], J. F. Leckman[1], R. Feldman[3] and K. A. Pelphrey[1], (1)*Yale University*, (2)*Yale Child Study Center*, (3)*Bar-Ilan University*

Background:

Social dysfunction is a core deficit in individuals with Autism Spectrum Disorders (ASD) and yet the underlying neural mechanisms remain unclear. Novel avenues of translational research come from recent discoveries regarding the effects of the neuropeptide Oxytocin (OT) on a wide range of social behaviors in humans, especially increased sociability, empathy and theory-of-mind. Additionally, variations in the OT receptor gene (OXTR) have been linked to ASD in several studies. Considering the known social deficits in ASD, it is important to seek a deeper understanding of the mechanisms underlying OT's effects using functional magnetic resonance imaging (fMRI).

Objectives:

This study aims to identify the impact of OT on brain regions linked to social motivation, social perception, and social cognition. We hypothesize that during fMRI tasks that require processing of social information, OT administration will result in increased activity in regions who play a key role in reward circuitry (such as the striatum, caudate and nucleus accumbens) as well as key nodes of the social brain (specifically, the anterior cingulate and prefrontal cortex, superior temporal sulcus, amygdala). We also expect increased connectivity between these brain regions due to OT's impact.

Methods:

We are currently performing a double blind, crossover, and randomized controlled study, in which 40 children and adolescents (ages 7-18) with ASD are randomly assigned to OT and placebo nasal sprays on two consecutive visits. To our knowledge, this is the first ever intranasal OT and fMRI study in ASD with such a young age group. After administration, we are testing participants' ability to detect biological motion and read others' emotions from the eye region using well-validated fMRI paradigms: Reading the Mind in the Eyes (RMET-R) and Biological Motion Detection.

Results:

Preliminary results are indicating that in children and adolescents with ASD, intranasal administration of OT results in enhanced activation of the superior temporal sulcus (STS)

region during perception of biological motion compared to placebo. When going through RMET-R, OT seems to improve the ability to accurately define and describe other's mental states as well as enhance brain activation in medial prefrontal cortex, STS, temporal parietal junction and fusifrom – all regions previously implicated in social perception and cognition, mentalizing, and theory of mind abilities.

Conclusions:

These initial results are currently being expended, but they provide a very promising and exciting indicator of the neural mechanisms' underlying OT's impact on social perception and cognition in children with ASD. At IMFAR, final results will be presented and discussed. Should this study show that modulating OT levels can induce specific effects on brain functioning and behavior in tasks linked to the social world, it would be possible to explore novel more optimal treatment strategies in ASD.

Services Program
165 Services
Chair: P. Mirenda *University of British Columbia*

165.001 Diagnostic and Health Care Experiences of Children with Autism Spectrum Disorder, Intellectual Disability, or Developmental Delay: An Introduction to New Nationally Representative Survey Data. R. M. Avila*[1], S. J. Blumberg[1], L. J. Colpe[2] and B. Pringle[2], (1)*The CDC's National Center for Health Statistics*, (2)*National Institute of Mental Health*

Background: From February-May 2011, the National Center for Health Statistics fielded the first ever Survey of Pathways to Diagnosis and Services, a nationally representative survey about children with autism spectrum disorder, intellectual disability, or developmental delay. The Pathways study examines the emergence of symptoms; the history of diagnoses; treatments and interventions used to address the problem; and current behavioral, diagnostic, and functional status. The Pathways study was sponsored and co-led by NIH's National Institute of Mental Health, using funds available from the American Recovery and Reinvestment Act of 2009.

Objectives: The purpose of this presentation is to describe the design and content of the survey, present key findings about the health care and diagnostic history of children with developmental conditions, and describe how researchers can access the data files to conduct their own analyses.

Methods: Follow-up interviews were conducted with parents and guardians who previously participated in the 2009-2010 National Survey of Children with Special Health Care Needs (NS-CSHCN) and who reported that their child had ever been diagnosed with at least one of the three developmental conditions. Parents who participated in the Pathways survey completed a telephone interview and were sent a self-administered mailed questionnaire, which consists of two previously tested and widely used instruments: the Children's Social Behavior Questionnaire, and the Strengths and Difficulties Questionnaire. Parents who did not send back the mail questionnaire were prompted by telephone to verify their mailing address and were given the option to complete the questionnaire on the phone.

Results: We were able to complete telephone interviews from 4,056 parents of CSHCN with these relatively rare but increasingly identified conditions. The interview completion rate exceeded 70%. Furthermore, of the parents who participated in the phone interview, almost 3,000 mailed back their self-administered questionnaire or completed the questionnaire through our telephone prompting efforts.

Conclusions: The Pathways study provides the largest ever nationally representative survey data on the health care and diagnostic history of CSHCN identified as having (or having had) autism spectrum disorder, intellectual disability, and/or developmental delay. Data files from this survey will be available to the public online at no charge. Conference participants will have an opportunity to learn about this new survey and its key findings, and be able to interact with the survey developers. Our goal is to provide information to assist other researchers in utilizing Pathways survey data and to gain knowledge from the Pathways study in an effort to generate and promote more research and better interventions and services for CSHCN with developmental conditions.

165.002 A Survey of the Use of Health Services by Children with Autism Spectrum Disorders in Israel. R. Raz*[1], L. Lerner-Geva[1], O. Leon[2], G. Chodick[1] and L. Gabis[1], (1)*Tel Aviv University*, (2)*Sheba Medical Center*

Background: The national health insurance act in Israel defines the eligibility of children with Autism Spectrum Disorders (ASD) for a basket of health services, which partially concur with clinical guidelines and parental preferences. Families tend to utilize private health and ancillary services in addition to reimbursed educational and therapeutic care, with significant economic burden and social implications.

Objectives: To examine the extent of utilization of health services by children diagnosed with PDD in Israel, and to analyze the factors that are associated with different utilization patterns.

Methods: A survey of children aged 4-10 years, with a diagnosis of PDD, who visited the child development center at the Sheba Medical Center. Data collection was based on a semi-structured telephone interview with the parents of the children. The main dependent variables were out-of-pocket expenditures for health services and hours of therapy. The main independent variables were clinical and socio-demographic child and familial factors. Multivariable logistic regression models were used in order to find independent predictors for health services utilization. Costs were converted to US Dollars using conversion rate of 1 USD = 3.74 New Israeli Shekel.

Results: Parents of 204 children were contacted and were asked to participate in the study. Parents of 178 of the children (87%) agreed to participate and completed the interview (85% males, mean age 6.7 +1.9 years).

The average annual "out-of-pocket cost" was $8,288, with a median of $4,473 and a range of $0-89,754, of which 85% is spent on private providers. High severity of ASD and at least one of the parents with academic education were independently and directly associated with higher out-of-pocket expenditure. Having at least one older sibling, siblings without developmental disorders, regular education of the ASD child, lower parent education and low income were independently associated with being at the lower expenditure. The average weekly hours of therapy was 7.3 (SD: 5.25), with a median of 6.0 hours and a range of 1.0 - 34.3. The only variable which was independently associated with very low number of services was full integration within regular educational frameworks, especially at school age. The variables that were found to be independently associated with getting very high amount of services: being a child to ultra-orthodox parents, income above average and high severity of ASD.

Conclusions: Children with ASD in Israel are receiving services mainly according to socio-demographic characteristics of their parents. This is related to the fact that most services required by families are not reimbursed by the national basket of services. Children of parents who are ultra-orthodox, have low income or low education level, immigrants, and children who are not firstborn – tend to go to special education settings, which include much more services at lower "out of pocket" costs. Parents with higher education and income level tend to integrate their children into regular settings, and consume services from private providers.

165.003 Transition to Secondary Education: Impact on Children with An Autism Spectrum Disorder. C. Willis*[1], O. Baykaner[2], S. Staunton[1], D. H. Skuse[2] and W. P. Mandy[3], (1)*Great Ormond Street Hospital*, (2)*Institute of Child Health*, (3)*University College London*

Background:

For many children with autistic spectrum disorders (ASD) in mainstream education, the transition from elementary to secondary education at the age of 11 years or so can be particularly stressful, clinical experience shows. No previous study has systematically evaluated the impact on the child, their family and the school of that period of transition. Nor do we know what potential individual and systemic influences determine the success of the transition.

Objectives:

Our objective was to identify a nationally representative sample of families with a child who had a confirmed ASD diagnosis. We aimed to recruit children before they made the transition to secondary education, and to undertake comprehensive

assessments of individual, family and school variables that could influence the success of the transition. Our aim was then to re-evaluate those variables 6 months after the transition, in order to identify the most discriminating predictors of outcome.

Methods:

28 schools participated in the investigation. Measures were obtained of autistic and comorbid conditions (3Di, ADOS), cognitive abilities (WISC), language skills (CELF) and functional impairment (Vineland) from parental reports and individual child assessment. Family stress was measured by questionnaire (PSI). School teacher's evaluation of the child was obtained from Autism Scenarios. School support was assessed by the My Class Inventory, both in elementary and secondary school.

Results:

At the time of the evaluation before transition 90% of children with ASD had significantly discrepant cognitive profiles, with a greater range of cognitive skills than are found in >97% of the general population. Impairments were in executive abilities (e.g. poor working memory or processing speed – 80% affected), or in verbal or non-verbal intelligence.

On measures of emotional and behavioural adjustment, over 50% had clinically significant anxiety, with a similar proportion having clinically significant depressive symptoms. 65% had severely compromised self-esteem and 28% showed disruptive behaviour.

Parenting stress was exceptionally high, over 60% of families suffered from levels of stress in the severe, clinically significant range.

Six months after transition, parenting stress remained high with 73% in the severe, clinically significant range. Self-reported child difficulties in: anxiety, depression, self-concept, disruptive behaviour or anger did not significantly change. Teacher ratings of significant peer problems identified 37% before transition and 40% afterwards, but impairment in prosocial behaviour had deteriorated from 33% before transition to 50% afterwards.

Conclusions:

The period of transition from elementary to secondary school is stressful for most children with ASD, whether or not they have support in terms of assistance for special educational needs. Families suffer tremendous stress at this time, which has not ameliorated 6 months afterwards. Independent ratings by teachers indicate there has been deterioration in some aspects of behavioural adjustment in most cases. Children with ASD rate themselves as distressed and depressed by the experience. Support structures are urgently needed to ameliorate this worrying situation, which can lead to school drop-out if not managed effectively.

165.004 RISK and PROTECTIVE FACTORS for Bullying and Victimisation AMONG STUDENTS with AUTISM Spectrum DISORDERS. N. Humphrey* and J. S. Hebron, *University of Manchester*

Background: Students with ASD are more likely to be victims of bullying than those with other or no special educational needs. However, research on actual prevalence of victimisation in this group has so far been equivocal. Furthermore, there has been very little research that has examined the various factors associated with the extent of exposure to bullying in ASD. Developing knowledge and understanding of such issues is a crucial step towards designing effective interventions.

Objectives: To determine the prevalence of bullying among students with ASD, and identify risk and protective factors associated with the extent of exposure to bullying in ASD

Methods: Teachers (N=725) and parents (N=121) completed surveys on the nature, frequency and extent of bullying experienced by students with ASD. Background data was collected on each student including age, sex, level of SEN support provided in school, educational placement, mode of transportation to school, behaviour difficulties, positive relationships, and parental engagement and confidence. These were regressed onto the bullying variables to determine their contribution to the variance in a forced entry model.

Results: Parents reported significantly higher prevalence of bullying than teachers. The teacher and parent regression models predicted 41% and 39% (respectively) of the variance in bullying experienced by students with ASD. Explanatory variables that contributed significantly to the variance in bullying included, in order of magnitude, behaviour difficulties (greater difficulties being associated with more bullying), educational placement (with higher rates of bullying among students attending mainstream schools), age (with a peak in bullying reported for students in early adolescence), positive relationships (with better relationships with teachers and peers being associated with reductions in bullying), mode of transport to school (with higher rates of bullying among students using public transport), level of support provided in school (with lower rates of bullying among students in receipt of significant additional support), and parental engagement and confidence (with higher engagement being inversely associated with bullying).

Conclusions: Students with ASD are more likely than those with other or no special educational needs to be bullied in school. However, the findings of the current study suggest that the extent of bullying they experience varies as a function of a number of risk and protective factors. These factors need to be taken into account when developing provision in order to prevent bullying among such students in the future.

165.005 : A Randomized Controlled Study of Face-to-Face and Web-Based COMPASS Consultation. L. A. Ruble*[1], J. H. McGrew[2] and M. D. Toland[1], (1)*University of Kentucky*, (2)*Indiana University - Purdue University Indianapolis*

Background:

Numerous authors have identified the need for teachers to be trained in evidence based practices for children with autism (Hess, Morrier, Heflin, & Ivey, 2008; Morrier, Hess, & Heflin, 2011; Simpson, Mundschenk, & Heflin, 2011; Stahmer, et al., 2005). One method ideally suited for supporting teachers is consultation. We have developed a decision-making model that combines an articulation of external and internal supports and challenges with a conjoint process to help participants craft consensus goals and personalized intervention plans called the Collaborative Model for Promoting Competence and Success (COMPASS; Ruble, Dalrymple, & McGrew, 2012). A previous randomized controlled trial (RCT; Ruble, Dalrymple & McGrew, 2010) comparing COMPASS to standard practice obtained a large effect size (Cohen's d = 1.0). This second RCT compares the control condition to COMPASS when coaching sessions are provided either face-to-face (FF) web-based (WEB).

Objectives:

To evaluate the impact of COMPASS on child educational goal attainment when coaching sessions are delivered FF or WEB technology, compared to "usual" education program practices.

Methods:

Forty-four teacher-child dyads were randomized into one of three groups: (1) teachers who received an online autism training that served as a placebo-control; (2) teachers who received COMPASS + follow-up FF teacher coaching sessions; and (3) teachers who received COMPASS + follow-up WEB teacher coaching sessions. Child educational outcome was based on direct observation from an independent observer using goal attainment scaling (GAS); the GAS change score from Time 1 (start of year) to Time 2 (end of year) was used in the analysis.

Results:

An omnibus ANOVA showed a statistically significant difference for raw GAS change scores for the three groups, $F(2, 41) = 7.62$, $p = .002$, $MSE = 6.47$, $h^2 = 0.27$. Planned comparisons showed the mean GAS change score for the control group ($M = 4.8$, $SD = 2.63$) was statistically significantly lower than both the FF group ($M = 8.5$, $SD = 2.31$), $t(41) = -3.88$, $p < .001$ (one-tailed), Cohen's $d = 1.49$, and WEB group ($M = 7.04$, $SD = 2.9$), $t(41) = 2.3$, $p = .014$ (one-tailed), Cohen's $d = 0.81$. No statistically significant difference was found between the FF and WEB groups on GAS change score means, $t(41) = 1.51$, $p = .07$ (one-tailed), Cohen's $d = 0.56$.

Conclusions:

This second RCT confirms that COMPASS is an effective consultation model that results in improved educational outcomes for young children with autism. Web based videoconferencing is an effective alternative means for delivering coaching sessions to teachers. Future research is needed on the scalability of the model and implementation of the model by community practitioners.

165.006 Predictors of Outcomes of Preschool Aged Children Enrolled in An Early Intervention Trial. K. Williams*[1], M. Carter[2], T. Clark[3], D. Evans[4], T. Parmenter[4], N. Silove[5] and J. Roberts[6], (1)*University of Melbourne and Royal Children's Hospital*, (2)*Macquarie University*, (3)*Autism Spectrum Australia*, (4)*University of Sydney*, (5)*Children's Hospital at Westmead*, (6)*Griffith University*

Background: Information about the likely outcome for young children diagnosed with autism spectrum disorder (ASD) is important for those who care for them. Information about predictors of outcome can help clinicians tailor messages about likely outcomes to individual children.

Objectives: This study assesses the predictors of diagnostic stability of a diagnosis of autistic disorder and social and communication adaptive behaviours at twelve months follow-up for preschool aged children enrolled in a comprehensive intervention trial. The trial was established to assess centre versus home-based intervention.

Methods: For the trial eligible (clinically diagnosed ASD, preschool age) children were either randomised to centre or home-based intervention or included as a wait list group. For this study outcome measures were diagnostic stability for children diagnosed with autistic disorder (N=55) and social and communication adaptive behaviour in all eligible children (N=84), measured by the Vineland Adaptive Behaviour Scales (VABS). All children were assessed at baseline and at twelve months follow-up using standardised measures. This study was funded by the Australian Research Council.

Results: Children had a mean age of 3.5 years (range 2.2–5.0, SD = 0.61) at baseline. Fifty-five children were diagnosed with autistic disorder at baseline using the Autism Diagnostic Observation Scale (ADOS). Of these children seven (13%) improved and were not diagnosed as autistic disorder using the ADOS at twelve months follow-up. Five were diagnosed as ASD and two as not ASD. Univariate analysis identified baseline Griffith Mental Developmental Scale (GMDS) developmental quotient, Pragmatics Profile (total Q range), and Reynell comprehension raw score as predictors of improvement, whereas VABS social and communication scores and the Reynell expression raw score were not statistically significant predictors. Following logistic regression analysis GMDS developmental quotient was the only significant predictor explaining approximately 20% of the improvement in diagnosis in this sample. Univariate predictors of VABS social and communication scores at twelve month follow-up were GMDS developmental quotient, and Pragmatics Profile, Reynell comprehension score, Reynell expression score and ADOS diagnostic classification but not treatment group. Using regression analysis only the GMDS developmental quotient and Pragmatics Profile persisted as significant predictors of both the VABS social and communication scores, with those two factors explaining 54% and 59% of the variation in follow-up scores respectively.

Conclusions: Developmental quotient as measured with the GMDS was an important predictor of diagnostic stability and adaptive behaviour for children with ASD in this study. Information about diagnostic features as well as a measure of overall developmental ability and pragmatic communication is needed to allow a meaningful conversation with parents about the likely short term outcome for their preschool aged child. Further distillation of other predictors of outcome and whether these predictors are the same for older children is also needed.

165.007 Empowering Latino Families of Children with ASD: A Psycho-Educational Intervention. S. Magana*[1], R. Paradiso de Sayu[1] and W. Machalicek[2], (1)*University of Wisconsin-Madison*, (2)*University of Oregon*

Background:

Recent research has found disparities in health care and specialty services for Latino children with ASD compared to White children, particularly among those whose parents are Spanish speaking. Contributing to these disparities are

language barriers, lower socio-economic status, and limited access to information about disabilities and autism. Furthermore, Latinos are rarely included in autism intervention studies. An empowerment approach to addressing educational and informational needs of Latino parents is essential in order to better support their children with ASD.

Objectives:

The purpose of our pilot study was to develop and assess a psycho-educational intervention which aims to help Latino parents learn about child development, autism and its symptoms, advocating for services, how to share information with family members, and how reduce stress and depression among parental caregivers.

Methods:

This pilot intervention used *Promotoras de Salud*, which are lay community members who are bilingual, bicultural and from the same community as the participants and are trained in specific interventions. Furthermore, our promotoras were also mothers of children with an ASD. A curriculum was developed with the content listed in the objectives, and a one group pre and post-test design was used. Working with a community based organization, Wisconsin FACETS, 20 Spanish speaking mothers of children with an ASD between the ages of 2 and 8 years old were enrolled in the study. Promotoras carried out 8 home visits with each participant using the developed curriculum. Promotoras also administered the pre and post-tests, which included the following measures: Family Outcome Survey (Bailey et al., 2008); Caregiver Burden, Satisfaction and Efficacy (Heller, Miller, & Hseih, 1999), and the Center for Epidemiology Studies Depression Scale (CESD). Focus groups were held with participants after completing the program.

Results:

Pre and Post-test data showed significant improvements in all five of the Family Outcome subscales: Understanding Child's Strengths and Needs (Pre μ=9.4, SD=4.1; post μ=14.3, SD=1.3; P<.001), Knowing your Rights and Advocating for Child (Pre μ=10.1, SD=6.4; post μ=18.1, SD=2.4; P<.001), Helping your Child Develop and Learn (Pre μ=10.3, SD=3.7; post μ=14.1, SD=2.3; P<.001), Having Support Systems (Pre μ=11.2, SD=7.0; post μ=16.5, SD=3.3; P<.05), and Accessing the Community (Pre μ=14.4, SD=8.0; post μ=21.5, SD=2.3; P<.05). We also found significant improvement in caregiver efficacy, but not in caregiver burden or satisfaction. Qualitative data shows that mothers were very satisfied with the program and valued having another parent of a child with ASD deliver the content material.

Conclusions:

Interventions are needed for Latino families of children with ASD to address the disparities in services received by their children. This pilot study used an empowerment approach to improve knowledge and skills about how to better help their children. Results suggest that this may be a promising psycho-educational intervention for Spanish speaking Latino families. A second module is currently being developed to increase parental skills in using evidenced based applied behavior analytic strategies with their child with ASD. Plans are underway to conduct a randomized trial for the first module.

165.008 An Online Survey of Early Signs, Diagnosis and Intervention for Children with Autism in China. X. Qian*, *University of Minnesota*

Background: Parental advocacy and the growing research in early diagnosis and intervention has resulted in an increase of services for children with ASD and their families (Lovass, 1987; Wetherby et al., 2004). However, in some countries such as China, parents face societal discrimination for having a child with ASD and historically have had fewer available services for their children with ASD (McCabe, 2007). Relatively little is known about the diagnostic process and early intervention services in China.

Objectives: The purpose of this study was to obtain information on early signs that caused parental concern, age of diagnosis and provision of intervention, available intervention services, and parental satisfaction with services. This investigation was an online survey of Chinese parents (*n* = 146) residing in mainland China who have a child with ASD.

Methods: *Participants and sampling procedure.* A convenience sample of 146 Chinese parents of children with ASD who reside in mainland China responded to this survey which was administered via a website created for the survey. A pre-survey notice was sent to parents to inform them of the upcoming survey and a second email containing the link of survey was sent a week after the pre-survey notice. An overall return rate of 28% resulted for the survey.

The survey contained questions addressing the age at which parents were concerned about their children's development, the signs that caused their concern, the age when the initial diagnosis was obtained, availability of services provided by public schools or private sectors, intensity of services, and overall satisfaction with the diagnostic and intervention process.

Results: Parents reported that they first had concerns about development at a mean 3.1 years old (*sd* = 0.9), diagnoses were provided, on average, at 3.8 years (*sd* = 1.3), and interventions began at a mean of 4.3 years of age (*sd* = 1.4). Children whose parents reported the presence of greater numbers of autism-related symptoms tended to have concerns about the child's development at lower age ($\chi 2$ (6, n=146) =24.07, p=.001), though the presence of more symptoms was not associated with earlier diagnosis or intervention, possibly suggesting the need for greater concentration on early identification of ASD in the professional community in China. Data also suggested that some ASD symptoms, (e.g. not responding to his/her name when called, lack of sharing interest in activities or objects, and less showing of objects) may be particularly salient as early signs of ASD for Chinese parents. Over 70% of parents reported that they were either dissatisfied or strongly dissatisfied with the diagnostic process and the intervention services accessed by their child.

Conclusions: These results suggested the need for increased early intervention awareness in the Chinese professional community, perhaps building on the U.S. *Know the Signs, Act Early* model. Data also indicated that the presentation of ASD-related symptoms may be distinct in Chinese families, indicating need for culturally relevant assessment and intervention strategies, some of which will be addressed.

Genetics Program

166 Genetics II

Chair: J. S. Sutcliffe *Vanderbilt University*

This session presents a broad array of work on genetics and genomics in ASD, ranging from gene discovery to study of molecular and biological function of autism candidate susceptibility genes in models.

166.001 Genome-Wide SNP and Environment Interaction Study in Autism. C. Ladd-Acosta*[1], B. K. Lee[2], J. Bonner[3], B. Sheppard[1], N. B. Gidaya[2], A. M. Reynolds[4], L. A. Croen[5], D. E. Schendel[6], C. J. Newschaffer[2] and M. D. Fallin[1], (1)*Johns Hopkins School of Public Health*, (2)*Drexel University School of Public Health*, (3)*Michigan State University*, (4)*University of Colorado Denver*, (5)*Kaiser Permanente Division of Research*, (6)*Centers for Disease Control and Prevention*

Background: Despite high heritability estimates for autism, genetic variants identified to date account for a small portion of total heritable risk and none have been definitively confirmed. One plausible explanation for this "missing heritability" is that genetic risk factors are modified by environmental exposures. In fact, several recent studies suggest environmental factors, especially in utero exposures, play a larger role in autism risk than previously thought. Thus, to fully understand the contribution of environmental and genetic factors to autism risk, genome-wide studies integrating genetic and environmental factors are needed. Both technical and practical limitations have hindered this type of integrated study in the past. However, the recent development of two new analytic methods coupled with the recent availability of environmental exposure, genetic, and phenotypic information on a large and representative population of children now make a genome-wide gene-environment interaction study (GEWIS) feasible.

Objectives: The overall goal of this study is to identify genetic and environmental factors that together influence risk for autism. More specifically, we aim to identify SNPs whose effects on autism risk vary across levels of selected prenatal environmental exposures. We plan to further characterize identified gene-environment interactions (GxE) by determining the relationship between specific features of the exposure,

such as which trimester the exposure occurred, and the associated SNP.

Methods: The Study to Explore Early Development (SEED) is a national epidemiologic study of autism with comprehensive phenotypic evaluation, broad prenatal environmental exposure information, and biospecimens available for DNA measurements. Thus, it is unique and particularly well suited for identification of GxE in autism. Using the HumanOmni1 BeadChip we measured genotypes at over 1 million loci. Prenatal environmental exposure information was derived from maternal self reported data using a structured interview. Specific exposures included maternal use of tobacco, alcohol, β-2 adrenergic receptor agonist or antidepressant medications, and maternal infection. For our GxE analysis, we utilize two recently developed approaches specifically designed for GxE to overcome previous limitations with traditional methods when applied to millions of genomic loci making this GEWIS effort on a moderately sized sample plausible. The first method, developed by Kraft *et al.,* is a case-control likelihood ratio test that is sensitive to genetic main effects but unlike traditional methods allows for the possibility that the genetic main effect is modified by an environmental exposure. The second method, developed by Mukherjee *et al.,* is a case-only likelihood ratio test for GxE that overcomes problems with gene-environment dependence assumptions problems by utilizing an Empirical Bayes type shrinkage estimator to allow for uncertainty in the model.

Results: A total of 968 children enrolled in SEED were genotyped, including 418 cases, and 550 general population controls. Several data quality control measures were implemented and potential genotyping errors at both the sample and SNP level were removed, leaving 878 samples (356 cases and 522 controls) and over 800,000 SNPs for GxE analysis. Results from our GEWIS analysis, currently underway, will be presented at the conference.

Conclusions: Here we present the first genome-wide study to examine gene-environment interactions in autism.

166.002 Clinical Application of 2.7M SNP Array for CNV Detection in Subjects with Idiopathic Autism and/or Intellectual Disability. Y. Qiao*[1], C. Tyson[2], M. A. Hrynchak[2], E. Lopez-Rangel[1], J. Hildebrand[1], S. Martell[1], C. Fawcett[2], L. Kasmara[1], K. Calli[1], X. Liu[3], J. J. A. Holden[3], E. Rajcan-Separovic[1] and S. M. E. Lewis[1], (1)*University of British Columbia*, (2)*Royal Columbian Hospital*, (3)*Queen's University*

Background:

Whole-genome arrays are an effective tool for identifying copy number variants (CNVs) and integral genes contributing to autism and/or intellectual disability (ASD/ID). Whilst higher resolution arrays can identify smaller CNVs, their confirmation requires molecular methods and their clinical relevance is often ambiguous. Reporting thresholds of 200kb for deletion and 500kb for duplication is common in clinical cytogenetic laboratories.

Objectives:

Our objective is to test the utility of the Affymetrix® Cytogenetics Whole-Genome 2.7M Array (Cyto2.7M Array) for detecting smaller, sub-threshold CNVs of potential clinical relevance.

Methods:

We applied Affymetrix Cyto2.7M Array for validating 39 positive CNVs previously identified by lower resolution arrays in 30 subjects with ASD and/or ID. Then, we screened a further 52 subject with ASD/ID using this platform. A total of 22 small, unique CNVs containing genes of potential ASD relevance but not previously detected by lower resolution arrays and/or under the clinical threshold were selected for investigation by FISH and/or Quantitative Multiplex PCR of Short fluorescent Fragments (QMPSF).

Results:

All of the 39 positive CNVs previously identified were confirmed using the Cyto 2.7M Array. Four out of ten small, unique CNVs (100-400Kb) previously undetected by lower resolution arrays were confirmed by FISH and/or QMPSF (40%). A further screen of 52 new subjects with ASD+/-ID using this array

platform uncovered 10 unique CNVs above the clinical threshold with 5 considered pathogenic, involving 4p14, 12q24.31, 14q32.31, 15q13, and 17p13.3. Twelve small unique CNVs below the clinical threshold (49~480 Kb) containing neurofunctional genes were selected and 9/12 of them were confirmed by QMPSF (75%); 8 were familial and 1 *de novo.* Putatively pathogenic CNVs included: a maternally transmitted duplication (130 Kb) spanning exons 64-79 of the *DMD* gene which was found in a 3-year old boy manifesting autism and mild neuromotor delays.

Conclusions:

Our study established that quality control criteria based on low waviness-segment-count decreased the number of false positive small CNVs from 60% to 25%. The study also identified small CNVs of putative pathogenic importance that could be missed using current standard clinical array reporting thresholds.

166.003 Genomic Landscape of Autism Spectrum Disorders.
S. R. Wadhawan*, X. Ji, K. J. Won, C. F. Lin, L. S. Wang and M. Bucan, *University of Pennsylvania*

Background: Identifying genetic factors underlying ASD susceptibility is challenging due to the clinical heterogeneity in symptoms and disease severity exhibited by the affected individuals. Recent genome wide association and copy number variant studies have not only identified over 240 genes and genomic regions carrying variants that lead to ASD susceptibility, but have also shown that a significant portion of these variants reside in the intergenic regions suggesting the importance of regulatory polymorphisms in ASD. Some variants behave in a Mendelian fashion showing high penetrance whereas others exhibit low penetrance where the phenotypic effect of a mutation within members of the same family is different. Current findings support a model that common variants with a moderate effect together with rare and *de novo* mutations in genes involved in neuronal development and signaling underlie ASD susceptibility.

Objectives: (i) To identify rare functional coding polymorphisms (ii) To identify rare functional noncoding polymorphisms

Methods: We sequenced 18 autistic individuals using two platforms (i) Whole Exome (ii) Custom Capture: 3.5 MB of prioritized 100 ASD-candidate genes and their conserved elements.

Results: We identified ~24,000 SNPs in each individual on the exome platform, 95% of which were catalogued in dbSNP. We performed systematic annotation using ANNOVAR to identify synonymous, missense and nonsense polymorphisms. We then used POLYPHEN2 and SIFT to study the effect of missense mutations on protein function. Finally, in order to identify rare SNPs we used data from 1000 genomes to obtain allele frequencies of potentially pathogenic variants (identified as 'damaging' by POLYPHEN2 or SIFT). Of all the SNPs, ~15,500 fall within exons and ~7,000 resulted in the change of an amino acid. Subsequent predictions using POLYPHEN2 and SIFT revealed ~2,000 SNPs that were potentially pathogenic, of which ~250 were 'novel'. Similar analysis of coding SNPs in our prioritized 100 ASD-candidate genes identified ~30 missense mutations and revealed remarkable heterogeneity as each individual carried on average 8-10 rare (<2% allele frequency) potentiallly 'damaging' SNPs in genes such as *DISC1, MAP2, CACNA1C, CACNA1H, MADCAM1, BZRAP1*, *HTR2A, CDH22 and OPRM1*. To analyze the noncoding variants we utilized histone modification marks, specifically H3K9ac, and DNAse1 hypersensitive site (DHS) information from the human brain to score and prioritize important regulatory regions and SNPs within them. We identified ~2,700 noncoding SNPs of which ~1600 resided in potential regulatory regions marked by DHS and H3K9ac marks. We used a score threshold of 0.3 to identify ~70 high scoring SNPs in genes such as *NBEA, BZRAP1, PACRG, ABAT, NLGN1, DACH1, NRXN1, CDH22, CDH9, CADPS2, CADM1, CTNNA3.*

Conclusions: Analysis of SNPs identified functionally important variants in key Autism genes, but most importantly, it highlights extreme genetic heterogeneity intrinsic to ASD. In addition to the observed coding variation we have also identified rare and novel SNPs in potential regulatory elements, including predicted p300 binding sites, experimentally validated neuronal enhancers. Understanding the predicted effects of these alleles on gene function and evaluation of these alleles

in functional assays, individually and in combinations, will provide key insights into the mechanisms underlying neurodevelopmental anomalies associated with autism.

166.004 First Genome Wide Association Study (GWAS) for Maternally Acting Gene Alleles Identifies New Candidate Genes in Autism. W. G. Johnson*[1], E. S. Stenroos[1] and S. Buyske[2], (1)*UMDNJ-RWJMS*, (2)*Rutgers University*

Background: Although several environmental factors have been suggested for autism, specific environmental risk factors have been hard to identify. Gene alleles that act in mothers can alter the fetal environment and contribute to the autism phenotype in their offspring. From the perspective of the fetus, maternal environmental factors and maternal genetic factors acting prenatally are both environmental factors. We and others have reported evidence of maternally acting gene alleles (MAGAs) in autism; however, there has been no systematic study of a maternal prenatal contribution to autism. There are at least 45 reports of MAGAs across all disorders, comprising more then 20 individual genes. This number has nearly tripled since the topic was reviewed in 2003 and most contribute to neurodevelopmental disorders. Three have been reported in autism using a candidate gene approach.

Objectives: To use genome-wide array data to identify MAGAs that contribute to autism.

Methods: Genotype and phenotype data were made available by The Autism Genetic Resource Exchange (AGRE). Genotyping was done by Dr. Hakan Hakonarson at the Children's Hospital of Philadelphia on the Illumina Hap550 GWAS platform for full or partial trios (affected individuals and parents). Families were restricted to those with at least one child with a diagnosis of "Autism without possible non-idiopathic autism". Pedigrees were trimmed to one nuclear family limited to both parents (if available) and all affected offspring, leaving 825 families with a mean of 3.6 genotyped individuals per family. We used the Weinberg log linear method extended to families with more than one affected child by averaging within families. The log linear method examines symmetric mother-father-child types (e.g., 2-0-1 and 0-2-1, where the numbers are the counts of a specified allele in the mother, father, and child, respectively) to test for asymmetric counts in the parental types (e.g., whether 2-0-1 is much more common than 0-2-1). A Poisson regression model is fit to the counts under the null and alternative hypotheses and the likelihood ratio test applied. The EM algorithm was used to incorporate families with a missing parental genotype.

Results: After QC, there were 825 full and partial trios (3,082 individuals) and 468,568 SNPs. One SNP, rs12487874 (intronic in gene *RTFN1*), showed genome-wide significance ($p = 8.6E-11$, genome-wide significance threshold $p< 5.0E-08$). In addition there was no evidence of a child effect for this SNP. We found that families where the mother has two copies of the allele dramatically outnumbered families where the father has two copies. There was no apparent effect for one copy versus none. Other SNPs of interest were in or near *GLI2* (8.28E−08), *HHLA2* (1.86E−05), *PHF21B* (1.44E−05) and *TLE1* (1.35E−05). The loci near *RTFN1* and *GLI2* seemed particularly notable for the lack of SNPs in linkage disequilibrium (LD) with our index SNP. SNP rs7120625 on Chr #11 has a suggestive p-value, but the lack of good p-values for SNPs that are in partial LD makes it less interesting.

Conclusions: This was the first GWAS for MAGAs. Several promising loci were found. The results will need to be replicated.

166.005 Follow-up Linkage and Association Analyses of a Nonverbal Motor Speech Phenotype Identified in the AGRE Data Set. A. Hare*[1], M. Azaro[1], R. Zimmerman[1], J. Flax[1], J. Burian[2], V. Vieland[2] and L. Brzustowicz[1], (1)*Rutgers University*, (2)*The Research Institute at Nationwide Children's Hospital & The Ohio State University*

Background: Using behavioral and genetic information from the Autism Genetics Resource Exchange (AGRE) data set we developed phenotypes and investigated linkage and association for individuals with and without Autism Spectrum Disorders (ASD) who exhibit expressive language behaviors consistent with a motor speech disorder. Speech and language variables from Autism Diagnostic Interview-Revised (ADI-R) were used to develop a motor speech phenotype associated with non-verbal or unintelligible verbal behaviors

(NVMSD:ALL) and a related phenotype restricted to individuals who were non-verbal or unintelligible but without significant comprehension difficulties (NVMSD:C). We previously identified several linkage peaks using the PPL framework to assess the strength of evidence for or against trait-marker linkage and linkage disequilibrium across the genome using Affymetrix 5.0 genotype data. As evidence for linkage disequilibrium was limited, Ingenuity Pathway Analysis (IPA) was then utilized to identify potential genes for further investigation.

Objectives: In this presentation, we fine mapped our genes of interest and used the PPL framework to assess evidence for association. We also present the addition of 88 new families from the AGRE data set to the NVMSD:ALL phenotype for sequential updating of our initial linkage analysis.

Methods: 1) Tag SNPs were selected from our genes of interest and were genotyped using an Oligonucleotide Ligation Assay. Genotype information was analyzed for association using an extension of the PPL that detects linkage disequilibrium. 2) The SNPstream assay was used to genotype 450 SNPs from our linkage regions in the additional NVMSD:ALL family members. Genotype information was checked for missingness, Mendelian inconsistencies, unlikely double recombination events, and departures from Hardy-Weinberg Equilibrium. The initial PPL analysis was sequentially updated to include evidence for or against linkage in our extended sample.

Results: Overall, evidence for linkage disequilibrium was limited in our candidate genes of interest, with the highest signals in TRPV2 (8%) and LMX1A (7%). The sequential update of our linkage analysis increased evidence for linkage in the following regions: 1q24.2, 3q25.31, 4q22.3, 5p12, and 17q22 while evidence for linkage decreased in regions 5q33.1, 17p12, and 17q11.2.

Conclusions: The additional 88 families from AGRE added power to our PPL analysis with increasing evidence for linkage in several regions. Even though there was a decrease in linkage evidence in a few regions and evidence for linkage disequilibrium was limited, the replication and strengthening of our previous findings support our continued investigation of this phenotype as playing an important role for reducing genetic heterogeneity in autism samples.

166.006 A Longitudinal Twin Study of the Causal Relationship Between Autistic Traits and Traits Characteristic of ADHD From Middle Childhood to Early Adolescence.

M. J. Taylor*[1], T. Charman[2] and A. Ronald[3], (1)*Institute of Education* , (2)*Institute of Education*, (3)*Birkbeck College*

Background: Individuals with autism spectrum disorder (ASD) are at a heightened risk of developing ADHD. Recent twin studies have suggested that traits characteristic of ASD and ADHD share a considerable degree of their genetic influences in middle childhood, early adulthood, and adulthood. This prior research has all been cross-sectional; longitudinal models are needed to explore the causal relationship between autistic- and ADHD-like traits across development, and to test whether traits of ASD and ADHD might directly influence one another across ages.

Objectives: The study aimed to examine genetic and environmental influences on the covariation of autistic- and ADHD-like behaviours in early adolescence, a period associated with heightened risk of mental health problems. It also aimed to use longitudinal statistical modelling to examine how traits of ASD and ADHD directly influence one another across ages. This longitudinal association was examined in relation to total scales as well as in relation to specific subscales.

Methods: Participants came from the Twins' Early Development Study, a longitudinal, general population UK-based sample of monozygotic and dizygotic twin pairs. Autistic traits were measured using parent ratings on the Childhood Autism Spectrum Test (CAST), while traits of ADHD were measured using the Conners' DSM-IV ADHD Subscales. Data were collected when twins were aged 8- and 12-years. Bivariate twin modelling enabled estimates of parameters relating to shared genetic and environmental influences. Longitudinal associations were tested using cross-lagged modelling, which enabled a consideration of the relationship between traits across time when the existing association at the first timepoint was taken into account.

Results: Bivariate twin model fitting on 12-year data suggested that the best fitting model was one that included additive genetic influences, and shared and nonshared environment, and separate estimates for males and females. The degree of genetic overlap between traits of ASD and ADHD was modest (genetic correlations = 0.41 for males, 0.23 for females) and nonshared environmental influences also showed moderate overlap (nonshared environmental correlations = 0.23 for males, 0.21 for females). Cross-lagged modelling suggested that both autistic- and ADHD-like traits influence each other across development. ADHD traits at age 8 were comparably more predictive of autistic traits at age 12 than autistic traits at age 8 were predictive of ADHD traits at age 12. Modest genetic influences were transmitted across time, while entirely different nonshared environmental influences operated on the traits at each age. Modelling by subscale suggested that autistic-like communication difficulties were more strongly predicted by ADHD scales than autistic-like social impairments or restricted, repetitive behaviours and interests. Cross-lagged associations were equally strong for both subdomains of the ADHD trait measure (inattention and hyperactivity/impulsivity).

Conclusions: Cross-lagged modelling suggested that autistic traits and traits of ADHD influence one another across time; this suggests that comorbidity in ASD is not a static phenomenon. These findings demonstrate that a greater understanding of the relationship between comorbid traits can arise from studying them within a longitudinal developmental design.

166.007 Heritability of Proposed DSM-5 Autism Symptom Domains in a Large, Clinically-Ascertained Sample. T. W. Frazier*[1], L. Thompson[2], P. A. Law[3], E. A. Youngstrom[4] and N. Morris[2], (1)*Cleveland Clinic*, (2)*Case Western Reserve University*, (3)*Kennedy Krieger Institute*, (4)*University of North Carolina at Chapel Hill*

Background: Population-based twin studies have identified strong genetic influences for both global and specific autism symptoms. These studies have also found predominantly independent heritability, suggesting unique genetic influences across social communication/interaction (SCI) and restricted/repetitive behavior (RRB). Additionally, population studies have identified similar magnitudes of genetic effects across more and less stringent thresholds, implying comparable genetic influences across typical and pathological levels of autism symptoms. Together, these conclusions support a model of autism spectrum disorder (ASD) as the confluence of extreme scores on independent liability continua. While population studies are extremely useful for examining heritability of the full range of autism traits, they are limited by the presence of a minority of diagnosed ASD cases - even within extreme score ranges. Therefore, these studies may have limited power to test for distinct genetic influences across ASD and non-ASD cases.

An alternative model posits that ASD is a distinct syndrome composed of underlying SCI and RRB symptom continua. This alternative view would predict strong common heritable influences across domains and higher heritability for categorically diagnosed ASD than for individual difference levels of the trait. A third viewpoint, supported by a recent behavior genetic study of ASD diagnoses, posits substantial contributions of shared environment.

Objectives: The present study evaluated these competing perspectives by estimating extreme group heritability, individual differences heritability, and shared environmental effects on proposed DSM-5 SCI and RRB symptoms.

Methods: Twin data were obtained from the Interactive Autism Network (IAN; ASD-affected twin pairs N=369). Caregivers reported autism symptoms using the Social Responsiveness Scale (SRS) and/or the Social Communication Questionnaire (SCQ). Basic and augmented DeFries-Fulker regression models were computed in extreme groups and in non-ASD twin pairs using SCQ and SRS total scores and domain scores reflecting SCI and RRB symptoms.

Results: Extreme group heritability (h_g^2) was very large (smallest β=.92, SE=.15, $p<.001$) and consistent across total, SCI, and RRB scores. Shared environment (c^2) and individual differences heritability (h^2) were not significant when extreme scores were examined (c^2 largest β=.54, SE=.82, $p>.10$; h^2 largest β=.52, SE=.48, $p>.10$). In spite of being underpowered, the difference between extreme group heritability and

individual differences heritability (h_g^2-h^2) was always large and reached significance for SRS total scores ($z \geq 2.0$; $\beta=1.12$, SE=.35, p=.002). Bivariate (cross-construct) heritability analyses - where twin pairs are selected for a high score on one symptom domain and group heritability is calculated for the second domain - indicated substantial genetic correlations for extreme SCI and RRB scores (smallest $\beta=.81$, SE=.15, $p<.001$).

Conclusions: Recent analyses of symptom data have supported an alternative view of ASD as a distinct category with SCI and RRB sub-dimensions. The present results further support this view. Heritability was stronger for extreme scores than for individual differences, and SCI and RRB domains showed overlapping heritable influences. These findings should be considered very preliminary and will require confirmation with more extensive modeling. If confirmed, results support a strong investment in genomic research and suggest that genetic influences are likely to be pleiotropic, simultaneously driving SCI and RRB symptoms.

166.008 Characterization of the Function and Regulation of the Autism Susceptibility Candidate 2 (AUTS2) Gene.

N. Oksenberg*[1], N. Ahituv[1] and L. A. Weiss[2], (1)*UCSF*, (2)*UCSF Department of Psychiatry, Institute for Human Genetics*

Background:

Heterozygous chromosomal aberrations in the *autism susceptibility candidate 2* (*AUTS2*) gene region, some of which remove only intronic regions, have been associated with autism spectrum disorders (ASDs). In addition, nucleotide variants, primarily noncoding, in the first half of *AUTS2* are thought to make up the most significant accelerated genomic region differentiating humans from Neanderthals.

Objectives:

The function and regulation of *AUTS2* are largely unknown despite the involvement of this gene in ASD and modern human evolution. Here, we set out to characterize the functional role and regulatory landscape of *AUTS2.* In addition, we are analyzing the mechanisms by which changes in this gene's regulatory sequences could lead to ASD and modern human evolution.

Methods:

To characterize *AUTS2* function, we used morpholinos (MOs) to knock-down *auts2* in zebrafish. To decode the regulation of *AUTS2*, we identified tissue specific enhancers that may regulate this gene. Using comparative genomics and available ChIP-Seq data sets, we scanned regions around *AUTS2* that are associated with ASD or human-Neanderthal sequence changes for potential enhancer elements. Enhancer candidates were tested using a transgenic zebrafish assay and a subset of positive enhancers were verified in a similar mouse enhancer assay.

Results:

Two different *auts2* MOs led to a smaller head size, a loss of neurons in the midbrain (including the cerebellum), decreased volume of motor neurons in zebrafish embryos and decreased movement in response to touch. These phenotypes were rescued by co-injection of human *AUTS2* mRNA. Further analysis of *auts2* morphants revealed an increase in cell death in the embryonic brain. As for *AUTS2* regulation, 21 of the 38 candidate sequences function as enhancers in zebrafish and had expression patterns that overlapped with *auts2*. Three of these were also functional brain enhancers in mice and are within a 33kb noncoding ASD-associated deletion.

Conclusions:

Combined, our results show that *AUTS2* is an important neurodevelopmental gene. In addition, they provide a regulatory map for central nervous system (CNS) enhancers that could regulate *AUTS2,* revealing candidate sequences where nucleotide variation could lead to ASD susceptibility and human specific traits.