Keynote Address Program
100 Understanding Autism From a Cross-Syndrome Developmental Perspective
Speaker: A. Karmiloff-Smith *Birkbeck Centre for Brain & Cognitive Development, University of London*

Autism and the neurodevelopmental disability, Williams syndrome, have often been characterized at opposite ends of a neural and cognitive continuum in terms of their social and cognitive profiles, whereas in-depth analyses reveal many commonalities that emerge across their developmental trajectories. In this address, I will show how tracing domain-specific phenotypic outcomes back to their domain-relevant processes in the infant start states can help to identify the ways in which tiny initial impairments can cascade over developmental time to result in large developmental differences in the end state.

100.001 Understanding Autism From a Cross-Syndrome Developmental Perspective. A. Karmiloff-Smith*, *Birkbeck Centre for Brain & Cognitive Development, University of London*

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Invited Educational Symposium Program
101 Characterizing Cognition In Nonverbal Individuals with Autism: Innovative Assessment and Treatment
Moderator: G. Dawson *Autism Speaks, UNC Chapel Hill*

Current estimates are that one quarter to one half of children with ASD enter school with minimal verbal skills. At this point we cannot determine pathways to language impairment—which children might be preverbal as preschoolers and which ones go on to be nonverbal. Parents are understandably concerned about this situation given the often cited finding that children who speak by the time they are 5 or 6 years of age have milder symptoms and function more adaptively as adults (Lord, 2000; Rutter, 1978). Moreover, recent evidence suggests that while some children can learn to talk after age 5 years, most do so between 5 and 7 years, have IQs over 50 and rarely progress to phrase speech (Pickett, et al, 2009). This symposium will describe a series of innovative studies for characterizing language impairment in school aged children with ASD with an overarching goal of enriching intervention research with translational, brain based methods

101.001 Assessing Cognition and Language In Nonverbal Children with Autism: Is the Frog Green?. A. A. Benasich*[1], V. L. Shafer[2], J. Flax[3], Y. H. Yu[4] and M. MacRoy-Higgins[5], (1)*Rutgers University Newark*, (2)*College of the City of New York*, (3)*Rutgers University*, (4)*The City University of New York*, (5)*Hunter College-CUNY*

The majority of nonverbal/minimally verbal subjects have little to no access to effective communication, thus their cognitive capacity remains essentially unknown. Given that lack of expressive language does not necessarily indicate lack of receptive language abilities, we developed a battery of adapted information processing tasks and linguistic EEG/ERP assessments that do not require expressive language and thus may allow more accurate descriptions of the capabilities of these children. An overview will be given of these tasks as well as preliminary results highlighting outcomes as compared to an age-matched typically developing control group. It is hoped that these passive electrophysiological and behavioral tasks will allow researchers to identify and begin to quantify the linguistic and cognitive abilities of this difficult to assess group of children with ASD.

101.002 Innovations In Assessing Cognition In Nonverbal Children with Autism Spectrum Disorder. J. Connolly*[1], J. A. Reitzel[2], P. Szatmari[3] and A. Harrison[1], (1)*McMaster University*, (2)*McMaster Children's Hospital/McMaster University*, (3)*Offord Centre for Child Studies, McMaster University*

Up to 25% of children with autism are labeled nonverbal with the implication that they can neither produce nor comprehend language and may have a restricted and limited cognitive life. In many situations these judgments are based on psychological assessments and behavioral observations only. This proof of principle study draws from experience successfully using event-related brain potentials (ERP) to assess cognitive and language abilities of patients with acquired brain injuries. We describe a study that seeks to determine if speech comprehension can be demonstrated in any of the individuals who have received a nonverbal autism diagnosis and, if such a

capacity is demonstrated, to further explore the range of cognitive functions that may exist.

101.003 Developing Biomarkers of Language Impairment In Nonverbal Children with Autism: An MEG Investigation. N. M. Gage*[1], A. L. Isenberg[1], P. T. Fillmore[2], K. Osann[1] and P. Flodman[1], (1)*University of California, Irvine*, (2)*University of South Carolina*

Language impairment is a defining feature of autism however its neural bases remain largely undiscovered. We present findings from an ongoing series of studies to develop brain-based predictors (biomarkers) of language function in minimally-verbal school-aged children with autism. We use MEG and a passive listening paradigm to assess cortical function in typically developing children and children with autism so that we may determine between-group differences that correspond to neural mechanisms and not to task-related attentional processes, compensatory strategies, or coping skills. We adopt a case-study approach so that we may assess cortical language processes and their correspondence to language outcome on a child-by-child basis. A key aim is to go beyond group-wise differences to determine which brain measures are predictive of language outcome as measured by standardized assessments. Our overarching goal is to develop biomarkers that are predictive of language outcome in school-aged children in order to provide methods for earlier detection in younger children so that treatment and interventions may be begun as early in life as possible.

101.004 CCNIA Intervention: Spoken and Augmented Means of Communication. C. Kasari*[1], A. Kaiser[2], R. J. Landa[3], P. Mathy[4], K. Goods[1] and J. Nietfeld[2], (1)*University of California, Los Angeles*, (2)*Vanderbilt University*, (3)*Kennedy Krieger Institute*, (4)*Kennedy Kreiger Institute*

Interventions are needed to assist nonverbal school aged children into becoming effective communicators. Interventions focusing on this population will be reviewed, and a novel social-communication intervention with two arms: spoken language and the use of a speech- generating device (eg ipad) will be described. The study uses a SMART design (sequential multiple alternating randomized trial) in order to determine responder status from the novel intervention, and the potential sequence of interventions that may be necessary to effect change. Particular challenges with this population will be highlighted, such as heterogeneity in child presentation and response.

Services Program
102 Services for Children with ASD

102.001 The Role of Compliance with American Academy of Pediatrics Guidelines for Well Child Care In the Early Detection of Autistic Disorder. A. M. Daniels*[1], S. C. Marcus[2] and D. S. Mandell[3], (1)*Johns Hopkins Bloomberg School of Public Health*, (2)*University of Pennsylvania* , (3)*University of Pennsylvania School of Medicine*

Background:

Clinicians can reliably diagnose autistic disorder (AD) starting from when children are two years of age; however, many children are not diagnosed until they reach school age. While studies have advanced our understanding of factors influencing age at diagnosis, many identified factors are not modifiable. Studies have also shown regional variation in age at diagnosis, yet have not identified specific regional characteristics that adequately explain this variation. Receipt of well-child care in compliance with American Academy of Pediatrics' (AAP) guidelines has been associated with improvements in care quality and enhanced screening of other chronic conditions. No studies have examined the extent to which well-child compliance and associated state policies influence the early detection of autistic disorder.

Objectives:

The objectives of this study are to 1) estimate the association of children's compliance with AAP guidelines for well-child care and age at diagnosis of autistic disorder and to 2) evaluate the extent to which state policies related to well child care are associated with age at diagnosis.

Methods:

This study used Medicaid data from 2001-2005 from all 50 states and Washington, DC. The study sample included all children born in 2001 who were diagnosed with autistic disorder between the ages of 24 and 60 months and who were continuously enrolled in Medicaid up to age of diagnosis (N=1402). Children were identified as having autistic disorder if they had at least two separate visits associated with a primary diagnosis of AD. Age at diagnosis was defined by subtracting the child's date of birth from the date of the earliest AD claim. Overall well-child care compliance was assessed by dividing the total number of well-child visits up to diagnosis by the total number of AAP recommended visits for that same time period. The relationship between well-child care compliance and age at

diagnoses will be examined using discrete time survival analysis.

Results:

Analyses are ongoing. The mean age at diagnosis was 38.2 (SD 7.8) months. The mean compliance ratio was 0.55 (SD 0.45); 11% (n=149) of the sample had no well-child visits from birth to age at diagnosis. Preliminary findings using random effects, linear regression showed a non-significant association between well-child care compliance and age at diagnosis, controlling for child-level demographic characteristics, other health service use (i.e. sick visits), the presence of chronic conditions, and county and state variables. Additional analyses using discrete time survival modeling with both time-fixed and time-varying covariates is ongoing and will reveal whether receipt of well-child care at certain time periods influences age at diagnosis.

Conclusions:

Preliminary findings suggest that children in this study received fewer well-child visits and have less average compliance than children of similar ages in the general population. Findings also reveal that overall compliance with AAP guidelines are not linked to early detection of AD. The implications of the relationship between receipt of well-child care at particular time periods and age at diagnosis will be discussed.

102.002 General Education Teachers' Perceptions of Inclusion for Children with Autism. P. Rosen*[1], E. Rotheram-Fuller[1] and D. S. Mandell[2], (1)*Temple University*, (2)*University of Pennsylvania School of Medicine*

Background: In recent years, inclusion has become increasingly common practice for children with special needs (Kasari, Freeman, Bauminger, & Alkin, 1999). Despite this growing trend, there has been some resistance from general education teachers, especially when students being included have been diagnosed with autism (McGregor & Campbell, 2001). This issue often is exacerbated in schools located in large, urban districts, which often contend with additional barriers to inclusion related to a lack of resources. Yet these districts serve a disproportionately large number of children with autism. More information is needed to better understand the beliefs and attitudes of general education teachers in these urban classrooms, as well as to assess their resource needs.

Objectives: To assess general education teachers' perceptions and attitudes toward the inclusion of children with autism in their classrooms, their beliefs regarding the child's educational placement, and specific child, classroom, and school-related factors impacting these attitudes.

Methods: A survey including both quantitative and semi-structured components was developed and administered to elementary school teachers in a large, urban district as part of a pilot study. Teachers answered survey items about individual students presently being included, as well as their perceptions of the success of inclusion in their schools. Eight teachers were administered the survey and offered consultation services. Teachers had an average of 10.25 years (range 1-30) of experience, while teaching experience specifically with students with autism ranged from 0 to 15 years (M=4.75). On average, teachers had 25.5 students in their classrooms, with between 2 to 4 students with autism included.

Results: Preliminary survey results indicate some general trends in beliefs about students' educational placement. Teachers rated the placement of only 44% students as being "completely appropriate," with placement for 33% of students was considered as "somewhat appropriate," and placement for 22% students deemed "somewhat inappropriate." When asked specifically if they would suggest a change of placement, teachers reported that they would recommend 33% of students for more restrictive settings, although overall, teachers thought that the majority of students (66%) should remain in their present placements. Teachers felt their own skills in managing a child with autism were strong, but that the students did not always come in to the classroom prepared for the demands of the general education setting. Resource needs mentioned by teachers included strategies for promoting socialization between children with autism and their peers, training regarding the implementation of IEP goals, as well as continued support from professional staff (i.e. special education teachers). Overall, all teachers reported positive attitudes about including children with autism in their classrooms.

Conclusions: Although these findings represent a small sample of teachers, the information collected provides an in-depth look at the needs of these teachers within the classroom. Results also indicate the need to explore child 'readiness,' prior to entering the general classroom setting. Overall, teachers were not resistant to having children with autism included in their classroom, but felt they need additional resource to make this process successful.

102.003 Differences In Parenting Stress for Parents of Young Children with ASD Between Ages 2 and 4. L. E. Herlihy*, T. Dumont-Mathieu, M. Barton and D. A. Fein, *University of Connecticut*

Background: Previous research from the current project found that when children with autism spectrum disorder (ASD) were 18-24 months, lower yearly family income and higher levels of symptom severity were associated with increased parenting stress (Herlihy et al., 2010). No association emerged between adaptive skills level and parenting stress. Clarifying the relation between parenting stress and child factors at various ages could lead to a better understanding of the needs of this population of families.

Objectives: The aims of the current study were to (1) compare previous findings on parenting stress in parents of 18-24-month-olds with ASD to parenting stress in parents of 42- to 62-month-olds with ASD, and to (2) compare parenting stress levels longitudinally in a subsample who contributed data at both time points.

Methods: Comparison: Participants were 84 parents of children presenting for follow-up evaluation at 42 to 62 months as part of the Early Detection study. The child's ASD diagnosis was confirmed and parenting stress was measured with the Parenting Stress Index- Short Form (PSI-SF). Child symptom severity was measured with the CARS and adaptive skills were measured with the Vineland. Parents self-reported yearly income data on a demographic questionnaire. Longitudinal: Participants were a subset of 30 parents from the above sample who completed the PSI-SF at both Time 1 (18-24 months) and Time 2 (42-62 months).

Results: Comparison: In a sample of parents of 42- to 62-month-olds with ASD, the child's score on the Vineland Social domain was negatively correlated with parenting stress level ($r=-.246$, $p<.05$). PSI score was not associated with CARS score or family yearly income at this age. Longitudinal: A paired samples t-test revealed a significant mean difference ($t= -2.650$, $p<.05$) between parents' PSI-SF score at the two time points, with parents reporting higher levels of stress at Time 2. In this subsample, parents' PSI-SF score was negatively correlated with the child's Vineland Social domain score at Time 2 ($r= -.435$, $p<.05$). PSI score was not associated with Vineland Daily Living or Communication domains, or with CARS score.

Conclusions: In this preliminary study of parents of 42- to 62-month-olds with ASD, parenting stress level was not associated with family yearly income as it had been in a sample of toddlers from the same project. Lower parenting stress in this sample was associated with better adaptive skills in the Social domain, which was not the case in a study of toddlers reported in a previous poster (Herlihy et al., 2010). In a subsample of parents who reported parenting stress at both time points, parenting stress level was significantly higher on average when the children were 42-62 months old and was negatively associated with the child's current level of social skills. Results suggest that at the time of diagnosis family factors such as degree of child impairment and family resources are associated with high stress, while after two years, as children continued to exhibit significant impairments, the degree of social/emotional attachment displayed by the child is more important in influencing parental stress.

102.004 Fidelity of Implementation of Evidence-Based Practices by Paraprofessionals In Community Classrooms. V. Zandi*[1], A. C. Stahmer[2], S. Reed[2], E. L. Lee[3], S. Shin[4] and D. S. Mandell[5], (1), (2)*Rady Children's Hospital, San Diego*, (3)*Rady Children's Hospital*, (4)*University of Pennsylvania*, (5)*University of Pennsylvania School of Medicine*

Background: The evidence from efficacy trials supporting interventions for children with autism has increased dramatically in the past decade. There are few studies, however, that examine whether community-based educators can implement these sometimes complicated interventions with fidelity to the manual, even when extensive training and support are provided. In particular, the capabilities of paraprofessionals, who often are the educators spending the most time with these children, have been essentially ignored. Understanding whether teachers and paraprofessionals trained in a specific approach can effectively implement the intervention is essential for translating evidence-based programs (EBPs) into schools.

The Strategies for Teaching based on Autism Research (STAR) program is a comprehensive curriculum that uses EBPs to teach academic and social skills. Strategies include the highly structured discrete trial teaching (DTT), and the more naturalistic behavioral strategy, pivotal response training (PRT). STAR was developed specifically for classrooms and is starting to be widely disseminated; however treatment integrity among classroom educators has not been systematically examined.

Objectives: To examine fidelity of implementation of the STAR program components, including DTT and PRT, among teachers and paraprofessionals after training.

Methods: STAR was implemented in K-2 autism support classrooms in one large urban school district as part of a randomized trial. Teachers and paraprofessionals in 42 classrooms participated. Participating teachers agreed to attend training in STAR strategies and paraprofessionals were

offered the opportunity to attend. Classroom teachers and paraprofessionals were videotaped monthly using DTT and PRT. Videotapes were coded for fidelity of implementation by undergraduate research assistants blind to the study hypotheses. Reliability of data coding was greater than 80% on all measures.

Results: Fifteen paraprofessionals and 40 teachers were observed to implement DTT; 18 paraprofessionals and 35 teachers were observed during PRT implementation. By the end of the school year, 86% of both groups were implementing DTT with fidelity. Both groups were good at providing clear cues and immediate consequences, and struggled with using appropriate cues, giving immediate prompts and following prompting rules. Paraprofessionals struggled more than teachers using appropriate cues and gaining children's attention. At the end of the year, 71% of teachers and 39% of paraprofessionals were implementing PRT with fidelity. Both groups were proficient at providing children a choice of activity, using clear cues and finding effective reinforcers. Both had difficulty with differential and direct reinforcement. Paraprofessional staff had significantly greater difficulty with having clear goals and using contingent reinforcement. Teacher and paraprofessional fidelity in PRT was not correlated within classrooms, but there was a significant correlation (.40) in fidelity of DTT within classrooms.

Conclusions: Implementing DTT may be an appropriate role for paraprofessionals. Compared with teachers, paraprofessionals had difficulty implementing PRT, perhaps due to limited education in teaching strategies in general (which overlap with PRT). Given the specific strategies posing difficulty, paraprofessionals may need more specific training on how to target individual children's goals, and how to determine how to use strategies that require differential responding, such as prompting and reinforcement.

102.005 Quality of Autism Websites. B. Reichow*[1], T. Steinhoff[2], N. Letsinger[3], J. Halpern[2] and F. R. Volkmar[1], (1)*Yale University*, (2)*Fordham University*, (3)*Providence College*

Background: The World Wide Web (WWW) is the most frequently utilized method by parents of children with autism to obtain information (Mackintosh, et al., 2005; Chowdhury, et al. 2002). Although there are now millions of websites on autism, only one analysis has been published; Chowdhury and colleagues (2002) found 116 of 145 (80%) websites had information that could not be verified as accurate. No further research documenting methods for evaluating or studies of the content on autism websites has been published.

Objectives: First, we sought to evaluate the quality and comprehensiveness of information presented on highly ranked websites. Second, we sought to evaluate the presence or absence of quality assurance benchmarks and other characteristics of these websites. Finally, we sought to synthesize the results to make recommendations to families on how to locate high quality sites.

Methods: One-thousand four-hundred forty-eight autism experts were invited to participate in an online survey; 299 (22%) participated. A majority of the experts had a doctoral degree (63%) and 47% of the experts had 10+ years of experience in autism. The survey contained text from 30 websites identified using a 4-step selection process in July 2009. The survey contained five pages: one page of demographic questions, three pages with one website text and three corresponding questions per website (websites removed of identifying information and randomly paired and ordered across participants), and one page for open-ended comments. Each website text contained one or more of the following pieces of information on autism: general characteristics, signs and/or symptoms, causes, and treatments. Participants responded to three questions for each website. Each participant used a 5-point Likert scale (1 [lowest] to 5 [highest]) to rate the accuracy of the information and the currency of the information presented. Two members of the research team also independently evaluated sixteen characteristics of each website.

Results: The mean accuracy rating (M_{ACC}) across websites was 3.42 (SD=.83, median= 3.805) and the mean currency rating (M_{CUR}) was 3.45 (SD=.59, median=3.65). The accuracy rating and currency rating were highly correlated; $r_s = .87$, $p < .001$. For the websites in the top quartile on the accuracy rating ($M_{ACC} \geq 4.0$), zero offered a product or service for sale, zero promoted a non-evidence based treatment, and 6 of 7 had M_{CUR} greater than the median value. For the websites in the bottom quartile on the accuracy rating ($M_{ACC} \leq 2.71$), 5 of 7 offered a product or service for sale, 7 of 7 promoted a non-evidence based treatment, and 7 of 7 had M_{CUR} less than the median value.

Conclusions: Methods for directing parents to the most accurate websites containing information on autism is needed. Although the current sample was small, two characteristics emerged; 8 of 9 websites containing a top level domain of .edu or .gov had a M_{ACC} > median (4 in the top quartile) and 6 of 7 websites classified as "health informational sites," (e.g., Mayo Clinic, Google health) had a M_{ACC} > median (2 in top quartile).

102.006 Service Use and Unmet Needs Among School-Aged Children with ASD. C. B. Zimmerman*[1], D. R. Langer[2], M. A. McCarthy[1], L. J. Lawer[1], E. Brusilovskiy[3] and D. S. Mandell[1], (1)*University of Pennsylvania School of Medicine*, (2)*Children's Hospital of Philadelphia, Center for Autism Research*, (3)*Temple University*

Background: There is limited research describing intervention services used by school-aged children with autism spectrum disorders (ASD). A variety of treatments are recommended for school-aged children (e.g. behavior modification programs, occupational therapy, social skills training) which are often delivered by multiple service systems, complicating the study of services for this age group. The few studies in this area have been inconsistent regarding the types and intensity of services these children receive. The lack of information about met and unmet needs makes it difficult to establish recommendations regarding necessary policy and practice changes to address the service needs among children with ASD.

Objectives: To identify the types of services school-aged children with ASD are receiving and assess which services school-aged children with ASD still need.

Methods: This study relies on data from the largest survey of individuals and families living with autism to date. Data for this study were gathered from the ASERT (Autism Services Education Research and Training) Collaborative Needs Assessment, funded by the Pennsylvania Bureau of Autism Services. An invitation to participate was sent to all parents and caregivers of an individual with autism who received Medicaid-funded services associated with an ASD diagnosis in 1999, 2004 or 2009. Survey questions asked about service experiences for the person with ASD.

Results: 2,651 parents and caregivers completed the survey. Children about whom the survey was completed ranged in age from 4 to 21 years. There was a wide range of services used and unmet service needs. One-to-one support in the community and case management were the most utilized services with 74% of respondents receiving these; 41% of respondents reported needing more of these services. Seventy-one percent of respondents reported using speech/language, occupational and physical therapy, yet 51% of respondents still reported unmet needs in this area. Sixty percent of parents and caregivers responded that their child was receiving social skills training, and 62% reported needing additional training. Medical services (including neurology services and medication management) and mental health counseling services were utilized by 58% and 56% of respondents respectively. Only 27% of respondents reported needing additional medical services and 44% reported needing additional counseling services. Forty-six percent of respondents reported receiving summer academic support or tutoring, but 47% responded that they needed more. Thirty-four percent of respondents reported using summer camps and 53% need more. Only 15% of parents and caregivers of school-aged children reported utilizing sexual health education services; however 57% of respondents reported this as an unmet service need.

Conclusions: School-aged children use a wide variety of services and vary in the extent to which they report needed additional services. The results of this study will inform efforts to identify which services school-aged children are utilizing and which services they still need, improve the availability of services that children need, and enable the advancement and expansion of commonly utilized services to accommodate the needs of school-aged children with ASD.

102.007 Socio-Economic Based Disparities In Classification and Educational Services to Autism Spectrum Disorder Children. S. Neves*[1], S. Kurland[1], J. Shenouda[1], N. Scotto-Rosato[2], S. Howell[2] and W. Zahorodny[3], (1)*UMDNJ*, (2)*NJ State Health Department*, (3)*New Jersey Medical School*

Background: While the number of children receiving special education services for Autism Spectrum Disorders (ASD) is increasing, little is known about the educational classification and placement of these children. Children on the spectrum receive a wide range of services, ranging from general education interventions to self-contained classrooms. It is important to understand how children with ASD are properly identified in order to receive services to fit their individual needs.

Objectives: The purpose of this study is to understand the provision of special education services to children with ASD in a large, population-based sample. Case-specific data were analyzed according to sex, race, and socio-economic status (SES), in order to identify patterns of special education classification and placement.

Methods: Data were collected as part of the New Jersey Autism Study (NJAS), an ASD surveillance investigation carried out in Essex, Union, Hudson and Ocean Counties. Using an active case-finding method established by the Centers for Disease Control and Prevention (CDC), ASD surveillance data were developed for children who were born in 1998 and resided in the surveillance region during 2006. NJAS data were based on review, analysis and independent ASD case-determination derived from information contained in health and education

records. Demographic information, impairment and case-specific data, including the educational and program classification of children in their analyzed. The socioeconomic status (SES) of children with ASD was represented by the District Factor Group (DFG) ranking, a community-level index. Statistical analysis was performed using t-tests.

Results: In a population of over 30,000 8-year old children, 533 children were identified with an ASD, 509 (95%) received special education services and 224 of children with ASD (46%) were classified Autistic. Moreover, 123 classified Autistic children (54%) were placed in an Autism program. Autistic classification and Autism placement did not vary significantly by sex, race or SES. Among severely impaired children, 65.9 % were classified Autistic and 49.6% were placed in Autism program than less-impaired children (36.6% and 17.4%, respectively) ($p<0.05$). ASD children from affluent communities were over 4 times less likely to be classified Cognitively Impaired or Multiply Disabled (1.5% and 6.9%) than non-affluent children (7.0% and 26.3%) ($p<0.05$). Children from affluent communities were also more likely to be placed in less restrictive environments, such as pull-out (34.6% to 7.5%) and inclusion programs (14.6% to 4.0%)($p<0.05$).

Conclusions: Almost all children with ASD in our region (95%) received special education services in 2006, indicating the comprehensive identification of special education needs in ASD children. Children residing in higher SES communities are more often mainstreamed and according them the opportunity to learn with other general education students, which might improve their outcome. When compared to their affluent peers, students from lower SES communities were more often placed in more restrictive educational environments. Further research is needed to understand the relationship between socio-economic status and the educational interventions provided to ASD children.

102.008 Outcomes of Early Intervention Services for Families of Children with Autism Spectrum Disorders. B. Elbaum*[1], D. M. Noyes-Grosser[2], E. Morgan[3], L. Yan[4] and K. Siegenthaler[5], (1)*University of Miami*, (2)*Bureau of Early Intervention, New York State Department of Health*, (3)*State University of New York*, (4)*University at Buffalo*, (5)*New York State Department of Health*

Background: State early intervention programs (EIPs) are charged with delivering evidence-based interventions for infants/toddlers with developmental delays and with providing supports and services to their families. Since 2005, states have been required to report annually on outcomes for families in their EIPs. Outcomes for families of children with autism spectrum disorder (ASD) are particularly important in that research indicates that these families may experience significant stressors related to parenting their child with ASD. The New York State Bureau of Early Intervention (NYSBEI) is one of approximately 25 state EIPs that collects EIP family outcome data using the Impact on Family Scale (IFS) developed specifically for this purpose by the National Center for Special Education Accountability Monitoring. The IFS was validated on an ethnically and geographically representative sample of families participating in EIPs across the U.S.; however, scale developers did not have diagnostic information needed for validation of the instrument for families of a child with ASD.

Objectives: The primary purpose of this study was to validate the IFS for families of a child with ASD.

Methods: Each year, NYSBEI mails a survey that includes the 35 IFS items (e.g., "EI services have helped me/ my family understand my child's special needs," ". . . take part in typical activities for children and families in my community," ". . . advocate for my child") to representative samples of families exiting the EIP. Respondents rate their agreement with each item on a scale of 1 (very strongly disagree) to 6 (very strongly agree). Families' responses were linked to the state's EIP database to provide de-identified demographic and diagnostic information. Data were analyzed through the Rasch measurement framework using Winsteps software.

Results: Valid item-response data were available for 2,877 families, including 165 families of a child with ASD. The IFS exhibited high item and person reliabilities (all greater than r=.94) both for families of a child with ASD and those whose child had a different diagnosis or developmental delay(s). Item calibrations estimated independently for the two subgroups correlated r =.98, indicating identical ordering of item difficulties. Only one IFS item, related to families' ability to manage their child's behavior, exhibited statistically significant differential item functioning (DIF), suggesting a greater challenge on the part of EIPs in helping families of a child with ASD in this area. A t-test of the difference between mean IFS measures for families of a child with and without ASD was not statistically significant, suggesting that NY's EIP has similar levels of positive impact on families of children with ASD and those with children who have other developmental delays.

Conclusions: Results of this study indicate that measures on the IFS can be interpreted identically for families of a child with ASD and other families participating in EIPs, providing strong support for use of the IFS for statewide program evaluations as

well as for planned studies that will model the mediating effect of family outcomes on outcomes of EIPs for children with and without ASD.

4th Oral Brain Imaging in ASD temporary Program
103 Structural and Functional Brain Imaging In Older Children, Adolescents and Adults with ASD
Moderator: M. Solomon *Department of Psychiatry, MIND Institute, Imaging Research Center*

103.001 ASD Risk Polymorphism in MET is Associated with an Aberrant Pattern of Functional Activity Across Regions of High MET Expression. J. D. Rudie*[1], L. M. Hernandez[1], D. Shirinyan[1], N. L. Colich[1], P. Gorrindo[2], D. H. Geschwind[1], P. Levitt[2], S. Y. Bookheimer[1] and M. Dapretto[1], (1)*University of California, Los Angeles*, (2)*Keck School of Medicine, University of Southern California*

Background: A common variant (rs1858830) in the promoter region of MET receptor tyrosine kinase (*MET*) has been associated with ASD risk across multiple independent samples (Campbell 2006, Campbell 2008, Jackson 2009). In the primate, *MET* is enriched in neurons and their axons which project from subcortical limbic forebrain structures -- as well as temporal, parieto-occipital and limited frontal cortices -- to target regions during synaptogenesis (Judson 2010). *MET* transcript and protein expression in postmortem temporal cortex is reduced in ASD, as well as in neurotypical individuals who carry this common risk variant (Campbell 2007). Interestingly, many regions in which *MET* is highly expressed are involved in socio-emotional processing and have been found to exhibit abnormal functional activity in ASD (see Di Martino 2009).

Objectives: Despite clear evidence that the *MET* promoter variant disrupts *MET* expression, which is crucial for typical circuit development, no studies have examined the effect of this variant in humans using *in vivo* neuroimaging. Therefore, we sought to examine the effects of the *MET* risk polymorphism in a relatively large sample of neurotypical subjects and individuals with ASD using functional magnetic resonance imaging (fMRI) during an emotional face processing task (Dapretto 2006, Pfeifer 2008).

Methods: While undergoing fMRI, 23 children and adolescents with ASD and 59 typically-developing subjects (matched by age, IQ and head motion) passively observed faces displaying different emotions (angry, fearful, happy, sad, and neutral). Using a jittered event-related design, each facial expression was presented 16 times for 2 seconds. DNA was extracted from saliva samples and rs1858830 was genotyped using a custom Taqman assay. Random-effects group-level analyses were performed to examine the main effects of ASD diagnosis and *MET* risk polymorphisms on emotional facial processing (genotype groups were matched by ASD diagnosis, age, IQ and head motion).

Results: Regardless of diagnosis, analyses of individuals possessing one or two *MET* risk alleles showed hyperactivated subcortical structures that receive *MET* cortical projections, including thalamus, striatum, and amygdala, as well as cortical regions including inferior frontal gyrus and supplementary motor cortex, according to an additive genetic model. Additionally, risk carriers displayed reduced deactivation of *MET*-enriched cortical regions, particulary temporo-parietal regions that include primary auditory cortex, planum temporale, superior temporal sulcus, and parietal operculum. When examining the main effect of ASD diagnosis, a similar pattern emerged whereby nearly all of the regions displaying greater activity in risk carriers displayed greater activity in children with ASD (most significantly in temporal regions). Preliminary analyses did not find evidence of an interaction between *MET* risk alleles carrier and ASD diagnosis.

Conclusions: While autism is a highly heritable neurodevelopmental disorder, relatively little is known about how genetic factors alter the development of circuitry underlying social and emotional processing. Our findings suggest a relationship between a risk allele that reduces *MET* expression and disrupted activity in specific subcortical and cortical circuits where *MET* is highly expressed. These findings lend support to the notion of a broader autism phenotype and highlight how an imaging genetics approach may further elucidate the neurobiology of ASD.

103.002 A Common Oxytocin Receptor Polymorphism Interacts with Adverse Social Experiences In Influencing Brain Responses to Angry Faces and Social-Affective Problems. E. Loth*[1], B. Thyreau[2], A. Lourdusamy[1], D. Stacey[1], A. Cattrell[1], G. Barker[1], C. Buechel[3], P. Conrod[1], H. Flor[4], J. Gallinat[5], H. Garavan[6], A. Heinz[5], M. Lathrop[7], K. Mann[4], J. L. Martinot[2], T. Paus[8], L. Poustka[4], T. W. Robbins[9], M. Rietschel[4], M. Smolka[10], J. B. Poline[2] and G. Schumann[1], (1)*Institute of Psychiatry*, (2)*CEA*, (3)*University Medical Centre Hamburg-Eppendorf*, (4)*Central Institute of Mental Health*, (5)*Charite - Universitaetsmedizin Berlin*, (6)*Trinity College*, (7)*Centre National de Genotypage*, (8)*Univerity*

of Toronto, (9)*University of Cambridge*, (10)*Technische Universitaet Dresden*

Background:

Over the past several years, there has been a growing interest in the role of oxytocin (OT) in the neurobiological basis of social behaviour, and in social and affective disorders (e.g., autism spectrum disorders, anxiety disorders). While nasal OT administration has been hailed as a possible treatment for these disorders, animal work indicates that OT-effects may chiefly depend on OT-receptor expression in the brain. More specifically, the comparison between high social-affiliative prairie voles and 'asocial' montane voles suggests that 1) social attachment formation requires linking social cues to OT-receptors in brain regions involved in reward processes, and that 2) in high social-affiliative species, especially females, OT-receptor expression and social behaviour are affected by adverse social experiences during development.

Objectives:

We used a gene-neuroimaging approach in 393 13-14 year-old adolescents from the IMAGEN sample to test the hypotheses that 1) rs2268494, a common OXTR-polymorphism previously linked to autism and social behaviour, influences brain activity in reward regions to social threat; 2) that OXTR-genotype effects are moderated by adverse social experiences, primarily in girls; and 3), that genotype x environment-dependent ventral striatal activity affects social and affective functioning.

Methods:

65 AA/AT and 328 TT-carriers of central European descent, matched on age, IQ, and puberty development, were assessed on fMRI BOLD reactivity to anger expressions, frequency of negative life events, and conduct, peer, and emotional problems.

Results:

We found that genotype effects on brain reactivity in regions implicated in reward processing and mentalising (the ability to infer others thoughts and feelings) were moderated by gender and negative experiences. In girls, only minor A-carriers but not TT-genotype showed decreased ventral striatal activity after negative experiences, which in turn increased risk for social-emotional problems. in boys, the A-allele was associated with increased reactivity in regions engaged in mentalizing and fewer emotional and behavioural problems. This supports reports of abnormal reactivity in the mentalizing network in male-dominant disorders of social dysfunction (ASD, conduct disorder).

Conclusions:

Together, our findings point to a novel neurobehavioural mechanism through which the OXTR polymorphism rs2268494 interacts with negative experiences in contributing to risk versus resilience for social-emotional problems in adolescent boys and girls. We will discuss implications for ASD.

103.003 Abnormal Brain Circuitry In ASD: Preliminary Resting State fcMRI Findings from an Adolescent Sample of Low and High Functioning Individuals. N. M. Kleinhans*, G. Pauley, N. Martin, A. M. Estes, D. Shaw, A. Artu and S. R. Dager, *University of Washington*

Background:

Abnormal connectivity is likely a key component of the neural basis of ASD. Resting state fcMRI is an emerging technique for studying brain circuitry, which can be used with individuals who cannot actively perform cognitive tasks in the scanner. Studies utilizing fcMRI techniques in high functioning ASD have identified abnormal connectivity between brain regions during task-free "resting states". However, as fcMRI studies have not been reported in low functioning individuals with ASD, it is unknown whether functional connectivity abnormalities are generalizable across the autism spectrum.

Objectives:

1) identify fcMRI abnormalities in lower functioning (LFA) and higher functioning (HFA) adolescents with ASD and idiopathic developmental delay (DD) 2) evaluate the relationship between functional connectivity and clinical severity.

Methods:

Three task-free fcMRI scans with physiological monitoring were collected on all participants. A subset of cognitively impaired participants with ASD (i.e., the LFA group) and all participants with DD were scanned under propofol sedation (Amundsen et al . 2005). Study participants are part of a larger longitudinal cohort first diagnosed at age 3-4 years. Data collection is ongoing. Valid data has been obtained on 41 participants (HFA = 7; LFA = 14; Control = 16; DD = 4). Participants scanned while awake (i.e., without propofol) were instructed to close their eyes, relax and let their mind wander. Participant scanned under sedation were not provided specific instructions. Scans were analyzed using standard preprocessing steps. In addition, physiological correction was applied using Retroicor and a low-

pass filter removed frequencies above .1 Hz. Resting state networks were identified using MELODIC's model-free independent component analysis with multi-session temporal concatenation. Tests for between-group differences (HFA v Control; LFA v DD; HFA v LFA) and the correlational analyses were conducted using FSL's dual regression. Statistical significance was determined using threshold-free cluster enhancement corrected for multiple comparisons ($p < .05$).

Results:

Over 30 components were identified in each group; only a-priori defined resting-state networks will be presented: default mode network (DMN), dorsal attention network (DAN), right ventral attention network (R-VAN), left ventral attention network (L-VAN), and salience network (SN; HFA & control only). Contrasts not specifically reported are null findings. For LFA v DD (both sedated), the LFA had significantly greater connectivity in the R-VAN and reduced connectivity in the DAN. For HFA v control, the HFA showed significantly increased connectivity in the SN and decreased connectivity in the DMN and the L-VAN. In general, HFA and LFA had similar patterns for all networks, albeit with decreased connectivity in the LFA group. Lastly, in the HFA group, stronger connectivity in the SN was correlated to increased ADOS severity. Specific anatomical loci will be further described.

Conclusions:

Large-scale brain system abnormalities are observable in both higher and lower functioning individuals with ASD. All resting state networks except the SN were observable under propofol-induced anesthesia. The observation of lower connectivity with LFA within the context of sedation effects and in relation to the DD group will be discussed. Abnormal connectivity will be discussed within the context of symptomotology.

103.004 Disambiguating Reward Circuitry Function In Autism: New Insight Into Social Cognition From a Three-Group fMRI Study. J. A. Richey*[1], G. S. Dichter[2], A. Rittenberg[1], R. Pretzel[3], A. B. Ratto[2] and J. W. Bodfish[3], (1)*University of North Carolina at Chapel Hill*, (2)*University of North Carolina*, (3)*University of North Carolina - Chapel Hill*

Background:

A number of theorists have suggested that autism is characterized by motivational deficits centered around appetitive pursuit of social activities (Dawson et al., 2005; Schultz, 2005), ultimately leading to diminished interest in engaging in reciprocal social behaviors. Recent research from our group has highlighted disruptions in the dopamine-rich mesolimbic reward pathway as a potential explanation for this phenomenon (Dichter, Richey et al., under review). The mesolimbic pathway influences the perception of natural rewards such as food, sex and social interactions. Abnormal (upward) modulation of this circuit has been linked to pathologic pursuit of drugs of abuse, whereas under-recruitment leads to diminished pleasure from normally rewarding stimuli. Although it has been posited that social-motivational deficits in autism are perhaps mediated by this circuit, it is unknown whether dysfunction in the mesolimbic pathway is specific to autism, or whether it is a non-specific phenomenon shared by any disorder characterized by deficits in social-motivational behaviors.

Objectives:

To address this issue, we conducted fMRI on a group of 16 adults with autism, 18 neurotypical control subjects, and a group of patients (N=15) with a psychiatric disorder that is also characterized by problems in social approach behavior: **Social Anxiety Disorder** (SAD).

Methods:

During fMRI, subjects completed a well-validated task of reward circuitry function, the monetary incentive delay task (M.I.D.; Knutson et al., 2002), which is designed to assess neural responses during both anticipatory and outcome phases of reward processing. We assessed neural functioning in the nucleus accumbens and other nodes in the mesolimbic pathway while anticipating and receiving 1) social rewards (human faces) and 2) money rewards.

Results:

Using responses to money as a baseline for reward circuit functioning, we found that in comparison to controls, both autism and SAD subjects displayed significantly diminished activity in the nucleus accumbens during anticipation of faces (Right Accumbens; talairach *x,y,z,* 41,74,61; $F[1,49]=6.68$, $p = .01$; Left Accumbens; 61,74,60, $F[1,49]=6.556$, $p = .012$). However, autism was best differentiated from SAD on the basis of amygdala functioning. Specifically, we found that in comparison to SAD, autism subjects displayed greater amygdala activity during anticipation of faces, (Right Amgdala: talairach 34,60,66; $F[1,29]=6.68$, $p = .01$; Left Amygdala: talaraich: 58,60,64 $F[1,29]=6.69$, $p = .01$), and relative to autism SAD displayed greater right amygdala firing during viewing of faces (Right Amygdala: $F[1,29]=3.99$, $p < .05$). In

SAD, diminished responsivity in accumbens during face anticipation was associated with greater impairment in social reciprocity on the Social Responsiveness Scale (Constantino et al., 2003; r = .41; p<05). In autism increased responsivity in the amygdala during face anticipation was associated with greater impairment in social reciprocity (r = .39; p<05).

Conclusions:

Autism and SAD share common disruptions in the mesolimbic pathway, but autism may be differentiated from SAD by amygdala activity as a function of temporal phase (anticipation versus viewing of faces). The combination of low social-incentive motivation and high or even aversive anticipatory expectation (codified by the amgydala) could influence experience-dependent development such that nonsocial events acquire salience over social events.

103.005 The Neural Substrates of Probabilistic Reinforcement Learning In Adults with Autism Spectrum Disorders: Relationship to Behavioral Inflexibility. M. Solomon*[1], A. C. Smith[2], M. J. Frank[3], S. Ly[4] and C. S. Carter[5], (1)*Department of Psychiatry, MIND Institute, Imaging Research Center*, (2)*U.C. Davis* , (3)*Brown University*, (4)*MIND Institute*, (5)*UC Davis Department of Psychiatry and Behavioral Sciences, Imaging Research Center*

Background:

There has been extensive successful neurocognitive research to explain the unique pattern of strengths and challenges faced by individuals with ASDs. Our program of research seeks to extend the explanatory power of existing approaches through the validation of a new, complementary, mechanistic, and clinically relevant paradigm, which conceptualizes ASDs as learning disorders. Learning deficits are clinically meaningful as they contribute to the academic, social, and adaptive functioning challenges experienced by individuals with ASDs. Here we examine probabilistic reinforcement learning in young adults with ASDs.

Objectives:

Our objectives were to investigate the neural substrates of reinforcement learning deficits revealed in our previous behavioral study (Solomon, Smith, Frank, Ly and Carter, in press) using functional magnetic resonance imaging (fMRI), and to relate findings to symptoms of behavioral inflexibility in affected individuals.

Methods:

Participants were young adults aged 18 – 40 with ASDs (n=8) and age, IQ, and gender-matched controls (n=12). They were scanned while completing a probabilistic reinforcement learning task including three stimulus pairs with 80%, 70%, and 60% valid reinforcement contingencies. Two hypotheses were derived from a computational model of the inter-workings of prefrontal cortex (PFC), orbito-frontal cortex (OFC), and basal ganglia (BG) during the paradigm (Frank et al., 2004). These were (1) that individuals with ASDs would show less activation in fronto-striatal neural circuits required for flexible updating of motivational context, and (2) that repetitive behaviors would be associated with these impairments in fronto-striatal functioning. Hypotheses were tested using fMRI.

Results:

Behavioral data indicated that individuals with ASDs learned the task more slowly than neurotypical individuals, replicating our prior study. The probability of learning was assessed using state-space models for the three different trial types for each participant. Individuals' state-space learning curves were then used as parametric modulators in the GLM for the fMRI analysis. The probability of early learning was associated with activation in the PFC, OFC, and basal ganglia in neurotypical adults, but not in those with ASDs. In individuals with ASDs, rituals/sameness behavior as assessed by a self-report inventory (RBS-R) was negatively associated with activation in the OFC (r = -.67, p = .098) and positively associated with activation in the putamen (r=.64, p =.12). These findings provide preliminary support for the hypotheses generated in the context of the computational model that ASDs involve atypical activation of neural circuits involved in reinforcement learning, and that poor top down modulation of the basal ganglia by the OFC is related to inflexible repetitive behaviors found in the disorders.

Conclusions:

The study of reinforcement learning has clinically significant implications given the centrality of learning problems to ASDs, and the extensive use of learning theory-driven interventions to treat the disorders. Functional neuroimaging studies of reinforcement learning can provide both novel insights into and an important neuroscience "evidence base" for applied behavior analysis and other learning theory-based interventions that constitute the majority empirically supported treatments. Furthermore, reinforcement learning methodologies provide a

new way to conceptualize aspects of behavioral inflexibility found in persons with ASDs.

103.006 A Dissociation In Function: Brain Regions Hypoactive to Social Exclusion and Hyperactive to Rule Violation In Children with ASD. D. Z. Bolling*[1], N. B. Pitskel[2], B. Deen[1], M. J. Crowley[3], M. D. Kaiser[4] and K. A. Pelphrey[1], (1)*Yale University Child Study Center*, (2)*University of Pittsburgh School of Medicine*, (3)*Child Study Center, Yale University*, (4)*Yale University*

Background: Cyberball, a virtual ball-tossing game, elicits feelings of social exclusion in typically developing (TD) children, adolescents, and adults. One behavioral study exploring the psychological effects of social exclusion in adolescents with autism spectrum disorder (ASD) found that arousal but not mood was modulated by exclusion in adolescents with ASD, whereas both were modulated in TD counterparts. Social exclusion, while threatening to interpersonal relationships, also involves expectancy violation, in that one generally expects to be included. The expectancy violation inherent in Cyberball might elicit the sensitivity to environmental change which is characteristic of ASD. No study to date has explored the underlying brain mechanisms for processing social exclusion and/or rule violation in ASD.

Objectives: Using a novel adaptation of Cyberball (Cybershape) with a shape-matching rule dictating the correct recipient of the ball, along with the original Cyberball, we examined neural responses to social exclusion and rule violation. During a functional magnetic resonance imaging (fMRI) scan of age- and IQ-matched children and adolescents with and without ASD, we sought to identify differences in brain responses to social exclusion compared to rule violation within and between groups.

Methods: Participants with (n = 24) and without (n = 24) ASD played Cyberball in alternating blocks of fair play and exclusion. In fair play, the participant received the ball on one-third of the throws; in exclusion the participant did not receive the ball. Participants also played Cybershape in alternating blocks of fair play and rule violation. In fair play, the participant received the shape one-third of the time; the shape rule was never broken. In rule violation, the participant received the shape one-third of the time; but one of the players consistently violated the shape rule by throwing the shape to the wrong player. After playing, participants were given ten questions addressing emotional distress to exclusion or rule violation.

Results: Though both groups reported equal distress following exclusion, a Group by Condition interaction analysis revealed regions of activation that were differentially modulated by inclusion and exclusion in children with and without ASD. Regions previously implicated in processing exclusion, including the right insula and ventral anterior cingulate cortex, were hypoactive in children with ASD relative to their TD peers. In rule violation compared to fair play, the same interaction revealed regions that were hyperactive in ASD, including the right temporoparietal junction, insula, and dorsal prefrontal cortex. A dissociation in activation was identified in the right insula, where it was hypoactive to social exclusion and hyperactive to rule violation in the ASD group. Further probed, different regions of right insula were active in each group, highlighting subtle differences in regional specificity for which subsequent analyses revealed differences in patterns of functional connectivity.

Conclusions: These results demonstrate neurobiological differences in processing social exclusion and rule violation in children with ASD. Specifically, brain regions found to be hypoactive to social stimuli in ASD were hyperactive to rule violation, suggesting that “deficits” in activation of these regions may be contextually specific.

103.007 White Matter Abnormalities Between Youth with Autism and Unaffected Siblings: A Pilot Study Using Tract-Based Spatial Statistics. R. J. Jou*, N. Mateljevic, M. D. Kaiser, A. C. Voos, D. R. Sugrue, A. Y. Nguyen-Phuc, F. R. Volkmar and K. A. Pelphrey, *Yale University*

Background: Numerous studies have been published using diffusion tensor imaging (DTI) to demonstrate white matter abnormalities in autism spectrum disorders (ASD). However, only one study to date has used DTI to assess whether white matter abnormalities exist in unaffected siblings (US) of those with ASD, reporting similar aberrations in a group of children with ASD and their US. More specifically, the ASD and US groups did not differ significantly in white matter structure; however, both groups differed significantly from controls. While these results support the presence of an intermediate brain phenotype in US, they also suggest that this is skewed more towards the ASD phenotype.

Objectives: The present study was conducted to confirm that an intermediate neuroendophenotype exists in US. Given that US participants show no autistic symptomatology (absence of the broad autism phenotype), it is hypothesized that this intermediate brain phenotype is not skewed towards to that of ASD participants.

Methods: Participants included 15 boys with ASD (mean age = 10.9 ±3.7 years), 13 US (mean age = 10.4 ±2.9 years), and

eight gender- and age-matched controls (mean age = 11.5 ±2.6 years). T1-weighted and diffusion-weighted MRI (directions = 30 and b0 = 5) were acquired using a 3-Tesla scanner. FMRIB Software Library (FSL) was used to process and analyze diffusion-weighted data. Fractional anisotropy (FA) was chosen as the primary measure of the structural integrity of fiber tracts. Voxel-wise analysis of multi-subject diffusion data was conducted using FSL's Tract Based Spatial Statistics (TBSS). Three comparisons were made: ASD versus control, ASD versus US, and US versus control. Areas of significant difference were computed using Threshold-Free Cluster Enhancement and displayed as p-value images, where $p < 0.0167$ corrected for multiple comparisons. Post-hoc correlation analyses were performed between FA of each affected fiber tract and scores on the Social Responsiveness Scale.

Results: When compared to controls, the ASD group had significant bilateral reductions in FA involving association, commissural, and projection tracts. Affected association tracts included the superior longitudinal fasciculus, inferior fronto-occipital fasciculus, and cingulum. Commissural fibers included the forceps minor, and projection fibers included the anterior thalamic radiation. The tract with the greatest number of affected voxels was the forceps minor. There were no areas of increased FA in the ASD group. There were no significant group differences in FA for the ASD versus US and US versus control comparisons. There were no significant group differences in age and intracranial volume. All post-hoc correlation analyses became non-significant after controlling for multiple comparisons.

Conclusions: This study supports the presence of an intermediate neuroendophenotype in US. The presence of significant differences only in the ASD and control comparison suggests that this intermediate brain phenotype is neither skewed towards that of ASD participants nor controls. Lack of significant differences in the US and control comparison does not preclude that aberrant white matter structure could represent a marker for increased risk for ASD.

103.008 Using Information-Based Functional Brain Mapping to Detect Biomarkers of Autism In Adults. M. V. Lombardo*[1], N. Kriegeskorte[2], I. Charest[2], C. Ecker[3], B. Chakrabarti[4], E. T. Bullmore[5], D. G. Murphy[3], M. R. C. AIMS Consortium[6] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*MRC Cognition and Brain Sciences Unit*, (3)*Institute of Psychiatry, King's College London*, (4)*University of Reading*, (5)*Brain Mapping Unit, University of Cambridge*, (6)*University of Cambridge, King's College London, University of Oxford*

Background: Highlighting objective biomarkers at the neural level are of paramount importance in autism research. In addition to providing insight into the mechanisms contributing to the clinical phenotype, from a practical standpoint, they may also aid in the diagnostic process or be used for evaluating treatment outcome. Machine learning techniques applied to massively multivariate biological datasets have particularly important utility here as they may be able highlight such biomarkers.

Objectives: Here we investigate whether individuals can be classified according to diagnostic status solely based on information present in fMRI data when individuals are engaged in self-reflective thought. We use a support vector machine (SVM) and an information-sampling technique known as 'searchlight' mapping to hone in on specific brain regions whose fMRI response patterns contain information for making a distinction between those with and without a diagnosis.

Methods: Twenty eight adult males (18-45 years old) with an ADI-R confirmed diagnosis of an autism spectrum condition (ASC) and 28 age-, sex-, and IQ-matched Control adults were scanned with fMRI at 3T while making mentalizing or physical judgments about themselves or a non-close other (i.e. the British Queen). A linear SVM was applied over 8mm radius spherical 'searchlights' centered on every voxel in the brain. Classification accuracy, sensitivity, and specificity was obtained with 28-fold cross validation (i.e. leave-one-subject-pair-out) on the unsmoothed Self>Other t-maps. P-values were assigned to each searchlight after simulating the null hypothesis distribution of cross validated classification accuracies using permutation testing (1,000,001 iterations). FDR control was used for thresholding at the whole-brain level and within an a priori ROI in ventromedial prefrontal cortex constructed from a quantitative meta-analysis of normative studies reporting a Self>Other contrast. To investigate the utility of local multivariate information-sampling over other approaches, searchlight mapping results were compared to a whole-brain SVM and classification based on univariate 'activation' data (i.e. averaged t-values within the searchlight).

Results: Whole-brain SVM yielded classification accuracy no better than chance (50%). With searchlight mapping, no searchlights survived stringent whole-brain FDR correction. However, within the vMPFC ROI known to be sensitive to self-relevant information processing, one cluster survived FDR small-volume correction. The peak searchlight within vMPFC was 87.5% accurate in predicting diagnostic status and gave

92.85% sensitivity and 82.14% specificity. This classification accuracy was very improbable to have occurred at chance (p = 6 x 10^{-6}). This kind of multivariate classification outperformed univariate SVM classification on the same searchlight (66.07% accuracy), demonstrating that the added information from multivariate response patterns aid classification over and above univariate approaches.

Conclusions: These results are a proof of concept that local pattern-information from vMPFC during self-referential thought can classify ASC from Controls with high accuracy, sensitivity, and specificity. In addition to providing a potential biomarker for ASC in male adults, these results also demonstrate the utility for using local information-based functional brain mapping rather than multivariate whole-brain classification or massively univariate activation-mapping in autism neuroimaging research.

Animal Models & Cell Biology Program
104 Animal Models and Cell Biology
Moderator: R. Paylor *Baylor College of Medicine*

104.001 Abnormal Behavior, Epileptic Seizures and Atypical Neuronal Circuit Functioning In Cntnap2 Knockout Mice: a New Mouse Model of Autism Spectrum Disorders. O. Penagarikano*[1], B. S. Abrahams[2], R. T. Jones[1], K. C. Winden[1], A. Bragin[1], I. Mody[1], E. Peles[3] and D. H. Geschwind[1], (1)*University of California at Los Angeles*, (2)*Albert Einstein College of Medicine*, (3)*Weizmann Institute*

Background: The *contactin associated protein-like 2* (*CNTNAP2*) gene encodes for a neuronal transmembrane protein, member of the neurexin superfamily (Poliak et al., 1999) which loss of function has been associated to a syndromic form of ASD called cortical dysplasia-focal epilepsy syndrome (CDFE), a rare disorder resulting in epileptic seizures, language delay, intellectual disability, hyperactivity and, in nearly two-thirds of the patients, autism (Strauss et al., 2006). In addition, common and rare genetic variations in *CNTNAP2* have been associated to an increased risk of autism or autism-related endophenotypes (Alarcon et al., 2008; Arking et al., 2008; Bakkaloglu et al., 2008; Vernes et al. 2008). We have recently shown that the *CNTNAP2* variant that increases risk for the autism endophenotype "specific language impairment", also leads to increased short range and decreased long-range functional connectivity in human subjects (Scott-Van Zeeland et al., 2010), consistent with emerging theories of autism pathophysiology (Belmonte et al., 2004; Courchesne and Pierce, 2005). Together, these data suggest a role for *CNTNAP2* in development of brain regions and/or circuits involved in Autism Spectrum Disorders (ASD).

Objectives: Behavioral and neuropathological characterization of the *Cntnap2* knockout mice as a potential mouse model for ASD.

Methods: Ten *Cntnap2* knockout mice and wildtype littermates were evaluated in a broad battery of behavioral tests relevant to ASD (Silverman, 2010). Immunohistochemistry and electrophysiological studies were performed in three mice per genotype using conventional methods.

Results: *Cntnap2* knockout mice recapitulate features observed in patients with idiopathic autism including abnormal vocal communication, repetitive and restrictive behaviors, and abnormal social interactions. In addition, they show hyperactivity and epileptic seizures, as has been reported in humans with CDFE syndrome. Neuropathologically, we observe defects in the migration of cortical projection neurons and a reduction in the number of GABAergic interneurons, which is accompanied by an imbalanced excitatory/inhibitory network. These data show that CNTNAP2 is involved in the development of cortical circuits, and further support alterations in excitatory-inhibitory balance in ASD pathophysiology. In addition, treating *Cntnap2* knockout mice with risperidone, an antipsychotic drug approved for autism treatment by the FDA, rescues the repetitive behavior, but not the social deficits, a dissociation similar to what is seen in human patients.

Conclusions: These data demonstrate the validity of the *Cntnap2* knockout as a mouse model for ASD and provide initial insight into the underlying mechanisms by which CNTNAP2 affects brain development and function, being an excellent tool for further studies to unravel ASD pathophysiology and for therapeutic research.

104.002 Social Monitoring In Rhesus Monkeys with Lesions to Either the Amygdala, Hippocampus, or Orbitofrontal Cortex. A. P. Goursaud*[1], J. I. Borjon[2], W. Jones[2], A. Klin[2] and J. Bachevalier[1], (1)*Emory Department of Psychology & Yerkes National Primate Center*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Investigation of the social skills of non-human primates in the wild and in the laboratory have revealed that monkeys, like humans, live in social groups characterized by complex and dynamic social organization through a variety of specific, long-term relationships between group members. This inherently social behavior has a neural basis, and indeed, the

large cortex of primate brains is considered by some to be the direct result of an increase in social group size. Although both ablation and neurophysiological recording studies in monkeys have implicated the amygdala and orbitofrontal cortex as two brain structures involved in social behavior, such as the visual monitoring of others, additional experiments are needed to elucidate the neural mechanisms guiding such actions. Little is known about the role of these brain structures in the typical deployment of skills such as social monitoring.

Objectives: The current project aims to measure and analyze social monitoring mechanisms employed in both typical nonhuman primates and those with lesions to brain structures involved in social behavior. Specifically, we explore whether or not lesions to the amygdala, orbitofrontal cortex, or hippocampus alter social monitoring behavior while non-human primates view video scenes of conspecific interaction.

Methods: Four adult male rhesus monkeys (*Macaca mulatta*) received selective lesions to either the amygdala, hippocampus, orbitofrontal cortex, or a sham operation. Eye-tracking data were collected while monkeys watched video scenes of primate social interaction taking place in naturalistic settings. Eye movement data were analyzed in terms of frequency and duration of fixations as well as frequency, duration, amplitude, and velocity of saccades to control for basic oculomotor function. Social monitoring was analyzed in terms of percentage of visual fixation time to discrete social behaviors (e.g., particular interactions between monkeys) and to conspecifics in general.

Results: Preliminary analyses suggest that monkeys with lesions to the amygdala, orbitofrontal cortex, and hippocampus each exhibit diminished social monitoring relative to control: lesioned monkeys make fewer saccadic shifts between monkeys and look less at monkeys in peripheral areas of the video scenes. In contrast, the sham-lesioned monkey scans a larger portion of the video scenes and more frequently monitors the actions of monkeys in the backgrounds of scenes. Frequency and duration of fixations appears similar across all monkeys.

Conclusions: The hippocampus, amygdala, and orbitofrontal cortex are thought to be part of a neural circuit crucial to associating social salience with perceptual information. While preliminary, the results of the current study suggest that lesions to each of these regions may impact the ability to recruit the entirety of this circuit in order to successfully execute typical social monitoring. These results provide avenues for further investigation into the building blocks of primate social behavior.

104.003 Absence of Engrailed 2 (En2), the Autism Spectrum Disorder (ASD) Associated Gene, Alters Monoamine Transmitter Systems, Forebrain Structure and Developmental Neurogenesis and Apoptosis. M. Genestine*[1], L. Lin[1], Y. Yan[1], S. Prem[1], J. H. Millonig[2] and E. DiCicco-Bloom[1], (1)*Robert Wood Johnson Medical School*, (2)*Center for Advance Biotechnology & Medicine*

Background:

We have found the homeobox gene EN2 is associated with ASD in 3 different datasets, and disease associations have been reported by 4 other groups. It is perhaps surprising that EN2, a transcription factor that patterns mid/hindbrain and cerebellum, contributes to ASD symptoms that depend more on forebrain structures and functions. However, ASD has been characterized functionally by abnormal neurotransmission between hindbrain and forebrain, and structurally by brain enlargement. Furthermore, ASD is associated with changes in monoamines, especially serotonin (5HT), including increased plasma 5HT, disturbed central 5HT development and responsiveness to related drugs, as well as symptoms influenced by monoamines including attention, mood and aggression. Is it possible changes in patterning genes in hindbrain secondarily affect forebrain development?

We are using En2 knock out (KO) mice as a model system to define roles of En2 in development of monoamine transmitters, including 5HT and norepinephrine (NE) and effects on forebrain structure. Previous work indicates NE levels are reduced 30-40% in hippocampus and cortex, with parallel changes in biosynthetic enzyme tyrosine hydroxylase protein and axonal fibers, and smaller changes in 5HT. Transmitter reductions are associated with smaller structures including 12% decreases in hippocampus and 4% in cortex. Stereological analysis indicates a 16% reduction in hippocampal dentate gyrus (DG) granule neurons. Since the DG exhibits lifelong neurogenesis that might contribute to changes in DG structure, we examined changes in cell proliferation and cell death.

Objectives:

Define the consequences of En2 deletion on forebrain neurogenesis and apoptosis.

Methods:

Wild type (WT) and En2 KO mice were injected on P21 with BrdU, a marker of cells in mitotic S phase, and sacrificed 2hrs later. Fixed brains were frozen sectioned and immunostained

for nuclear BrdU labeling or activated caspase 3, a marker of apoptosis.

Results:

In P21 hippocampal DG, there was a 77% increase in caspase 3+ cells compared to WT mice ($p<0.004$), suggesting cell death was increased, a potential mechanism contributing to smaller structure. However, BrdU labeling was increased >2-fold ($p<0.01$), raising the possibility of compensatory responses. To compare changes in DG to another neurogenetic region, we assessed the subventricular zone (SVZ) lining the lateral ventricles. Caspase 3 was increased by 46% ($p<0.05$), which was also accompanied by 66% increase in BrdU labeling ($p<0.03$), results paralleling those in DG.

Conclusions:

Our observations indicate that in the absence of hindbrain En2, forebrain cell death and neurogenesis are both increased. An excess of cell death over neuron production may account for smaller forebrain structures and neuron numbers. These observations suggest that reduced monoamines may lead to reduced cell survival, with compensatory cell production, yet underlying mechanisms remain to be defined. More generally, changes in the levels or timing of EN2 expression may contribute to human ASD by altering forebrain development through changes in neuronal production and/or survival.

104.004 Proteomic Analysis of the Autism Candidate Gene, Jakmip1, Suggests Its Role In Brain Translational Regulation. J. Bomar*[1], A. Oguro-Ando[1], O. Penagarikano[2], J. Miller[1], H. Dong[3], S. Pellegrini[4], J. Wohlschlegel[1] and D. H. Geschwind[2], (1)*The University of California*, (2)*University of California*, (3)*The University of California, Los Angeles*, (4)*Institut Pasteur*

Background : Janus kinase and microtubule-interacting protein 1 (*JAKMIP1*) is dysregulated in the lymphoblastoid cells of autistic subjects with Fragile X, maternally inherited 15q duplication, and idiopathic autism spectrum disorder. Studies suggest *JAKMIP1* is downstream of both fragile X mental retardation 1 (FMR1) and cytoplasmic FMR1 interacting protein 1 (CYFIP1), a gene within the 15q duplication region, in mouse and human. *Jakmip1* is predominantly expressed in neural tissues and is enriched in neurons.

Objectives : We determined JAKMIP1's expression during development and adulthood in the neocortex, a brain region associated with autism, and characterized JAKMIP1's neuronal sub-type and cortical layer expression pattern. We subsequently performed Multidimensional Protein Identification Technology (MudPIT) to annotate JAKMIP1's *in vivo* proteomic interactome so as to better understand JAKMIP1 function.

Methods : Developmental expression profiling was determined using Western Blotting. The neuron-specific and cortical layer expression patterning was ascertained using double-label immunohistochemistry. MudPIT was used to discover JAKMIP1's *in vivo* proteomic interactome in mouse cerebral neocortex. MudPIT read-out values were compared between JAKMIP1 and rabbit preimmune serum immunoprecipitated neocortices. Ingenuity Pathway Analysis was used to determine the gene ontology categories of JAKMIP1's interactome. We implemented permutation analysis to test the statistical significance of protein-protein interactions in the top gene ontology network. PatternLab ACFold analysis was conducted to determine statistically significant protein interactors. We used bidirectional co-immunoprecipitation to validate top protein interactions.

Results : We found that JAKMIP1 is expressed predominantly in glutamatergic projection neurons of mouse neocortex and broadly throughout neocortical layers. Its peak expression occurs from p8 to p12 in mouse cerebral cortex, concomitant with neuronal maturation and synaptogenesis. We identified a group of 36 JAKMIP1 protein interactors by MudPIT. Additional analysis using PatternLab ACFold generated a conservative core of 11 proteins within this list of 36. The most predominant gene ontology theme of JAKMIP1's protein binding partners is protein synthesis, being a common denominator between networks and the most significant molecular and cellular function. Permutation analysis indicates a statistically significant enrichment of "protein-protein interactions" in the top gene ontology network of JAKMIP1 binders, suggesting JAKMIP1's membership in a protein complex. We were able to experimentally validate 4/6 MudPIT-identified interactors, some of which are known to regulate protein expression. JAKMIP1 and validated protein binding partners fractionate with polyribosomes in independent mouse postnatal neocortices. Some of JAKMIP1's protein associations in mouse neocortices depend on single stranded RNA, suggesting select associations may exist in the polyribosome.

Conclusions : Using a combined approach, multiple lines of evidence implicate a role for JAKMIP1 in protein translation during cortical development. Understanding JAKMIP1's dynamic relationship with key players of this essential cellular process will advance our knowledge of this autism candidate gene's role in neural development and further suggests the

importance of translational control in the pathophysiology of autism spectrum disorders.

104.005 Maternal Intrauterine Inflammation Induces Kynurenine Pathway Activation and Leads to Decreased Cortical Serotonin In the Newborn Rabbit Brain: Implications for Maternal Infection and Autism. S. Kannan*[1], B. Balakrishnan[1], H. Dai[1], W. Lesniak[2], A. Jyoti[1], O. Muzik[1], K. Rangaramanujam[2], R. Romero[3] and D. C. Chugani[1], (1)*Children's Hospital of Michigan, Wayne State University*, (2)*Wayne State University*, (3)*NICHD, NIH, DHHS*

Background:

Maternal intrauterine infection and inflammation have been implicated in neurodevelopmental disorders, including autism spectrum disorders. Activation of the kynurenine pathway of tryptophan metabolism may play a crucial role in the development of these disorders, by causing serotonin depletion and increased production of neurotoxic kynurenine metabolites in the fetal and neonatal brain.

Objectives:

The objective of this study was to determine if maternal endotoxin administration is associated with increased expression of kynurenine pathway enzymes and formation of neurotoxic kynurenine metabolites, decreased cortical serotonin and increased pro-inflammatory microglia in the periventricular regions of the newborn rabbit brain.

Methods:

All animal procedures were approved by the institutional animal care and use committee. Pregnant New Zealand White rabbits were injected with saline (control-saline group) or 20μg/kg of E.Coli endotoxin (endotoxin group) along the length of the uterus at 28 days gestation. A third group comprised of rabbits that had no intervention (control) (N=4 per group). Newborn rabbits (denoted entotoxin-kits, control saline kits and control kits) were delivered spontaneously at term (31 days gestation). The newborn kits underwent PET imaging with alpha[^{11}C]methyl-L-tryptophan (AMT) to evaluate tryptophan metabolism *in vivo* on day 1 of life. Following the imaging, the kits were euthanized and rabbit brains processed for (1) serotonin concentration in the cortex and hippocampus, (2) concentration of kynurenine metabolites quinolinic acid (QA), kynurenic acid (KA) and 3-hydroxykynurenine (3HK) by HPLC (3) mRNA expression of the kynurenine enzymes indoleamine 2,3 dioxygenase (IDO) and kynurenine 3 monooxygenase (KMO) (3) immunohistochemistry for presence of activated microglia indicated by CD11b staining and for serotonin immunoreactivity in the cortex.

Results:

Decrease in standard uptake value for AMT and decrease in serotonin concentration was noted in the frontal and parietal cortices of endotoxin kits when compared to controls (x^2 = 43.24, *df* = 1, $p<0.001$ for endotoxin vs. both control groups). In addition, a significant decrease in cortical serotonin concentration (Mean±SD= 0.188±0.042 ng/ml for endotoxin, 0.546±0.049 ng/ml for control and 0.586±0.002 ng/ml for control-saline; $p<0.001$ for endotoxin vs controls) and decrease in serotonin immunoreactive fibers was measured in the somatosensory cortex. A significant increase in formation of the neurotoxic metabolite QA was noted in the brain of endotoxin kits (2646 ± 21 pg/g of tissue in endotoxin vs. 6 ± 3 pg/g in controls; $p<0.001$) along with a 62% increase in expression of KMO, the upstream enzyme for QA formation. This was associated with an increase in CD11b expression in the periventricular region of the endotoxin kit brain indicating an increase in pro-inflammatory microglial phenotype. Increased 3HK staining was also noted in this region in the endotoxin kits.

Conclusions:

These results indicate that maternal intrauterine endotoxin exposure is associated with increased tryptophan metabolism by the kynurenine pathway, decreased cortical serotonin and increased formation of neurotoxic metabolites. This model shows potential mechanisms by which intrauterine infection/inflammation may produce brain injury associated with autism and other neurodevelopmental disorders in the neonate.

104.006 Childhood Behavioral Correlates of Maternal Antibodies In Autism. D. Braunschweig*[1], I. N. Pessah[2] and J. Van de Water[3], (1)*University of California at Davis*, (2)*University of California at Davis, M.I.N.D. Institute*, (3)*University of California, Davis*

Background: We recently identified fetal-brain reactive IgG antibodies in a subset of mothers of children with autism spectrum disorder (ASD). Specifically, simultaneous maternal antibody reactivity to 37kDa and 73kDa fetal brain proteins was observed exclusively among mothers of children with ASD, and reactivity to a 39kDa and 73kDa were observed significantly more often in ASD.

Objectives: This study sought to identify associations between specific childhood autistic behaviors and the presence of fetal-brain reactive antibodies in mothers of children with autism.

Methods: Behavioral data from 204 children with autism was collected using the Mullen Scales of Early Learning (MSEL), the Vineland Adaptive Behavior Scales (VABS), the Autism Diagnostic Observation Schedule (ADOS) and the Autism Behavioral Checklist (ABC) instruments. Scores for these instruments were compared between individuals with autism whose mothers have fetal-brain reactive antibodies and those who do not.

Results: Children with ASD whose mothers have circulating IgG antibodies which recognize fetal brain proteins at 37kDa and 73kDa displayed significant impairment in the use of expressive language compared with ASD children whose mothers did not show such reactivity ($p < 0.0001$). Additionally, ASD children of mothers possessing the 39kDa and 73kDa bands exhibited increased irritability ($p = 0.0473$).

Conclusions: The constellation of behaviors noted in ASD likely stem from multiple causes. Approximately 13% of mothers of children with autism have IgG antibodies that recognize fetal brain proteins, while such antibody reactivity is not observed among mothers of typically developing children. Comparison of behavioral test results between children with autism whose mothers have these antibodies versus those who do not yield significant differences in language usage and irritability. These findings support the hypothesis that some cases of autism, or specific behaviors observed in some cases of autism, may be related to neurodevelopmental perturbations induced by fetal brain-reactive maternal antibodies.

104.007 Abnormal Cell Properties and Down-Regulated FAK-Src Complex Signaling In B Lymphoblasts of Autistic Subjects.

X. Li*[1], H. Wei[1], M. Malik[2], A. Sheikh[1], G. Merz[1] and W. T. Brown[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*New York State Institute for Basic Research in Developmental Disabilities*

Background:

Recent studies suggest that one of the major pathways to the pathogenesis of autism is reduced cell migration, since the linkage between RELN and autism is a frequently replicated genetic finding. The Reelin protein, encoded by the RELN gene, plays a pivotal role in neuronal migration. Focal adhesion kinase (FAK) has an important functional role in neural migration, dendritic morphology, axonal branching and synapse formation. The FAK/Src complex activated by up-stream reelin and integrin β1 can initiate a cascade of phosphorylation events to trigger multiple intracellular pathways including MEK/ERK and PI3K/Akt signaling.

Objectives:

The aims of this study is to 1) determine whether integrin β1 and FAK-Src signaling are abnormally regulated in autism by using B lymphoblasts as a study model, and 2) whether abnormal FAK-Src signaling leads to defects in B lymphoblast adhesion, migration, proliferation, and IgG production.

Methods:

Both autistic lymphoblasts and control lymphoblasts from the normal siblings were obtained from Autism Genetic Resource Exchange (AGRE). In this study, Western Blot Analyses were used to detect the expression and activity levels of Integrin, FAK, Src and Paxillin. Cell Adhesion Assay, Modified Boyden Chamber Migration Assay and Cell Proliferation Assay were used to examine the lymphoblasts' adhesion, migration and proliferation. A human IgG ELISA kit was used to **measure the immunoglobulin production.** Fluorescence Staining and Computer-assisted morphometry were performed to determine the morphology of lymphoblasts.

Results:

For the first time**,** we show that 1) the protein expression of both integrin β1 and FAK are significantly decreased in autistic lymphoblasts and that 2) Src protein expression and the phosphorylation of active site (Y416) are also significantly decreased. These findings suggest there is reduced FAK-Src signaling activity in autistic lymphoblasts. We also found that lymphoblasts from autistic subjects exhibit significantly decreased migration and increased adhesion properties, as well as an impaired capacity for IgG production. Overexpression of FAK in autistic lymphoblasts was found to counter the adhesion and migration defects. In addition, we demonstrate that FAK mediates its effect through the activation of Src, PI3K/Akt and MEK signaling cascades and that Paxillin is also likely involved in the regulation of adhesion and migration in autistic lymphoblasts.

Conclusions:

Our findings suggest that compromised Intergin/FAK/Src signaling and reduced paxillin activites could be responsible for the observed abnormal adhesion, migration and IgG production of B lymphoblasts in autism. FAK mediates its effect in

lymphoblast migration through the activation of Src, PI3K/Akt and MEK signaling cascades. These various abnormalities could be used to develop an approach for early autism diagnosis.

104.008 In Utero Cytokine Exposure Influences Postnatal Development of T Helper Cells. M. Mandal*[1], A. Marzouk[2], R. Donnelly[2] and N. M. Ponzio[2], (1)*Department of Pathology and Laboratory Medicine, UMDNJ - Graduate School of Biomedical Sciences*, (2)*Department of Pathology and Laboratory Medicine, UMDNJ - New Jersey Medical School*

Background: Behavioral abnormalities in the offspring of mice that were immunologically challenged during pregnancy have been well documented in the literature. In these prenatal models, IL-6 induced by poly(I:C) is critical in mediating these abnormalities. While much has been published on the behaviors of offspring in this model, much less is known about how maternal immune stimulation during pregnancy affects the adaptive immune system of the offspring, and its possible role in the observed pathophysiology in neurodevelopmental disorders, such as autism.

Objectives: A major objective of this study is to optimize existing mouse models of autism (that currently use immunologically naïve pregnant dams) to more closely resemble the human scenario, where women develop immunological memory resulting from immunizations and natural exposure to antigens prior to pregnancy. Thus, a more robust mouse model of autism might be developed, and reveal factors that are significant in the etiology and/or pathogenesis of this disorder that are currently not considered in these animal models.

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 and IL-6 KO ($IL\text{-}6^{-/-}$) female mice were mated with WT B6 ($IL\text{-}6^{+/+}$) males. On gestational day 12, pregnant females were injected i.p. with PBS (control) or poly(I:C). 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.

Results: Overall, higher levels of pro-inflammatory cytokines IL-6, MCP-1, and GM-CSF were present in amniotic fluids than in sera in both immune and naïve poly(I:C)-injected pregnant dams. Levels of IL-6 trended higher in maternal sera of immune compared to naïve poly(I:C)-injected dams although they did not reach significance. FACS analysis of activated spleen cells from offspring of immune poly(I:C)-injected dams showed >5 fold increase in Th17 (CD4+ IL-17A+) cells compared to naïve poly(I:C)-injected dams. In mating between IL-6 KO dams and WT B6 males, significantly higher levels of IL-6 were found in the amniotic fluids compared to maternal sera. Analysis of supernatants of cultured placental and spleen cell preparations from these IL-6 KO dams demonstrated that IL-6 was produced from the heterozygous fetal ($IL\text{-}6^{+/-}$) component. These results indicate that immune challenge during pregnancy in females with immunological memory leads to development of a T helper cell repertoire in offspring that has been shown to mediate CNS pathology in autoimmune rodent models (e.g., EAE).

Conclusions: The presence of immunological memory in dams prior to immune activation during pregnancy promoted development of pro-inflammatory Th17 cells in their offspring. This preferential differentiation could be due to differences in the cytokine profiles measured in amniotic fluids of immune vs naïve dams. Matings between IL-6 KO females and WT B6 males confirmed a significant fetal source of IL-6 production. Thus, although IL-6 may be a critical factor for the development of the behavioral abnormalities seen in offspring of poly(I:C)-injected pregnant dams, these abnormalities appear not to be solely dependent on its production from the maternal immune system.

Treatments Program

105 Interventions I: Early Intervention and Language Intervention

105.001 1 A Comparison of Naturalistic Behavioral and Developmental, Social-Pragmatic Interventions on Language Use and Social Engagement In Children with Autism. S. Jelinek*[1], B. Ingersoll[2], K. A. Meyer[2] and N. Bonter[2], (1)*Michigan State University* , (2)*Michigan State University*

Background: Naturalistic interventions show promise for improving language in children with autism. Specific interventions differ in direct elicitation of child language and indirect language stimulation, which may produce different language outcomes. Naturalistic behavioral interventions use direct prompting and reinforcement within natural contexts to teach specific social-communication skills while naturalistic developmental/social pragmatic interventions focus on increasing the adult's responsiveness to the child and establishing balanced turns between the child and the adult.

Objectives: This study compared the effects of responsive interaction (a naturalistic developmental/social pragmatic

intervention), milieu teaching (a naturalistic behavioral intervention), and a combined intervention on the type and communicative function of expressive language in five preschoolers with autism. In addition, it examined the differential effect of the three interventions on the children's social engagement with the therapist.

Methods: This study used a single-subject, ABACAD design across five children with autism. Children received three weeks of each intervention. The order of interventions was determined for each child by a coin flip.

Results: Results suggested that the milieu teaching and combined conditions were more effective at increasing the overall rate of expressive language targets than responsive interaction. These conditions also led to substantial increases in prompted language and requests. Responsive interaction had a small but consistently higher rate of commenting than milieu teaching. All children showed higher social engagement ratings with the therapist during treatment than baseline.

Conclusions: Overall, these results suggest that the direct elicitation of child language within naturalistic interactions is the most effective strategy for producing short-term gains in child use of expressive language targets and can promote social engagement.

105.002 2 A Comparison of Two Treatments for Teaching Language, Play, and Imitation Skills to Young Children with Autism. A. B. Cunningham*[1], L. Schreibman[1], A. C. Stahmer[2], K. Pierce[1] and E. Courchesne[1], (1)*University of California, San Diego*, (2)*Rady Children's Hospital, San Diego*

Background: Given the heterogeneity of treatment response in autism, research should focus on identifying the variables that influence the effectiveness of specific interventions in different learning domains and at different times in development. Two interventions for teaching language, play, and imitation to children with autism are discrete trial training (DTT) and pivotal response training (PRT). Both are grounded in applied behavior analysis, accepted as best practice, and used widely in community settings. Data suggest that although rates of acquisition may be similar for both DTT and PRT, PRT facilitates greater spontaneity, generalization, and maintenance of skills, and decreased disruptive behaviors in comparison to DTT. Importantly, most studies have been conducted with children over 3 and comparison studies have focused on teaching expressive language, although these interventions are commonly used to teach receptive language, play, imitation, and other social skills. It is unknown whether the same strengths and limitations extend to these other domains and to younger children. Finally, although many have emphasized the importance of treatment individualization, little is known about how to determine a priori what combination of methods is most likely to benefit individual children.

Objectives: To evaluate the relative effectiveness of DTT and PRT for teaching children with autism under the age of 3 years receptive and expressive language, play skills, and imitation skills, and to identify variables influencing whether specific children are more likely to benefit from DTT or PRT in these domains.

Methods: Preliminary data are presented for three children who participated in a single-subject alternating treatments design. Expressive and receptive language, play, and imitation targets were matched on developmental appropriateness and difficulty level 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. Order of teaching procedures was randomly determined on the first day of the study and counterbalanced across subjects. Data are reported on session rate of learning, skill acquisition and generalization during weekly probes, and maintenance of gains at 3-month follow-up. Potential predictor variables were also collected at pre-treatment.

Results: Participants made gains in the acquisition and generalization of the target items taught via DTT and PRT. Children demonstrated distinct patterns of responding to DTT and PRT. Word acquisition and generalization, as well as rates of learning and disruptive behaviors during treatment sessions, varied depending on the treatment method used and domain of focus. Potential predictor variables useful in deciding treatment appropriateness a priori will be discussed.

Conclusions: These data corroborate with other studies emphasizing 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 are not as explicit as previous research may suggest. Effectiveness may vary depending on child variables and curriculum area focus. Follow-up research aimed at improving methods for combining interventions into comprehensive treatment programs is important.

105.003 3 A MODEL of THERAPY Mediated by Parents IN Pervasive Developmental Disorders. L. D'Elia*[1], G. Valeri[2], C. Napolitano[3], I. Fontana[3] and S. Vicari[4], (1), (2)*IRCCS Ospedale Bambino Gosu - Roma*,

(3)*Ospedale pediatrico Bambino Gesù*, (4)*Ospedale pediatrico Bambino Gesù*

Background: The social impairment, communicative, attentive and play skills shared reduce opportunities for children with Autism and Pervasive Developmental Disorder (PDD) to take advantage of natural experiences of everyday interaction. The development of socio-communicative skills in PDD was, in fact, the goal of many research from which they originated many types of therapeutic intervention.

Objectives: Among the treatments currently used in our contribution concerns a model of Therapy Mediated by Parents (TMG) experienced at the outset, at the UOC Neuropsychiatry Unit of "Bambino Gesù" Children's Hospital in Rome. This model aims to enhance mutual communication and social interaction in a setting starring children and their parents. They become mediators of the proposed therapy in the clinical setting, proposing it to the child in his daily environment.

Methods: We created a detailed manual of the TMG's steps which each operator is required to follow. In order to standardize the treatment all therapists had one meeting per month (6 monthly meetings) before and after the treatment verifying the adherence to the manuals. The sample consisted of 26 children with DGS who followed a cognitive-behavioral therapy by up to 6 months. The subjects belonging to the two groups were matched 1:1 for age, sex and diagnosis according to DSM IV.

Results: The comparison between the two groups after treatment showed a significant difference in the communications' scales for the group that followed the TMG.

Conclusions: A first analysis of data shows a statistically significant difference between the experimental group and control groups in the areas of communication, measured by ADOS and percentage of children who become verbal (use of more than 5 words). In order to further verify the effectiveness of the treatment we propose to increase the sample, systematically measure and carry out follow up at 6 months and a year.

105.004 4 A Picture's Worth a Thousand Words: Examination of Pre-Requisite Skills for the Picture Exchange Communication System. K. McFee*, J. Koudys, J. M. Bebko and A. Perry, *York University*

Background: Disordered communication is one of the core deficits of autism. Interventions logically focus on the development of functional communication systems. One of the most frequently used approaches with children who lack speech is the Picture Exchange Communication System (PECS; Bondy & Frost, 2002). In general, PECS users communicate by exchanging pictures for preferred items or activities. Despite PECS growing empirical support, communication outcomes vary considerably and little is known about what accounts for this variation. There has long been debate as to whether there are prerequisite skills, such as picture discrimination or a symbolic understanding of pictures, required for children to use PECS successfully. The present study is an examination of these child characteristics as they relate to communication outcomes using PECS.

Objectives: An overall objective of this study is to determine those children with ASD who benefit most from PECS. Such results will increase our ability to provide early communication interventions that are tailored to match the individual characteristics of children.

Methods: Twenty-two children with a previous diagnosis of an ASD were recruited from a therapeutic summer camp and participated in a 7-week PECS intervention. Data were collected according to a pre-post longitudinal research design. Each child was assessed for entry level/phase of PECS at the beginning of camp, along with a number of child characteristics: age, developmental level (Mullen Scales of Early Learning or Stanford Binet-5), and severity of autism symptoms (Childhood Autism Rating Scale). Specific cognitive skills assessed pre-treatment included the ability to learn associations between words and pictures and a symbolic understanding of pictures. Outcome variables assessed post-treatment were the phase of PECS attained and speech production.

Results: Most children mastered at least one or two phases of PECS by the end of camp, with a subset mastering three to five phases. Developmental level was highly related to PECS outcomes, while severity of symptoms of autism was not. Associative learning and symbolic ability with pictures were developmental constructs that predicted the phase of PECS attained post-treatment. The majority of children with a symbolic understanding of pictures, that a picture represents real-world items, mastered a more complex, high PECS phase. However, there were a number of children who mastered these phases without a symbolic understanding. These children demonstrated the ability to learn that a particular picture would result in them receiving a specific object through repeated pairings or operant conditioning principles. A subset of children demonstrated functional speech post-treatment.

Conclusions: Even children with significant cognitive delays and severe symptoms of autism can use PECS as a functional

communication system. Associative learning is highly predictive of mastering a complex PECS phase and supports the use of behaviourally based teaching strategies with this population. Symbolic ability is facilitative, although not necessary. Implications for outcome expectations and teaching will be discussed.

105.005 5 Acoustic Characteristics of Maternal Speech to Young Children with Typical Development and Young Children with Autism. H. Flores*, J. A. Burack and A. Nadig, *McGill University*

Background:

Child-directed (CD) speech is often used rather than adult-directed (AD) speech in caregiver-child interactions and is distinguished by its higher pitch, slower tempo and exaggerated intonation (Fernald, 1985; Kitamura et al., 2002). Typically-developing (TD) children prefer listening to CD over AD speech or non-speech analogues (Cooper & Aslin, 1990; Pegg et al., 1992; Newman & Hussain, 2006), whereas children with autism spectrum disorder (ASD), or at risk for ASD, show a preference for AD speech (Paul et al., 2007, Nadig et al., 2007), background noise (Klin, 1991), or non-speech analogues (Kuhl et al., 2005). As CD speech can facilitate language development (Thiessen et al., 2005; Tsao et al., 2004), the focus of this study is to examine whether natural speech input to children with autism involves the acoustic properties of CD speech, and if it is related to the child's language development.

Objectives:

We compare the acoustic properties of maternal speech to children with ASD or TD, with a focus on the extent of the production of CD modification relative to their AD speech by individual mothers. Two exploratory predictions were evaluated. One, mothers of children with ASD may increase their use of CD modification, since it is likely difficult to attract their child's attention (Nadig et al., 2007). Alternatively, mothers of children with ASD may produce less CD modification if it is driven by child responsivity (Lam & Kitamura, 2008). CD modification by individual mothers was also expected to be positively related to her child's vocabulary growth over a 1-year period.

Methods:

Target enrollment for this study is 25 families for both the ASD and TD groups. The groups of children are matched on language level, with an age range of 2-6 years for ASD and 18-41 months for TD. CD samples were collected during a 10-minute storybook session where mothers read to their child. AD samples were collected via a 5-minute interview in which the experimenter asked the mother questions about the storybooks. Individual words that were produced in both CD and AD contexts were extracted and analyzed in PRAAT for mean pitch, pitch range, and duration. The MacArthur CDI (Fenson et al., 2004) were collected at the beginning of the study and 1 year later, providing a measure of vocabulary growth.

Results:

Preliminary analyses (ASD=4; TD=15) indicate that mean pitch and pitch range are significantly higher for CD than AD speech, but only for mothers of the TD children. Ten of 15 mothers in the TD group, and 2 of 4 in the ASD group consistently increased their pitch in speech to their child, and 9 of the mothers in the TD group and 2 of 4 in the ASD group increased their pitch range.

Conclusions:

We observed significant individual differences with respect to CD modification among both groups of mothers. Data collection is ongoing and acoustic analysis of CD speech will be conducted, as will a comparison of CD modification by each mother with her child's vocabulary development over a 1-year period.

105.006 6 Acquisition of Requests, Labels, and Answers to Questions Through Sign Exposure In An Individual with Autism. A. L. Valentino* and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Children with autism may not develop vocal language and may require specific teaching with alternative communication systems such as sign language. In the absence of vocal language, sign language may serve as a main form of communication. Therefore, when teaching sign language, it is important to examine the situations under which sign can be acquired without direct instruction. A practical problem exists in teaching language if each individual word must be directly taught. However, if language can be acquired through incidental observation, language may grow quickly. Children who communicate with vocal responses have the opportunity to observe language outside of the teaching environment. However, children who communicate with alternative systems are at a distinct disadvantage because it is unlikely that others in the environment consistently communicate with those same systems outside of direct teaching situations.

Objectives: The purpose of the current study was to assess the effects of sign exposure only without direct teaching on the emergence of language in a child with autism.

Methods: Jethro was 7- years old. The dependent variable was a correct independent response, which was recorded if Jethro emitted the corresponding sign for the targeted item when the opportunity was presented. Requests, labels, and answers to questions were targeted. A multiple baseline design across activities was used. Three activities with corresponding items were included: playing with bubbles (bubble wand), balloon play (balloon), and playing with shaving cream (shaving cream). During baseline and probe sessions, the activity was initiated. Ten opportunities for Jethro to emit signed requests, labels, or answers to questions were provided. During sign exposure sessions, the targeted activity was initiated. During the activity, the therapist modeled the sign with the targeted item 10 times for each component of language. One sign exposure session was always conducted prior to a probe session.

Results: Results showed that all signs were emitted across requests, labels, and answers to questions during post-sign exposure probes.

Conclusions: These results had particular significance for Jethro. Specifically, caregivers were instructed to use sign language in their interactions with Jethro in order to expose him to sign language experiences and promote future emergence of untrained language. Jethro acquired sign language the way many typically developing children acquire vocal language. These results led to specific recommendations regarding the importance of modeling sign language outside of direct teaching sessions. During sign exposure sessions, Jethro engaged in some imitative responses. He engaged in the most imitation during sign exposure sessions with the first targeted activity and with subsequent activities his imitation occurred only initially, yet he still acquired signs. This imitative behavior may parallel the function of self-talk responses that occur when vocal children engage in expressive language that then becomes more covert. Procedures to observe the effects of sign exposure in individuals with autism who communicate with alternative systems is an exciting avenue for future research and may have significant benefit to this population.

105.007 7 An Innovative Preference Assessment Method and Subsequent Teaching to Expand Requesting Skills In Children with Limited Preferences. L. B. Shibley*, C. N. Bowen, N. A. Call and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Early language instruction for individuals with autism often focuses on teaching functional communication skills such as requesting. When teaching requesting, incorporating a variety of highly preferred items and activities for the individual to ask for is vital to the success of language programming. Individuals with autism, however, often present with a restricted range of interests and preferences. These limited preferences can present substantial challenges to clinicians once requesting skills for the few primary reinforcers have already been acquired and the individual's requesting repertoire has plateaued. Therefore, innovative approaches to assessing additional items that can be used to expand requesting repertoires are needed for continued language development.

Objectives: The current study sought to identify a procedure to assess preference for items in the environment that are deemed "typically neutral" but may become preferred under certain conditions. A second objective of the current project was to subsequently teach functional requesting skills for the "typically neutral" items under particular conditions to further develop requesting repertoires.

Methods: Three children diagnosed with autism and one child diagnosed with PPD-NOS and traumatic brain injury between the ages of 5 and 8 years were included in the study. For each participant a preferred item with an associated "typically neutral" item was selected (e.g., Ice cream and spoon, juice box and straw, fruit cup and fork). Preference for the "typically neutral" item (i.e., fork, spoon, straw) was assessed under varying conditions. More specifically, preference for the associated neutral item was assessed either in the presence of the associated preferred item or in the absence of the associated preferred item. In experiment 1 preference was assessed using a modified version of the paired-choice (PC) preference assessment and in experiment 2, preference was assessed using a modified version of the multiple stimulus without replacement (MSWO) preference assessment. In each assessment, the "typically neutral" item was presented in an array of preferred items. During the motivation present condition, the preferred item associated with the neutral item was presented to the child throughout the assessment. During the motivation absent condition, the preferred item associated with the neutral item was not present. The dependent variable was change in choice responding allocated to the "typically neutral" item. Subsequent to the preference assessment, request training was implemented.

Results: Results indicated that all participants chose the "typically neutral" item more often in the presence of the

associated preferred item compared to when the preferred item was absent. Subsequent request training was successful.

Conclusions: The current project demonstrates a data based method for assessing momentary preference for "typically neutral" items in order to expand functional communication skills in children diagnosed with autism. Both the paired-choice and MSWO preference assessments produced similar results.

105.008 8 Assessing Grammar, Vocabulary, Syntactic Complexity and Pragmatics In Children with Autism Before and After STAR and TEACCH. S. M. Romano*[1], F. Hurewitz[1] and D. S. Mandell[2], (1)*Drexel University*, (2)*Children's Hospital of Philadelphia, Center for Autism Research*

Background: Language abilities in children with autism are one of the strongest predictors of behavioral and social outcomes (Rogers, 2005). Interventions targeting language skills generally conceptualize them very broadly; almost no larger studies offer detailed reporting of the intervention's benefits for specific aspects of linguistic competence other than expressive or receptive vocabulary and language or communication composite scores.

Objectives: To examine changes in grammar, vocabulary, pragmatics and syntactic complexity among children with ASD in response to a community implementation of evidence-based autism intervention, and whether intervention fidelity moderates linguistic change across the intervention period.

Methods: The Autism Instructional Methods Survey (AIMS) study (Mandell, Shin, Stahmer & Marcus, 2010), is a randomized field trial taking place in collaboration with the School District of Philadelphia. AIMS compared two evidence-based interventions Strategies for Teaching based on Autism Research (STAR) and **T**reatment and **E**ducation of **A**utistic and **C**ommunication related handicapped **Ch**ildren (TEACCH) in 38 autism support classrooms in one urban school district. STAR comprises three instructional strategies – discrete trial training, pivotal response training and teaching in functional routines – matched to a comprehensive curriculum. TEACCH comprises visual strategies and physical prompts to clarify and highlight important tasks the child has to accomplish. Classroom staff received didactic training and in-school consultation in the intervention condition to which they were randomized. Children were assessed in September and May of the intervention year using the Differential Abilities Scale and the Autism Diagnostic Observation Schedule. The study also assessed teacher fidelity to the assigned intervention.

The sample for the current study included 91 of the 138 students enrolled in AIMS. These 91 had a confirmed diagnosis of autism, were between the ages 5.2 and 9.1 years, and were assessed using the Module 2 or Module 3 of the ADOS.

Naïve coders trained in linguistics transcribed > 200 utterances for each child using coding guidelines from the Child Language Data Exchange System (CHILDES). These Natural Language Sample (NLS) Transcripts were analyzed in 4 areas, both pre- and post- intervention: Productive Grammar (measured by Mean Length Utterance (MLU)), Vocabulary (assessed using number of distinct words divided by number of absolute words), Pragmatics (evaluated using the ratio of responsive interactions versus interruptions), and syntactic complexity (assessed using the Index of Productive Syntax (IPSyn) (Scarborough, 1990)).

Results: Analysis, which is ongoing, will compare treatment groups stratified by teacher fidelity and intervention condition.

Conclusions: While experts have emphasized that NLS is a crucial component of assessing functioning in children with autism (Tager-Flusberg, Rogers, Cooper, Landa, Lord, Paul et al., 2009), few intervention studies have reported using related measures of outcome and we know of no comparative intervention studies that provide detailed NLS-based language outcomes**.** The results can provide information on how different therapeutic methods contribute to generalizable linguistic skills in vocabulary, syntax, utterance length and pragmatics, and how these outcomes are affected by treatment fidelity.

105.009 9 Characteristics and Outcomes of Community-Based Early Intervention for Three to Five Year Old Children with Autism. A. S. Nahmias*[1], S. Shin[2], M. Xie[1] and D. S. Mandell[3], (1)*University of Pennsylvania*, (2)*District of Columbia Department of Education*, (3)*University of Pennsylvania School of Medicine*

Background: Although research provides increasing evidence that early intervention can improve outcomes for young children with autism (Rogers & Vismara, 2008), less is known about treatment outcomes for preschoolers with autism who receive intervention services in the community. The small body of research in this area suggests that community practices do not mirror evidence-based interventions (Stahmer, 2007) and do not result in the large gains observed in research trials (Magiati, Charman & Howlin, 2007). Previous community-based studies also tended to focus on child rather than intervention characteristics when predicting child outcomes (Perry et al., 2011). Studying the characteristics of the community-based early interventions themselves and associated outcomes in

elementary school is a critical step in the path to developing both interventions that have a higher chance of use in community settings, and more effective community-based implementation strategies.

Objectives: to 1) describe features of early intervention received under IDEA Part B by three-to-five-year-old children who are later placed in autism support classrooms; 2) investigate the association between these early intervention characteristics with outcomes measured upon entry to elementary school; and 3) investigate how early intervention experiences as associated with intervention response in elementary school.

Methods: The sample comprises 400 children who part of an intervention effectiveness trial in kindergarten-through-second-grade autism support classrooms in the School District of Philadelphia. Participants' early intervention records from Elwyn will be reviewed. These records include initial assessments, the Developmental Assessment for Young Children (DAYC; Voress & Maddox, 1998), Evaluation Reports, and Individualized Education Programs (IEP), which will be coded for intervention features (e.g. frequency and duration, location (center vs. home based), program orientation), as well as child and family characteristics. Intervention features will then be associated with clinical presentation in elementary school, as measured by the Differential Abilities Scale –II, the Autism Diagnostic Observation Schedule, as well as other parent and teacher-reported measures. We then will examine the association of these early intervention characteristics with intervention response during elementary school.

Results: Data collection is ongoing and will be completed in time for the conference.

Conclusions: This study will add to the small body of literature describing the characteristics of community-based early intervention by measuring 1) components of the intervention received; 2) associated outcomes based on standardized measures, administered by a research clinician; and 3) response to intervention in elementary school as a function of early intervention experiences. This information can help guide improvements to community-based intervention programs for young children with autism by identifying which features of current practices are associated with more favorable outcomes.

105.010 10 Children's Progress Across An Intensive 3-Month Unity Parent ABA Training Program. J. L. Scammell*, D. D. Barrie, V. A. Bruce, M. N. Gragg, T. M. Carey and M. Tahir, *University of Windsor*

Background: Applied Behaviour Analysis (ABA) is one of the leading evidence-based interventions for improving the functioning of children with Autism Spectrum Disorders (ASD). Although early intervention is important for positive outcomes, demand for ABA is high and waitlists are long. Thus, finding alternative ways for parents to access earlier treatment for their children is critical, including training parents to implement ABA in their homes. Few studies; however, have examined the effect parent training programs have on children's development.

Objectives: To investigate the effectiveness of intensive, 3-month *Unity* parent training for improving children's progress in cognitive and adaptive functioning, comparing their cognitive and adaptive skills before and after the training program.

Methods: Twenty parents of preschool children with ASD were selected to participate in *Unity* parent training (85% mothers, M_{age} = 33.3 years). Children (94% boys) ranged in age from 17 to 51 months (M_{age} = 39.1 months). Half were diagnosed with Autistic Disorder and half with PDD-NOS. Parents learned to apply ABA with their children during 180 hours of centre-based ABA training across 12 weeks. Children's cognitive and adaptive functioning was assessed before and after *Unity* as part of a larger study. Children's cognitive functioning was measured with the Mullen's Scales of Early Learning (MSEL); adaptive behaviour was measured with the Vineland Adaptive Behaviour Scales, Second Edition (VABS-II).

Results: Significant progress in children's cognitive and adaptive functioning was found. Children's cognitive functioning levels on the MSEL before the *Unity* program were below the 1st percentile on average (Early Learning Composite = 65.75, *SD* = 18.37). Dependent-samples *t*-tests of standard scores indicated significant improvement in the overall Early Learning Composite ($t(19) = -4.44$, $p < .001$, $M_{diff} = -10.80$), Visual Reception ($t(19) = -3.24$, $p = .004$, $M_{diff} = -10.35$), Fine Motor skills ($t(19) = -2.35$, $p = .03$, $M_{diff} = -9.80$), and Expressive Language ($t(19) = -2.65$, $p = .02$, $M_{diff} = -8.75$). Children's average overall cognitive functioning significantly improved (after *Unity* Early Learning Composite = 76.55, *SD* = 23.92). Children made an average of 6 to 8 months gain in cognitive skills over 3 months. Children's adaptive functioning levels on the VABS-II before the *Unity* program were moderately low on average (Adaptive Behaviour Composite [ABC] = 77.00, *SD* = 9.08). Dependent-samples *t*-tests of standard scores indicated improvement in the ABC scores ($t(19) = -3.21$, $p = .005$, $M_{diff} = -2.60$) and Communication subdomain ($t(19) = -3.66$, $p = .002$, $M_{diff} = -5.75$). Children's average overall adaptive functioning significantly improved (after *Unity* ABC = 79.60, *SD* = 10.14).

Children made significant gains in the ABC and all domain age equivalent scores, with an average of 3 to 5 months gain in adaptive skills over 3 months.

Conclusions: Parents were effective in improving the cognitive and adaptive functioning of their preschool children with ASD over the 3 months of Unity parent training, especially in early learning skills, visual reception, language, and communication skills. Data collection is ongoing.

105.011 11 Choosing Treatments for Children with Autism Spectrum Disorders: The Influence of Parent and Child Factors. C. M. Brewton*[1], S. Mire[2] and R. P. Goin-Kochel[1], (1)*Baylor College of Medicine*, (2)*University of Houston*

Background:

Countless treatment options exist for children with autism spectrum disorders (ASD), and new therapies are introduced all the time. Choosing which therapeutic program(s) will be best for their children is undoubtedly a difficult task for parents (Green, 2007; Heflin & Simpson, 1998; Marcus, Kunce, & Schopler, 1997). Most often, parents of children with ASD implement several treatments simultaneously (Goin-Kochel, Myers, & Mackintosh, 2007; Stahmer & Aarons, 2009). However, little is known about the factors that influence their selection of various treatments. Parent-specific characteristics, such as education level (Wong & Smith, 2006) and family income (Mandell et al., 2008), as well as child-specific characteristics, such as ASD-symptom severity (Aman, Lam, & Collier-Crespin, 2003) have been reported to have an effect on parent decision-making processes. Yet, more research in this area is necessary in order to help clinicians understand how best to guide parents toward optimal treatment plans for their children with ASD.

Objectives:

To investigate the relationship between classes of treatments parents choose for their children with ASD and specific parent and child factors.

Methods:

Participants are children with ASD from the Simons Simplex Collection (SSC; https://sfari.org/simons-simplex-collection), which currently contains 1,887 affected probands between the ages of 4 and 18. All have received best-estimate clinical diagnoses of ASD via research-reliable administrations of the *Autism Diagnostic Interview—Revised* (ADI-R) and the *Autism Diagnostic Observation Schedule* (ADOS). Demographic information will include participant sex, age, race/ethnicity, parent education levels, and annual household income. Frequency counts will be generated for the number of children having ever used different classes of treatments, per parent report. Categories of treatments include: speech therapy, occupational therapy, psychotropic medications (e.g., antipsychotics, ADD/ADHD medications, anti-depressants), intensive behavioral therapies (e.g., ABA), biomedical treatments (e.g., chelation, special diets), and other treatments (e.g., social-skills training, picture exchange system). All data for this project have been collected via the SSC.

Results:

Appropriate correlations will be computed to assess relationships between each of the aforementioned categories of treatments and (a) the severity of children's autism symptomatology via the Calibrated Severity Score (CSS; Gotham et al., 2009); (b) children's verbal and nonverbal IQ scores; (c) parent education level; and (d) annual household income. For any correlations that are statistically significant, subsequent logistic regression analyses will be computed to determine whether the specific child or parent factor(s) predict use of that type of treatment. Because this investigation is exploratory, there are no hypotheses about directions of potential correlations.

Conclusions:

Findings from this study may uncover patterns of treatment use that are associated with specific demographic factors. This could have implications for the ways that clinicians or other helping professionals work with families to encourage use of treatments with the best empirical support.

105.012 12 Decreasing Echolalia In Individuals with Autism. G. R. Francis*, A. L. Valentino and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Echolalia is a defining characteristic of autism and may interfere with the development of functional language. Echolalia can be particularly problematic when teaching a child to answer questions. For example, when teaching a response to "what says moo?" by providing the verbal prompt, "cow," some may consistently echo the verbal stimulus (VS; "what says moo") and the verbal prompt ("cow"). Echolalia can also be problematic when teaching vocal imitation. For example, an instructor may present a task, "say oooh" and the child may, instead of imitating only the targeted sound "oooh" echo the entire phrase, "say oooh." In 1986, McMorrow and Foxx investigated the use of a procedure they labeled "cues-pause-

point" (CPP) which was successful in decreasing echolalia and increasing correct responding to questions with one adult with mental retardation. The results were replicated with other adults with mental retardation with successful generalization to novel people, places, and stimuli.

Objectives: The first aim was to replicate findings of previous CPP literature with a child with autism, specifically to teach the child to answer questions without echoing the verbal stimulus. The second aim was to extend the CPP procedure to vocal imitation tasks in another individual with autism.

Methods: Two male children participated in the study. Ian was 9-years-old and Tim was 4-years old. For Ian, conversational language was targeted. For Tim, vocal imitation was targeted. A multiple probe across responses design was used to evaluate treatment effects for both participants. During baseline for Ian, five trial sessions of each question were conducted. The therapist presented the VS (e.g., "what do you sleep in") and allowed 3 s for a response. If Ian responded correctly, brief verbal praise was provided. If Ian responded incorrectly or echoed the VS, the therapist moved to the next trial. During baseline for Tim, the vocal imitation task was presented ("say cup") and he was allowed 3 s for a response. If Ian responded correctly, brief verbal praise was provided. If Ian responded incorrectly or engaged in echolalia, the therapist moved to the next trial. During treatment, the cues pause point procedure consisted of two cues (a picture of the correct response, and the therapist holding her finger to her lips), a 2 s pause, and a point to a picture of the correct answer to the question. The procedure included fading of the picture for both participants so they emitted correct responding without the additional pictorial cue.

Results: The CPP procedure resulted in decreased echolalia and increased correct responding to answers to questions (Ian) and vocal imitation tasks (Tim). For Ian, training generalized to novel questions with just the application of the cue (i.e., finger gesture) and results were maintained at 8 and 12 mos follow-up.

Conclusions: Echolalia can result in reduced language acquisition. Thus, it is necessary to validate procedures to decrease echolalia. The results of the current study provide clinicians with a procedure that may be effective when teaching functional language to individuals with autism.

105.013 13 Effect of Negative Behaviors on the Achievement of Education Goals In Individuals with Autism Receiving Intensive Behavioral Intervention. R. A. Embacher*[1], T. W. Frazier[2], C. Vires[2], M. Vallinger[1], L. Speer[2], A. Sinoff[1], F. Dimitriou[1] and A. Newman[3], (1)*Cleveland Clinic Center for Autism*, (2)*Cleveland Clinic*, (3)

Background:

Behaviors such as tantrums, aggression, inappropriate verbalizations, and others can directly interfere with learning new skills. While this is well accepted in the education of individuals with ASD, the exact impact on educational progress is less clear. Examining the relationship between behavior intervention plans (BIP) and educational progress may help to better focus the educational planning process. To the authors' knowledge, no previous studies have examined the impact of the treatment of challenging behavior on educational progress.

Objectives:

The present study examines the impact of BIP implementation on the proportion of educational goals achieved over the 2008-2009 school year. Secondarily, the effect of BIP implementation on specific educational domains was evaluated.

Methods:

Participants included 64 children who were enrolled in the school program at Cleveland Clinic Center for Autism (CCCA). A year round program implementing the methodology of Applied Behavioral Analysis (ABA) served as the child's primary education and treatment setting. Participants received at least 11 months of intensive behavioral intervention. Total number of educational goals and objectives was determined by reviewing each child's individualized education program or curriculum plan. Goals were tallied and categorized according to 4 domains: academic content, communication, independent living skills, and other (e.g. physical education, fine motor skills). Progress and achievement was determined through annual reviews and progress reports. Progress was defined by completing at least 50% of an annual goal, while achievement was defined by completing 100% of a goal.

Results:

There were no significant differences between BIP groups for the proportion of total educational goals achieved ($F(1,62)=2.57$, $p=.215$) or for the proportion of educational goals showing progress ($F(1,62)=2.57$, $p=.215$). However, in each case, the trend was consistent with expectation and may suggest reduced power to detect a small or medium-sized effect. In looking at specific educational goals, there was a marginally significant difference between the BIP groups for the proportion of academic content goals achieved ($p=.057$). Students without a BIP had higher levels of academic content

goal achievement than individuals with one or more BIPs. Post-hoc comparisons indicated a significant differences in the proportion of academic content goals achieved between individuals with no BIP and individuals with 2 or more BIP ($p=.049$). Students with 1 BIP fell in between and were not significantly different from the other groups. There were no statistically significant group differences across other educational domains ($p>.10$).

Conclusions:

BIP are often needed to reduce serious and functionally impairing behavior and the present data suggest that the presence of these plans may not interfere with progress on most types of educational goals. The only exception was reduced achievement of educational goals where academic content was the focus. It is possible though that this finding simply reflects differences in baseline severity, with more severely affected students requiring BIP(s) and also showing less progress on academic content. If confirmed by future observational and randomized studies, it will be important to consider possible slowed progress on academic content goals when implementing a BIP.

105.014 14 Effects of Varying the Quality of Therapist-Provided Social Interaction During Discrete Trial Instruction. C. M. Gayman* and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: A behavioral approach has shown to be an effective method for the assessment and treatment of skill deficits in children diagnosed with autism and other developmental disabilities (Lovaas, 1987). The literature regarding quality of social interaction provided to children with autism and other developmental disabilities during discrete trail training is limited. However, behavior intervention manuals focusing on evidence based treatment for autism and related disabilities recommend high rates of enthusiastic interaction when conducting discrete trial instruction (Sundberg & Partington, 1998; Lovaas, 2003).

Objectives: The objective was to examine the quality of social interaction and reinforcement provided during discrete trial instruction.

Methods: Two studies with two children with developmental disabilities were conducted. Participants were a 5-year old male with Shaken Baby Syndrome and a 6 year old male with PDD-NOS with autistic-like features and language delays. The first study was conducted in an ABAB reversal design across high and low quality social interaction during instruction with easy, mastered tasks. The dependent variables included combined inappropriate behaviors and responding to instructions. Combined inappropriate behaviors were calculated as behaviors per minute and were defined specifically for each participant. Responding to instructions was calculated as a percentage of the number of correct plus incorrect responses to therapist provided instructions and excluded non-responses. The independent variables included high quality social interaction and low quality social interaction. The high quality interaction phase included smiling, physical attention such as hugs, tickles, or squeezes, and "Motherease." During the low quality social interaction phase the therapist was directed to avoid smiling, provide no physical attention, and to not speak in a "Motherease" manner (i.e., monotone). The therapist presented the instructions in either high or low quality style and provided a consequence in the same high or low quality manner. Study 2 was also conducted in an ABAB reversal design across high and low quality social interaction, with the exception that the therapist provided instruction to complete more difficult, non-acquired tasks. The dependent variables for Study 2 remained the same. Therefore, Study 2 was a systematic replication of study one with the addition of an evaluation of task difficulty in the form of non-acquired instructions.

Results: Data from both studies indicate idiosyncratic results suggesting that some individuals respond better with high quality, high energy instruction and interaction, while others may respond better to low quality, low energy interaction. The participant who responded with more problem behavior during the high quality condition in experiment 1 showed the opposite effect when tasks were more difficult suggesting an effect of task difficulty.

Conclusions: The results of these two studies provide some support for high quality social interaction when presenting difficult instructions to children with developmental disabilities. This study suggests the importance of considering the quality of social interaction in teaching environments and indicates that individual differences may exist. Therefore, blanket recommendations for high quality social interaction may not be warranted for all individuals.

105.015 15 Effects of a Parent-Coaching Component of a Developmental Intervention on Gesture Production Among Toddlers with Autism. M. Fusaro*[1] and S. J. Rogers[2], (1), (2)*University of California, Davis*

Background:

Communicative gestures provide evidence of preverbal children's emerging communication skills. Autism is characterized by a delay in verbal and non-verbal communication development. In Autism, early communication skill predicts long-term outcomes (Lord, Risi & Pickles, 2004; Mundy, Sigman & Kasari, 1990). Thus, an important goal of many early intervention programs, including the Early Start Denver Model (ESDM; Smith, Rogers, & Dawson, 2006), is to support the development of communication in toddlers and preschoolers. The ESDM is based on two treatment approaches: (1) the Denver Model (Rogers, Hall, Osaki, Reaven, & Herbison, 2000), and (2) Pivotal Response Training. Both approaches are supported by pre-post studies reporting improvements in behaviors across a range of developmental domains (e.g., Koegel, O'Dell, & Dunlap, 1988; Rogers & DiLalla, 1991; Rogers & Lewis, 1989; Rogers, Hayden, Hepburn, Charlifue-Smith, Hall, & Hayes, 2006; Schreibman & Pierce, 1993). A randomized treatment study of the ESDM is currently underway. Parents in the treatment group receive three months of weekly coaching in the application of ESDM principles to everyday family activities. It is not yet known whether this initial treatment phase facilitates children's acquisition of nonverbal communicative signals.

Objectives:

Our objective is to assess whether three months of parent coaching, the initial component of an intensive at-home intervention, increases gesture use by 2-3 year olds, compared to a control group of toddlers whose parents do not receive coaching.

Methods:

The current study will include up to thirty-eight toddlers enrolled in a multisite intervention study. All met Autism criteria on the ADOS-T and ADI-R and were randomly assigned to either the ESDM treatment or a community control condition. ADOS assessments were conducted at baseline (T1) and approximately three months later (T2). Gestures were identified from video-taped ADOS sessions examined by coders blind to treatment status. Thus far, T1 and T2 sessions from five treatment subjects and two control subjects have been analyzed.

Results:

Preliminary analyses were conducted using two-tailed t-tests. At baseline there were no significant group differences in overall frequency of gestures produced per minute (t=.23, p>.10, d= -.22). At T2, children in the treatment group produced slightly, though not significantly, more gestures per minute (M=.72), compared to the control group (M=.21; t=1.47, p=.20, d=1.55). Similarly, the percent of gestures coordinated with eye contact did not differ between groups at T1 (t=.82, p>.10, d= .79). At T2, children in the treatment group coordinated a slightly higher proportion of their gestures with eye contact (M=.16), compared to controls (M=0.0; t=2.45, p=.07, d=1.55). Future analyses will examine additional features of these gestures, such as the communicative intent conveyed and the coupling of gestures and words.

Conclusions:

These preliminary results are consistent with the views that 1) parent coaching in ESDM principles can support gesture development among children with Autism, and 2) social and cognitive systems underlying communicative gestures are plastic during the second to third year of life for children with Autism.

105.016 16 Efficacy of a Computer-Assisted ABA Intervention In a Study of 90 Preschool Students. C. Whalen* and L. Lara-Brady, *TeachTown*

Background: Numerous studies have shown that ABA-based (Applied Behavior Analysis) interventions produce some of the most promising results for children with ASD. In recent years, computer programs have been developed as another option for ABA-delivery and have shown some effectiveness for training service providers as well as for direct instruction for children. *TeachTown: Basics* is an ABA-based computer-assisted intervention that was designed to meet the developmental needs of children with ASD in the 2-7 year developmental range. The program includes computer lessons to teach language, cognitive, academic, and social skills, and also includes naturalistic off-computer activities to facilitate generalization and target skills not taught on the computer.

Objectives: This study investigated the effectiveness of the *TeachTown: Basics* intervention with 90 ASD and other special needs students in a preschool program in Killeen, Texas with teacher implementation.

Methods: Eight schools and 14 teachers participated with 64 students using *TeachTown: Basics* during and 26 students in the comparison group. Students in the intervention group differed only from the comparison group in that 1:1 ABA time was replaced with computer-delivered ABA through *TeachTown: Basics* (15-20 minutes/day for preschool and two 20-minute sessions/day for Pre-K). In addition, teachers were instructed to implement off computer activities throughout the school day as appropriate for each student (1:1 or small group).

To assess on-going progress, the *TeachTown: Basics* software collects data on student responses, duration of intervention, prompting, and mastery of skills. All students using *TeachTown: Basics* were assessed through this automatic data collection process. Developmental gains were also measured using the Brigance Inventory of Early Development (IED). To assess the impact of the intervention, differences in IED scores were accounted through a two way repeated measures ANOVA (pre/ post scores vs treatment group). The independent variable was the number of hours spent on using *TeachTown:Basics* and the dependent variable was the change in scores between the pre and post IED scores in each domain. Data gathered from the IED was also analyzed using T-tests and a within-subjects ANOVA. A t-test was used to check for any gains per group per IED domain. Additionally, a within-subjects ANOVA was used to analyze the performance of students with autism as a primary diagnoses and students with other diagnoses in the IED per domain.

Results: Results demonstrated that students that received the intervention made more developmental gains than students in the comparison group despite being higher functioning at baseline. A positive correlation was found between the amount of time students spent on the software and results in the IED, however results was not significant. Students with ASD performed at similar levels as students with other diagnoses after receiving the intervention.

Conclusions: The results of this study have important implications for special education and ABA programming and will hopefully encourage more research in the area of technology-based interventions designed for use by teachers. Student outcome, consistency of use, and social validity data will be shared and discussed.

105.017 17 Efficacy of a Facial Affect Recognition Training Tool for Children with Autism Spectrum Disorders. N. M. Russo*, B. Evans-Smith, J. Johnson and C. McKown, *Rush University Medical Center*

Background: A great deal of human communication is nonverbal. As such, recognizing facial expressions is critical to understanding and communicating with others. Children with autism spectrum disorders (ASD) often struggle to recognize emotions from facial expressions (facial affect), hindering their social interactions.

Objectives: We hypothesized that computerized facial affect recognition (FAR) training, paired with coaching, will help children with ASD (1) to improve their accuracy and speed at identifying facial affect by increasing their attention to critical facial features and (2) to more effectively communicate emotion in their own facial expressions with imitation training.

Methods: Children with ASD (8-14 years old) who had an existing FAR deficit were eligible for this study. To establish a pre-training baseline, children completed several direct assessments of FAR. Parent, teacher, and child self-report questionnaires of social functioning were also collected. During the intervention, trained coaches guided children through the MiX computerized training program (Humintell.com). The program utilizes audio-visual instruction with adult faces portraying seven emotions. Faces changed from neutral to expressive faces, reflecting particular emotions. Coaches modified the screens to direct children to important facial features associated with each emotion and also assisted children with imitation trials and practice tests. Individual training sessions (1 hour) were held twice weekly. Sessions were video-recorded to monitor treatment fidelity and to allow for multiple coders to rate imitations. The presentation rate of facial stimuli varied systematically across sessions and according to the child's previous success rate. Training continued until the child was accurate at a presentation rate 1/5 second across three consecutive sessions. Both immediately upon completion and then approximately one month later, direct assessments of FAR and social functioning questionnaires were re-administered.

Results: Each child progressed rapidly through the training, reaching criterion within six weeks. Improvements in recognition and processing speed were demonstrated by progression through the program and performance on the MiX post-test. Improvements also generalized to other FAR measures. Specifically, children performed at a higher level on experimental FAR measures that utilized adult faces via a similar labeling paradigm and a novel matching paradigm. A third experimental measure that utilized children's faces did not show consistent improvement across children. A composite FAR score, including all experimental measures, showed that children performed below age-expected levels before training and improved to at or above age-expected levels afterwards. Children also demonstrated modest imitation improvements as observed when coding the video recordings. Improvements persisted at maintenance testing. Further analyses are planned to evaluate extended effects on social functioning as rated by the child, parent, and teacher.

Conclusions: These data show that coach-assisted computerized training with imitation exercises successfully alleviated FAR deficits in children with ASD. Although effects persisted one month after training, future studies should

investigate whether "boosters" are necessary to maintain the skill long-term. Additional work is planned to isolate which components individually or together results in the greatest training effect and to better evaluate behavioral improvements in peer interactions after training.

105.018 18 Efficacy of the Language for Learning Curriculum with Children Diagnosed with ASD. C. N. Bowen*, R. Peterman and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Language is often significantly impaired in children with ASD and has been identified as one of the most common concerns of their parents. Given the staggering increases in the prevalence of ASD, the school is often a primary provider of intervention. Research is needed to help identify widely accessible, easy to implement, effective interventions for children with ASD being served in schools. Direct Instruction (DI), is an empirically-based instructional program that offers a comprehensive, widely accessible intervention method that is ideal for easy implementation by teachers and paraprofessionals. Research has provided empirical support towards the effectiveness of DI programs in teaching academic skills to children across grades (Becker & Gersten, 1982; Weisberg, 1988), socioeconomic backgrounds (Gersten & Carnin, 1984; Gersten, Darch, & Gleason, 1988), and some disabilities (Horner & Albin, 1988). Only two studies have evaluated the use of DI with children with autism, and only one study has evaluated the DI *Language for Learning* curriculum (Ganz & Flores, 2009). Both studies provided positive outcomes of the curriculum for children with ASD.

Objectives: The primary objective was to evaluate the efficacy of the *Language for Learning* Direct Instruction curriculum to improve language skills of children with ASD when conducted in a one-to-one teaching arrangement.

Methods: Participant's ages ranged from 4 years to 12 years. Twenty-five children with a diagnosis of ASD participated. Each participant was semi-randomly assigned to one of three groups. All three groups received treatment, which was implemented across the three groups sequentially. If the participant was not currently receiving treatment s/he served as a control. Procedures included in the study were directed by the *Language for Learning* Teacher's Manual, with a few additional modifications. Data were collected on each participant's performance during pre-, post-, and follow-up testing. Therefore, testing was administered at Time, 1, 2, 3, and 4.

Results: We compared the pre- and post-test scores to determine change in responding before and after treatment for each group. Additionally, pre-tests were completed prior to intervention by the participants serving as waitlist controls to assess for maturation effects. Statistical analyses included a one-way ANOVA test to compare baseline language skills *across* the three study groups. Paired-sample t-tests were used to compare pre- and post-intervention language acquisition scores *within* each of the three groups. Finally, one-way ANOVAs and post-hoc tests were conducted to compare language acquisition skills *across* the three groups within each study time period. Results indicate no differences across the three study groups in baseline language skills. For each group, language skills immediately following post-intervention were significantly higher than pre-intervention scores. Follow-test scores remained substantially higher than pre-intervention up to 6-8 months following intervention.

Conclusions: Approximately 36-40 total hours of intervention was provided per child over the course of 3-4 months and demonstrates the utility of the Direct Instruction *Language for Learning* curriculum. This curriculum is easy to implement and widely-accessible to school personnel.

105.019 19 Efficient Strategies for Teaching Receptive Language to Students with Autism: Observational Learning and Incidental Teaching. C. H. Delfs* and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Present research and legislation regarding mainstreaming children with autism into classrooms with neurotypical peers have raised the importance of studying whether these children can benefit from observing peers. Observational learning within the autism population has been a focus of research for the past 30 years (Varni, Lovaas, Koegel, & Everett, 1979; Egel, Richman, & Koegel, 1981; Tryon & Kean, 1986). Previous research has shown that students diagnosed with developmental disabilities can acquire new skills through observation of peer learning (Schuster, Gast, & Wolery, 1988). One-on-one instruction is commonly recommended for children with autism; however, this instructional format does not provide opportunities for observational learning of peers. Another potentially efficient teaching strategy is the incorporation of incidental information into structured, empirically-supported teaching strategies. Incidental learning is the acquisition of nontarget information present in the instructional context, but for which there are no programmed contingencies to aid in acquisition (Stevenson, 1972). Few studies have assessed the added potential benefits

of small group instruction and incidental teaching with children with autism.

Objectives: The purpose of this study was to assess the efficiency of teaching receptive language skills to individuals with autism and related developmental disabilities. The present investigation examined whether children with developmental disabilities acquired receptive language skills within a small group instructional format when taught via three methods of instruction: explicit teaching, observational learning, and incidental teaching. Maintenance of these skills across time was also assessed.

Methods: Two participants were taught specific receptive identification targets (e.g., “Point to the fish”) presented in an array of three items. Related information about the targets (e.g., “A fish has gills”) was provided, but no responses were required of the participants regarding this information. Each participant was taught different targets. During each dyadic teaching session, trial-by-trial data were collected on the receptive targets taught via explicit teaching procedures. The acquisition of these targets, as well as nontarget information delivered incidentally, was evaluated within a multiple-probe design across behaviors. Concurrently, observational learning of peer targets and nontarget information presented to the peer was also assessed.

Results: Data reported include percentage of acquisition for receptive targets, incidental learning of related nontarget information, and observational learning of peer’s targets and related nontarget information. Both participants acquired 100% of the receptive identification targets taught via explicit teaching procedures and observational learning. Both participants acquired 100% of the related nontarget information taught via observational learning and incidental learning. However, they differed on the average number of sessions to mastery criteria.

Conclusions: These findings indicate that students with autism can acquire receptive language skills through incidental teaching and observational learning; thus small group instructional formats may have added benefits for children with autism. Providing opportunities for incidental learning and observational learning within the instructional context may be important for efficient teaching of children with autism.

105.020 20 Enhancing Empirically-Supported Treatments for Autism Spectrum Disorders: A Case Study Using An Interactive Robot. K. Tang*[1], J. J. Diehl[1], M. Villano[1], K. Wier[1], B. Thomas[2], N. M. Shea[1], L. Schmitt[3], Z. DuBois[1], M. A. Millea[1], K. A. Uhland[1] and C. R. Crowell[1],

(1)*University of Notre Dame*, (2)*St. Mary's College*, (3)*University of Illinois at Chicago*

Background: The use of robots in clinical therapy for children with autism spectrum disorders (ASD) has begun to receive research attention, although most of the research has focused on robot development, and very little attention has been given to integrating robots into empirically-supported treatments (ESTs).

Objectives: The objective of this case study is to identify the feasibility of incorporating an interactive robot in an ABA-based social-communication therapy.

Methods: The participant in the case study was a nine-year-old male with ASD. Diagnosis was confirmed using the Autism Diagnostic Observation Schedule and the Social Communication Questionnaire. The participant’s IQ and language abilities were both three standard deviations below the mean. At the beginning of the study, the child’s language was predominantly echolalic, but did contain some spontaneous communication. The participant attended one baseline visit, followed by 50-minute therapy sessions two times a week for 8 weeks with a certified behavior analyst and a robot, and one posttest visit. The interactive robot was a humanoid robot capable of online text-to-speech communication and movement that allowed for human-like social gestures. We developed scripts relevant to the child’s ABA goals of initiating/responding to greetings, answering questions about feelings, and answering/asking recall questions. During the session, the participant would alternate between interacting with the therapist and interacting with the robot. The therapy session was monitored by an experimenter in another room who also controlled the robot. Verbal communication performance was coded from videos by identifying correct and incorrect responses to scripted conversation. Pre/post parent report of verbal communication outside of the therapy sessions was also collected.

Results: Results indicated an overall increase in the amount of correct verbal behavior inside and outside of therapy. At baseline, the participant used the appropriate communication behavior 29% of the time with the therapist. In the first session, the participant exhibited correct behaviors 25% of the time to the therapist and 22% of the time to the robot. At the midpoint of the study, the child exhibited an increase in correct behaviors with both the therapist (30%) and with the robot (30%). In the last session, the child was correctly responding to the therapist 59% of the time and only 9% to the robot. Additionally, parent pre/posttest data indicated a 62% increase in appropriate verbal behavior during interactions, suggesting

that at least some of the skills developed in therapy may have been generalized outside of the sessions.

Conclusions: Our participant showed individual verbal communication gains both inside and outside of the sessions. The benefits of the robot for this participant's ABA goals were short-term, and by the end of the therapy most of his correct behaviors were directed at the therapist. Our method and data suggest it is feasible to incorporate an interactive robot into ESTs such as ABA, and further suggest that the robot may allow for some scaffolding of verbal skills. Additional research is needed to validate our procedure and confirm its effects.

105.021 21 Evaluation of An Imitation Intervention for Low-Functioning Adolescents with Autism. K. A. Meyer*[1], B. Ingersoll[1], D. Carlsen[2] and T. Hamlin[2], (1)*Michigan State University*, (2)*Center for Discovery*

Background: Individuals with autism have significant difficulties with social skills across the lifespan. While a variety of social interventions for young children and high-functioning older individuals have been developed in recent years, few interventions focused on improving social skills in older low-functioning individuals with autism have been examined. Previous research suggests that reciprocal imitation training improves imitation and other social-communication skills in young children with autism. A developmental perspective would suggest that this intervention might also be appropriate for older low-functioning individuals with autism.

Objectives: This study investigated the effect of two to six 20-minute sessions per week of reciprocal imitation training on imitation skills, social engagement, and repetitive behaviors in four adolescents with low-functioning autism over the course of ten weeks.

Methods: This study used a non-concurrent multiple-baseline design across four adolescents with autism and severe to profound intellectual disabilities residing at a residential treatment facility.

Results: Preliminary results indicate that all four adolescents improved their imitation skills over the course of the 10-week treatment. In addition, the two adolescents who displayed high rates of repetitive behaviors during baseline sessions also decreased their rate of repetitive behaviors over the course of treatment.

Conclusions: Overall, these results suggest that reciprocal imitation training may be effective at improving imitation and decreasing repetitive behaviors in adolescents with low-functioning autism.

105.022 22 Evolutional Pattern of Children with Autism Spectrum Disorders In Speech and Language Therapy. A. C. Tamanaha*[1], M. T. Mercadante[2] and J. Perissinoto[3], (1), (2)*UNIFESP*, (3)*Universidade Federal de Sao Paulo*

Background: The speech and language therapy for children with Autism Spectrum Disorders can be approached by direct intervention and indirect intervention (parents orientation).

Objectives: To analyse and to compare the extension and speed of the evolutional pattern of children with Autism Spectrum Disorders in direct and indirect interventions over only to indirect.

Methods: This study is double-blind randomized clinical trial pilot**.** The sample was composed of 11 children diagnosed with Autism (6) and Asperger Syndrome (5) patients of the Language and Speech Laboratory – Autistic Spectrum Disorders at Federal University of São Paulo. These children were randomly divided into two groups: Six received both direct and indirect intervention (Therapy Group-TG), and five were receiving exclusively indirect intervention (Parents Orientation Group-OG). We used the following parts of ASIEP-2: Autism Behavior Checklist (ABC) and Sample of Vocal Behavior (SVB) on three occasions: at the beginning, six months later and 12 months later.

Results: We observed there was greater evolution of Therapy Group –TG in the Autism Behavior Checklist and Sample of Vocal Behavior. The mothers and the Speech and Language Therapist perceived behavioral changes. The influence of the multidisciplinary diagnosis, age and measures of the adaptive functioning was analysed. The performance of children with Asperger Syndrome was considered more positive. There was greater evolution in the children with age 73 -120 months, and in the children with normal, mild and moderate adaptive functioning.

Conclusions: In both groups were observed behavioral changes. The tendency of better performance of the children attended in direct and indirect intervention showed that this association was fundamental. The performance of TG in presenting better scores was probably due to the efficacy of the direct intervention, and not to the OG´s parent´s lack of attention in promoting behavioral changes in their children.

105.023 23 Frankfurt Early Intervention Programme: Description and One-Year Therapy Effects on IQ Development. E. Duketis*, C. Wilker, J. Valerian, S. Feineis-Matthews and C. M. Freitag, *Johann Wolfgang Goethe-University*

Background: To date no German manualized early intervention program for children under the age of 5 years exist. As only a limited number of therapy units per week are supported by public services, intensive early intervention programs are hardly affordable for parents. We therefore set out to develop a program which includes parent information and education, individual therapy with the child, training educational staff and eventually including the children into small therapy groups. Methodological elements are classical ABA approaches for very young children, incidential teaching and natural learning paradigms as well as social learning within the group.

Objectives: In this poster we describe the program and present preliminary one-year follow-up data on 20 children treated within the program, focussing here on IQ-outcome. The study is an effectiveness study on a therapy approach which can easily be implemented in early intervention centres in Germany.

Methods: 20 children with a diagnosis of autism or atypical autism, age 3-5 years old were enrolled into the study. Diagnosis was made by ADI-R and ADOS, IQ testing was performed by the Bayley Scales II or the Snijders Oomen non-verbal intelligence test. Measures were repeated after one year.

Results: Most children who could be tested before and after therapy showed an increase in measured IQ.

Conclusions: This early intervention for preschool children with ASD can be implemented as a therapy within the public service domain, is highly appreciated by parents, children, and therapists, and shows some promise with regard to the improvement of target parameters in children with ASD.

105.024 24 Increasing Vocalizations In Children with Autism Through Extinction of Previously Acquired Signed Requests. E. T. James*, A. L. Valentino and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Deficits in speech have been identified as one of the most common complaints of parents of children diagnosed with autism. Although much research supports the use of behavioral strategies such as reinforcement and shaping for teaching vocal speech one limitation of existing treatments is the lack of procedures for producing vocalizations in children who do not respond to basic behavioral strategies. A new area of study has incorporated the use of extinction procedures to induce vocalizations and other novel responses. Research has shown that responding during extinction is often characterized by an initial increase in response frequency, duration, and variability. This effect is referred to as an extinction burst and is generally described as a negative result of extinction. However, extinction bursts may have clinically beneficial applications.

Objectives: The purpose of experiment one was to assess the effects of reinforcement of vocal requests and extinction of signed requests on the rate of vocalizations in two children with autism. The purpose of experiment two was to determine whether the effects obtained in study one could have been obtained through reinforcement of vocalizations or whether the effects were due to extinction. Therefore, experiment two examined the effects of extinction of signed requests only after reinforcement of vocalizations during baseline was ineffective in increasing vocalizations.

Methods: In experiment one, Oliver was 3-years old and Sam was 5-years old. Rate of vocalizations was the dependent variable. A multiple baseline design across responses was used. During baseline, access to a preferred item was provided contingent upon correct emission of the previously taught signed response. No consequences were provided following vocalizations. In treatment, access to the item was provided contingent upon emission of any vocalization. No consequences were provided following signed responses. Signed responses contacted extinction conditions. In experiment two, Ethan was 4-years old. Rate of vocalizations and signed requests were the primary dependent variables. A multiple baseline design across responses was used. During baseline, access to the item was provided for 10 s or until consumed contingent upon emission of the signed response or any vocalization. In treatment, access to the item was provided contingent upon emission of any vocalization. No consequences were provided following signed responses.

Results: Results of experiment one indicated low rates of vocalizations and high rates of signed requests during baseline. Upon implementation of extinction of the signed request, the rate of vocalizations increased and remained elevated during subsequent treatment sessions. In experiment two, Ethan's rate of vocalizations in baseline did not increase despite direct reinforcement of vocalizations. Extinction of the signed requests was necessary to obtain elevated rates of vocalizations.

Conclusions: The failure to acquire vocalizations through established treatment procedures such as shaping and differential reinforcement is a significant clinical concern for children with language deficits and interventions designed to address this concern are relatively understudied. Little is known regarding how to produce and develop vocalizations in children who do not respond to commonly used procedures making research into new methods to teach vocal language important.

105.025 25 Joint Attention and Social Reciprocity In Mother-Child Interactions: Efficacy of An Early Intervention Approach for ASD and 'at –Risk' Groups. A. M. Mastergeorge*[1] and D. F. Thompson[2], (1), (2)*UC Davis*

Background: Joint attention is considered to be a pivotal skill in elucidating developmental trajectories of young children(e.g. Bakeman & Adamson 1984; Adamson & Bakeman 1991; Mundy & Gomes, 1998), and is a construct facilitated in interactions with parents, and studied extensively in typically developing children (e.g., Adamson, Bakeman & Deckner, 2004; Moore & Dunham, 1995; Tomasello & Farrar, 1986). However, little systematic research has focused on mother's strategies to recruit their children's joint attention behaviors during dyadic interactions (Adamson, Bakeman & Deckner, 2004), and even less has been discussed in high-risk populations (Bornstein, Hendricks, Haynes & Painter, 2007).

Objectives: This paper examines an early intervention program focused on joint attention and social reciprocity in very young children in mother-child interactions as a potential mediator of resilience in high-risk mother-child dyads for children with autism and those 'at risk' for neurodevelopmental delays.

Methods: Two groups of children and their mothers are the focus of this study: those recently diagnosed with autism and young children considered to be 'at –risk' due to compromised social-emotional environments. The specified intervention included targeted interactions to facilitate joint attention based on evidence-based practices. The home-based intervention was implemented several times a week , and mother-child interactions were videotaped once a week . Maternal behaviors, child behaviors, and dyadic interactions were coded using the *Maternal Child and Behavioral Rating Scale* (Mahoney, 1988, 1999) which was implemented to assess maternal directiveness, sensitivity, and responsivity of the mother in dyadic interactions, as well as the *Dyadic Interaction Coding System Adaptation* (Timmer, Zebell, Culver & Urquiza, 2010) which is designed to assess the quality of parent-child interactions through categorization of maternal verbalizations to the child. This paper focused on the following questions: (1) Does a targeted joint attention intervention increase maternal sensitivity and reciprocity? ; and (2) What factors appear to mediate maternal strategies used in dyadic interactions?

Results: Results revealed an overall increase in maternal scores of sensitivity and responsivity, and a decrease in maternal directiveness. Additionally, observed maternal responsivity had a significant negative correlation with mothers' reported stress of their child's adaptability score. A Wilcoxon Signed Ranks text showed a significant increase in observed child joint attention ($z = -2.23$, $p=.03$), a significant increase in the proportion of maternal praise ($z= -1.93$, $p =.05$) to their child from the total verbalizations during the mother-child joint attention contexts, and a significant decrease in the proportion of maternal commands ($z = -.77$, $p=.05$) from the pre-intervention to post-intervention assessment.

Conclusions: These findings suggest that relationship-based interventions targeting children's joint attention with their mothers provides evidence of both direct and indirect effects of the intervention as well positive effects on children's developmental outcomes. Overall, joint attention intervention for autism and at-risk populations appears be constructed as a pivotal skill that mediates resilience in the mother-child dyadic interventions. Further, these interventions demonstrate that change in one or two pivotal behaviors appear to be relate to important collateral changes in developmental outcomes(Koegel & Frea, 1993; Koegel, Koegel & Schreibman; Whalen & Schreibman, 2003).

105.026 26 Modifications of PCIT for Young Children with Autism. N. A. Parks*, N. A. Call and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Parent-Child Interaction Therapy (PCIT) is an effective, evidence-based intervention that has proven effective at decreasing problem behavior and increasing the quality of parent-child relationships in typically developing children (Edwards, et al., 2002; Eyberg & Ross, 1978). Recently, researchers have begun to evaluate the effectiveness of PCIT with children with developmental disabilities (Brinkmeyer & Eyberg, 2003) including autism (Bagner & Eyberg, 2007; Solomon, Ono, Timmer, & Goodlin-Jones, 2008). However, initial studies have not examined modifications for children with autism with low receptive and expressive language skills. Many young children with autism who have low language abilities often engage in mild to moderate behavior problems.

Objectives: This study examined modifications to the traditional PCIT model to teach parents of children with autism to teach

language to their children and to decrease behavior problems.
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Methods: Three children diagnosed with autism between the ages of 3 and 5 participated, two males and one female. All participants engaged in mild to moderate behavior problems and did not possess any functional communication skills. Three mothers and one father participated in weekly 1-hour sessions for 12 weeks. One 5-minute baseline session was conducted during the initial visit. During the second visit didactic and role play instruction were used to teach parents to teach their child to make requests, to engage with the toys appropriately, to ignore problem behavior, and to use a least-to-most prompt hierarchy for compliance. The child was not present during this training. Parents practiced these skills for 5 minutes at the beginning of each subsequent visit and data were collected on child behavior (vocalizations and compliance with requests) and parent behavior (comments, demands, and questions). Following the 5-minute probe, the therapist coached parents using a bug-in-ear device for 30 minutes. Sessions concluded with additional modeling with the therapist and the child and a summary of skills practiced and learned. Parents were asked to spend at least 5 minutes each day interacting with their child using skills learned in session.

Results: Results indicated that all participants increased spontaneous vocalizations. In addition, parents asked fewer questions, followed through with demands, and made more comments on their child's play.

Conclusions: PCIT has been traditionally used with young children with mild to moderate behavior problems to decrease problem behavior and increase parent-child relationships. This model has advantages in that it is manualized and easy to implement with a wide variety of families. This study successfully incorporated modifications to adapt this treatment program for use with children with more significant symptoms of autism, including teaching them to make requests, environmental manipulations to increase toy interaction, and using a least-to-most prompt hierarchy to ensure compliance. Future research should expand upon this program, including studying PCIT with a larger and more diverse sample of children with ASD.

105.027 27 Object Play as a Moderator of Intervention Effects on Responding to Joint Attention In Children with ASD. R. G. Lieberman*[1], A. S. Nahmias[2], S. Celimli[3], D. S. Messinger[3], W. L. Stone[4], A. S. Carter[5] and P. J. Yoder[6], (1)*Peabody College, Vanderbilt University*, (2)*University of Pennsylvania*, (3)*University of Miami*, (4)*University of Washington*, (5)*University of Massachusetts Boston*, (6)*Vanderbilt University*

Background: Children with autism spectrum disorders (ASD) appear to demonstrate deficits in responding to bids for joint attention. Importantly, the ability to allocate attention more flexibly and consistently may allow children to map adult linguistic input more accurately to objects or events to which their attention has been drawn (Bono et al., 2004). Previous findings suggest children with ASD who are more competent responders to adult bids for joint attention may make larger language gains over time (Siller & Sigman, 2002). Development of spoken language has been linked to better outcomes in individuals with ASD. Therefore, early prelinguistic skills such as responding to joint attention (RJA) are important targets for early intervention in young children with ASD. Many early intervention and instructional strategies are implemented during routines or play involving objects. Logically, a child's knowledge of objects used during such routines may influence a child's ability to engage successfully in triadic interactions with adults and access the content of interventions. Additionally, as children become competent in their knowledge of objects, they may direct more cognitive resources to new skills, such as following another's attention.

Objectives: The current study examined the following research question: Does object knowledge (the number of differentiated actions performed on toys) moderate the effects of a parent-mediated social-communication intervention (More Than Words [MTW]) on frequency of RJA acts in young children with ASD?

Methods: A multi-site, randomized controlled trial was used to address the research question. Sixty-three participants were randomized to the treatment or control group. Forty-five children had analyzable data. Twenty-three children were randomized to the control group, and 22 were randomized to the MTW intervention. Object knowledge was measured pretreatment (Time 1) using the *Developmental Play Assessment* (Lifter, 2000). Responding to joint attention was measured at the five month posttreatment follow up period (Time 3) using the *Early Social Communication Scales* (ESCS; Mundy et al., 2003). The ESCS was administered by an unfamiliar examiner using different materials, setting, and interactional style, providing a measure of far generalization of RJA skills.

Results: Hierarchical linear regression was used to examine object knowledge as a moderator of effects of treatment on RJA. A significant interaction was found, where treatment led to changes in RJA conditional upon Time 1 object knowledge ($t(45) = -2.60$, $p = .013$). Children with lower levels of object

knowledge at Time 1 showed greater gains in RJA when assigned to the MTW treatment; children with higher levels of object knowledge at Time 1 showed greater gains in RJA when assigned to the control condition.

Conclusions: Children with lower levels of object knowledge may have experienced increases in object knowledge due to the MTW treatment, which allowed them greater access to intervention strategies targeting social-communication skills (e.g., RJA). It is not yet understood why children with more play skills showed greater gains in RJA when assigned to the control condition. These findings highlight the importance of continued research into child and family characteristics that influence effects of treatment.

105.028 28 Parent-Implemented Intervention In An Underserved Population. T. Carr*[1], K. Lopez[1], A. Barriger[1], L. A. Jeanpierre[1] and C. Lord[2], (1)*University of Michigan Autism and Communication Disorders Center*, (2)*University of Michigan*

Background: Families of racial/ethnic minority, lower levels of education, and those who live in non-metropolitan areas experience greater limitations in accessing services for ASD (Mandell, et al., 2009; Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). Consequently, there has been a significant lack of intervention research focusing on families with limited resources.

Objectives: The purpose of the study is to expand, adapt, and evaluate a modified version of the Early Social Interaction (ESI) parent-implemented program by working with caregivers from a low-income, underserved population. As recommended by the Interagency Autism Coordinating Committee Strategic Plan for ASD, the study 1) applies methods from an established treatment paradigm (ESI) to a diverse community setting, 2) collects information about the mode of delivery, intensity, and duration for interventions targeting families with limited resources, and 3) obtains first-hand insights and perspectives of family members and caregivers of children with ASD that will inform intervention research addressing the needs of diverse populations.

Methods: This intervention utilizes a single-subject multiple baseline design in which caregivers are taught specific strategies to support their child's social communication during everyday activities. Baselines are defined by the systematic variation of targeted and non-targeted activities. Eligible families include those with a child between 24 and 48 months whose caregivers have less than two years of higher education and whose family income does not exceed more than two times the federal poverty level. All families are recruited from two geographic regions. Participating families receive 3 months of weekly home-intervention sessions followed by an additional 3 months of community resource and follow-up support. Child and family outcome are measured at pre-treatment, post-treatment, and follow-up. Changes in caregiver behavior comprise the primary outcome measure while secondary outcome measures include child outcome (autism symptoms, social communication, developmental level, and adaptive behavior) and family outcome (caregiver measures of self-reported family functioning, resources, well-being, and treatment adherence, fidelity, and satisfaction.)

Results: This project continues to enroll participants. To date, of the 15 families eligible to participate, 8 have completed the first evaluation and begun or completed the 3 month-intervention phase. 4 families are scheduled for the first evaluation, and 3 families discontinued their involvement after the first month of intervention due to time constraints. We anticipate that 20 families will have completed the project by Summer 2011. Preliminary analyses indicate that the modified ESI protocol is successful in enrolling and retaining families for participation. Caregivers' behavioral supports have been shown to increase in targeted activities with some generalization to non-targeted activities by the end of the intervention.

Conclusions: This project is one of the first treatment outcome studies to deliberately recruit families from diverse socioeconomic backgrounds, a population that has been traditionally underrepresented in autism research. Preliminary results suggest promise for the applicability of a modified caregiver-implemented early intervention benefiting families from low socioeconomic status. Implications for the development of policy designed to eliminate barriers to autism services will be discussed.

105.029 29 Pointing and Anticipatory Responding to Joint Attention In Children with Autism. H. Kinugasa* and S. Sonoyama, *Universty of Tsukuba*

Background: Joint Attention is trainable for children with ASD (Drew et al., 2002; Whalen & Schreibman, 2003; Siller, 2006; Kasari et al., 2006; Yoder & Stone, 2006), and showed collateral effect such as expressive language gain (Kasari et al., 2006, 2008). Children with Autism whose Language-Social Developmental Age (L-S DA, in Kyoto Scale of Psychological Development) is above twelve months respond to Joint Attention (Beppu, 1996). There are few study on sequential effect within Joint Attention skills.

Objectives: **Study 1** aimed to assess anticipatory Responding to Joint Attention (RJA) and pointing for young children with autism and Down syndrome in ESCS. **Study 2** aimed to see whether a child with autism learns anticipatory RJA through intervention for pointing.

Methods: In **Study 1**, six children with ASD and one child with Down syndrome (ages 2 to 6 years, Developmental Age 9 months to 6 years, 2 female) were assessed in Early Social Communication Scale (ESCS; Mundy, Hogan, & Doehring, 2003). In **Study 2**, a participant was a five-year-old boy with autism; L-S DA was twelve months. During intervention, he was trained to request out of two choices (edible/ non-edible) by approximation from reaching to pointing, once a week at university clinic session. ESCS was applied before intervention and after intervention.

Results: In **Study 1**, 3 children with ASD, one child with Down syndrome anticipated RJA in ESCS. All of them had pointing skill in daily life or in ESCS, and DA was above thirteen months. In **Study2,** the participant learned proximal pointing during intervention. In RJA task at pre-ESCS, he responded to the tester's pointing in hundred percent; and in post-ESCS, he anticipated the tester's pointing in fifty percent as well as followed the tester's head-turn in thirty-eight percent. He also showed reaching toward the poster, and gaze shift from the poster to the tester.

Conclusions: Children with ASD and Down Syndrome who had pointing skill showed anticipatory RJA in ESCS; and a child with autism who learned pointing also showed anticipatory RJA and respond to the tester's head-turn. This study suggests the possibility of sequential effect of teaching one skill in Joint Attention toward another JA skill. The limitation of the study is small number of the participants and other factor possibly underlies anticipatory RJA.

105.030 30 Synchronization of Interplay In Children with Autistic Disorder and Preschool Teachers. A. J. Nordahl Hansen*[1], A. Kaale[2] and S. E. Ulvund[3], (1)*Oslo University Hospital* , (2)*Ullevaal University Hospital*, (3)*University of Oslo*

Keywords: Free-play, autistic disorder, preschool teacher, joint engagement, positive affect, object manipulation

Background: Joint engagement is associated with the ability to participate in social interaction, and is related to a vide range of developmental domains (Adamson & Bakeman, 2008; Bakeman & Adamson, 1984; Carpenter, Nagell, & Tomasello, 1998). More knowledge about within joint engagement in children and adults is needed. Some studies have investigated children with autism and their mothers in free-play settings (Gulsrud, Jahromi, & Kasari, 2010; Siller & Sigman, 2002; 2008). However, little is known about the interplay in dyads of children with autism and their preschool teachers.

Objectives: The aim of this study was to investigate how children with autistic disorder and their preschool teachers coordinate *positive affect, expansion of objects, change of objects,* and *language* within episodes of joint engagement.

Methods: 60 children with autistic disorder (mean age= 48 months, range 29-60) and their preschool teachers were filmed during a 10 minute free-play session with a standard set of toys. The videotapes were coded for duration of joint engagement (supported joint engagement and coordinated joint engagement combined) according to Bakeman and Adamsons procedure (1984). Within joint engagement, frequency of children's and preschool teachers' positive affect, expansiveness, change of object, and language were coded.

Results: Correlation analyses showed that within episodes of joint engagement, preschool teachers and children coordinated their expansiveness ($r = .45$, $p = .001$) and change of object ($r = .38$, $p = .001$). However, the dyads did not coordinate their positive affect or language. Further analyses revealed significant negative correlations between preschool teachers positive affect and the children's expansiveness ($r = -27$, $p = .005$), change of object ($r = -29$, $p = .005$), and language ($r = -40$, $p = .001$).

Conclusions: The results of the study revealed an association between the behaviour of preschool teachers and children with autism during joint engagement. There was a significant positive correlation for object manipulation (expansion of objects and change of objects). In contrast, preschool teachers' positive affect was negatively correlated with child behaviours meaning that less initiatives from the children was associated with more positive affect from preschool teachers. Maybe preschool teachers use positive affect as a mean to engage children in mutual activities. However, we do not know whether the preschool teachers are adjusting to the children's behaviours or if the children are reacting to the preschool teachers' expression of positive affect. Probably, the association can be explained by transactions between preschool teachers and children. More research is needed to understand these relationships between children with autism and adults. Knowledge about child-preschool teacher transactions has clinical implications, especially in enhancing social skills in children with autism.

105.031 31 Teacher Commitment and Burnout: Their Effects on the Fidelity of Implementation of Comprehensive Treatment Programs for Preschool Children with Autism Spectrum Disorders. D. C. Coman*, A. Gutierrez and M. Alessandri, *University of Miami*

Background: The primary source of intervention for most children with ASD and their families is provided through the school system. For more than two decades, however, special education teacher shortages and attrition have been of concern to policymakers and administrators who work to recruit and retain special educators (Council for Exceptional Children [CEC], 2000). This deficiency may have serious and far-reaching consequences for children with ASD. It is imperative, therefore, to investigate the antecedents that may be at the root cause of the decision by special educators to leave the field. Considerable research has shown that teacher burnout, a unique type of stress syndrome, directly influences attrition rates and student outcomes (Billingsley, 2004). Fortunately, there are factors that have been shown to mitigate the onset of this syndrome. Prior research suggests that teachers who endorse the underlying philosophy of their teaching approach experience lower levels of burnout (Jennet, Harris, & Mesibov, 2003). A better understanding of these factors may provide school districts, policymakers, and administrators with information that would enable them to make necessary adaptations in policy and practice which may help ameliorate these current issues within the field.

Objectives: This study explored teacher commitment to model philosophy and teacher burnout (i.e., Emotional Exhaustion [EE], Depersonalization [DP], and Personal Accomplishment [PA]) across three preschool classroom models for children with ASD: TEACCH (Treatment and Education of Autistic and Related Communication-Handicapped Children); LEAP (Learning Experiences and Alternative Program for Preschoolers and their Parents); and Business As Usual (BAU). Additionally, this study examined effects of these variables on the fidelity of implementation of these programs.

Methods: This study was conducted in conjunction with and support from a larger multi-site (FL, NC, CO, MN) treatment comparison project. 53 teachers (17 TEACCH, 15 LEAP, and 21 BAU) completed the Teacher Philosophy Questionnaire-Adapted Version, a Demographic Form, and the Maslach Burnout Inventory-Educators Survey. Additionally, fidelity of classroom implementation was assessed with empirically validated fidelity measures.

Results: LEAP teachers were significantly more committed to LEAP philosophy and practice relative to the TEACCH and BAU teachers, $F(2, 50) = 9.16$, $p<.001$, $\eta^2 = .27$. TEACCH teachers were not significantly more committed to TEACCH philosophy and BAU teachers reported similar levels of commitment to both TEACCH and LEAP. Additionally, results provided support for a quadratic relationship between teacher commitment and EE experienced in the middle of the school year, $R^2 = 0.66$, adjusted $R^2 = 0.44$, $F(14, 38) = 2.09$, $p < .05$. The individual regression coefficient for the quadratic variable ($\beta = 0.37$), $t(38) = 2.28$, $p < .05$ accounted for 8% of the variance in the EE variable. Results did not indicate any significant relationships with the fidelity construct.

Conclusions: This study suggests that LEAP teachers may have significantly higher levels of commitment to their own classroom model philosophy relative to TEACCH and BAU teachers. Additionally, commitment to the underlying philosophical tenets and practices of TEACCH and LEAP may serve as a buffer to some aspects of experienced levels of burnout during the school year.

105.032 32 Teaching Children with Autism to Seek Information by Asking Questions. D. E. Conine*, C. N. Bowen, A. L. Valentino and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: A common problem for children with autism is the lack of asking questions (Koegel, 1996). Requesting information is typically emitted as a “wh” question such as who?, what?, when?, where?, or which? 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 the overall language repertoire. Children with autism often require specific teaching to learn to request information. Some studies have demonstrated effective procedures to teach requests for information (Sundberg, Loeb, Hale, & Eigenheer, 2002). However, the research is limited regarding types of questions taught and the specific procedures that result in the most functional use of the skill outside of teaching sessions.

Objectives: Strategies for teaching request forms other than “what?,” “where?,” and “who?” to children with autism have not yet been studied. Additionally, assessing and programming for the motivational variables that lead to correct, functional use of requests for information have not been fully demonstrated. Therefore, the objective of the current study was to examine procedures to teach the request for information “which?” and other previously examined request forms (i.e., “who?”).

Methods: A six-year-old male with autism participated. To teach the requests “which?” and “who?”, scenarios were arranged to contrive a motivation for the needed information. During “which” scenarios, 10 opaque cups were numbered and placed in sight. When the participant asked for a snack, the instructor indicated that his snack was in one of the cups. During “who” scenarios, several of his therapists were present. When he asked for a snack, the instructor indicated that one of his therapists had his snack. In both scenarios the information regarding which cup or which therapist was withheld. 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. Generalization probes were conducted to assess requests for information in untargeted situations.

Results: During Baseline, the participant did not request information using “who?” or “which?”. The participant acquired both requests for information during teaching. Additionally, results showed that he was able to discriminate when information was needed versus when it was already provided, was able to use each request form under the appropriate conditions, and also successfully used the information that was provided to access his snack. Lastly, generalization probes demonstrated that he generalized the request for information “Which?” across four additional untaught situations.

Conclusions: The procedures used in the current study were successful in teaching a child with autism to emit requests for information when the information was desired. The child was successful in using the two different requests appropriately and generalizing the requests to novel situations.

105.033 33 Teaching Individuals Diagnosed with Autism to Recruit Social Interaction: Initiating Joint Attention. B. R. Lopez*, D. E. Conine, A. L. Valentino, C. H. Delfs and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Individuals diagnosed with autism and other pervasive developmental disorders often lack appropriate skills for initiating social interaction. Specifically, such individuals may not spontaneously initiate sharing enjoyment, interests, or achievements with other people and display marked impairments in gestures used to regulate social interaction (*Diagnostic and Statistical Manual of Mental Disorders*, 4th Ed. Revised, APA, 2003). These types of skills are often referred to as initiating joint attention skills. Previous research has examined treatment packages that have resulted in increases in joint attention following years of intensive intervention. Other research has specifically examined procedures to improve components of joint attention with individuals displaying low levels of initiating joint attention and responding to bids for joint attention. Less research is available examining specific procedures to teach joint attention initiation skills in children with autism who do not exhibit the skill.

Objectives: The current study sought to examine treatment procedures aimed at increasing verbal and gestural joint attention initiation skills in children with autism.

Methods: Three boys and one girl diagnosed with autism between the ages of 3 and 9 years participated in the current study. All four participants were included in the present study because they were never observed to initiate joint attention in the form of recruiting attention or sharing interests with others. A pre-assessment was conducted in which 10 opportunities to initiate joint attention were embedded in a naturalistic language instruction session. Following the pre-assessment, treatment was initiated in which each participant was taught to show a completed project to a therapist or family member by vocally requesting “look” or “look what I did” and showing the item to the other person. Each trial consisted of having the child complete a leisure activity such as drawing a picture, completing a maze, or completing a puzzle. Once completed, vocal and physical prompts were provided to teach the response. Once independent responding was observed the distance between the therapist and the child was lengthened requiring the child to seek out social interaction from further distances. Additionally, a post-assessment of joint attention initiations during naturalistic teaching was conducted.

Results: None of the four participants engaged in correct responding during the pre-assessment or baseline. Following treatment, all four participants began recruiting social attention from others vocally and by showing the completed project. All four participants continued to initiate joint attention in a more naturalistic setting and when tangible reinforcement was removed.

Conclusions: This study provides a simple treatment procedure that can used to teach social interaction and social initiation skills to children with autism.

105.034 34 Teaching Reciprocal Imitation Skills. M. Jung* and T. Nagasaki, *University of Tsukuba*

Background:

Children with autism spectrum disorder(ASD) exhibit significant deficit in imitation skills. The importance of imitation in early development is evident in relationship with social-communicative context. Reciprocal Imitation Training (RIT), a naturalistic imitation intervention, was developed to teach spontaneous imitation skills to young children during ongoing play interactions. Previous research has demonstrated that RIT is effective for teaching gesture imitation (Ingersoll, Lewis, & Kroman, 2007).

Objectives:

In the present study, we attempted to develop and apply a Japanese traditional play (Iponbashi) as one of RIT task.

Methods:

A participant is a boy who received an ASD diagnosis before age 4. We conduct 'Iponbashi' for 1 year in a small university playroom. 'Iponbashi' consists of six imitation behavior steps in play, step 1 - writing '1' on the adult's palms by his index finger, step 2 - tickling the adult's palms, step 3 - slapping the adult's palms, step4 - pinching the adult's palms, step 5 - tapping on the adult's arms, step 6- tickling the adult's body.

Results:

Results from this study indicated an increase in the frequency of the spontaneous imitation used in 'Iponbashi'. Moreover, results indicated an increase in positive emotion for 1 year. Also, 'Iponbashi' have been conducted the other ASD and coding of the continuous measure is currently underway. More detailed conclusions will be available, for presentation at the conference.

Conclusions:

There is good variability in the frequency of spontaneous imitation use in a boy with ASD, and we will discuss the possibility that young children with autism implement 'Iponbashi' to train reciprocal imitation with parent.

105.035 35 The Effectiveness of Joint Attention Intervention In Nonverbal Preschool Children with Autism. Y. C. Chang*[1], K. A. Goods[2], E. H. Ishijima[3], K. Krueger[2] and C. Kasari[3], (1)*UCLA Semel Institute for Neuroscience & Human Behavior*, (2)*UCLA*, (3)*University of California, Los Angeles*

Background: Children with autism often demonstrate delays in both joint attention and play (Mundy, Sigman, & Kasari, 1990). Longitudinal studies have demonstrated that increased ability to initiate and respond to joint attention in preschool years has predicted language ability as many as eight years later (Siller & Sigman, 2002; Sigman & Ruskin, 1999). Furthermore, interventions that target joint attention skills can both improve both pretend play and expressive language, and children who may benefit the most from joint attention interventions are children who are nonverbal prior to intervention (Kasari et al., 2010).

Objectives: The current study will examine the effectiveness of a joint attention intervention for nonverbal children (less than 10 spontaneous words) in a preschool setting.

Methods: Fifteen nonverbal preschool children (ages 3-5) with autism were recruited from a non-public school to participate in the study. Children had been enrolled for at last one year in 30 hours of intervention at the school based on Skinner's verbal behavior approach. Participants completed assessments on their cognitive skills (Mullen Scales of Early Learning) and language abilities (Reynell Developmental Language Scale).

Children were randomized to either an observation-control (OBS) group (n = 8) or a joint attention treatment (TX) group (n =7). Children in the OBS group continued to receive their individualized education services through their school. Children in the TX group continued with their school services and were also pulled out from their classes twice a week for a 30-minute treatment session (total of 60 minutes of treatment per week) for 10 weeks. Treatment sessions were one-on-one sessions with an interventionist in a naturalistic play setting in which social communication gestures and functional play were targeted.

Children were observed in their classrooms for 20 minutes during their classroom free play at entry and at exit. Specially, children's joint engagement and spontaneous social communication were observed in their classrooms.

Results: An ANOVA revealed that there were no significant statistical differences in mental age, $F(1,13) = 2.721$, $p > .05$, receptive language, $F(1,13) = .508$, $p > .05$, or expressive language, $F(1, 13) = 1.122$, $p > .05$ between the two groups at entry. With spontaneous gestures as the covariate at entry, an ANCOVA revealed that children in the TX group initiated more spontaneous gestures (joint attention and behavioral requests) than children in the OBS group at exit, $F = 12.82$, $p < .01$. With the percentage of time spent in *unengaged state* as the covariate at entry, an ANCOVA also revealed that children in the TX group were spending less time in *unengaged state* than children in the OBS group at exit, $F = 11.98$, $p < .05$.

Conclusions: Findings from the study suggest that the joint attention treatment was effective in improving engagement and spontaneous social communication in nonverbal preschool children with autism. Children who were in the TX group were able to generalize the skills they had learned in their pull out sessions to their classrooms. Future studies should continue to develop interventions that target these skills for this population.

105.036 36 The Effects of a Parent-Mediated Joint Attention Intervention on Children's Play Skills One Year Later.
K. Berry*[1], L. Lomtevas[1], I. Cozma[1], S. Menon[1], M. J. Siller[2], T. Hutman[3] and M. Sigman[4], (1)*Hunter College, City University of New York*, (2)*Hunter College of the City University of New York*, (3)*UCLA Center for Autism Research and Treatment*, (4)*University of California, Los Angeles*

Background: Autism intervention literature has shown that targeting a pivotal skill can lead to improvements in other areas (Koegel, Koegel, & Carter, 1999). For example, interventions teaching symbolic play behaviors have led to improvements in children's social abilities (Kasari et al., 2006; Thorp, Stahmer, & Schreibman, 1995; Stahmer, 2005). However, teaching joint attention behaviors did not result in improved symbolic play, which suggests that symbolic play may require more direct teaching (Kasari et al., 2006). This is contrary to theoretical beliefs that symbolic play is acquired through shared meaning with another person (Werner & Kaplan, 1963; Vygotsky, 1978) and does not require direct teaching.

Objectives: This study will examine if children assigned to an experimental parent-mediated intervention targeting joint attention will display greater gains in play behaviors up to one year later when compared to a control group. Potential moderators of response to intervention will be examined.

Methods: Seventy children diagnosed with autism (chronological age: *M* = 57.1 months, *SD* = 12.3) participated in a randomized controlled trial with two treatment conditions. The experimental group received 12 in-home parent-mediated intervention sessions targeting children's joint attention behaviors in the context of toy play interactions. The control group received four in-home advocacy sessions. A battery of assessments, including the Structured Play Assessment (Ungerer & Sigman, 1981), was administered and videotaped at pretreatment, post treatment, and 1 year follow-up periods.

Four independent raters coded the Structured Play Assessment for novel and spontaneous play behaviors. A composite play score was calculated by adding the frequency of functional (e.g., feeding baby with spoon), symbolic (e.g., making the doll slurp out of a cup), and sequenced (e.g, pouring into cup, then drinking out of cup) play behaviors. Excellent inter-rater reliability was established based on approximately 70% of the videotapes (ICC = .94-.97).

Results: No significant differences in pretreatment characteristics (e.g., CA, nonverbal mental age and language abilities) were found between experimental and control groups. No significant differences were found for gains in play behaviors between the experimental and control group at post-intervention, $t(58) = -0.31$, $p = .76$, or 1 year follow up, $t(49) = -0.54$, $p = .60$.

To examine a potential moderated effect, the sample was split at the median of the children's initial nonverbal mental ages. For children with low initial nonverbal mental ages, results reveal greater gains in play behaviors at 1 year follow up for children in the experimental group ($M = 4.67$, $SD = 5.61$) compared to the control group ($M = -0.50$, $SD = 8.97$), $t(24) = -1.72$, $p < .05$, one-tailed. There was no significant improvement immediately after intervention, $t(29) = -0.915$, $p = 0.37$. Children with incomplete data had equivalent baseline characteristics when compared to children with complete data.

Conclusions: Findings from this study suggest play skills of children with autism can be improved by means of a parent-mediated intervention designed to promote their joint attention abilities.

105.037 37 The Importance and Effectiveness of Cross-Setting Complementary Staff and Parent Mediated Early Intensive Behavioral Intervention for Young Children with ASD.
L. Fava*[1], K. Strauss[1], G. Valeri[2], L. D'Elia[3], S. Arima[4] and S. Vicari[3], (1)*Fondazione Handicap Dopodinoi-Onlus*, (2)*IRCCS Ospedale Bambino Gesù* , (3)*Children's Hospital Bambino Gesù*, (4)*University of Rome " La Sapienza"*

Background:

Comprehensive treatment that start early and bases on the principles of ABA substantially improve outcomes in children with autism spectrum disorders. Research suggest that EIBI need to be delivered in many of the child's daily environments to provide differential learning opportunities. Therefore, one of the most critical elements of including natural environments is the generalization of skills across settings and persons (Matson & Smith, 2008).

Objectives:

The current study investigated the effect of EIBI in preschoolers with ASD on standardized tests of severity in autism core symptoms (ADOS), developmental performance (GMDS-ER 2-8), adaptive behavior (VABS-II), language skills (CDI) and change in child's problem behaviors.

Methods:

12 children with ASD (10M:2F), range 26-71 month (M = 46.6 month, SD = 16.4), received a complementary staff- and parent-mediated EIBI treatment based on ABA-VB principles of 25 h/week in centre-based one-to-one (structured) and play room sessions (quasi naturalistic) and 14 h/week in home (naturalistic) (ABA-VB-group). Cross-setting treatment has been done in a 1 week centre – 3 weeks home rhythm for 12 month with a initial 3 week parent training period, to accomplish maintenance and generalization of skills acquired at the clinical setting in a natural environment of the children (Fava & Strauss, 2011). The ABA-VB group was compared with 10 children with ASD (9M:1F), range 28-66 month (M = 43.7 month, SD = 12.5) that received Eclectic interventions for 16 h/week (psicomotricity, speech therapy, music therapy and uncontrolled in-home ABA). All children followed initial 6 month of the full 12 month treatment. Statistical analysis have been performed using R software. Mean scores before and after the therapy have been compared using paired T-tests.

Results:

After the initial 6 month, a independent examination of a child psychiatrist revealed that there was a significant decrease in ADOS scores in the ABA-VB-group (total: $p<.001$; communication: $p<.05$, social interaction: $p<.01$) and GMDS-ER 2-8 scores show a significant improvement of developmental state (QS: $p<.01$) as well as the CDI language skills scores (comprehension: $p.<01$, speaks: $p.<05$) while the eclectic group did not show any significant change. VABS-II scores increased significantly in both the ABA-VB-group ($p<.01$) and the eclectic group ($p<.01$). Furthermore, within the ABA-VB group problem behaviors decreased significantly (aggressive behavior $p<.001$, stereotypes $p<.001$ and dysfunctional behavior $p<.0001$).

Conclusions:

Our results point to effectiveness of a staff- and parent mediated EIBI program based on ABA-VB for children with ASD for reducing symptom severity and problem behaviors as well as improving the development state, adaptive behaviors and language skills. These finding highlight the importance of generalization across setting and persons and focalize the attention on verbal behavior and incidental teaching for improving functional behavior in various environments that result in reduced problem behaviors and increased language skills. As adaptive behaviors do significantly improve in both study groups, the results will be discussed to specify potential factors that facilitate the generalization of such skills and to help professionals and parents in their program application to maximize EIBI efforts.

105.038 38 The Infant and Toddler Program: Evaluation of a Community-Based Intervention for Newly Diagnosed Infants and Toddlers with Autism. M. Stolte*[1] and S. Hodgetts[2], (1)*Centre for Autism Services Alberta*, (2)*University of Alberta*

Background: **This poster presents outcomes from a community-based model to provide intensive, multi-disciplinary intervention to newly diagnosed infants and toddlers (18-42 months) with Autism Spectrum Disorder (ASD) in a large urban centre in Canada. The model was developed in consultation with regional experts and based on best practices literature for this age group. The model was informed by contemporary evidence-based behavioral theory (Pivotal Response Treatment (PRT); Koegel & Koegel, 2006) and developmental theory (the Hanen Centre's "More than Words" (MTW) program; Sussman, 1999). The model consisted of weekly home-based professional consultation from a multi-disciplinary team, group and individual parent training, the inclusion of the child in community play groups and day care settings with typically developing peers, and the use of a behavioral aide in both home and community settings for up to 9 hours per week.**

Objectives: **This poster describes the treatment model and presents child and family outcomes from the first 11 families. Associated difficulties with ASD and their results are also summarized.**

Methods: **Objective child outcomes were the Vineland Adaptive Behavior Scales, 2nd edition (VABS-2) composite and domain scores as well as the autism index scores from the Pervasive Developmental Disorder Behavioral Inventory (PDDBI). Outcomes were also gathered on associated challenges identified with autism including feeding and sleeping concerns. Qualitative data was also obtained through parental interview.**

Results: **Child demographics were as follows: mean age at intake 30.5 months, mean program length 10.4 months, 91% of the children came from a two parent household and 27% of the families were of a minority cultural background. The VABS-2 indicated objective gains for 55% of the**

children. When compared to their same aged peers, 73% made objective progress in daily living skills, 55% in communication skills, 36% in socialization skills and 27% in motor skills. PDDBI results indicated that 55% of the children had a reported decrease in their autism severity index. Associated difficulties included feeding problems in 82% of the children and sleeping problems in 55% of the children. Despite significant variability in child outcomes, all parents reported a high level of satisfaction with the intervention model and an overall increase in their confidence and ability to interact with their child.

Conclusions: **Results suggest that this comprehensive, community based early intervention model can improve developmental outcomes in young children with ASD and improve the quality of parent-child interactions.**

105.039 39 The Influence of Parental Stress, Parental Inclusion and Parental Treatment Fidelity In Cross-Setting Complementary Staff and Parent Mediated Early Intensive Behavioral Intervention for Young Children with ASD. K. Strauss*[1], L. Fava[1], G. Valeri[2], L. D'Elia[3], S. Arima[4] and S. Vicari[3], (1)*Fondazione Handicap Dopodinoi-Onlus*, (2)*IRCCS Ospedale Bambino Gesù* , (3)*Children's Hospital Bambino Gesù*, (4)*University of Rome " La Sapienza"*

Background:

Research indicates that parental stress counteract the effectiveness of EIBI programs. Recent results suggest both, that stress decreases when parents provide intervention as well as that involvement increases stress. Less research focused on factors interfering with changes in parent's stress over time during implementing interventions and its relation to treatment outcomes. It is supposed that stress does not directly impact the child's outcome, rather than it is mediated by a function of intense inclusion and parental stress.

Objectives:

To determine how parental stress change during a 6 month period out of a 1 year program and if parent stress affect the child's outcome. Further, to determine how parent's involvement and treatment fidelity interfere the relationship between parental stress levels and child outcomes.

Methods:

12 children with ASD (10M:2F; M_{age}= 46.6 month, SD = 16.4), received a staff- and parent-mediated EIBI treatment based on ABA-VB in centre-based one-to-one, play room and home sessions (ABA-VB-group). Treatment followed a 1 week centre – 3 weeks home rhythm for 12 month to accomplish maintenance and generalization of skills. Initial 3 weeks parent training included intensive theoretical and practical training. Outcomes of the ABA-VB group was compared with 10 children (9M:1F; M_{age}= 43.7 month, SD = 12.5) that received eclectic interventions (psicomotricity, speech therapy, uncontrolled in-home ABA). Repeated measures have been calculated using paired T-tests, influences on outcomes using linear regressions.

Results:

After 6 month, parental stress decreased significantly in the eclectic group (p.<.05) while remained stable in the ABA-VB group with having significantly more stress (p<.01). While decreased stress positively impact the eclectic group in language (CDI comprehension p<.001, CDI speaks p<.001) and developmental state (GMDS-ER QS p<.001), such effect does not appear in the ABA-VB group. Findings are incoherent since the ABA-VB group showed better outcome for ADOS (total: p<.001), GMDS-ER 2-8 (QS: p<.01), and CDI language skills (comprehension: p.<01, speaks: p.<05) while the eclectic group did not significantly change. Consistent with our focus on parent inclusion, in average 174 targets have been worked on (SD=75.5, range 55-343) with an average of 60% introduced, mastered and generalized by the parent (SD=15.9; range 29.5%-81.6%). The treatment fidelity of parents increased in data collection (p<.001), facilitated play (p.<01), training of new targets (p<.01) and mastered targets (p<.01). Intensity of treatment application and treatment fidelity of parents does not interfere neither with parental stress nor with child's outcome.

Conclusions:

Parental stress, treatment fidelity and intensity does not directly interfere child's outcome nor parental stress directly derived by parents treatment fidelity or effort to provide treatment. A detailed evaluation of the child's treatment progress has been followed controlling weekly the mastery and generalization of introduced targets, providing variables such as speed of learning and change of acquisition rates over time, appropriateness of targets chosen by the supervisor and effectiveness of the parent-supervisor relation in controlling and forwarding child's progress. A progress model is aimed to include those variables and is charged to explain how our treatment effects are mediated. Results will be presented at the conference.

105.040 40 Use of Computer Based Interventions to Teach Communication and Literacy Skills to Children with

Autism Spectrum Disorders: A Systematic Review. S. Ramdoss*[1], A. M. Mulloy[1], R. Lang[2] and M. F. O'Reilly[1], (1)*The University of Texas at Austin*, (2)*Texas State University*

Background: Children with autism spectrum disorders (ASD) frequently experience challenges regarding development of communication and literacy skills. Overcoming such challenges often requires special and intensive instruction and support. Computer-based instruction (CBI) represents a potential method for teaching communication and literacy skills and meeting the unique learning needs of students with ASD. Given that a moderately large number of studies have been conducted on the use of CBI with students with ASD for the development of communication and literacy skills, a systematic review of the research is warranted.

Objectives: The purpose of this review is to provide a systematic analysis of studies involving the use of CBI to teach communication and/ or literacy skills to children with 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 communication and literacy skills in students 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 January 1990 and June 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 16 studies involving the use of CBI to teach communication and literacy skills to a total of 119 individuals with autism. Studies that measured the effectiveness of CBI on communication skills reported varying degrees of improvement for all participants. Studies that measured the effectiveness of CBI on literacy skills reported inconsistent results across studies.

Conclusions: The variations in the effects of CBI appear to be due to (a) differences in software characteristics, (b) differences participant characteristics, and (c) differences in study designs, sampling procedures, and measurement tools. However, the existing literature does not allow for statistical testing of relationships between study variables and participant outcomes. Possible directions for future research include evaluation of the effects of various types of feedback, functional literacy approaches to instruction, and strategies for addressing unusual reinforcer hierarchies.

105.041 41 Augmentative Communication for Individuals with Autism Spectrum Disorder, Intellectual Disability and Visual Impairment: Development of the ComFor-V. I. Noens*[1], K. Hermans[1], R. Verpoorten[2], J. P. W. Maljaars[3] and I. A. van Berckelaer-Onnes[3], (1)*Katholieke Universiteit Leuven*, (2)*Koninklijke Kentalis*, (3)*Leiden University*

Background:

Augmentative communication is very important for individuals with autism spectrum disorder, intellectual disability and visual impairment. Most individuals with autism spectrum disorder take in information most readily through visual channels. Consequently, visualization forms the key to many educative programs and communication strategies for individuals with autism. Such approaches are not evidently applicable to individuals with a visual impairment. The ComFor (Forerunners in Communication; Verpoorten, Noens, & van Berckelaer-Onnes; Dutch version: 2004, revised Dutch version: 2007; English version: 2008), an instrument for the indication of augmentative communication, has proven to be a very valuable tool for individuals with autism spectrum disorder and intellectual disability, but visual impairments were not taken into account in the development of the original ComFor. The main objective of the study is to adapt the ComFor to be appropriate for individuals with a co-occurring visual impairment.

Objectives:

1. To evaluate and refine the pilot version of the ComFor-V;
2. To assess the psychometric properties of the ComFor-V;
3. To study the interpretation and implementation of the ComFor-V-results.

Methods:

Data were gathered in three phases. First, a semi-structured interview about the pilot version of the ComFor-V was administered from 6 experts in autism spectrum disorders, intellectual disabilities, and/or visual impairments from the Netherlands and Belgium. The pilot version was further explored in a focus group interview with 11 participants. Second, the ComFor-V was tested on a sample of children and adults with visual impairment, autism spectrum disorder and/or

intellectual disability (*n* = 84) with a developmental level between 12 and 60 months on the domain of daily living skills, measured with the Vineland Screener 0-6yrs-NL (Scholte et al., 2008). Third, interpretation and implementation of the ComFor-V results were investigated via 10 case studies (selected from the second phase of the study); this phase is currently running.

Results:

On the basis of the feedback gathered in phase one, the pilot version of the ComFor-V has been refined. The most important adaptation concerned a revision of the structure of the ComFor-V. In order to adjust to the large heterogeneity within visual impairments, the final instrument provides two tracks with a common start; one track for blind individuals (including deaf blind individuals) and one track for individuals with low vision. Preliminary results indicate good to excellent inter-rater reliability. Further psychometric properties and preliminary results of the case studies will be available at the IMFAR.

Conclusions:

The ComFor-V seems a promising tool to explore underlying competence for augmentative communication in individuals with autism spectrum disorder, intellectual disability and low vision or blindness. Areas for future research and clinical relevance will be discussed.

105.042 42 Large-Scale Study of an Automated Data Collection Method of a Computer Assisted Instruction ABA Program. L. Lara-Brady*, K. MacDonald and C. Whalen, *TeachTown*

Background: Computer assisted instruction (CAI) has long been presented as beneficial to learning. Literature supports CAI as it relates to faster learning, positive attitudes towards computer usage and CAI, and increased motivation (Kulik, 1994; Flether-Flinn & Gravatt, 1995). Other benefits include generalization (Bosseler & Massaro, 2003; Hetzroni & Shalem, 2005), fast and efficient data collection, and automatic data reporting.

Previous research has focused on comparing CAI's data collection methods and other data collection including paper and pencil methods (Couper, 2005; Velikova, et, al, 1999). Additionally different automatic data collection methods have also been compared in regards to their usability, data entry, and reliability. However, the number of studies that analyze the structure and the types of information that automated data collection methods of CAI yield is very limited and needed in this growing field. This study looked at the automated data collection method of TeachTown, a CAI, to understand the underlying structure of the data reporting, important variables, and the types of results that can be collected by using this method.

Objectives: To understand trends, uncover underlying structures, and extract important variables from an automated data collection method from TeachTown, a CAI. *TeachTown: Basics* is an Applied Behavior Analysis (ABA)-based CAI that was designed to meet the developmental needs of children with Autism Spectrum Disorders in the 2-7 year developmental range.

Methods: Data from over 3000 students between the ages of 1-20 years of age currently using TeachTown was examined using an exploratory data analysis to understand general patterns, important variables, and the automated data collection method. Areas examined were student's usage of the software, frequency of attempts, progress, and specific domain information (response time, accuracy, and prompting). Additionally a case analysis was conducted on a single student to better understand individual patterns in software usage and learning.

Results: After analyzing over 2 million data points, results point at the underlying structure of the automated data collection method. Important variables related to students' scores in the software are reviewed, as well as a description of a frequent user are examined.

Conclusions: Results will allow future CAI to make improvements in their products, customer support system, and in their automated data collection system. Limitations and directions for future research are also discussed.

105.043 43 Improving Reciprocal Social Conversation Through Question Asking In Children and Adolescents with Autism. R. A. Doggett*, R. L. Koegel and L. K. Koegel, *University of California, Santa Barbara*

Background: Impairment in social communication is a defining feature of individuals with autism spectrum disorder (DSM-IV-TR, APA, 2000). Individuals with ASD lack the appropriate use of verbal initiations during conversation, which leads to appearing disinterested and unfriendly to others (Marans, Rubin, & Laurent, 2005). A lack of initiations contributes to social isolation and fewer opportunities to practice conversation and improve (Charlop-Christy & Kelso, 2003). Although scholars have researched the social communicative difficulties that individuals with ASD face, only a few studies have investigated interventions to improve social conversation in high-functioning older children and adolescents with ASD. This study focuses on one initiation, namely question asking, which

has been shown to be less frequent in children with ASD, yet is central to appropriate social conversation (Koegel, 2000).

Objectives: The aim was to investigate whether a new technique for monitoring questions would improve the rate of question asking and reciprocity during social conversation in older children and adolescents with ASD. Additional questions included whether the intervention could be successfully faded, if the skills would generalize to new conversational partners and if there would be any socially significant gains.

Methods: The participants were two ethnically diverse males, ages 11 and 15, who had previously been diagnosed with autism. Both participants had conversational language and knew how to ask questions, but were reported to have difficulty integrating questions into their conversations. A non-concurrent multiple baseline across participants design was employed. During the intervention phase, the participants monitored their questions and their conversational partner's questions by using a self-management based system while talking. The participants were told to give themselves a point for each question they asked and to give their partner a point for each question he/she asked. The child was told that the goal was to ask an approximately equal number of questions as the conversational partner. Every three minutes, the clinician would check-in with the participant about the balance of the conversation and what he could do to make it more even. Following the conversation, the participants received their chosen reinforcer.

Results: With implementation of the intervention, both participants increased the number of on-topic questions asked. Furthermore, conversation monitoring improved the reciprocal interaction, with both participants displaying appropriate levels of question asking during the majority of the conversation. These gains held once intervention was faded and generalized to new conversational partners, including peers. Social validity data suggest that both participants improved in the expected direction on variables including interest, reciprocity, and normalcy.

Conclusions: Conversation monitoring is a promising technique for improving social conversation in children with ASD. Given the lack of existing research, this study serves as a foundation for how to teach skills necessary for typical social conversation. By increasing initiations that result in the child being more interested and an easier conversational partner, the cycle of social isolation may be broken. Conversation monitoring is a skill that can be used naturally and has important implications for helping older children and adolescents with ASD thrive in friendships and relationships.

105.044 44 Choose Your Own Conjecture: An Analysis of Social Stories™ Text. J. Breidbord*[1], D. B. McAdam[2], D. A. Napolitano[2] and C. R. Peterson[3], (1)*University of Cambridge*, (2)*University of Rochester Medical Center*, (3)*University of Wisconsin -- Stout*

Background: Social Stories™ strategies are used in schools, often to address the behaviors of children with a clinical autism diagnosis. Each intervention package comprises materials that are written as a short story for a specific person and procedures that are chosen for convenient implementation in a specific place. These features have widespread appeal but intervention studies have varied results; this discrepancy may reflect the confounding influence of Social Stories™ text variables.

Objectives: To characterize the full text of Social Stories™ research interventions using conceptual guidelines for storybook development and conventional measures of text difficulty.

Methods: Intervention studies published between 1993 and 2009 were identified by comprehensive pearl growing. Social Stories™ passages with full text were transcribed and summarized in terms used by intervention developers (e.g., perspective sentences, first-person voice) and those used generally to measure readability (e.g., Flesch-Kincaid grade level), decodability (e.g., percentage of high-frequency words), and other aspects of text difficulty (e.g., mean sentence length).

Results: Social Stories™ were used in 38 intervention studies including 26 studies that provided the full text of 48/48 passages, 7 studies that provided the full text of 8/38 passages, and 5 studies that provided the full text of 0/15 passages. Written for more children than adolescents, this corpus has questionable readability (mean Flesch-Kincaid grade level: 6.6; median: 6.0; range: 1.2-9.4). Only 25/56 passages contained the low proportion of directive sentences specified as a guideline; however, the high frequency of flexible language (e.g., *try*, *sometimes*) matches another guideline for Social Stories™ construction.

Conclusions: The characteristics of some Social Stories™ are varied. Research reports should provide the full text of intervention materials and research reviews should consider the relation of efficacy, text attributes, and other Social Stories™ variables.

105.045 45 Evaluating Promising Approaches for Children with Autism: Matching Best Practice to Needs. S. M. Shore*, *Adelphi University*

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). Relational Developmental Intervention (RDI) and Social Communication Emotional Regulation Transactional Supports (SCERTS) are also discussed.

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.

Some preliminary research in comparing historical pre and post test scores using the Assessment of Basic Language and Learning Skills-Revised (ABLLS-R) between one group of children being treated with TEACCH and another group with the Miller Method may also be incorporated in to the presentation.

Objectives: To initiate research towards identifying particular strengths of each approach with with goal of matching 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. Further research into RDI and SCERTS was also conducted to include them in this presentation.

Results: Findings suggest...

• current definitions of autism are incomplete and disagreement between the persons interviewed,

• multi-dimensional approaches to diagnosis and treatment are needed,

• the autism spectrum as currently employed is too wide to be useful without meaningful subtyping, and,

• a sense people with autism have something valuable to contribute to the community.

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 best practice to the needs of children and youth with autism.

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105.087 87 Designing for Themselves: Investigating the Capability of Children with ASD to Become Effective Design Partners. L. Benton*, *Bath University*

Background: Children with autism spectrum disorders (ASD) are seldom involved in the design of products and services developed for their use. This may be due to communication difficulties or the extra support required to enable participation. However, the nature and variability of the ASD profile (incorporating relative strengths and weaknesses) suggests that *generic* design principles underpinning the development of products and services may not be extendable to an ASD population. An overall research question concerns whether participatory design (PD), a method of actively involving end users in the design process, could provide the means to achieve this goal.

Objectives: The study aims to assess the utility of PD for use by this population, and involves: (1) investigating whether children with ASD are able to generate their own design ideas for a maths-based computer game, and; (2) determining whether they can undertake activities associated with existing PD techniques without modification.

Methods: Twenty high-functioning children with ASD (18 boys, 2 girls), aged 11-15 years used one of two sets of design activities: one set based on an existing PD method for children, Cooperative Inquiry (CI) (Druin, 1999), and the other specifically developed for children with ASD called IDEAS. The children were matched on age, sex and verbal IQ across the two methods and originated from three specialist ASD schools. A mixture of children from each of the schools undertook one

design session using either the CI-based or IDEAS method. Each child undertook the session on their own and was provided with a selection of art materials with which to draw out their design for a computer-based mathematics game. Children who struggled to generate their own designs using IDEAS were given pre-prepared templates that they could then modify or add to. Children using CI were not given any additional support.

Results: Seventeen children were able to generate at least one design idea. Of the three remaining children, who were unsuccessful, one was using CI and two were using IDEAS. Thirteen children were able to generate an original idea that was substantially different to the examples provided during the session. Two children were unsuccessful in producing a final design that satisfied the brief of a 'mathematics-based game', both using the IDEAS technique. Six out of 10 children required additional support provided in the IDEAS technique. The number of ideas across both techniques was comparable overall, but the support offered by IDEAS helped four children successfully produce a final design not possible using CI.

Conclusions: Children with ASD can potentially be involved in the activities undertaken in PD sessions. Over half the children in this study generated ideas without any support and the majority of children were successful with support. Some children clearly have the capability to participate in a full Cooperative Inquiry session but other children would need additional support, ideally provided through a specially adapted PD method like IDEAS.

105.088 88 Relationships Between Stereotyped Movements and Sensory Processing Disorders In Children with HFASD Versus Children with ASD and Intellectual Disability. E. Gal*, *University of Haifa*

Background: Stereotyped movements (SM) are a defining characteristic of autism spectrum disorders (ASD), but are also present in children with a range of sensory and developmental disorders. SM may be an adaptive response in children whose sensory processing disorders (SPD) cause them to experience environments as over or under-stimulating.

Objectives: The main aim of this study was to examine relationships between SPD and SM in children with and without developmental or sensory disorders to discover whether SPD accounted for differences in the prevalence and severity of SM. A second aim was to assess whether intellectual disability makes an independent contribution to SM, and if so, whether it also interacts with SPD to exacerbate SM in children with ASD.

Methods:

Instrumentation *The Short Sensory Profile (SSP)* (McIntosh et al., 1999) is a caregiver Likert-style rating scale that reports behavioral sensory processing difficulties in children aged 3 to 10 years. In the context of persons with disabilities, the profile is used with persons up to age 21 years. The SSP was designed for screening and research use and includes 38 items.

The Stereotyped and Self-Injurious Movement Interview (SSIMI), a 32-item clinician-administered questionnaire designed to assess stereotyped body movements, manipulation of objects, and self-injurious behavior (Gal et al., 2002, 2009).

Participants SSP and Stereotyped and Self-Injurious Movements Interview were administered to 221 children (129 boys, 92 girls) aged 6 to 13 years (mean= 9.40, SD=1.81) children with HFASD (n=28), Low functioning ASD (n=28), intellectual disability (no ASD) (n=29), visual impairment (n=50), hearing impairment (n=51), and typical children (n=30).

Data analysis Pearson correlations were calculated to assess the strength of any linear relationship between SSP scores and SM within and across samples. A series of stepwise multiple regression analyses was conducted to discover which linear combination of SSP section scores best predicted SM within and across samples. An analysis of covariance was conducted with disorder type and intellectual disability as the main factors and Short Sensory Profile summary scores as the covariate, to define whether group differences in sensory processing anomalies account for differences in SM.

Results: The results indicate significant and sometimes strong relationships between the SSP summary score and SM in each sample. The results suggest that children who have both intellectual handicaps and ASD show much more SM than children with HFASD, children with intellectual handicaps who do not have ASD, or children who have sensory loss with or without intellectual handicaps. When group differences related to sensory profile are taken into account (SSP scores serve as a covariate), those who have HFASD show the relatively highest amount of SM.

Conclusions: Sensory processing disorder may be a source of SM. For children with HFASD the relationship between sensory profile and stereotyped movements are of specific importance. Clinicians should use the individuals' stereotyped movements as indicators for their sensory systems and accordingly define the focus of intervention.

105.089 89 A Synthesis Review of Interventional Outcomes In Autism Spectrum Disorder. D. B. Nicholas*[1], L. Zwaigenbaum[2], M. Clarke[1], W. Roberts[3], J. Magill Evans[2], M. Saini[3], L. Lach[4], R. MacCulloch[4], D. Barrett[5] and M. Spoelstra[6], (1)*University of Calgary*, (2)*University of Alberta*, (3)*University of Toronto*, (4)*McGill University*, (5)*Autism Society of Edmonton Area*, (6)*Autism Ontario*

Background: The impact of autism spectrum disorder (ASD) is substantial. The need for resources is often daily and across the lifespan, with implications for personal development, family life, school and vocational involvement, community engagement, funding; mental health, and diagnostic, developmental, rehabilitation and other services. The mix of needed resources varies as symptoms and outcomes range widely. Several systematic reviews have evaluated the impact of early intervention on children's outcomes. These reviews suggest that therapy increases positive outcomes, yet there continues to be a lack of consensus regarding best treatment, particularly over the lifespan.

Objectives: To address this uncertainty within existing evidence, this study examined interventional outcomes for children and adults with ASD. The project is a synthesis review of relevant intervention studies, and the development of an evidence-informed framework mapping case characteristics and needs with potential interventional approach. It brings a unique focus relative to recent reviews (e.g., National Standards Report) in seeking to identify specific outcomes relative to intervention type *and* case-based manifestation of autism symptoms.

Methods: The study is guided by Campbell collaboration specifications for quantitative, qualitative and mixed method systematic review. Study inclusion reflects a multi-stage process comprising: (1) initial electronic database searching for studies with definable autism intervention and outcome data; (2) strict screening for inclusion/exclusion criteria, evaluation design, sample description, contextual elements (e.g., ASD severity), findings and methodological rigor; and (3) data extraction and systematic review.

Results: Initial screening of the literature (to November 2010) yielded 22,878 studies. However, after the articles were reviewed for redundancy, methodology and verification of an ASD focus, 4,130 articles remained. This database represents the following interventional approaches: (1) Behavioural (n= 3,341 articles); (2) Social (n= 1,811); (3) Pharmacological (n= 1,768); (4) Communication/Language (n= 1,347); (5) Academic (n= 727); (6) Non-Conventional (n= 698); (7) Sensory (n= 586); (8) Developmental (n= 229); and (9) Diet (n= 192). Some articles addressed more than one approach and age group. Articles addressed ages: 0 to 4 years (n= 1,981); 5 to 12 years (n= 6,077); 13 to 17 years (n= 1,700), and 18 years and over (n= 941). This preliminary description of the types of interventions covered will be followed by a focused review and synthesis of treatments by intervention approach and age group.

Conclusions: Behavioral, social and pharmacological approaches in ASD have most frequently been evaluated. On balance, the provision of intervention is preferable to non-intervention. There are notably fewer studies addressing interventions for older adolescent and adults with the most evidence for children ages 5 to 12 years old. It is still difficult to contrast the effectiveness of interventional approaches given varying metrics, sample characteristics, outcomes and methodological rigor within primary studies. Well-designed comparative studies are needed in contrasting varying approaches across ASD population subtypes.

105.090 90 An Occupational Therapy Intervention for Sensory Differences In Children with Autism. R. C. Schaaf*[1], T. Benevides[1], D. Kelly[2], Z. Mailloux[3], J. Hunt[2], P. Faller[2], E. VanHooydonk[2], C. Neuwirth[2] and R. Freeman[2], (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 such as extreme sensitivity to auditory or tactile stimuli, excessive seeking of deep pressure touch, or craving of oral stimulation by chewing on clothing or non-food items. 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 recently completed a feasibility study of an occupational therapy intervention protocol for sensory differences. The specific aims of this study are to: 1) Evaluate the feasibility of an intervention protocol that utilizes evidence-based, theory driven occupational therapy strategies designed to address sensory differences in a cohort of children ages 4-8, diagnosed with

autism; 2) Determine whether therapists are able to provide the intervention in a way that is in keeping with its principles and practices as outline in the protocol.

Methods:

The design of the proposed 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 present the findings from 10 case studies. Children diagnoses with autism using the ADOS and ADI-r whose IQ scores were above 65 were included in the study and received the intervention for 6 weeks. Data on safety, feasibility, parent and therapists satisfaction and therapists fidelity are presented. Behavioral outcomes include measures of adaptive behavior, sensory behaviors, and participation in activities of daily living, as well as individual, parent-identified goals.

Results:

Data shows that this intervention is feasible and safe, that parents are satisfied with the intervention, and that it is replicable (therapists are able to obtain fidelity to the intervention) (Author, et al submitted). In addition, outcomes are in the hypothesized direction (improvement) with statistical significant improvements in individual, parent-identified goals.

Conclusions: The data supports the next steps in evaluating the efficacy of this intervention and a randomized controlled trial has been initiated.

105.091 91 Assessment and Treatment of Elopement Utilizing a Trial-by-Trial Format. K. B. Crow*, N. A. Parks, A. J. Findley and N. A. Call, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Elopement, or leaving caregiver supervision, is a behavior with potentially dangerous consequences for individuals with autism (Matson & Rivet, 2008). As with other forms of problem behavior, understanding the function of elopement is important for successful treatment. Individuals have been shown to elope for various reasons, including to access attention, to access preferred items/activities, or to escape from nonpreferred demands. Piazza et al. (1997) presented a method of identifying the function of an individual's elopement by systematically presenting specific antecedent events and delivering an associated consequence when elopement occurred. A retrieval procedure was used to reinstate the antecedent condition following elopement. Elevated rates of elopement in one or more test conditions relative to a control condition suggested that the consequence maintained within that condition was responsible for maintaining elopement. However, because some preferred items or activities are conditionally available (e.g, elopement towards an ice-cream truck can only occur when the ice-cream truck approaches), it can be difficult to assess certain forms of elopement utilizing this type of assessment.

Objectives: The purpose of this study was to develop a novel procedure for identifying the function of elopement when it is necessary to do so in a more naturalistic setting.

Methods: The participant had a history of elopement toward elevators and other items with buttons. Thus, all sessions were conducted a lobby and adjoining elevators. Attention, demand, and toy play conditions were conducted in the elevator. In these conditions, RM was able to press buttons and ride the elevator continuously. In all sessions, one instance of the elevator doors opening constituted the beginning of a trial. A trial ended when RM either eloped or the elevator doors closed. Each session consisted of five trials. RM received continuous attention during the *toy play* condition. Throughout each session of the *demand* condition RM was required to complete non-preferred demands. A 20 s break from demands was delivered contingent upon elopement. During the *attention* condition, no attention was delivered unless elopement occurred; in which case the therapist delivered 20 s of attention. During the *tangible* condition, a trial started as soon as the therapist and RM began walking through the lobby area. The trial ended following either the occurrence of elopement toward the elevator, in which case RM was provided access to the buttons and one elevator ride, or when RM and the therapist finished walking through the lobby area without the occurrence of elopement.

Results: Low percentages of elopement were observed in the attention (M=10%), demand (M=15%), and toy play (M=0%) conditions. In contrast, a high percentage of trials containing elopement occurred in the tangible condition (M=100%). These results suggested that elopement was maintained by access to the elevator.

Conclusions: This study demonstrates a novel methodology for assessing the function of elopement when typical methods are unfeasible. Future research should focus on adapting this trial-by-trial format to assessing elopement hypothesized to be maintained by other idiosyncratic sources of reinforcement.

105.092 92 Characterizing Parent-Child Interaction In Young Children with ASD. L. Elder*[1], A. M. Estes[1], S. J.

Rogers[2] and S. E. Zebrowski[1], (1)*University of Washington*, (2)*University of California, Davis*

Background:

Parent-child interactions (PCIs) are important to consider in Autism Spectrum Disorders (ASDs). PCI may be a mediator through which parent-delivered intervention acts to improve outcomes for young children with ASDs. Since core deficits of ASDs such as social communication are evident in parent-child interactions, PCI is a naturalistic setting in which to measure core symptoms of ASD. General developmental growth has been shown to be associated with parental responsiveness, a construct measured through observing and coding PCI, in children with developmental disabilities. Thus, PCI is a potentially important domain to investigate in families of young children with ASDs. More research is needed to better understand a wider variety of interaction styles and behaviors, and the relationship of PCI to child outcomes and response to intervention.

Objectives:

We aim to 1) examine the relationship between parent interaction style and child social behavior, 2) examine the relationship between child interaction behavior and standardized child assessments of cognitive ability, social communication and adaptive function, 3) examine the relationship between parent interaction style and family characteristics.

Methods:

Participants include parents and toddlers12-24 months of age who demonstrated early signs of ASDs. Participants were part of a larger, multisite randomized trial of the Early Start Denver Model (Rogers, PI). Results will be presented for the pre-intervention assessment. PCI was coded from a five-minute parent-child play interaction using the Maternal Behavior Rating Scale and the Child Behavior Rating Scale (Mahoney, 1985). Parental interaction style subscales include Responsivity, Affect, Directiveness, and Achievement Orientation. Child interaction style subscales include Attention and Initiations. Reliability criteria included initially scoring individual items and subscales within one point on three consecutive tapes. Double-coding of 20% of the PCIs was conducted to ensure on-going reliability. Measures include the ADOS assessing child social behavior, Mullen Scales of Early Learning assessing child cognitive ability, and Vineland Adaptive Behavior Scales assessing adaptive behavior. Family characteristics, income level, family status and maternal education, were obtained via questionnaire.

Results:

Results suggest higher parent responsiveness is significantly associated with higher child social communication including Attention and Initiations. Higher child Attention and Initiations are significantly associated with higher social behavior and higher cognitive ability, but not adaptive functioning. Family status, family income, and maternal education are not significantly related to parental interaction style.

Conclusions:

The current study shows parental responsiveness is associated with social behavior in one year olds with ASD. Additional research is needed to understand the causal direction between increased parental responsiveness and increased child social behavior in the parent-child interaction. Parental interaction style is independent of family characteristics in this sample. Child social behavior is significantly associated with child developmental level and scores on diagnostic measures. This indicates PCI may be a useful measure in studies of parent-delivered intervention. Future research will include exploring the relationship between parent interaction style and parent stress and investigating change in parent interaction style as a potential mediator of child outcomes.

105.093 93 Chelation Therapy In the Treatment of Autism Spectrum Disorders: A Systematic Review. A. M. Mulloy*, S. Ramdoss and M. F. O'Reilly, *The University of Texas at Austin*

Background: Many organizations for care-takers of individuals with autism spectrum disorders (ASD) and a number of medical professionals tout chelation therapy as a strongly effective treatment for ASD. Supporters assert ASD is caused by heavy metal toxicity and that chelation therapy can lead to recovery from ASD via detoxification. However, many medical professionals warn against use of chelation therapy for individuals with ASD, due to its known health hazards (e.g., mineral depletion, potential for causing death; Baxter & Krenzelok, 2008) and the lack of a scientific basis for the heavy metal aetiology (Stratton, Gable, & McCormick, 2001). Research has shown that care-takers do in fact often seek various forms of chelation therapy for their children with ASD (Green, Pituch, Itchon, Choi, O'Reilly, & Sigafoos, 2006). To date, no review or meta-analysis has evaluated the efficacy of chelation therapy in treatment of ASD.

Objectives: The purpose of this review is to provide a systematic analysis of all available studies in which chelation therapy was used to treat ASD. This review comprises efforts to (a) evaluate the evidence regarding chelation therapy, (b) guide and inform practitioners in decisions of whether to implement chelation therapy, and (c) identify directions for future research.

Methods: Database, hand, and ancestry searches were performed to identify intervention studies published before or during December 2010 that involved administration of chelation therapy. Articles meeting inclusion criteria were analyzed in terms of (a) characteristics of the studies (e.g., participants, therapy procedures), (b) therapy outcomes, and (c) certainty of the evidence. When possible, effect sizes for individual studies were estimated and synthesized using calculations for Hedges' *g*. The therapy outcomes from studies for which quantitative summarization was not possible (e.g., case studies) were summarized and synthesized narratively.

Results: Database, hand, and ancestry searches identified 13 studies involving the administration of chelation therapy. Studies reported a wide range of therapy outcomes, ranging from substantial improvements in social and communicative functioning, no apparent effect, and death. Appraisal of the studies' certainty of evidence reveals the support for use of chelation therapy is weak. All studies reporting favourable outcomes possessed major flaws.

Conclusions: The current scientific literature does not support chelation therapy as treatment for ASD. The lack of support and the health risks of chelation therapy suggest it should not be administered to individuals with ASD. Should additional research be conducted on chelation therapy, it should be limited to evaluation of naturally occurring, food-based chelators, which have received little attention in the literature. However, due to the lack of support for the heavy metal aetiology, little rationale exists for performing such research.

105.094 94 Coloured Filters Enhance the Visual Perception of Social Cues In Children with Autism. A. K. Ludlow*[1], E. Taylor-Whiffen[1] and A. J. Wilkins[2], (1)*Anglia Ruskin University*, (2)*University of Essex*

Background: Social deficits in Autism Spectrum Disorders (ASD) have been repeatedly described. For example, avoidance of eye contact and inefficient use of eye gaze are early social features of autism. Reports in the literature consistently note that children with ASD often inspect objects (e.g. hands, moving objects) in an unusual way, using their peripheral vision. These sensory behaviours are reminiscent of those characterised in other literature as visual stress, though possibly more extreme.

Objectives: To date, it is unknown whether perceptual abnormalities underlie the failure to observe subtle facial expressions in children with autism. Coloured filters have previously been found to reduce visual distortion of text in children with ASD and to improve perception more generally. The aim of the current study was to assess whether coloured filters could also benefit social cognition in children with ASD.

Methods: 15 high functioning children with a diagnosis of Autism Spectrum Disorders (mean 13 years of age) and 15 typically developing children (mean age 12 years 4 months) matched for age, gender and non-verbal IQ undertook the "Rate of Reading Test" and "Mind in the eye" task with and without coloured overlays. The first test required them to read a passage of randomly ordered common words aloud for one minute. In the second test the children were shown monochrome photographs of the eye region of various faces and were asked to judge which emotion was being expressed in the eyes.

Results: Consistent with previous studies 80% of children with ASD were found to read faster with the use of a coloured overlay. Importantly, a similar proportion of children with ASD (73%) were also found to improve their perception of the emotion when the photograph was covered by a coloured overlay. The improvement was significantly greater than in controls, who showed no significant effect of using an overlay on either the Rate of Reading Test or the Mind in the Eye Task.

Conclusions: The facial expression of emotions has profound implications for social understanding and deficits in social perception are among the core characteristics needed for a diagnosis of autism. Little is known about the underlying reasons for such deficits but the current findings suggest that a perceptual impairment may contribute.

105.095 95 Combination of Repetitive Transcranial Magnetic Stimulation and Neurofeedback for Treatment of Autism: A Case Study. L. L. Sears*, E. M. Sokhadze, J. M. Baruth and M. F. Casanova, *University of Louisville*

Background: In a recent experimental treatment trial we reported positive therapeutic effects of low frequency repetitive transcranial magnetic stimulation (rTMS) over the dorsolateral prefrontal cortex (DLPFC) in children with autism spectrum disorders (ASD). We have also found positive effects of electroencephalographic (EEG) biofeedback (neurofeedback) self-regulation training in behavioral and EEG outcomes in

children with ASD. To evaluate the potential benefits of combining these two treatments, we completed a pilot study of rTMS with neurofeedback in a high functioning 13-year-old male with autism and an anxiety disorder.

Objectives: To determine if concurrent application of bilateral rTMS over DLPFC and self-regulation of prefrontal EEG activity results in improvements in behavior, performance on selective attention tests, and electrophysiological indices of attention.

Methods: The diagnosis of autism in the 13-year-old male was confirmed using DSM-IV criteria and ascertained with the Autism Diagnostic Interview -Revised. Cognitive testing indicated Average intelligence and, based on psychiatric evaluation, he also met criteria for an obsessive compulsive disorder and generalized anxiety disorder that was being treated with Zoloft. Behavioral assessments using the Aberrant Behavior Checklist, Social Responsiveness Scale, and Repetitive Behavior Scale - Revised were conducted before and after a 4 week long waiting (no-treatment) period. The patient was also tested using a selective audio-visual attention test (IVA+Plus, Brain Train) and a visual oddball test with event-related potential (ERP) recording. Following pre-treatment evaluation, the patient completed 12 weekly sessions of experimental treatment where 1 Hz rTMS treatment (150 pulses, 90% of motor threshold, 6 left and 6 right DLPFC) was immediately followed by 25 min long prefrontal neurofeedback training. Neurofeedback was aimed at suppression of low frequency (delta, theta) and enhancement of high frequency (beta, gamma) EEG activity using visual and auditory feedback provided by a DVD controlled by EEG measures. Twelve sessions of combined rTMS and NFB were followed by post-treatment behavioral, neurocognitive, and ERP assessments. After 4 weeks the patient was invited for six additional sessions of bilateral DLPFC rTMS and NFB followed by completion of the same behavioral, neurocognitive, and neurophysiological assessment instruments. Long-term effects were determined by a follow-up evaluation three months after conclusion of the 18-session treatment.

Results: Experimental treatment using the combination of rTMS and NFB coresponded to improvements in behavior, sustained auditory and visual attention (IVA+Plus), and in enhanced magnitude of ERP measures for target stimulus processing in the visual oddball task. The patient exhibited more pronounced positive changes on several ERP measures of attention than children with ASD undergoing only 12 sessions of rTMS without NFB.

Conclusions: This single case experimental study provides support for the combination of rTMS with neurofeedback to treat symptoms of autism presenting with a comorbid anxiety disorder. Further investigation is warranted including combining these approaches with behavioral intervention strategies.

105.096 96 Correspondence of Single Versus Daily Preference Assessment Outcomes and Reinforcer Efficacy Under Increasing Schedule Requirements. J. M. Hodnett*[1], N. M. Trosclair-Lasserre[2], A. J. Findley[1], M. A. Shillingsburg[1] and N. A. Call[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*GNO Resource Center on Developmental Disabilities*

Background: Identifying items that can be used as reinforcers is a critical component of treatments for autism, because they are used to teach language, social skills and other important behaviors. There has been growing interest in the autism treatment literature in identifying methods for assessing reinforcer efficacy, which refers to the degree to which a stimulus increases such behaviors when delivered as a consequence (Trosclair-Lasserre, Lerman, Call, Addison, & Kodak 2008). Unfortunately, reinforcer efficacy analyses are too laborious to conduct in most treatment situations. Instead, preference assessments serve as a method of efficiently predicting which stimuli have adequate reinforcer efficacy for treatment applications. Most preference assessment methods identify preferences based on choice, and differ primarily in the manner in which the stimuli are presented. The paired-stimulus (PS; Dattilo, 1986; Fisher et al., 1992) and multiple stimulus without replacement (MSWO; Windsor, Piche, & Locke, 1994) are two of the most commonly used preference assessments. However, research has shown that a daily MSWO may have greater correspondence with reinforcer efficacy than a PS (DeLeon et al., 2001). Unfortunately, this prior research measured reinforcer efficacy using another choice arrangement. Recently, progressive ratio (PR) arrangements have been identified as a more effective means of measuring reinforcer efficacy (Bickel & Madden, 2006). In a PR arrangement, the item is delivered following increasingly effortful responses until the individual discontinues responding. The PR arrangement then gauges how hard the individual will work for a particular stimulus, and this serves as a better measure of reinforcer efficacy. Yet, to date, there have been no comparisons of how well the MSWO and PS preference assessments each predict reinforcer efficacy as measured by a PR arrangement.

Objectives: The objective of the current study was to evaluate the extent to which results of MSWO and PS assessments each correspond with reinforcer efficacy as measured by a PR arrangement.

Methods: A single PS preference assessment was administered to each participant by presenting trials consisting of a choice between two potential reinforcers until each of six items had been paired with every other item. Following the PS, a daily MSWO was conducted by presenting the same items all at once and allowing participants to select one. Following each selection the selected item was removed from the array and the remaining items were re-presented until all items had been selected. On each day the MSWO was administered, participants also worked for each stimulus within a PR arrangement.

Results: The correspondence between results of each preference assessment and the PR analysis were examined using a statistical analysis consisting of Kendall's-Tau. Statistically significant ($\alpha<.01$) correlations were demonstrated between results of the PR arrangement and both preference assessment formats. However, unlike previous studies, results of both preference assessments showed approximately equal correlations with results of the PR arrangement (PS: T=.35; MSWO: T=.39).

Conclusions: Although both preference assessments predicted reinforcer efficacy equally well, the PS took less time to administer than a daily MSWO. Thus, clinicians may find the PS a more efficient method of identifying likely reinforcers.

105.097 97 Developing Best Practice Procedures to Increase Success Rates for Functional and Structural MRI Scans In Individuals with Autism Spectrum Disorder. K. Robbins-Monteith*[1] and E. Hanson[2], (1), (2)*Children's Hospital Boston*

Background: There has been an increasing interest in gathering neuroimaging data on individuals with Autism Spectrum Disorders. Individuals with this disorder, particularly those who are lower functioning or younger, can often have great difficulty completing the protocols due to behavioral and sensory issues. This bias can significantly impact the ability to generalize data gained in these studies. There is currently no standard of best practice for helping to prepare individuals with ASD for imaging procedures and only one paper, (Nordahl, et al., 2008), which has examined the success rates of particular imaging interventions. This paper was also limited to sleep studies.

Objectives:

1. To develop a behavioral intervention program specific to individuals on the Autism Spectrum to increase completion success rates of structural and functional MRI scans.

2. To create a standard of best practice for clinical application in the use of structural and functional MRI scans for patients on the Autism Spectrum.

Methods:

Our intervention program plans to target those families how have endorsed concerns about the participant's abilities to complete an MRI scan. We plan to have data on 25 probands analyzed by the IMFAR meeting.

The social stories were developed in accordance with guidelines established by Gray and Garand (1993). The stories detailed the steps of having an MRI scan and were broken down into five practice sessions. Each practice session was endorsed with the use of a positive reinforcement for the child. Desired rewards were chosen by the child's preference. Additionally each child received a Boardmaker picture schedule outlining the MRI scanning process.

Supplementary to the social story and picture schedule, we included a habituation kit of MRI related materials. These included: headphone, earbuds, an audio CD of MRI sounds and photobook of imaging staff and MRI bay locations. Dependent upon the participant's age and level of cognitive functioning kits were tailored to their specific needs. Parents were instructed to practice for approximately 2 weeks before the mock MRI scan.

Preceding the actual MRI scan, families are scheduled for a mock MRI scan to prepare for the actual scan. Children are given 5-10 minutes to acclimate themselves to the MRI suite and are then encouraged to watch a parent go through a mock scan and then attempt a mock scan themselves. Ability to "pass" mock scans was based on the researcher's observation of behaviors and compliance during the session.

Following the MRI scan sessions, families receive a general satisfaction survey. We inquire about the length and duration which they practiced, as well as which aspects were most useful.

Results:

We plan to track participants' success rates utilizing pass/fail checklists for both mock and actual MRI scans, as well as parental response surveys.

Conclusions: We anticipate that participant's adherence to the behavioral intervention program with increase their completion success of functional or structural MRI scans

105.098 98 Development and Reliability of the Autism Work Skills Questionnaire (AWSQ) for People with HFASD. E. Gal*[1], A. Ben Meir[2] and N. Katz[2], (1)*University of Haifa*, (2)*Ono Accademic college*

Background: Individuals with ASD and especially those with high functioning Autism (HFASD) can work successfully in community businesses, as evidence suggests. However, many persons with HFASD report substantial difficulties in finding and maintaining employment. In order to achieve successful match between a person and a job for this population, there is a need to construct a valid and reliable assessment tool that can be instrumental in guiding clinicians' decisions as to what kind of job placement could match the needs of the individual with ASD. In this study a comprehensive assessment for employment of people with Autism, Autism Work Skills Questionnaire (AWSQ) was developed, and its content validity and reliability were established.

Objectives:

(1) To Construct a questionnaire that will assess the work related strengths and barriers for people with HFASD, and determine its content validity.

(2) To determine the questionnaire's reliability in two ways: a. examination of the internal consistency of the questionnaire's domains; and b. examination of inter respondents' reliability of the questionnaire domains.

Methods:

Participants included 60 Individuals in the ages of 18-40 years, who are diagnosed as HFASD with at least 10-12 years of education, in transition from an educational setting to employment or are or were employed already, and their parents.

Instruments The Autism Work Skills Questionnaire (AWSQ) is a structured interview which addresses personal and educational data, employment history, habits, styles and independent work, work related strengths and weaknesses, past work barriers, preferred physical and social environment, routine daily activities, interpersonal skills and future aims.

Data analysis 1. Cronbach's alpha coefficient was used to examine the domain scale's internal consistency. 2. In order to test the cross informant agreement (inter respondent reliability) paired sample t-tests were performed between participants and their family member.

Results: AWSQ was originally developed in Hebrew and has later undergone a standardized translation process into English. Content validity was established by expert qualitative evaluation in both languages, and was proven to be high. Internal consistency reliability of the 6 subscales of the questionnaire range from moderate to high Cronbach alpha of r=.645 to .900. Paired sample t-tests were performed between participants and their family member. Results from the AWSQ of individuals with HFASD were not significantly different from their family members except for one area "sensory work environment"(t=2.18, p<.036) were participants rated themselves higher (more sensitive and in need of adjustments) than family members.

Conclusions: This study provides a comprehensive assessment of vocational related strengths and drawbacks of people with HFASD. Reliability of the tool was established. The AWSQ may serve as the first step toward establishing a good job placement for those with HFASD, as well as an appropriate intervention plan and treatment objectives that aims at maintaining the job.

105.099 99 Development of a Fidelity of Implementation Tool for a School-Based Intervention. J. Kinard*, K. P. Wilson, L. R. Watson, B. Boyd, S. Horvath and J. Grisnik, *University of North Carolina at Chapel Hill*

Background: Measurement of intervention fidelity is vital when determining evidence-based practices for individuals with autism. Without knowledge of intervention fidelity, researchers cannot determine the causes of poor treatment outcomes, which could result from a failed intervention—or from poor fidelity of implementation (Dane & Schneider, 1998). Unfortunately, fidelity measurement is often overlooked by researchers. Investigators may not understand this process, or may not know how to apply fidelity measures from other fields into their own work (Century, Rudnick, & Freeman, 2010). To overcome these difficulties, this research team created a multi-component intervention fidelity measure for use in a school-based intervention for preschoolers with autism. This measure incorporates the following dimensions of intervention fidelity: implementer knowledge and planning, intervention quality and dosage, and progress monitoring (Cordray, Hulleman, & Lesnick, 2008; Dane & Schneider, 1998). The team predicts that: a) the measure will differentiate intervention and non-intervention classrooms, and b) through our descriptions of how we created the measure, other investigators can adapt the measure to their own intervention research.

Objectives: (a) To describe the process of creating a multi-component measurement of intervention fidelity; and (b) To report psychometric data and data illustrating the tool's effectiveness in differentiating intervention and non-intervention classrooms.

Methods:

This multi-component tool was developed through examination of extant research, modification of a previously-developed measure, and consideration of the ASAP intervention model and components. In addition to describing this tool development process, the presentation will report results of a quasi-experimental comparison group study used to pilot this fidelity measure in preschool classrooms using the ASAP intervention and comparison/business-as-usual classrooms. This pilot study includes trial measurement of implementer knowledge and planning, intervention quality and dosage, and progress monitoring across groups in order to identify the aspects of intervention fidelity which best discriminate intervention and business-as-usual classrooms (discriminant analysis results will be reported). Furthermore, the pilot study of the ASAP intervention fidelity measure includes assessments of the tool's psychometric properties through examination of inter-rater reliability and stability across three bi-monthly measurements.

Results: Based on the intervention literature base, this research team's experience, and the ASAP intervention components, the following areas were identified as vital in measuring intervention fidelity in preschool classrooms implementing the ASAP intervention: Intervention quality (e.g., appropriateness of target goals/materials, responsiveness to child, appropriateness of prompts), implementer knowledge (e.g., language used to talk about goals and their importance), intervention dosage, team planning (e.g., team meeting frequency), and progress monitoring practices (e.g., data collection, complexity of notes). Psychometric properties and discriminant analysis results are forthcoming and will be reported in this presentation, along with implications for future revisions of the measure.

Conclusions: The importance of measuring intervention fidelity has been established and the complexity of this undertaking is supported by the experience of the ASAP research team in its development and piloting of a multi-component fidelity measure.

105.100 100 Differential Learning of a Blended Intervention Approach Among Therapists of Varied Backgrounds. E. L. Lee*[1], A. C. Stahmer[2], S. Reed[3], K. L. Searcy[4] and L. I. Brookman-Frazee[3], (1)*Rady Children's Hospital*, (2)*Rady Children's Hospital, San Diego*, (3)*University of California, San Diego*, (4)*CRIMSON Center*

Background: Recently there has been an increase in the variety of intervention approaches used with young children with autism spectrum disorders (ASD). Providers from different theoretical backgrounds are implementing approaches that may or may not align with their previous experience. Two prominent approaches are naturalistic, behavioral interventions based on applied behavior analysis (ABA) and developmental, social pragmatic interventions based on the social, relational learning of typical development. Approaches based on ABA have been empirically validated and are widely used in research and applied settings. Developmental, interventions are acquiring a growing body of support and are the subject of much current investigation. Recent research has called for cross-fertilization between these two approaches to advance the understanding of active ingredients in autism intervention and improve treatment. Blended models of early intervention are gaining support for young children with ASD.

Objectives: Examine the differences in therapist fidelity for specific intervention strategies by therapist background, discipline and experience.

Methods: As part of a pilot project examining a treatment for young children at-risk for ASD, providers from varied theoretical backgrounds were trained in a blended behavioral and developmental intervention. Participants included seven therapists from four community agencies serving children with ASD. Each therapist had a self-reported background in behavioral interventions (n=3), developmental/social pragmatic interventions (n=2), or family systems (n=2). All therapists worked with children ages 12-24 months, and received training in the blended behavioral and developmental intervention approach described in *Teaching Social Communication to Children with Autism* (Ingersoll & Dvortscak, 2008). Ten minute video probes were collected of each therapist implementing the intervention and were scored for fidelity of implementation of intervention techniques. Fidelity scores on individual strategies were compared among therapists of differing backgrounds.

Results: No differences based on theoretical background were found in therapist skill level for three strategies including: following the child's lead, using varied levels of animation to keep the child engaged, providing consequences immediately following child behavior and following through with prompting specific behavior. However, therapists differed in their use of other strategies. For example, therapists from behavioral backgrounds were more likely than therapists from other

backgrounds to meet fidelity for using prompts to elicit more complex skills, and adjusting prompts to support spontaneity. Therapists with developmental backgrounds were more likely than other groups to meet fidelity for modeling play and expanding on child responses.

Conclusions: Therapists from all backgrounds had some common areas of strengths and weakness in a blended intervention model. Therapists were most likely to meet fidelity on strategies consistent with their theoretical training. Therapists with behavioral backgrounds were better able to implement directive teaching techniques; those with developmental backgrounds were more skilled at interactive strategies. Family systems therapists excelled in the interactive techniques but struggled with direct teaching techniques. Directed suggestions for areas of optimal cross-fertilization will be discussed.

105.101 101 Differential Reinforcement with and without Blocking as Treatments for Elopement. D. T. Zavatkay*[1], R. S. Pabico[2], A. J. Findley[1], A. L. Valentino[1] and N. A. Call[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Shabani Institute*

Background: Elopement, or leaving caregiver supervision without consent, is a problem behavior with potentially dangerous consequences for individuals with autism (Matson & Rivet, 2008). Blocking attempts to elope is a common treatment component, (Piazza et al., 1997) but it can be particularly difficult for caregivers to anticipate the behavior and quickly restrain the eloping individual. Given that blocking some individuals' elopement may be impractical or even impossible to implement, a direct comparison of treatments that do and do not include blocking would seem worthwhile. This study evaluated the role of blocking in treating the elopement of an individual diagnosed with autism.

Objectives: The purpose of this study was to evaluate the use of blocking in the treatment of elopement by utilizing a differential reinforcement of other behavior (DRO) treatment with and without blocking.

Methods: It was hypothesized that failure to block elopement would result in degradations in treatment effectiveness. Therefore, a treatment evaluation was conducted using a reversal design to compare the occurrence of elopement during baseline and two treatment conditions consisting of a resetting differential reinforcement of other behavior (DRO) with and without blocking respectively. All sessions were conducted in two adjacent therapy rooms (referred to as Room A and Room B). Furniture blocked the hallway to prevent egress from Room A to anywhere other than Room B (or vice versa). A previous functional analysis had demonstrated that the participant eloped to gain access to preferred items. Therefore, prior to each session, the participant was provided with 2 min of access to preferred items in Room B, after which he was removed to Room A, which contained no preferred items. Elopement was defined as passing the plane of the doorway of Room A. During *baseline* elopement resulted in 20 s of access to the preferred items. During the *DRO with blocking* the therapist provided 20 s access to a preferred activity in Room B contingent upon the absence of elopement for 30 s. Attempts to elope were blocked by the therapist who obstructed the participant's egress from the room by stepping into the doorway and/or used their hands to gently redirect his upper body (i.e., back, shoulders, arms, etc.) in the opposite direction. The *DRO without blocking* was identical to the DRO with blocking condition with the exception that 20 s of access to the preferred activity in Room B was delivered contingent upon elopement as well as the DRO contingency.

Results: During treatment the participant engaged in similarly elevated rates of elopement in baseline (M= 0.97) and DRO without blocking condition conditions (M= 0.98). However, decreased levels of elopement were observed in the DRO with blocking condition.

Conclusions: This study extended previous findings on the treatment of elopement by demonstrating that blocking may be a critical component of treatments for elopement for at least some individuals. This finding is potentially problematic given the nature of elopement, which can make blocking difficult to implement, and suggests that caregivers may need to be vigilant to block.

105.102 102 Discounting of Delayed Outcomes of Treatments for Problem Behavior or Language Development by Parents of Children with Autism. R. S. Lesack*, A. J. Findley and N. A. Call, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Behavior analytic treatments have been shown to be relatively effective in addressing many symptoms of autism, including remediating skill deficits and decreasing problem behaviors (Campbell, 2003; Smith et al. 2008). However, these treatments can require implementation over extended periods of time. Delay discounting refers to the degree to which individuals devalue delayed outcomes. Typically, discounting has been evaluated by presenting individuals with choices between hypothetical immediate and delayed rewards of

varying magnitudes. However, to date, no literature exists examining whether delay discounting influences the manner in which caregivers of children with autism value treatment outcomes. Additionally, there may be differences between the manner in which caregivers discount the value of delayed treatment outcomes based on the type of treatment goals (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 by examining the extent to which they discount delayed outcomes of behavioral treatments for their child's problem behavior.

Methods: Caregivers of children with autism who were receiving treatment in one of two day-treatment programs for children with autism served as participants. Half were receiving treatment to reduce significant problem behavior, whereas the other half were receiving treatment to remediate skill deficits. Each caregiver was asked to operationally define their treatment goals for their child. Participants were then asked to make choices between hypothetical treatment outcomes. Each outcome varied with respect to the percentage of the treatments goals they had identified and the latency to achieving the stated outcome. Choices were presented in pairs of outcomes, one of which was always an immediate outcome. The value of the delayed treatment outcome was always fixed at 100% of the treatment goal achieved. 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 from now?" If the caregiver selected the immediate treatment, then the next choice would ask "Would you prefer a treatment that will achieve 55% of your treatment goals immediately, or a treatment that will achieve 100% of your treatment goals 6 months now?" This titrating procedure continued until the caregiver switched from the immediate outcome to the delayed one. The process was repeated at 7 delay values (i.e., 1 week, 2 weeks, 1 month, 6 months, 1 year, 3 years, and 10 years).

Results: Both groups of participants demonstrated significant discounting of the delayed treatment outcomes. However, preliminary results do not indicate any significant differences between the two groups with respect to the extent to which discounting occurred.

Conclusions: This study demonstrates caregivers of children with autism discount the value of treatment outcomes based on the delay to those outcomes. This result highlights the need for those who deliver or develop treatment services to those with autism to continually refine their interventions to make them increasingly efficient.

105.103 103 Evaluation of An Outpatient Parent-Lead Toilet Training Program for Children with Autism Spectrum Disorders. S. E. Crossett* and N. A. Call, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Children with autism spectrum disorders frequently exhibit delays in adaptive functioning. Toilet training can be an especially challenging process for parents of children with ASDs. In fact, more than half of parents of children with autism report toileting problems (e.g. Whiteley, 2004). Incontinence in children can create further social isolation, negative reactions from caregivers and school staff, and may limit participation in mainstream educational opportunities or community activities, making it an important target of intervention. Recent research has provided strong support for behavioral interventions for toilet training in this population (for a review see Kroeger and Sorensen-Burnworth, 2009) however parents are rarely included in the treatment process and few studies include treatment acceptability data.

Objectives: The goal of the current study, therefore, was to evaluate the effectiveness and treatment acceptability of a behavioral treatment package targeting urinary incontinence using a parent training model conducted in an outpatient clinic.

Methods: Children ages 3-7 participated in the study with their primary caregivers. All children had previously been diagnosed with an autism spectrum disorder, had been unsuccessful with previous attempts at toilet training, and did not exhibit significant findings related to bowel or bladder on physical exam. The treatment package consisted of the following components: sitting schedule, positive reinforcement for voiding, negative reinforcement for sitting & voiding, communication training (pairing), graduated guidance and prompting, use of a urine alarm, positive practice/overcorrection, and fluid loading. Parents were trained to implement the treatment during a 6 hour in-clinic training day and were expected to implement procedures and collect data in the home setting. On the third day after treatment was implemented, a therapist visited the home to ensure treatment fidelity and to collect interobserver agreement data. Treatment acceptability data and long term follow-up data were collected by paper and pencil parent report.

Results: All three children achieved continence within 10 days of starting the program. Data on the rate of continent and incontinent voids during training, treatment acceptability, and long term follow-up will be presented.

Conclusions: Behavioral toilet training programs including those adapted from Azrin & Foxx's (1971) protocol are effective in helping children with ASDs achieve urinary continence. Furthermore, with adequate training and supervision by clinicians, these treatments can be implemented effectively by caregivers in the home setting, have lasting effects, and are viewed as acceptable treatment procedures by parents.

105.104 104 Examining Curriculum-Based Assessment as a Measure of Early Intervention Outcome. L. Schreibman*[1], A. C. Stahmer[2], E. Worcester[3], R. Gutierrez[1], K. Pierce[1] and E. Courchesne[1], (1)*University of California, San Diego*, (2)*Rady Children's Hospital, San Diego*, (3)*UC San Diego*

Background:

As children with autism spectrum disorders (ASD) are increasingly identified at earlier ages, researchers and clinicians must adapt to develop effective, comprehensive interventions suitable for very young populations. Currently, the literature is lacking empirically supported intervention packages for children under age three (Rogers & Vismara 2008). Furthermore, standardized assessments often used to evaluate the effects of treatment may not be sensitive to progress in this population.

Objectives:

This study examined the utility of a curriculum-based measure to assess the efficacy and appropriateness of an early intervention for children under age three with risk for ASD. Each participant received an individualized program addressing communication, social, play, cognitive and developmental skills. Interventions included *Strategies for Teaching Based on Autism Research Program* (STAR; Arick, Loos, Falco, & Krug, 2004), systematically combined with the *Teaching Social Communication* (TSC) curriculum (Ingersoll & Dvortcsak, 2010).

Methods:

To date twenty-eight children between 13 and 27 months of age (M=22.4) identified withrisk for, ASD have participated in the intervention as part of the UCSD Autism Center of Excellence. Children receive an average of 9.29 treatment hours per week. The curriculum is based on the STAR program, which utilizes behavioral interventions including Pivotal Response Training, Discrete Trial Training and Functional Routines to teach a range of skills. To target engagement and social interaction, including joint attention, TSC was used to supplement the STAR Program. Initially, and every 3 months thereafter, each child was assessed using the adapted Student Learning Profile (aSLP) from the STAR curriculum, designed to measure mastery level of the child's skills across domains. The aSLP provides a consistent and comparable measure of skills mastered across participants during the treatment period. Children also received a battery of standardized cognitive and behavioral assessments every 6 months.

Results:

To date, 20 children have completed at least 6 months of treatment. As measured by the aSLP at post treatment, all children showed increases in the number of skills mastered across intervention domains (M=93.5; range=29-151). As expected, aSLP results did not correlate with standardized assessments. Likewise, standardized assessments of cognitive or communication skills at intake were not predictive of progress. Results did identify a novel treatment response index, namely rate of skill mastery, in that the rate of learning after three months of intervention was indicative of outcome.

Conclusions:

All children benefited from the intervention as indexed by the acquisition of new skills. A greater range of scores and progress was obtained with the curriculum assessments in comparison with standardized tests, and early scores were often predictive of outcome. As such, curriculum-based assessments may be a more appropriate method for measuring intervention progress in young children with ASD. Overall, these data provide preliminary evidence that early intervention programs designed for children with ASD over age three can be adapted to improve communication, cognitive, play and social skills in children under three. However, the variability in skill acquisition across children is high.

105.105 105 Examining the Use of a Visual Schedule/Reinforcement System for Routine Medical Exams with Children on the Autism Spectrum: Pilot Study. J. A. Agnew*[1], R. L. Gabriels[1], J. S. Runde[2], J. Gralla[3], Z. Pan[3], E. Goldson[3] and M. Z. Wamboldt[1], (1)*The Children's Hospital / The University of Colorado at Denver and Health Sciences Center*, (2)*University of Denver*, (3)*The Children's Hospital / The Children's*

Hospital / The University of Colorado at Denver and Health Sciences Center

Background: Children with autism spectrum disorders (ASDs) have unique social-communication and behavior impairments that complicate their medical care. Research supports using visual cues and structure to decrease disruptive behaviors and increase cooperation in medical procedures.

Objectives: This study examined the effect of using a picture schedule paired with a reinforcement system during a routine medical exam with a nurse and medical resident.

Methods: Participants were 15 pre-pubescent children (ages 4 – 10 years) diagnosed with an Autistic Disorder or Asperger's Disorder and below average adaptive communication impairment and all of whom were rated by their caregivers as either having "Poor Cooperation" or being "Completely Uncooperative" with physical exams on a 4-point scale of cooperation. Participants were randomized into either the treatment (n =8) or control group (n = 7) by the Vineland Adaptive Behavior Scale-II standard Communication scores (<75, or >75). Both groups received a medical examination. Caregivers rated participants' irritability behaviors using the Aberrant Behavior Checklist-Community (ABC-C) before the exam (in the waiting room) and during the exam. The nurse and medical resident tallied the number of procedures they were able to complete, and the caregiver, nurse, and the medical resident rated the participants' exam cooperation.

Results: A paired t-test was performed for the change in ABC-C irritability scale scores from before the exam to during the exam for each group separately. Marginal significance was noted (p=0.09) for the treatment group while no significance for the control group (p=0.34). A linear regression was then used to examine the difference between the two groups with respect to the change in ABC-C irritability scale scores after adjusting for age and IQ. The treatment group had a reduction of 12.1 points while the control group showed a 1.2 point increase in ABC-C irritability scores; such a difference was significant (p=0.049). The effects of age and IQ were that older children and children with lower IQ were more irritable during the medical examination.

Conclusions: Subjects in the treatment group had a greater reduction in ABC-C irritability scores during the medical exam using the picture schedule paired with a reinforcement system. However, one cannot exclude the possibility that this result was not a regression-toward-mean effect since the randomization was not made with baseline ABC-C irritability scores or IQ scores. Therefore, these results should be interpreted with caution and future similar studies should consider randomizing groups based on IQ and baseline ABC-C irritability scores in addition to adaptive communication abilities. Finally, this line of research has the potential to improve the success of medical procedures for individuals with an ASD by establishing techniques that can be easily employed by the general medical practitioner and autism researchers.

105.106 106 Factors Associated with Psychotropic Medication Use In Autism Spectrum Disorders (ASD). D. L. Coury*[1], E. Anagnostou[2], S. L. Hyman[3], T. Clemons[4] and C. Lajonchere[5], (1)*Nationwide Children's Hospital*, (2)*Bloorview Research Institute, University of Toronto*, (3)*University of Rochester School of Medicine*, (4)*EMMES Corp*, (5)*Autism Speaks*

Background:

Individuals with autism spectrum disorders (ASD) often have challenging behaviors and symptoms which are treated with psychotropic medications. Patterns of use of these medications have suggested that young children with ASD are placed on medications at early ages and often engage in polypharmacy when there is a co-morbid psychiatric disorder.

Objectives:

We examined the use of psychotropic medications in a large population of individuals with ASD to determine factors associated with their use.

Methods:

The study population consisted of children and adolescents ages 2 – 18 years entered in the Autism Treatment Network (ATN) Registry. The ATN collects data on children with ASD at fourteen sites across the US and Canada. Children with a diagnosis of ASD (autism, Asperger disorder, or PDD-NOS), as determined by comprehensive multidisciplinary evaluation, including ADOS, were included in this analysis. Psychotropic medication use was established by both parent and clinician report at entry into the registry.

Results:

Medication information was available for 2,053 children. Of these, 582 (28%) were on at least one psychotropic medication. Commonly prescribed drugs included stimulants, serotonin reuptake inhibitors, and second generation antipsychotics. Twenty percent (20%) of the children without a previous diagnosis of ASD were on psychotropic medications versus 36% with a prior diagnosis of ASD (p-value < 0.001).

Children receiving Medicaid had a higher, yet not statistically significant, rate of being on psychotropic medications compared to children on other public types of insurance or private insurance (private insurance – 28%; public insurance – 28%; Medicaid – 32%; p-value = 0.09). A higher percentage of older children are exposed to these medications (42% no previous diagnosis and 57% previous diagnosis). Very few children under the age of 3 were taking psychotropic drugs (2%). Of the 347 children with medication data and a comorbid diagnosis of ADHD, bipolar disorder, obsessive compulsive disorder, depression or anxiety w, 230 (66%) are on at least one psychotropic medication. The percentages of children on psychotropic medications by diagnosis are as follows: ADHD - 65%; OCD - 46%; Anxiety - 49%: Bipolar - 33%; Depression - 41%. If a child did not have a comorbid diagnosis (N=1,327) their chance of being on a psychotropic medication was 16%. If a child had only one psychiatric comorbidity, then their probability of being on a psychotropic medication was 75%. This increases as the number of comorbidities increases (p= 0.014, Cochran-Armitage Trend test). Children with 2 – 4 comorbidities have an almost 90% chance of being on a psychotropic medication.

Conclusions:

: Overall use of psychotropic medication in this ASD population is lower than prior descriptions from other datasets. Psychotropic medication use is frequently initiated prior to a formal diagnosis of ASD. Comorbid psychiatric conditions greatly increase the likelihood of use of psychotropic medications, suggesting that such individuals present with much more challenging behaviors.

Support from ATN-CRT-07-02 (Autism Speaks) and UA3MC11054 (MCHB).

105.107 107 Food Dyes, Behavior, and Autism: Does What Children Eat Color Behavior?. S. L. Hyman*[1], C. Hannum[2], B. L. Schmidt[3], J. Foley[3] and P. A. Stewart[3], (1)*University of Rochester School of Medicine*, (2)*SUNY Upstate Medical University*, (3)*University of Rochester*

Background: A common dietary modification used by families with and without autism spectrum disorders (ASD) is the removal of artificial food dyes and preservatives based on studies that suggest these additives increase hyperactivity in children (Mc Cann et al, 2007; Schrab, 2004). To date no studies have investigated this association in children with ASDs.

Objectives: The purpose of this study was to examine the association of ingestion of artificial food dye by children with ASD with parent report of symptoms of ADHD, sleep problems, and repetitive behaviors.

Methods: The prospective three-day food records of 25 children from Rochester participating in a larger study examining the diet and nutritional status of children with ASD were studied. Exposure to food dyes was quantified by number of exposures based on examination of the ingredients of all foods and beverages recorded in the food records. Behavior was quantified by the parent rating scales collected for the larger study: the Children's Sleep Habits Questionnaire (CHSQ), the Child Behavior Checklist (CBCL), and Repetitive Behavior Scale – Revised (RBS-R).

Results: Five of the children (20% of the sample) did not ingest any food dyes during the three-day record either because of a dye free diet or secondary to ingestion of a gluten free diet. Of the remaining 20 children, the exposure to artificial food dye ranged from 1 food exposure to 50 food exposures over the 3 days of recording. There was no correlation between artificial food dye exposure and ADHD or externalizing symptoms on the CBCL or repetitive behavior on the RBS-R in the 20 children who ingested artificial food dyes. Modest to moderate correlations (r=0.75, 0.68) were found for ingestion of yellow 6 specifically and for ingestion of all yellow artificial coloring and total score on the CSHQ.

Conclusions: Limitation or elimination of food dye is a common dietary intervention in children with ASD. It is possible that the children whose families had already eliminated artificial food dyes did so because of observable behavioral responses and this would not have been detected in this study. Rating scales suggest that further examination of sleep disturbance and yellow food dye exposure might be warranted. Prospective data from a double blind, placebo controlled study would be necessary to determine if there might be an association between artificial food dye intake and hyperactivity, repetitive behaviors, or sleep.

The authors thank the Autism Treatment Network (ATN) for the use of the data collected as part of the ATN; a program of Autism Speaks. Further support was from a cooperative agreement (UA3MC11054) from the US Dept of Health and Human Services, health Research and Service Administration, Maternal and Child Health Research Program to Massachusetts General Hospital and to the National Center for Research Resources(NCRR) UL 1RRO24160

105.108 108 Frequency of and Treatment Approach Used for Problem Behaviour and Mental Health Issues In Children with Severe DD with or without ASD. E. K. Cooper*[1], A. Perry[1], J. A. Weiss[1] and R. Condillac[2], (1)*York University*, (2)*Brock University*

Background:

In addition to impairments in cognitive ability and adaptive skills, individuals diagnosed with Autism Spectrum Disorder (ASD) and/or a developmental disability (DD) often also exhibit different problem behaviors (e.g., self-injurious, stereotyped, aggressive or destructive behaviors) and/or mental health issues. Given the potential consequences of these behaviors for both the individual and their family, it is important that individuals receive treatment (e.g., participation in behavioural programs, medication) to reduce the frequency and/or intensity of such behaviors. Although formal behavioral methods have been shown to be most effective, there is some evidence to suggest that informal behavioral strategies (Feldman et al., 2004) and alternative approaches (e.g., diets, expressive therapies) (Green et al., 2004) are often used.

Objectives:

The purpose of the current investigation was to: 1) document the frequency of four types of behavioral/mental health issues (aggression, self-injury, stereotypy, and mental health issues such as anxiety, depression) among individuals with ASD and DD or DD alone; 2) examine the treatment methods used to treat each type of problem behavior/mental health issue in the above two diagnostic groups; and 3) explore the relationship between each type of problem behavior/mental health issue and the individual's age, gender, diagnosis, and adaptive skill level.

Methods:

This project is part of GO4KIDDS (Great Outcomes for Children Impacted by Severe Developmental Disabilities), a CIHR Emerging Team Grant about the health, well-being, and social inclusion of school-aged children across Canada with severe DD. One aspect of GO4KIDDS is a nationwide survey that includes information regarding adaptive skills, behavioral concerns, and treatment methods. Participants currently consist of 80 parents raising children, between 6 and 18 years of age, with ASD and DD or DD alone. Additional participant data continue to be collected. Participants from the partial sample completed the GO4KIDDS Basic Survey.

Results:

Preliminary results indicated that 85% of the children in the sample were demonstrating some form of behavioral problem and/or mental health issue. A greater proportion of children with diagnoses of ASD and DD demonstrated problem behaviors and/or mental health issues compared to children with diagnoses of only DD. As well, a greater proportion of children with both ASD and DD received treatment than children with DD alone. Interestingly, informal behavior programs are noted by parents to be the most frequently used form of treatment for problem behaviors and/or mental health issues. Further data analysis incorporating the additional participants is underway, and examines predictors of treatment choice.

Conclusions:

Findings are consistent with research that shows that individuals with ASD and/or DD present with a variety of problem behaviors and/or mental health issues. Despite research that has demonstrated that formal behavioral programs are the most effective, the most frequent form of treatment used within this sample was informal. These findings have important implications for service providers and policy makers. Understanding what factors lead parents of children with severe DD to choose specific treatment options is critical if we are to work with families to ensure that treatments that are accessed are in line with empirically supported practices.

105.109 109 Identifying Therapeutic Mechanisms with Intervention Studies. T. Charman*[1], A. Pickles[2], J. Green[3], H. McConachie[4], C. R. Aldred[3] and .. The PACT Consortium[3], (1)*Institute of Education*, (2)*Institute of Psychiatry, King's College London*, (3)*University of Manchester*, (4)*University of Newcastle*

Background: While the current focus is on identifying effective treatments the understanding of treatment mechanisms is crucial to development and improvement of those treatments. The traditional methods of Baron, Judd and Kenny (BJK) for assessing treatment mediation are helpful but require assumptions to be made about the absence of confounding and reverse causation between mediator and outcome that are hard to justify. Where confounding and reverse causation exist, for example where within a caregiver training program changes in a child's symptoms and behaviour influence a caregivers behaviour, mistaken conclusions may be being drawn.

Objectives: We describe how randomisation can be exploited to construct "instruments" that moderate the effect on the mediator which in turn allow us to estimate the extent of

treatment mediation in a way that does not suffer from such bias. We illustrate the application of these methods using the PACT trial, the largest formal RCT of a parent based intervention for autism (Green et al, 2010, The Lancet).

Methods: We consider a range of candidate instruments that exploit the range of baseline variables available in PACT that might influence the extent of response to treatment of the first target mediator, parental synchrony. We examine the strength of the available instruments and compare the estimates of mediation obtained using this new methodology to those from the traditional BJK approach. We illustrate the use of model averaging.

Results: We examine a range of instruments based around potential variations in quality of therapy, parent compliance and engagement, and child characteristics. The range of estimates of mediation that we obtain is considerable and the relatively wide confidence intervals we obtain reflect our difficulty in finding strong instruments. We suggest using a model averaging method as a means of synthesizing the estimates to obtain a single overall conclusion.

Conclusions: The need to exploit intervention studies to the full as a means of achieving incremental progress in the development of treatments is clearly essential. Understanding treatment mechanisms is a key part of that process. While the limitations of the BJK approach to the analysis of mediation is becoming increasingly well known, and more sophisticated methods for their analysis are being developed, we will need to enhance the design and measurement protocols of studies in order to increase the power of these methods to deliver clear answers. In the meantime the new methods provide valuable guidance for a sensitivity analysis, may give some indication as to the extent of bias when using the BJK method, and can be blended with BJK estimates using model averaging.

*PACT Consortium members: Sam Barron, Barbara Barrett, Karen Beggs, Katy Bourne, Sarah Byford, Julia Collino, Ruth Colmer, Anna Cutress, Tori Houghton, Patricia Howlin, Kristelle Hudry, Ann Le Couteur, Sue Leach, Dharmi Kapadia, Kathy Leadbitter, Wendy MacDonald, Sarah Randles, Vicky Slonims, Carol Taylor, Kathryn Temple, Lydia White

105.110 110 Medication Use In Students with Autism Spectrum Disorders Attending a Nonpublic Special Education Program: Implications for Classroom Behavior. R. Church*, D. Stone, P. A. Law and S. Steppa, *Kennedy Krieger Institute*

Background: The number of children with Autism Spectrum Disorders (ASD) has grown precipitously since the 1990s. Students diagnosed with ASD present significant challenges to classroom teachers. While previous studies have described patterns of psychotropic medication use in children with ASDs, none have focused on the school setting or the implications for classroom behavior management. The Kennedy Krieger Institute, known for its autism research and education programs, operates the largest nonpublic school in Maryland, serving over 400 students with disabilities in grades PreK - 12. Such schools provide a specialized environment in which to measure and describe current practices that have broad implications for all school settings. A research committee was established to identify potential areas of study related to the importance of having accurate and updated information regarding medications taken by students that may impact their daily academic and behavioral classroom performance.

Objectives: Our objective was to describe use of psychotropic and non-psychotropic medications by students attending the Kennedy Krieger School, and to investigate associations between such use and student's disability status, graduation pathway (diploma vs. certificate), sex, race, age, and grade level.

Methods: This sample included 468 students, aged 5 to 22 years, who attend The Kennedy Krieger School Programs in Maryland, all with significant developmental concerns. Students were classified into one of two groups: those with autism as defined by the Individuals with Disabilities Education Act (IDEA) and those with other disability codes. Medications were coded by type (psychotropic vs. other). Multivariate regression models were used to evaluate predictors of psychotropic and non-psychotropic drug use. Data was maintained in a commercially available student information database, *PowerSchool*.

Results: In all, 63% of students were taking at least one psychotropic medication and 43% were taking at least one non-psychotropic medication. Students with ASD were taking an average of 1.3 psychotropic and 0.8 non-psychotropic medications, while non-ASD students were taking an average of 1.8 psychotropic and 1.2 non-psychotropic medications. Not having ASD, higher grade level, Caucasian race, and being in LEAP (a specialized program for lower functioning children with ASD) were strongly correlated with greater psychotropic medication use, while sex and graduation pathway were not. Not having ASD was also strongly correlated with non-psychotropic medication use, as was being Caucasian or being in the LEAP program, while grade level, sex, and graduation pathway were not. All positive correlations were above $p<0.05$.

Conclusions: Data show that an overwhelming number of students attending a nonpublic school are prescribed psychotropic medications. It is interesting to note that, while psychotropic medication use increases with age, non-psychotropic medication use does not. Patterns of medication use were identified that may influence the practice of school administrators. Results demonstrate that further investigation of medication use among older, lower functioning students with ASD is warranted. Findings suggest that the impact of pharmacological interventions on student achievement for students with ASD merits further study.

105.111 111 Nutrient Intake and Supplement Use In Children with Autism Spectrum Disorders: Do Multivitamins Provide the Nutrients Consumed In Low Amounts?. P. A. Stewart*[1], B. L. Schmidt[1], N. Lemcke[1], N. Wixom[1], T. Clemons[2], R. Peck[3], J. Foley[1] and S. L. Hyman[4], (1)*University of Rochester*, (2)*EMMES Corp*, (3), (4)*University of Rochester School of Medicine*

Background: Children with autism spectrum disorders (ASD) often engage in selective eating patterns, yet little is known about the adequacy of nutrient intake since many foods consumed are highly fortified. Additionally, children with ASD commonly take dietary supplements. It is unknown whether these supplements enhance the nutrient profile or result in excessive intake.

Objectives: To examine dietary intake and supplement use in children with autism to determine nutrients of concern and whether supplements enhance nutrient adequacy or result in excessive intake.

Methods: NDSR© software was used to perform an interim analysis of nutrient intake and supplement use on 126 three day diet records of children with ASD aged 2-11 in a multicenter study of dietary behaviors and nutrition status. Usual intake was compared to the IOM's Dietary Reference Intakes (DRI) for age and gender. The percentage of children meeting recommended nutrient intake levels and the percentage consuming nutrients above the Upper Limit (UL) from food alone were determined. The UL is the highest intake level likely to pose no risk, above which the potential of adverse effects increases. Nutrients provided by dietary supplements were assessed and compared to the nutrients low in the diet and to ULs for children.

Results: The chart below indicates DRIs were not met in many participants for vitamin D, choline, potassium, and fiber and UL was exceeded for sodium, niacin, and manganese from food alone. Sixty-six percent of children were taking dietary supplements, compared to 32% in the general pediatric population and 62% in other children with chronic diseases. Multivitamin/minerals were the most common dietary supplements consumed followed by fatty acids and probiotics. The supplement content was compared to dietary needs. Ninety-seven % of the multivitamins used contained vitamin D, while only 37% contained choline, 11% vitamin K , 8% potassium and 0% fiber. The amount of potassium and choline provided by supplements was far below the recommended intake levels. Folate, niacin and vitamin A were nutrients in supplements most likely to exceed the UL even before including nutrients from food.

Age	n	% Meeting DRI				
		Fiber	Potassium	Vitamin D	Choline	Vi
(1-3)	33	2	2	10	30	
(4-8)	79	1	0	10	20	
(9-13)	14	1	0	16	13	

Conclusions : Many children with ASD do not meet recommended intakes for nutrients. Children who are selective eaters may be better served by consultation with dietitians to correct nutrient imbalances using food rather than with general multivitamin use. When indicated, targeted supplementation may avoid exceeding the UL while meeting the child's nutritional needs.

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105.112 112 Positive Behavior Supports for 3 ASD Individuals with Problem Behaviors Using Un-Prompted Differential Reinforcement Strategy. A. R. Amraotkar*[1] and M. Boman[2], (1)*Kelly Autism Program, Western Kentucky University*, (2)*Kelly Autism Program at 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 population for this study consists of three non-verbal individuals of different age groups and genders diagnosed with ASD These individuals attend an after school program at the Kelly Autism Program, Western Kentucky University. Problem behaviors identified in all three were targeted for gradual extinction. Six tasks, three involving life skills and three involving behaviors, previously heard or seen by participants have been included in the lesson plans for these individuals. Tasks are being facilitated by trained professionals from Exceptional Education & allied majors by applying 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). Documentation has been collected regarding the type of tasks administered and performance graphs of all participants. Functional Analysis & Screening Tool (FAST), developed by the Florida Center on Self-Injury (2002) and Behavioral Observation Frequency Recording, Caveland Educational Support Center were used to perform frequency analysis of problem behaviors. Positive Behavioral Support (PBS), developed and updated based on consecutive assessment report, has been implemented successfully.

Results: All the participants exhibited positive changes in at least two tasks from each category. Behavior changes (e.g., respecting personal space) were quick to occur, while skills (e.g., tying shoe lace) developed later. Frequency of targeted problem behaviors reduced by 30% over a period of 2 months.

Conclusions: This strategy was effective in bringing the desired positive changes in skills & behaviors of individuals diagnosed with Autism Spectrum Disorders, which was evident from a reflection on their improved academic, communicative and social interactions.

105.113 113 Problem Behaviour Associated with Behavioural Inflexibility. N. D. Ollington*,

Background:

A lack of behavioural flexibility; that is an insistence on sameness or resistance to change, is one of the key features of autism. A lack of behavioural flexibility is often associated with problem behaviour. Disruption or minor changes in the environment may produce frustration, causing the child to act out. Although this type of behaviour is commonly observed in typically developing children, it has usually abated by around five years of age. In individuals with autism however, the behaviour may remain well into the adult years.

Objectives:

Although the concept of behavioural flexibility has emerged as an important topic in autism research, there is still a great deal of work to be done in order to understand its purpose for the child for intervention planning, and also in terms of diagnosis and to establish a cohort for treatment. The study aimed to empirically explore theories of motivation and adaptive functioning in order to establish a better understanding of the phenomenology of problem behaviour associated with behavioural inflexibility.

Methods:

Forty three parents of 2 to 10 year old children with an Autism Spectrum Disorder and typically developing controls were recruited from Victoria and Tasmania through a number of schools and child care centres, Autism Tasmania and the Autism Victoria 'Get Involved' database. Parents completed eight assessments of motivation and behaviour. Data for adaptive behaviour function is currently being collected via interview.

Results:

Data will be presented on a number of indicators of problem behaviour associated with a lack of behavioural flexibility in children with ASD and typically developing children. Associations between diagnosis, adaptive functioning, characteristics, behaviour and motivation will be explored.

Conclusions:

The findings of this research provide important information pertaining to the functional aspects of sameness behaviour for children with autism that may be used to guide future intervention, particularly in replacing maladaptive behaviour with more adaptive and appropriate behaviours that serve the same function.

105.114 114 Restricted and Repetitive Behaviors and Interests as Reinforcement. J. Hine*[1], B. Barger[2] and J. Campbell[3], (1), (2)*The University of Georgia*, (3)*University of Georgia*

Background: The presence of repetitive and restricted interests and/or behaviors (RRIB) is a core diagnostic symptom of Autism Spectrum Disorders (ASD). To date, most of the interventions regarding RRIB in the single-subject design literature have sought to diminish these behaviors in individuals with ASD. A small segment of the literature regarding RRIB, however, has sought to use the reinforcing properties of RRIB in order to shape the behaviors of individuals with ASD in a therapeutic direction.

Objectives: Review the single-subject design literature regarding the use of RRIB in either antecedent or consequence based interventions for children with ASD. Organize the literature according to interventions aimed at (a) increasing appropriate behaviors (e.g., Language/communication, social, engagement, compliance, academics,. etc.) or (b) decreasing aberrant behaviors (e.g., problem behaviors, self-injurious behavior, stereotypy, etc.). Description of intervention procedures including but not limited to use of differential reinforcement, noncontingent reinforcement, extinction, punishment, and other reinforcement-based strategies. Provide information regarding future research directions using RRIB as an intervention strategy.

Methods: Electronic, ancestral, and expert nomination searches were performed to locate studies. Only studies published in peer reviewed journals, whose primary language was English, were considered. This resulted in 13 studies published between 1978 and 2007. Authors address the following information: (a) proportion of studies using antecedent or consequent based interventions; (b) proportion of studies addressing increasing appropriate behaviors or decreasing problem behaviors,(c) comparison of RRBI interventions to others, (d) internal validity, (e) generalizability, and (f) choice of target children.

Results: Preliminary results show that seven of the thirteen (53.8%) interventions incorporated a consequence based intervention and six (46.2%) incorporated an antecedent based intervention. Six studies reported data addressing increasing social/communication skills, four studies report data addressing decreasing negative behaviors, and seven studies report data addressing increasing correct responding of children with ASD. Three studies reported data addressing two behavior areas. Seven studies compared RRBI interventions to other interventions with support generally found for the RRBI intervention. Studies were variable in regards to the strength of internal validity and generalizability of findings. To date, no study has reported data on children with ASD whose reported diagnostic battery includes well validated measure (e.g., Autism Diagnostic Observation Schedule; ADOS). Further results will summarize participant/setting characteristics, measurement procedures, assessment strategies, design/validity issues, and effects.

Conclusions: The use of the RRBI as a reinforcement tool for shaping the behaviors of children with ASD is an underexplored area in the SSD literature. The handful of studies published to date indicates that RRBI may be used in consequence- and antecedent-based interventions to increase desired behaviors and decrease inappropriate behaviors in this population. Future studies should address the ability of RRIB-based interventions to facilitate generalization and/or maintenance of target behaviors as well as fading procedures to increase participants' response to more naturalistic reinforcers.

105.115 115 Side Effect Monitoring of Children with ASD Prescribed Second Generation Antipsychotics (SGAs). L. Cole*[1], R. Panzer[2], D. Treadwell-Deering[3], R. McCoy[4], A. M. Reynolds[5], E. Anagnostou[6], D. Johnson[7], R. A. Vasa[8] and D. L. Coury[9], (1)*University of Rochester*, (2)*Autism Treatment Network*, (3)*Texas Children's Hosptial, Baylor College of Medicine*, (4)*OHSU*, (5)*University of Colorado Denver*, (6)*Bloorview Research Institute, University of Toronto*, (7)*EMMES*, (8)*Kennedy Krieger Institute*, (9)*Nationwide Children's Hospital*

Background: Psychotropic medications, particularly SGAs, are prescribed frequently to children with autism spectrum disorders (ASD), with two (Risperidone and Aripiprazole) being FDA approved. Risks of metabolic, neurologic, and cardiac side effects appear to be increased with young age, autism, intellectual disability, polypharmacy, and longer treatment duration. Although a consensus conference suggested metabolic monitoring standards, rates of monitoring are low and guidelines for cardiac and neurologic monitoring have not been established.

Objectives: This study investigates the monitoring practices of clinicians prescribing SGAs to children with ASD, compares metabolic monitoring practices with recommended standards, and describes cardiac and neurologic monitoring practices.

Methods:

Fifty two clinicians from the 14 Autism Treatment Network (ATN) sites were asked to complete an online survey on SGA prescribing and monitoring. Metabolic monitoring practices were compared to 2004 consensus conference recommendations: 1) Baseline personal/family history review, BMI, blood pressure, serum glucose and lipids, 2) quarterly BMI monitoring, 3) yearly glucose and BP, and 4) lipids every 5 years. Because no standard of care exists for monitoring of cardiac or neurologic risks, current clinician practices were described.

Results:

Responses were received from 31 clinicians, 23 of whom prescribe SGAs, including child neurologists, developmental pediatricians, nurse practitioners, and child psychiatrists. *Metabolic monitoring:* of those who prescribe SGAs, 70% obtain personal and family history to assess metabolic risks prior to treatment, 74% assess baseline growth parameters (Ht/ Wt/BMI) and 70% monitor them at least quarterly during treatment. Glucose is measured by 26% and lipids by 30% at baseline, while 61% monitor glucose at least annually and 64% monitor lipids at least every 5 years, with most monitoring yearly or biannually. *Cardiac monitoring*: Personal/family history for cardiac risk factors is assessed by 70% at baseline; blood pressure is checked by 65% at baseline and by 65% at least annually. *Neurologic monitoring:* At baseline, 65% perform a neurologic exam and 39% perform a standardized movement disorder evaluation. During treatment, 65% perform/order a neurologic exam quarterly and 48% perform a movement exam monthly to semi-annually. Lastly, many clinicians routinely order additional tests prior to or during treatment, including ECG [9%], CBC [26%], HgA1C [17%], serum insulin [13%], LFT [39%], and prolactin level [9%]. Additional data from clinics not affiliated with this network will be presented.

Conclusions:

In this initial study, metabolic monitoring rates were higher than has been reported in other studies. This may be a function of quality improvement in the ATN. More clinicians monitored regularly for metabolic and cardiac side effects than for neurologic side effects. Recommendations for monitoring of neurologic and cardiac side effects in pediatric populations are needed, as are studies documenting efficacy of the current metabolic monitoring recommendations in children with ASD.

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105.116 116 Single Case Design and Growth Curve Analysis of An Intervention to Promote Joint Attention for Toddlers with ASD. S. Odom*[1], H. Schertz[2] and K. Baggett[3], (1)*University of North Carolina*, (2)*Indiana University*, (3)*University of Kansas*

Background: For infants and toddlers with ASD, joint attention and social communication with caregivers is often delayed or nonexistent. The Joint Attention Mediated Learning Intervention (JAML, Schertz & Odom, 2007) has been developed to support family members' use of strategies that promote joint attention. In a sequential fashion, caregivers and intervention coordinators plan activities that promote two foundational behaviors (Focusing on Faces and Turn Taking) that lead to subsequent intervention emphasis on Responding to and Initiating Joint attention (RJA and IJA respectively). The purpose of this study was to examine the systematic replication of slight variations of JAML through multiple single case design (SCD) demonstrations and to explore an analytic strategy that would use growth curve analysis to examine aggregated SCD data across participants.

Objectives: To examine (a) the application of growth curve modeling to the aggregation of SCD replications of JAML and (b) the efficacy of the JAML for promoting initiating joint attention for toddlers with ASD.

Methods: Seventeen toddlers with ASD between the ages of 15-30 months and their caregivers participated in this study. Intervention coordinators delivered the JAML intervention in the families' homes. For the first eight families, the intervention consisted for four phases that corresponded to the four target behaviors noted previously (FF, TT, RJA, IJA). For the subsequent 9 children and families, the RJA and IJA phases were combined, so that the intervention consisted of three components (FF, TT, and RJA/IJA). Children and families were video recorded during weekly 15-minute play sessions in their homes, and the four target behaviors noted previously were coded. For the first set of children/families, a multiple baseline across four behaviors was conducted, and for the second set of 9 children/families a multiple baseline design across three behaviors (FF, TT, and RJA/IJA) was conducted.

Results: For the eight children in the first set, data were plotted on a four-tiered multiple baseline design graph. For each tier of

the graph, four growth curve models were run (linear, binary, cubic, and quadratic), with the cubic model accounting for the most variance. While variability existed in data, curves revealed acceleration in target behaviors that approximated to the range of onset dates of the interventions. Importantly, IJA displayed a marked acceleration at the end of the intervention. Similar patterns of growth curves occurred for the second set of 9 children with ASD.

Conclusions: A problem with conducting a large number of systematic replications of SCD demonstrations is concisely summarizing the results. This study reviewed that growth curve modeling may be a feasible procedures for displaying summary data of SCD replications. The replications, as a group, revealed that the intervention produced increases in IJA for very young children with ASD.

105.117 117 The Effect of Brief Workshop of Pivotal Response Teaching on Therapists Skills 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) maximizes the opportunities of receiving reinforcers in naturalistic conditions by keeping higher motivation level (Koegel & Koegel, 2006). In order for the PRT to be used to parents and therapists widely, it is necessary to examine the effect of staff training (Suhrheinrich et al., 2007).

Objectives: We examined the effects of a five-hour-intensive-staff-training on two therapists and on a child with autism spectrum disorder (ASD) in a therapy session.

Methods: Participants were two female student therapists in a graduate school, and a boy with ASD (3 years and 9 months). In *pre-assessment* and *post assessment phase,* we video-recorded the behavior of each therapist and the child for 10 minutes. Then, therapists evaluated themselves about techniques of interaction with the child. In *workshop phase,* a five-hour workshop was conducted. It covered the basic knowledge of ABA and role-play sessions of 10 PRT techniques during a play condition. Before and after the workshop, a quiz was given to the therapists in order to evaluate the acquisition of ABA and PRT knowledge. Dependent variables were 1) the quiz score of the therapists' basic knowledge and skills for ABA and PRT, 2) their self-evaluation score, and 3) units of interactions of the therapist and the child in a play situation. We digitized therapist-child interactions from recorded video, and conducted 10 seconds interval-recording to analyze the time series relations on "antecedent stimulus (A) – behavior (B) – consequence (C)." The interactions were coded as A-B unit (the child responded within five seconds after the therapist delivered the antecedent stimulus), and B-C unit (the therapist delivered a reinforcer to the child within three seconds). A-B-C unit targeted only to the following three-term unit: when the child responded within five seconds after the therapist's delivery of the stimulus, she reinforced him within three seconds after the occurrence of his response.

Results: The quiz scores between before and after the workshop showed the improvement for both therapists (40.0 to 81.4% and 61.4 to 88.6%, respectively). Therapists' self-evaluation scores between pre and post workshop also showed improvement (out of 50 points: 25 points to 33, and 22 to 40 points, respectively). Analyses of the video recording showed the improvement of: each therapist's interaction with a child (3.3 to 6.7 times per session and 0.0 to 10.0 times per session, respectively), the child's eye contacts (3.3 to 18.3 times per session and 1.7 to 16.7 times per session, respectively), and the A-B-C unit (6.7 to 16.7 times per session and 1.7 to 18.3 times per session, respectively).

Conclusions: The current study indicated that even a relatively short PRT workshop could improve knowledge of early intervention, self-evaluation, and early intervention skills of therapists. It also indicated that the time series analyses of A-B, B-C, and A-B-C were effective units to objectively evaluate the efficacy of early intervention.

105.118 118 The Parent Treatment Preference Questionnaire (PTPQ): Evaluation of a New Tool to Assess Attitudes to Interventions. S. N. Grondhuis*[1], C. A. Farmer[2], M. G. Aman[3] and E. Butter[4], (1)*The Ohio State University*, (2)*Nisonger Center*, (3)*Ohio State University*, (4)*Nationwide Children's Hospital*

Background: In most cases, a patient has agency to make decisions about the treatment plan they undergo when they receive a psychiatric diagnosis, but not when the patient is a child. Children, particularly those with developmental disabilities, defer to their parents or caregivers. There is ample evidence that parental views, on both the diagnosis and the treatment options available, influence where and when they pursue treatment for their child.

Objectives: The PTPQ was developed to assess parental attitudes about pharmacotherapy and behavior interventions as

well as parental willingness to actively participate in a given intervention. Such a scale would be useful to clinicians in determining the treatment(s) that are most preferred by the family, which may then the highest rates of compliance.

Methods: 122 PTPQs were completed by the parents of children enrolled in a study of combined treatment with a pharmacologic agent and parent management training. Each child had and autism spectrum disorder and significant problem behavior. The data were entered into a polychoric correlation matrix, which is recommended for interval or categorical data. Exploratory factor analysis with maximum likelihood estimation and oblique rotation was used to obtain the best factor structure. The resulting subscales were correlated with variables expected to support the validity of the subscale scores.

Results: A two-factor model provided the best fit for the data. Items meeting the 0.35 loading threshold were adopted onto the two subscales: “Feelings About Medication” and “Feelings About Behavior Therapy”. Analyses demonstrated that the RMSEA was “acceptable” according to established standards. When compared to a measure of vignettes called “Treatment Acceptability”, the Medication subscale (where higher values represent more negative attitudes) was negatively correlated with combined medicinal and behavioral therapy. The Behavior subscale (where higher values represent more positive attitudes) was positively correlated with combined medicinal and behavioral treatment.

Conclusions: The scale appears to be accessing parental thoughts about the most common treatment options for persons with disabilities: medication, behavior therapy, and the combination. This is an encouraging result, particularly since this is the first time the scale has been used. The sample size was relatively small and there was relatively little variability in PTPQ ratings, which may have affected the factor analysis. Measures of buy-in or adherence to treatment would have been welcome in determining the validity of the resulting structure. However, the results do suggest that the scale is tapping underlying attitudes held by parents, which should be confirmed in a larger sample. Future research on the PTPQ should explore additional items to “flesh out” the existing subscales.

105.119 119 The Prevalence of Preference Displacement of Leisure Items by Edible Stimuli In Children with Autism.
S. B. Clark*, N. A. Parks and N. A. Call, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: The identification of preferred stimuli is a critical aspect of successful treatment strategies for children with autism. Preferred stimuli are frequently used to shape or teach new adaptive behaviors or in programming to reduce maladaptive behavior. The paired-stimulus (PS) preference assessment developed by Fisher et al., (1992) constitutes one commonly used assessment method for creating a hierarchy of preferred items. In a PS, several stimuli are presented in pairs and an observer records the number of times the individual selects each item. Presentations are repeated until every item has been presented in a pair with every other item. The item selected most frequently is determined to be the most preferred. Studies have indicated that individuals often select edible stimuli instead of leisure items when compared during preference assessments (DeLeon, Iwata, & Roscoe, 1997; Bojak & Carr, 1999). This result suggests that edible stimuli may serve as more effective reinforcers compared to leisure items. However, the prevalence of displacement of leisure items by edible stimuli with children with autism is unclear. Additionally, the influence of reinforcer magnitude during a PS and delays on displacement is unknown. That is, most preference assessments present choices between one portion of an edible item and an arbitrary duration of access to a leisure item (e.g., 30 seconds). Displacement may be a product of the relatively brief periods of access to leisure items.

Objectives: The purpose of the current investigation was to examine the prevalence of displacement of leisure items in children with autism, and to determine whether duration of access to leisure items affects displacement.

Methods: In Experiment 1, 26 participants were exposed to three PS assessments that evaluated edible stimuli, leisure items, and the two combined. Results of the combined PS were compared to those of the two separated assessments to determine whether displacement occurred. In Experiment 2, participants chose between edible stimuli that displaced leisure items and the most preferred leisure item. The duration of access to the leisure item was then systematically increased across series to identify the point at which leisure items became more preferred. That is, as the duration of access to an item increases, a shift in preference to the leisure item emerges.

Results: Results of Experiment 1 indicate that for 20 of the 26 participants (77.0%) the most frequently selected item was food. Additionally, for 14 of the 26 participants (54.0%) the three highest ranked items were edible stimuli. During Experiment 2, the leisure stimulus eventually displaced all of the edible stimuli following increases in duration of access.

Conclusions: The current study suggests that the displacement of leisure items is common amongst children with autism. Additionally, the displacement of leisure items by edible stimuli during PS is likely influenced by the duration of access to the leisure item. Thus, it is important for clinicians who may use leisure items as reinforcers to consider the influence of particular dimensions of reinforcement (i.e., magnitude) on preference and reinforcer efficacy.

105.120 120 Treatment of Rigidity and Compulsion In a Child with Autism: A Case Study In An Intensive Treatment Center. N. M. Powell* and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: The Diagnostic and Statistical Manual of Mental Disorders—IV—Text Revisions (DSM-IV-TR) criteria for Autistic Disorder highlights repetitive patterns of behavior as a major qualitative characteristic of children with an autism spectrum disorder. Clinicians who work with children with an autism diagnosis often struggle with rigidity that may border on compulsion in their clients. These rigid and restrictive patterns of behavior often impact the quality of interventions as the clinician is often compelled to modify their own behavior to the child's desires. When dealing with rigid behavior, it is frequently seen as an "unavoidable characteristic" of autism that cannot be altered and when attempts to alter the behavior are made, significant problem behavior can emerge.

Objectives: This study aimed to examine rigid and compulsive behaviors in a child with autism and determine what strategies may be successful in reducing these characteristics in an intensive learning setting. The participant was rigid around the manipulation or restriction of any materials that surrounded him in the classroom environment or directly on his workspace. It was the objective to gain the ability to move, withhold, and restrict these items when necessary during instruction time.

Methods: The dependent variables were screaming and aggression. Before each session, the participant was allowed to choose items to bring to his work station. In session, these items moved from the work space or removed from sight. Initially, the participant was rewarded for the absence of screaming during brief intervals of item restriction. The intervals of restriction were gradually lengthened and the participant was required to tolerate longer and longer delays before the items were returned to his control. Gradually instructional demands were faded back into the work session. An ABAB reversal with a Changing Criterion design was used to evaluate treatment effects.

Results: Screaming was reduced by greater than 80% of original levels and instructional demands were successfully faded into the session. The participant tolerated his items being removed and controlled by the therapist during instruction.

Conclusions: These results indicate that the extensive restrictive and rigid behavior of a child with autism is a behavior that can be modified. Addressing rigid behavior emitted by children with autism is of significant value, particularly in intensive treatment settings or academic arenas, due to the necessity of controlling the environment in which the child is learning.

105.121 121 Unmet Need for Autism Treatment: Variation by State Prior to Autism Insurance Reform. L. A. Bilaver*,

Background:

Early treatment for autism relies heavily on the use of speech and behavioral therapies. National data has found that children with autism spectrum disorder (ASD) are significantly more likely to have unmet health care needs and to live in families reporting greater financial burden and medical expenditures compared with other children (Kogan et al., 2008; Liptak et al., 2006). It is unknown to what extent the unmet health care needs are specifically associated with unmet need for autism therapies and how unmet needs vary by state. This question is particularly important to answer empirically given efforts to enact health insurance reform around autism at the state level.

Objectives:

The purpose of this analysis is to use existing national data to measure the association between a parental report of ASD and unmet need for speech, occupational, and physical therapy. In addition, the association is examined by insurance type and state. The data will present a nationally representative picture of U.S. children in the period prior to the enactment of any state autism insurance reform laws.

Methods:

Weighted logistic regression is used to measure associations in the National Survey for Children with Specially Health Care Needs (NS-CSHCN), 2005-2006. The subpopulation examined in this analysis includes all children age 3 and older whose parent indicated the need for speech, occupational, or physical therapy in the survey screener. All analyses accounted for the complex sampling design of the survey.

Results:

Within the subpopulation, 1,457 children had parent-reported ASD compared with 4,817 children without ASD. 85% of children with parent reported need for speech, occupational, or physical therapy received services (95% confidence interval (CI), 84%, 89%). After controlling for an array of potential child and family-level confounders, children with ASD had 0.76 times the odds of receiving needed speech, occupational, or physical therapy compared with children without ASD ($p<0.077$, [CI, 0.56, 1.03]). Controlling for the type of health insurance had no substantive effect on the adjusted odds ratio, and there were no significant interactions between insurance type and ASD. There was some variation by state in the prevalence of receiving needed therapies. Estimates ranged from only 66% receiving needed therapy in Arizona (CI [55%, 77%]) to 94% in North Dakota (CI [89%, 995]). While the NS-CSHCN is powered to provide state level estimates overall, specific subpopulations may not have adequate power to detect differences. In regressions of ASD status on receipt of needed therapy by state, only four states had statistically significant odds ratios ($p<.1$). In each of the four states, children with ASD had lower odds of receiving needed therapy compared with children without ASD.

Conclusions:

National data indicate that children with ASD are less likely to receive needed therapy services than children with parent reported need without ASD. While the majority of special needs families needing therapy report that they receive therapy, there is some significant variation by state. The NS-CSHCN could be used to evaluate the impact of insurance reform in the future.

105.122 122 Use of a Token Economy to Treat Vocal Stereotypy In a Boy with Autism. M. A. Shillingsburg*[1], J. E. Lomas[2] and D. W. Bradley[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Louisiana State University*

Background: A core feature of autism is repetitive, nonfunctional behavior. A common form of this includes loud vocalizations referred to as vocal stereotypy. Although vocal stereotypy usually does not cause harm to the individual or others, it can be impairing to social, academic, and adaptive functioning. Vocal stereotypy can result in social isolation and placement in a more restrictive academic setting. Consequently, children with autism who engage in loud vocal stereotypy are often prevented from participating in regular education activities. Vocal stereotypy may be automatically reinforced by the sensations that it generates in the individual. Previous research on the treatment of automatically maintained vocal stereotypy has shown that it can be treated. However, many of the treatment options may not be feasible in the everyday environment. For example, research has shown that vocal stereotypy reduces when individuals engage in a preferred activity, such as listening to music, and subsequently lose access to the activity contingent on vocal stereotypy. However, this intervention is entails allowing constant engagement in preferred activities leaving no time for academic and daily living tasks. Thus, there is a need for data demonstrating successful treatment of vocal stereotypy that will easily transition to the everyday environment.

Objectives: The purpose was to examine the effects of a treatment package used to treat automatically reinforced vocal stereotypy in a child with autism without interfering with academic instruction or other daily activities.

Methods: Carl, a 12 year-old male with autism, exhibited loud vocal stereotypy which resulted in a more restricted classroom placement than his level of functioning required. The use of a Token Economy plus Response Cost (TE+RC) arranged to allow for inclusion of academic instruction was implemented. Access to the computer was identified as the reinforcer. During baseline, attempts to access the computer were blocked and there were no programmed consequences for vocal stereotypy. During treatment, tokens were earned for the absence of screaming for a specified time period. Additionally, tokens were lost contingent upon vocal stereotypy. The required number of tokens to access reinforcement, the length of the reinforcement interval, and the length of the specified time with no screaming were all gradually increased simultaneously. The terminal goal was 30 min of academic instruction required to access 5 min of reinforcement.

Results: During baseline Carl engaged in high and stable rates of vocal stereotypy (M = 10.3 RPM). During TE+RC, vocal stereotypy dropped to zero levels (M = 0.5 RPM). When baseline was repeated, rates increased (M = 2.1 RPM). When TE+RC phase was repeated, rates of vocal stereotypy remained at near zero levels. The token requirement increased from 1 to 15, the length of the DRO interval increased from 10 s per token to 116 s per token resulting in a 29 min work interval. The reinforcement interval increased from 1 minute to 5 minutes.

Conclusions: The token economy package was successful at reducing vocal stereotypy while allowing for everyday activities to continue.

105.123 123 Using the ADOS Severity Metric to Evaluate the Trajectory of Students with ASD In a Large Public

School District. C. M. Harker*[1], E. M. Reisinger[1], S. Shin[1] and D. S. Mandell[2], (1)*University of Pennsylvania*, (2)*University of Pennsylvania School of Medicine*

Background:

Though intended as a categorical diagnostic tool, there is an increasing trend in autism research to use the Autism Diagnostic Observation Schedule (Lord et. al 2000) as a severity and outcome measure. In response to the growing need for a measure that would allow for longitudinal comparisons of symptom severity within the same individual, Gotham et al. (2009) developed a severity metric, allowing for across-module and cross-age comparisons. To date, however, this severity metric has been used only for long-term comparisons, not for periods of time generally used to test interventions. If the metric is sensitive to change over relatively short periods of time, such as an academic year, it would have important implications for its use as an outcome measure in intervention studies.

Objectives:

To examine the utility of the ADOS severity metric as a measure of trajectory of students with ASD in a large public school district.

Methods:

The sample included 225 students from 49 kindergarten-through-second-grade autism support classrooms in a large, urban school district who were participating in a study of a classroom-based autism intervention. Students were assessed at the beginning and of the academic year using the ADOS Modules 1-3, depending on their language ability. Trajectories of the group were calculated using the ADOS severity metric. Growth mixture modeling was used to examine whether children could be empirically classified by their change in ADOS score. These groups were then compared based on their change in other outcome measures used in the study.

Results: Analyses are ongoing and will be completed by the time of the conference. Preliminary results suggest that children vary greatly in their change in ADOS score over the course of the academic year. Changes in scores correlated moderately with other outcome measures.

Conclusions:

Preliminary results suggest that the ADOS severity metric may be a useful tool in evaluating intervention outcomes.

105.124 124 Validation of the Wing Subgroup Questionnaire Using a Concurrent Operants Design. A. R. Reavis*, M. A. Shillingsburg, C. N. Bowen, A. J. Findley and N. A. Call, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Several subtypes have been proposed to explain some of the heterogeneity in ASD. These include Wing's subgroup paradigm that classifies individuals as aloof, passive, active but odd, or typically developing based on the frequency and quality of their social interactions (Wing & Gould, 1979). Castelloe and Dawson (1993) adapted Wing's typology to produce the Wings Subgroup Questionnaire (WSQ), which based subtype on caregiver ratings. Concurrent operants assessments are an example of a preference assessment based on observation of choices. They have frequently been used to assess relative preference for two simultaneously available stimuli (Fisher et al., 1992). Concurrent operants arrangements have been used to assess preference for tangible items (e.g, toys), but have also been extended to assess preference for non-tangible items, such as social attention (Harding, 1999). A concurrent operants assessment may be ideally suited to directly identify subgroups of individuals with ASDs along Wing's typology.

Objectives: The objective of this study was to directly assess social subtypes using a concurrent operants assessment and compare the results to those of the WSQ for each participant.

Methods: Participants consisted of children with an ASD and their primary caregivers. Each caregiver completed the WSQ. Next, each child participated in a concurrent operants assessment in which preferences for social attention were assessed based on allocation to different sides of a symmetrical room. Throughout the analysis, the participant was free to move about a room that was divided in half by a line on the floor. If the participant stepped onto the same side of the room as the experimenter, they received social attention in the form of descriptive statements and joint play. Whenever the participant was on the opposite side of the room, the experimenter ignored them. Three different conditions were used to evaluate preference for social attention. The experimenter remained on the same side of the room throughout the *stay* condition. During the *chase* condition, if the participant chose the non-attention side of the room the experimenter would switch sides and begin to deliver attention after 30 s. Thus, aloof individuals had to continually switch sides to avoid social attention. In the *flee* condition, if the participant spent 30 s on the same side of the room as the experimenter, the experimenter would switch sides and stop delivering attention. Thus, active but odd or typically developing

individuals had to continually switch sides to maintain access to social attention.

Results: All participants choices resulted in the clear identification of a social subtype. However, correspondence between WSQ and concurrent operants assessment was quite low (25%) and statistically insignificant, with approximately half of participants showing greater preference for social attention than was suggested by the WSQ.

Conclusions: Although there was poor correspondence between the concurrent operants assessment and WSQ, this difference could well be explained by a variety of procedural variations, including the use of novel therapists. However, these results raise questions for future research about how best to measure preferences for social attention in those with ASD.

105.125 125 Yoga and Autism. L. S. Nicholls*, *National Autistic Society*

Background: The practice of Yoga in neurotypical children has shown an increase in engagement in classroom situations (McIntyre et al 2003; Jones et al 2007; Schiffmann 1996). In October 2009 a Scottish Government initiative funded a project to bring yoga to 15 schools in Glasgow. Anecdotal reports indicate improvement in concentration and self discipline. The 'Juniper Programme' (Keith 2000), which included Yoga, evidenced increased calm and self-confidence among participants.

Work in America shows that similar results can be gathered from Programmes of Yoga with children on the autistic spectrum (Cuomo 2007; Goldberg 2006; Betts 2006). A study in India also showed Yoga can increase imitation and social communicative behaviour in children with ASD (Radhakrishna 2010).

Objectives: What effects does a short Yoga Programme, delivered on a regular basis, have on the presentation of a small group of young people on the autistic spectrum?

Methods: There is still limited research validating the use of Yoga and autism. Using a case study approach, this study involved 6 participants, aged between 11 and 19, who participated in 20-minute sessions of Yoga 4 days a week for one year, lead by the Researcher. Research questions included:

- How do the participants engage in the programme?
- Any change in physicality?
- Any change in social communication?

Data was gathered from:

- Researcher
- Classroom Teachers
- Practitioners working 1:1 with the pupils
- Parents

Results:

Participant 1:

- 16 years
- Little body awareness
- Echolalia/delayed echolalia with use of 3-word sentences
- Vineland Adaptive Behaviour Scale (VABS) = 3.3 years
- Increased:
    - Flexibility in movement
    - Agility
    - Joint attention skills and gained stillness
- Spontaneously greeting
- Verbalises associated memories

Participant 2:

- 14 years
- Comprehension limited to routine
- Can express basic needs
- Uses 2-3 word sentences
- VABS = 3.9 years
- Increased:
    - Length of utterance and expressive language is clearer

- Joint attention

Participant 3:

- 11 years
- Used to being on her own agenda
- Uses a great deal of video-speak
- VABS = 3 years
- Increased listening skills
- More able to take instruction and stay on task

Participant 4:

- 15 years
- Little body awareness
- Non-verbal
- VABS = 2.7 years
- Increased:
  - Flexibility of movement and much more agile
  - Stillness
  - Appropriate vocalisation

Participant 5:

- 18 years
- Prone to extreme mood shift – Catatonic to manic
- VABS = 5.9 years
- Increased
  - Stillness
  - Body awareness
- Calming Yoga poses seem to settle him when he is hyperactive

Participant 6:

- 19 years
- Displays Tourette-like involuntary movements
- Uses a great many learned, stereotypical phrases inappropriately
- VABS = 9 years
- When doing the asanas, he is quite still and focussed
- Increased body awareness
- Appears less agitated for up to one hour after Yoga

Conclusions: First results are indicating that a structured, regularly practised Yoga programme will promote social interaction and communication, self-confidence and increased agility.

105.126 126 Impact of a Standardized Pamphlet on Sleep In Children with Autism. K. Adkins*[1], C. A. Molloy[2], T. E. Clemons[3], S. E. Goldman[1], K. L. Surdyka[1], D. Wofford[1], D. Fawkes[1] and B. A. Malow[1], (1)*Vanderbilt Medical Center*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*Emmes Corporation*

Background: Sleep difficulties are common reasons why parents seek medical intervention in children with autism spectrum disorders (ASD).

Objectives: To determine the efficacy of a sleep education pamphlet on sleep latency (time to fall asleep) in children with ASD.

Methods: Children were ages 2- 10 years, enrolled in the Autism Treatment Network at Vanderbilt University and Cincinnati sites, with a clinical diagnosis of ASD, confirmed by the Autism Diagnostic Observation Schedule. Parents were randomly assigned to receive a sleep education pamphlet containing information about daytime habits, bedtime routine, and sleep environment. Children wore actigraphy devices, which measure activity and rest to estimate sleep parameters, prior to receiving the pamphlet (baseline) and two weeks after randomization (treatment). Sample size of 36 participants was predetermined to detect a difference in sleep latency of at least 30 minutes in children whose parents received the pamphlet. Independent t-tests were performed to compare mean sleep parameters at baseline, and mean change in sleep parameters by treatment.

Results: As shown in the Table, the group receiving the pamphlet showed improvement from baseline in all sleep parameters, although statistical significance was not reached ($p > 0.10$). Differences observed between treatment and control groups on mean change in sleep parameters showed

significance (p = 0.04) only for sleep efficiency in the pamphlet group; this was not clinically significant.

Sleep Education Program- Treatment Results in Children with ASD				
	Pamphlet (n = 19)		No Pamphlet (n = 17)	
	Baseline (mean, SD)	Treatment (mean, SD)	Baseline (mean, SD)	Treatment (mean, SD)
Age, years	5.4 (2.4)		7.1 (2.5)	
Sleep Latency, min	56.7 (27.1)	49.5 (26.7)	52.1 (25.1)	61.3 (47)
Sleep Efficiency, %	75.5 (6.1)	77.8 (7.0)	76.8 (6.0)	75.1 (6.7)
Wake Time after Sleep Onset, min	61.9 (27.4)	60.4 (32.1)	53.2 (20.2)	59.9 (24.2)
Total Sleep Time, min	465.7 (66.3)	483.0 (67.8)	461.4 (42.4)	470.8 (35.3)
Fragmentation, min	36.8 (9.0)	36.3 (10.9)	32.2 (7.2)	33.3 (7.5)

Conclusions: Providing a sleep education pamphlet to parents of children with ASD did not significantly improve sleep latency. We are conducting studies to determine if more intensive education improves sleep patterns in this population.

105.127 127 Interventions for Atypical Feeding Behaviour

Interventions In Children with Autistic Spectrum Disorders (ASD): a Systematic Review of the Evidence. S. Studnik*[1] and D. E. Simkiss[2], (1)*Imperial College Healthcare NHS Trust*, (2)*University of Warwick*

Background: Many children with ASD have feeding, eating and mealtime challenges . These feeding difficulties may be one of the earliest symptoms of ASD and these problems may be lifelong without appropriate treatment.

Objectives: This study systematically reviews the literature on the safety and effectiveness of interventions for atypical feeding behaviours. .

Methods: Articles were identified by electronic database and manual searches and critically reviewed using established criteria. Interventions needed to focus on eating or feeding problems as a discreet outcome measures. Effectiveness in Atypical Feeding Behaviour was defined as reduced symptoms in children with Atypical Feeding Behaviour and ASD or reduced parental stress; improving clinical parameters or symptom scales for these children with additional data on safety of any interventions if appropriate. Outcome parameters were Atypical Feeding Behaviour in a child or impact on the child's family such as stress.

Results:

Two systematic reviews (1 of them specific to ASD) and 23 case studies were identified. 6 of the case studies focussed on pica type behaviour. The 2 systematic reviews of behavioural interventions found only case studies and low grade evidence for effectiveness with a wide variety of outcome data (few directly observed) and little follow-up data. The articles covered a wide range of different interventions but most involved behavioural therapy including functional analysis. All case studies reported that their intervention had been effective, but no studies had a control group. Behavioural treatments seemed better accepted if they involved parent training, were based within a child's home or school or if children were offered simple programs such as pager prompting or fading. Children were reported to show individual responses to different interventions (particular in pica type behaviour) and programmes were often tailor-made for a particular child. Where children presented with very severe feeding difficulties multi-disciplinary programs seemed helpful and in some extreme cases intervention required hospitalisation. No evidence for effectiveness of interventions by Speech & Language therapy, Occupational therapy or Dietietics were found. Anectodal evidence for the effectiveness of medication was presented with little data on safety. It was not possible to do a meta-analysis because of the heterogeneity of patients, interventions and outcomes in the studies. .

Conclusions:

There is low level –(i.e. case study) evidence that some types of behavioural therapy may work on atypical feeding behaviour in children with ASD . The characteristics of children who may

benefit are unclear. It seems after many case studies it is time now to design intervention studies with control groups and agreed meaningful out comes with follow up. This will help to see whether interventions work consistently, can be generalised, are safe and work long-term. The research into functional analysis seems best placed to enlarge this body of knowledge.

105.128 128 Predictors and Moderators of Parent Training for Children with Autism Spectrum Disorders and Serious Behavioral Problems. C. A. Farmer*[1], L. Lecavalier[2], S. Yu[3], L. E. Arnold[2], B. L. Handen[4], C. McDougle[5], L. Scahill[6], C. Johnson[7] and M. G. Aman[2], (1)*Nisonger Center*, (2)*Ohio State University*, (3)*Yale University*, (4)*University of Pittsburgh School of Medicine*, (5)*Indiana University School of Medicine*, (6)*Yale University School of Medicine*, (7)*University of Pittsburgh Medical Center*

Background: The Research Units on Pediatric Psychopharmacology--Autism Unit (RUPP) reported the results of a 24-week trial of combined treatment with risperidone/aripiprazole and parent training versus antipsychotic alone in children with autism spectrum disorders (ASD) and serious behavioral disturbances (Aman et al., 2009). The impact of medication only (MED) on the primary outcome measure was *d*=2.3, with an additional effect of 0.34 from parent training (COMB). Additionally, parent training was associated with lower doses of antipsychotic.

Objectives: The goal of this analysis was to evaluate potential predictors and moderators of the effect of parent training in this study. Predictors and moderators are important tools for uncovering masked treatment effects and maximizing power in future trials, and may be used clinically to help match patients to treatments. Twenty-two baseline variables, including demographics, were evaluated.

Methods: Participants were 124 children aged 4-14 years (*M* = 7.4 years) with ASDs and parent-rated Aberrant Behavior Checklist (ABC) Irritability scores of at least 18. Seventy-five children were assigned to the COMB condition and 49 to MED alone. In addition to the effect found on the on the Home Situations Questionnaire (HSQ), RUPP found an effect of COMB on ABC Hyperactivity/Noncompliance, so it was adopted as an additional outcome measure in the current study. The original ITT model was re-run with the putative predictors and moderators inserted. A random-effects regression model with fixed effects for treatment, time, site and their interactions was employed. Predictor and moderator variables were defined as follows: (a) the variable must temporally proceed the treatment, (b) the variable must be reasonably independent from the treatment, and (c) a significant main effect (predictor) or interaction with treatment (moderator) must be observed.

Results: One variable was found to predict outcome on the HSQ: higher baseline values on the HSQ predicted greater improvement, regardless of treatment assignment [$F(1,548) = 7.23$), $p = 0.007$]. No significant predictors of ABC Hyperactivity/Noncompliance outcome were observed. No variables significantly moderated the impact of COMB on either the HSQ or ABC Hyperactivity/Noncompliance.

Conclusions: The finding that baseline levels on the HSQ predicts outcome mimics a result from a trial of risperidone versus placebo in children with ASDs. Together, these findings suggest that treatment with antipsychotic brings patients to approximately the same target symptom level, regardless of initial severity. The lack of significant moderators may be encouraging; this suggests that COMB is appropriate for a wide range of children with ASDs. However, it is possible that this study was not adequately powered to explore moderators. The search for predictors and moderators of treatment remains an important part of clinical treatment trials.

Aman, M., McDougle, C., Scahill, L., Handen, B., Arnold, L.E. et al. (2009). Medication and parent training in children with pervasive developmental disorders and serious behavior problems: Results from a randomized clinical trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 48,* 1143-1154.

105.129 129 Use of Complementary and Alternative Medicine In Children with Autism and Other Developmental Disabilities: Associations with Ethnicity, Child Co-Morbid Symptoms and Parental Stress. M. D. Valicenti-McDermott*, L. Bernstein, B. Burrows, 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 Autism Spectrum Disorder (ASD) frequently engage in the use of complementary and alternative Medicine (CAM). Little information is available about frequency/types of CAM used in an inner city, ethnically diverse population and associations with specific child co-morbid symptoms or parental stress.

Objectives: To examine the use of CAM therapy in families of children with ASD, compared to families of children with other developmental disabilities (DD) and to assess the relationship of CAM with gastrointestinal (GI), sleeping and behavioral problems and parent stress.

Methods: Cross sectional study with structured interview in 50 children with ASD and 50 children with DD, matched by age/gender. Interview included: CAM questionnaire, GI Questionnaire, Child's Sleep Habits Questionnaire, Aberrant Behavior Checklist and Parenting Stress Index. Statistical analysis included chi-square, t test, correlations and Logistic Regression.

Results: Mean age 8 3yr, 15% White, 44% Hispanic and 24% AfricanAmerican. CAM use was reported in 67% of the ASD group and 22% of the DD ($p<0.001$). Children with ASD presented more co-morbidities such as GI (66% vs. 40% $p=0.04$), sleeping (78% vs.33% $p<0.001$)and behavioral problems (78% vs.33% $p<0.001$) and their parents reported greater stress (45% vs.22% $p=0.003$). Mothers born in the US were more likely to use CAM (65% vs.40% $p=0.002$) and Latino mothers were more likely to use fewer types of CAM (0.4 0.6 vs.1 1.8 $p=0.01$). In the ASD group CAM use was related to child's irritability ($r=0.4$ $p=0.002$), food allergies (24% vs.0% $p=0.01$), use of laxatives ($r=0.4$ $p=0.003$) and parental stress ($r=0.2$ $p=0.04$). In the DD group CAM use was not associated with child specific problems or parental stress. CAM use was not related to sleep problems or maternal age. The association between CAM use and ASD diagnosis persisted after adjusting for demographics, child-comorbidities and parental stress (OR 4.7 95%CI 1.3-18.2).

Conclusions: **:** Families of children with ASD were more likely to use CAM than families of children with other DD and the use was related to child behavioral problems, food allergies, use of laxatives and parental stress. Mothers born in the US were more likely to use CAM and Latino families used fewer types of CAM therapies.

105.130 130 The Development of a Coding System for Social-Communication Behaviors for the ADOS. J. Dykstra*, L. Christian, S. Pearson, J. Kinard, L. R. Watson and B. Boyd, *University of North Carolina at Chapel Hill*

Background: Social-communication behaviors are viewed as pivotal skills and are common targets for intervention in young children with an autism spectrum disorder (ASD). In order to examine the impact of these interventions, it is essential to have measurement tools to assess change in social-communication skills. Indeed, researchers have highlighted the importance of using measurement tools that correspond to the targets of a given intervention (Kasari, 2002). The Autism Diagnostic Observation Schedule (ADOS) is a tool that is used for diagnostic purposes, but has also been utilized to measure change for descriptive and intervention studies. Modules 1 and 2 of the ADOS offer opportunities for elicited and spontaneous social-communication through a variety of semi-structured tasks in naturalistic and play-based settings.

Objectives: The goal of this research was to develop a reliable and valid coding system to utilize with repeated administrations of the ADOS to assess social-communication behaviors in preschool children with ASD. The coding scheme focused on three broad categories of social communication: social interaction (SI), requests (RQ), and joint attention (JA).

Methods: The development team used the social-communication hierarchy from the Advancing Social-Communication and Play intervention (ASAP; Watson, Boyd, et al., 2009) as a starting point for selecting target behaviors. Using previous literature, existing social-communication measures, and research and clinical experience, initial coding definitions were created. The team viewed ADOS videos from previous phases of the intervention. Following these reviews and team discussions, examples, non-examples, and decision rules were added to the coding manual. Next, the team individually viewed additional ADOS videos and coded social-communication behaviors. The coding manual was revised to maximize reliability. Finally, a weighting system was devised using literature on the development of social-communication behaviors. Thus far, ADOS videos from twenty-eight of thirty-two subjects have been coded at pre- and post-test. The following data are based on the ADOS videos

Results: The final coding system includes three sub-scales of social-communication categories (SI, RQ, and JA), with four to six behaviors within each category, for a total of 15 targeted social-communication behaviors. Inter-rater reliability was examined on 20% of the videos using intra-class correlations (ICCs) for the total and sub-scale scores. The ICC was .946 for overall score, and ranged from .765 to .938 on the sub-scales. Pre- and post-test total scores were significantly correlated (r=.77) and the scores also showed consistent positive change from pre- to post-test across participants, suggesting the coding system is capturing a stable construct yet is sensitive to change. Additionally, the researchers explored concurrent validity of the coding system. The total scores for the ADOS social-communication coding system were significantly correlated with the age equivalents from the Mullen Expressive Language subscale (r=.557).

Conclusions: The coding system developed for use with Module 1 and 2 ADOS assessments is a reliable method for measuring social-communication behaviors of preschool children with ASD. Advantages and challenges of the specific coding system and use of video-taped ADOS assessments will

be discussed. Also, the researchers will share practical tips for application in an intervention study.

105.131 131 How Much Change In Imitation Aptitude Is True Change?. M. Vanvuchelen*, *Katholieke Universiteit Leuven - PHL-University College, Belgium*

Background:
The teaching of imitation skills is often the first step in interventions for young learners with intellectual disabilities and autism spectrum disorders. Although the existing literature on effects of imitation teaching provides evidence that this kind of early intervention strategy improves the prognosis of the children, research findings are based on methodologically weak studies, including the absence of a systematic imitation assessment.

Preschool Imitation and Praxis Scale (PIPS):
The Preschool Imitation and Praxis Scale (PIPS) is a reliable and valid measure to identify preschoolers with imitation problems (Vanvuchelen, Roeyers, & De Weerdt, 2010; Vanvuchelen, Roeyers, & De Weerdt, 2011). However knowing that the PIPS has achieved a certain level of psychometric adequacy to identify preschoolers with imitation problems says nothing about its sensitivity to treatment-related changes in child functioning. To be clinically meaningful the PIPS must be reliable enough to evaluate outcomes of a therapeutic intervention, such as teaching imitation skills. To determine if the imitation aptitude has changed, an examiner must know what part of the difference between children's measurements is attributable to real change, and what part is due to measurement error.

Objectives:
The aim of this study was to determine the smallest detectable difference at 95% confidence of the PIPS in preschoolers with intellectual disabilities of heterogeneous aetiology, including children with low-functioning autism.

Methods:
Two raters independently scored videotapes of the imitation performance on the PIPS of 44 preschoolers (7 with Low-functioning Autism, 10 with Non-Specific Mental Retardation and 27 with Down syndrome) between 13 and 58 months of age (mean age 39.6 months, SD 11.9 months). The children with Low-functioning Autism were diagnosed according to a multidisciplinary clinical consensus classification in addition to a positive ADOS-G-classification.

Results:
Results revealed that the PIPS demonstrated acceptable interrater reliability on item level (weighted kappa values ranged from .52 to 0.96) and scale level (ICC= 0.986; 95% CI: 0.975-0.993). The smallest detectable difference of the PIPS was 7.2%, indicating that the change score rated by different raters for an individual child with an intellectual disability is valid.

Conclusions:
The Preschool Imitation and Praxis Scale (PIPS) can be used by early interventionists and researchers as an outcome measure to determine children's maturation or improvement. For further research we suggest the investigation of the utility of the PIPS in a randomised controlled trial to evaluate the effectiveness of different intervention programs for improving the imitation skills of young learners with imitation problems.

References:
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105.132 132 A Descriptive Analyis of Elementary SCHOOL Students' Conceptions of AUTISM. J. Campbell*[1], N. R. Silton[2] and K. Roulston[1], (1)*University of Georgia*, (2)*Marymount Manhattan College*

Background: Within public schools, roughly 30-40% of students with autism spectrum disorders (ASD) are educated alongside typically developing peers (Sanford, Levine, & Blackorby, 2008). Inclusion is thought to yield social benefits by (a) reducing stigma (b) fostering social learning of appropriate behavior (c) inspiring social acceptance and (d) improving social status of students with ASD (Frederickson, 2010). Successful inclusion strategies are especially important since students with ASD experience less social acceptance, social reciprocity and peer companionship than their peers (Chamberlain et al., 2007).

Objectives: In order facilitate acceptance and enhance peer education, it is important to identify what typical children know, think and believe about autism. Prior studies indicate that elementary students have little knowledge of autism. For example, Magiati et al. (2002) reported that no children had heard of the word autism. Middle school students report greater awareness (Campbell & Barger, 2009); however, many lack knowledge about its symptoms, chronicity, and lack of

communicability. In the present investigation, we aim to update knowledge about elementary school students' conceptions of autism using a recently developing coding scheme. Overall, we aim to provide a more detailed understanding of elementary school students' conceptions of autism in order to identify curricular targets for peer education interventions.

Methods: Participants were 158 students (82 boys, and 75 girls), ages 9 to 12 from Baltimore, MD (*n* = 88), Syracuse, NY (*n* = 28) and two schools in Albany, NY (*n* = 31 and *n* = 11). Investigators asked students if they had prior contact with an individual with autism and provide a written definition of autism. Definitions were coded for accuracy and content with Campbell et al.'s (2010) *"What is Autism?" Coding manual*.

Results: Over three-quarters (77.22%, *n* = 122) of the participants endorsed prior contact with an individual with autism. Girls (51.7%; *n* = 62) were more likely to report prior contact than boys (48.3%; *n* = 58). The majority of students with previous exposure to autism were 10 (33.9%; *n* = 41) or 11 (37.2%; *n* = 45) compared to 9 (13.2%; *n* = 16) and 12 (15.7%; *n* = 19) year olds. Accuracy and content coding proved to be reliable with κ = .706 - 1.0; we found poor inter-rater agreement for discrimination between content describing associated symptoms and attributions of characteristics. After combining codes, agreement was acceptable (κ = .840). We calculated frequency counts for accuracy of responses and content in various areas, such as report of core symptoms and etiology. Most (70.7%) responses were judged to be accurate and a majority of respondents (53.5%) reported that autism was a disability; however, few identified social difficulties as characteristic of autism (22.22%).

Conclusions: Elementary school students report greater awareness of autism than in prior studies (e.g., 77% versus 0%) and many understand that autism is a disability; however, students reported little understanding about social, communicative, and behavioral difficulties characteristics of students with autism. Peer education efforts should target improving students' basic understanding of autism to facilitate greater awareness and acceptance.

105.133 133 Temperament Intervention for Problem Behavior In Children with Autism Spectrum Disorders. L. Adamek*[1], S. Nichols[2] and S. Tetenbaum[3], (1)*Stony Brook University*, (2)*ASPIRE Center for Learning and Development*, (3)*ASPIRE center for learning and development*

Background: Environmental modification is a common intervention for problem behavior in children with autism spectrum disorders (ASDs), however, temperament is rarely considered when implementing this treatment strategy. Within the child development field, a child's temperament profile is used to redesign the environment to produce a better match with his or her individual characteristics. Children with ASDs who are highly surgent (e.g., active and impulsive) are more likely to engage in problem behavior (Adamek, et al., 2010), and may benefit from temperament based-intervention strategies.

Objectives: The aim of the current study was to evaluate the effectiveness of temperament-based intervention for highly surgent children with ASDs in reducing problem behavior and improving family quality of life.

Methods: Six children ages 3-7, with a diagnosis of ASD, a history of problem behavior and a highly surgent temperament style were included in the study. A multiple baseline design was used and each participant engaged in 3-5 sessions of baseline assessment, 4-6 sessions of intervention implementation, and 12 sessions of post-intervention assessment. Interventions included (1) educating parents about temperament, (2) identifying the child's temperament profile, and (3) modifying problematic contexts (e.g., dinnertime, grocery store) to make them a better fit for the child's temperament. Latency to problem behavior and percentage of task components completed were recorded during each session. Pre and post intervention measures included parent-reported frequency and intensity of context-specific problem behavior, global problem behavior, parenting stress, parental locus of control, and disruption of home situations.

Results: All six children who participated showed substantial improvement in latency to problem behavior and task completion within contexts identified by their parents as most problematic. There was evidence of lower frequency of contextual problem behavior, t (5) = 8.00, $p < .01$, d = 3.13, lower intensity of contextual problem behavior, t (5) = 10.95, $p < .01$, d = 5.79, and a significant difference in global problem behavior, t (5) = 9.91, $p < .01$, d = 2.14. Parenting stress, parental locus of control, and disruption of home situations all improved from pre to post-intervention; however, the results were not statistically significant due to the small sample size.

Conclusions: Findings demonstrate that environmental modification strategies that include temperament may reduce problem behavior in children with ASDs. Limitations and recommendations for future research that includes a larger sample and incorporates temperament assessment and

goodness-of-fit strategies into comprehensive behavioral interventions for children with ASDs are discussed.

105.134 134 Intervention-related Changes in Brain Activation in Adolescents with Autism. S. E. Christ*[1], J. P. Stichter[1], A. J. Moffitt[1], K. E. Bodner[2] and K. V. O'Connor[1], (1)*University of Missouri*, (2)*University of Missouri, Columbia*

Background:

Social skill deficits, including difficulties with social relationships and interactions, manifest in individuals with Autism Spectrum Disorders (ASD) as key signifiers of the disorder, with varying degrees of severity across the spectrum. From a theoretical standpoint, researchers have hypothesized that deficits in executive function (i.e., those higher-order cognitive processes that allow for the flexible modification of thought and behavior in response to changing cognitive or environmental contexts) may contribute to such social difficulties. If this is true, then it follows that changes in executive function and its neural substrates could accompany intervention-related improvements in social skills.

Objectives:

To utilize functional magnetic resonance imaging (MRI) technology to evaluate the impact of social skills intervention on brain activation and performance on a socially-relevant executive function task.

Methods:

Brain imaging data is being collected from adolescents (current n = 6, mean age = 13.7 yrs) immediately before participating in a short-term social skills intervention program and then again shortly after completion of the intervention. The intervention of interest is the Social Competence Intervention (SCI) program (Stichter et al., 2010, in press). The SCI program is based on cognitive behavioral principles and has been shown to be effective at improving social skills in adolescents with high functioning autism and Aspergers syndrome. It is delivered over the course of 10-12 weeks (45-60 minutes twice per week; total = 20 hours of intervention). Functional MRI techniques (Siemens 3T Trio Scanner) are being used to assess neural activity during performance of an n-back working memory task using novel face stimuli. In the 2-back “working memory” condition of the task, participants are shown a series of faces one at a time and are instructed to respond when the current face is the same as the face that appeared two stimuli before (i.e., 2-back condition).

Results:

Preliminary analysis revealed intervention-related changes in neural activation in a number of working memory-related brain regions including right inferior frontal gyrus, left hippocampal gyrus, and left intraparietal sulcus ($p < .01$ FDR corrected in all instances). Additional data collection remains ongoing.

Conclusions:

The present findings provide preliminary support for the hypothesis that participation in the social skills intervention program is accompanied by changes in underlying neurocognitive processes such as executive control. Additional research with a larger sample size and inclusion of a non-intervention comparison group is still needed.

Treatments Program
105 Interventions II: Social Skills Interventions.

105.046 46 Teacher-implemented joint attention intervention: Pilot randomized controlled study for preschoolers with autism. K. Lawton* and C. Kasari, *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. Currently, most preschool practices are not evidence-based and almost none target the core deficits of ASD. Joint attention is a core deficit of autism spectrum disorders that has been linked to the emergence of several critical skills in children who are typically developing or who have an autism spectrum disorder. Several studies suggest it is possible to improve the joint attention of children with autism. Unfortunately, at this time, few intervention studies exist for improving the joint attention skills of children with autism in the preschool context where they spend the most time and none are implemented by preschool teachers during naturally occurring preschool activities.

Objectives: This study investigated whether preschool teachers could reach fidelity on a validated intervention (the Joint Attention and Symbolic Play/Engagement and Regulation intervention-JASP/ER) that targeted the instruction of joint attention to preschoolers with autism during ongoing classroom activities. In addition, the study focused on which of the 11 specific JASP/ER strategies teachers/paraprofessionals reached fidelity with.

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. JASP/ER teachers/paraprofessionals reached fidelity with six JASP/ER strategies.

Conclusions: Findings suggest that teachers/paraprofessionals could implement a validated treatment in a public preschool context.

105.047 47 A Family Focused Group Cognitive Behavior Therapy for Adolescents with High-Functioning Autism Spectrum Disorders and Anxiety: A Pilot Study. J. Reaven*[1], A. Blakeley-Smith[2], E. Leuthe[3] and S. Hepburn[4], (1)*Univ. of Colorado Denver-JFK Partners*, (2)*Univ. of Colo. Denver-JFK Partners*, (3)*JFK Partners – University of Colorado Denver*, (4)*University of Colorado Denver, Anscutz Medical Campus*

Background: Anxiety disorders are among the most common mental health conditions in childhood. Children and adolescents with high-functioning autism spectrum disorders (ASD) are at high risk for developing clinically significant anxiety symptoms (Brereton et al. 2006; White et al. 2009). Cognitive behavior therapy (CBT) has been identified as the treatment of choice in addressing anxiety symptoms in the general population, and an emerging body of literature indicates that modified CBT for youth with ASD can be effective in reducing anxiety symptoms (Reaven et al. 2009; Wood et al., 2009). However, very few treatment studies published to date have specifically targeted adolescents with ASD. Thus, the feasibility, acceptability and potential efficacy of modified, family-focused, group CBT approaches with teens needs to be empirically examined.

Objectives: (1) To expand the Facing Your Fears (FYF) program (Reaven et al., in press), a group CBT program for school-aged children with ASD and anxiety to adolescents with ASD (ages 13-18) and co-occurring anxiety disorders, and (2) to assess the feasibility and acceptability of the intervention for this age group, and (3) to conduct a pilot treatment study, using an A-B design to examine the potential impact of the FYF intervention on the severity of anxiety symptoms.

Methods: Twenty-four teens, ages 13-18 (and their parents) participated in the study and met strict diagnostic criteria for Autism or Asperger Syndrome and were reported by their parents and/or by self-report to be presenting with clinically significant anxiety symptoms. After completing the pre-treatment assessment battery, which included the Screening for Childhood Anxiety and Related Disorders (SCARED, Birmaher et al. 1999), the Anxiety Disorders Interview Schedule – Parent versions (ADIS-P; Silverman & Albano, 1996), and the Developmental Behavior Checklist (DBC; Einfeld & Tonge, 1994), teens and their parents participated in the 14 week group treatment. The adolescent version of FYF is different from the child version in that it includes a social skills module, emphasizes teen group cohesion, and uses technology (i.e. PDA/iPod Touch) to record anxiety symptoms and document exposure practice

Results: Teen participants presented with multiple psychiatric diagnoses in addition to ASD (range = 2-11). Participation in the group sessions exceeded 90% and attrition was very low. Parent and youth acceptability data will be also be presented. Preliminary findings on pre-post treatment analyses revealed significant reductions in anxiety symptoms as reported by the parents ($t=2.875$, $p = .009$) and youth ($t=3.896$, $p=.001$) on the SCARED. Based on the Clinical Global Impressions Scale – Improvement (CGIS-I) derived from the ADIS-P, mean ratings of improvement were 2.80 (much improved). In addition, paired t-tests revealed significant reductions after treatment in Total Problem Behavior Scores from the DBC ($t=4.818$, $p=.0001$).

Conclusions: Implementation of the FYF treatment package with psychiatrically complex teens with ASD was found to be feasible and potentially therapeutic. Pilot results suggest possible decreases in anxiety severity and problem behaviors; however, the A-B design limits the interpretability of the findings. Our next step is to conduct a randomized controlled trial of the intervention.

105.048 48 CBT for Anxiety Disorders In Children with An Autism Spectrum Disorder. F. J. van Steensel* and S. M. Bögels, *University of Amsterdam*

Background: Children with autism spectrum disorder (ASD) often suffer from co-morbid disorders such as anxiety disorders, depression or behavior problems. Prevalence rates of anxiety disorders in children with ASD range from 17 to 84 percent. Anxiety disorders in ASD, however, can be misdiagnosed easily due to the considerable overlap in symptoms between anxiety and ASD, and because separating the two disorders can be very hard. Nonetheless, anxiety disorders seem to contribute to children's functional impairment over and above the functional deficits of ASD. Cognitive behavioral therapy (CBT) has proven effective in children with anxiety disorders, however, only a few studies examined CBT for anxiety disorders in children with ASD.

Objectives: The current study has two main aims: (1) to explore if anxiety disorders in children with ASD are different compared to anxiety-disordered children, and (2) to examine the effect of CBT for the treatment of anxiety disorders in children with ASD.

Methods: Children of 8-18 years (N is about 120) with anxiety disorders, with and without ASD, and their parents were asked to participate in the study. The children were referred to a mental health centre because of anxiety or ASD problems. Children were treated for their anxiety disorders with a short, standard individual CBT program. The CBT program involved 12 sessions with the child and three sessions with the parents in a time period of approximately three months. Children's anxiety disorders, anxiety symptoms, autism spectrum symptoms, other child psychopathology, parental rearing behavior, and quality of life were measured using clinical interviews (ADIS-C/P) and questionnaires (e.g. SCARED). Pre- and post measurements were conducted, and a follow-up assessment three months after treatment took place.

Results: Anxiety disorders in children with ASD were highly similar to anxiety-disordered children, although specific phobias were more common in children with ASD compared to anxiety-disordered children. The mean number of anxiety disorders in children with ASD was significantly higher compared to the anxiety-disordered children based on parent reports, but not according to child reports. The effect of CBT was examined with repeated measures MANOVA's. A significant time effect was found for anxiety severity (ADIS) and anxiety symptoms (e.g. SCARED), however no significant interaction effects were found. Additional effects were found for quality of life, ASD symptoms and parental rearing behavior.

Conclusions: Children with ASD have anxiety disorders highly similar to anxiety-disordered children. Compared to anxiety-disordered children, CBT was found equally effective for anxiety disorders in children with ASD. Furthermore, CBT has several additional effects such as the improvement of quality of life, a decrease in ASD symptoms and a change in parental rearing behavior. Adaptations to the CBT program for the special needs of children with ASD will be discussed.

105.049 49 Can CBT Improve Core Deficits Among Adolescents and Young Adults with Anxiety Disorders and ASD?. A. M. Rowley*[1], G. R. Simpson[2], E. A. Laugeson[3], J. J. Wood[4] and J. Ehrenreich-May[2], (1), (2)*University of Miami*, (3)*UCLA Semel Institute for Neuroscience & Human Behavior*, (4)*University of California, Los Angeles*

Background:

Anxiety-related concerns are common among high-functioning youth with an autism spectrum disorder (ASD); some studies suggest a comorbidity rate as high as 42 to 84 %. Given the potential distress experienced by adolescents with these comorbid conditions, it may be beneficial to examine treatments targeting anxiety symptoms and their utility in treating individuals with ASD. Research has established the preliminary efficacy of cognitive-behavioral treatments (CBT) for concurrent anxiety and ASD in younger children; but adolescents and young adults, who have a higher rate of anxiety disorders, have been under represented or ignored in this research thus far. Additionally, it is unclear to what degree CBT treatments may improve core deficits associated with ASD.

Objectives:

The present multiple-baseline design study explored the feasibility of a modified version of an evidence-based, cognitive behavioral treatment (BIACA; Wood & Drahota, 2006), adapted for adolescents and young adults with anxiety disorders and ASD. It was expected that there would be some reductions in autism related symptoms as measured by the SRS (Constantino & Gruber, 2005) and current symptoms on the SCQ (Rutter et al., 2003), though not as substantial as anxiety-related improvements. The SRS is quantitative and measures autistic traits in 4-18 year-olds. Questions focus on behaviors occurring over the past six months. The SCQ is a parent measure focusing on autism-like behaviors at the age of 4-5 and currently.

Methods:

The 16-session treatment protocol utilized in this investigation includes source material from BIACA, the Unified Protocol for the Treatment of Emotional Disorders in Youth (UP-Y; Ehrenreich et al., 2008) and the Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2006) manuals. After an initial diagnostic interview, and before beginning treatment, six adolescents and young adults (aged 14-21) were assigned to one of three baselines (i.e., 4-, 8-, or 12-week). The SRS and SCQ were completed at pre-baseline, post-baseline, post-treatment, and one month follow-up, along with a battery of anxiety related questionnaires.

Results:

Prior presentations have detailed positive changes in anxiety symptoms and social responsiveness following treatment for

these participants (Rowley et al., 2010; Simpson et al., 2010). For the present study, SCQ total scores were observed to decrease from pre-baseline levels to post-treatment for five of the six participants using visual inspection techniques. SRS total scores decreased from intake to post-treatment for three of the six participants and maintained for one. At the time of presentation, reliable change index (RCI) scores for SRS and SCQ scores will also be discussed.

Conclusions:

Initial findings suggest CBT treatments for anxiety in adolescents and young adults with ASD may also improve core deficits associated with this comorbidity among some participants. Limitations of these results, including potential response biases among parents of participants and difficulty discriminating between improvements in anxiety versus ASD will also be detailed.

105.050 50 Cognitive Behavior Therapy for Irritability In High-Functioning ASD: Pilot Study of Neurobiological Mechanisms. D. G. Sukhodolsky*[1], D. Z. Bolling[2], J. Wu[3], M. J. Crowley[3], J. McPartland[3], L. Scahill[4] and K. A. Pelphrey[2], (1), (2)*Yale University*, (3)*Yale Child Study Center*, (4)*Yale University School of Medicine*

Background: In addition to the core symptoms, up to 50 percent of children with ASD exhibit irritability and disruptive behavior problems. If present in childhood, these problems may persist in adolescence and adulthood and place considerable strain on individuals and their families. Psychotropic medication, notably risperidone and aripiprazole, and psychosocial treatments based on applied behavioral analysis have been used for irritability in ASD. There is also emerging evidence that Cognitive Behavioral Therapy (CBT) can be helpful for irritability in children with high-functioning ASD (Sofronoff et al., 2007). CBT teaches children to recognize antecedents and consequences of problem behavior and to use emotion regulation and problem-solving skills to reduce irritability, aggression and noncompliance.

Objectives: We investigated the neurobiological mechanisms of CBT by evaluating functional magnetic resonance imaging (fMRI) and electrophysiological (EEG) markers of socioemotional functioning before and after treatment in a 16-year old girl with Asperger Syndrome.

Methods: CBT was adapted from our work in typically developing children (Sukhodolsky et al., 2005, 2009) and consisted of 10 weekly sessions. The ABC irritability subscale (Aman et al., 1985) was completed by the subject's mother before and after treatment. fMRI and EEG data were collected while the subject performed the frustration-induction Go-NoGo task before and after treatment. The frustration-induction Go-NoGo task represents a mixed blocked/event-related design for fMRI and EEG studies. The subject was asked to view a steady stream of objects and press the button in response to pre-determined experimental conditions. The opportunity to win a prize was manipulated across three conditions with known frustration-induction effects (Perlman and Pelphrey, 2010). We examined changes form pre- to post-treatment in 1) the fMRI blood oxygenation level dependent signal (BOLD) and 2) the amplitude of the Go versus NoGo N2 event related potentials (ERPs) between the neutral versus frustration conditions of the Go-NoGo task.

Results: Parent ratings revealed a decrease in the ABC irritability score from 17 at baseline to 5 at endpoint. The fMRI regions of interest analysis revealed significantly increased activation from pre- to post-treatment in the subgenual anterior cingulate cortex, right ventrolateral prefrontal cortex, and left ventrolateral prefrontal cortex in frustration vs. neutral conditions. The analysis of electrophysiological data revealed a reduction in the difference between NoGo and Go N2 ERPs at post-treatment versus pre-treatment in the frustration condition.

Conclusions: The 12-point change in the ABC irritability score represents a meaningful decline in irritability which is similar to the mean improvement in the medication trials. The fMRI results suggest that brain regions which are recruited in a cognitive task requiring emotion regulation following a period of frustration were hypoactive in the subject before treatment but showed increased activation following treatment with CBT for irritability. The result of the ERP analysis suggests more efficient cognitive control of frustration when performing a response inhibition task after CBT. Thus, reduction of irritability was paralleled by changes in the neural circuitry of emotion regulation. This pilot study supports the feasibility of using fMRI and EEG technology to investigate neurobiological mechanisms of CBT in adolescents with high-functioning ASD.

105.051 51 Cognitive Behaviour Drama: A New Intervention Model Designed to Improve Social Functionning In Children with Asperger Syndrome. H. Karnezi* and K. Tierney, *Trinity College Dublin*

Background:

Children on the autism spectrum lack the intrinsic motivation to engage in the social world early in development, missing out on learning opportunities available to their typically developing peers who become increasingly knowledgeable about

interpersonal relationships as they get older and obtain more experiences. As a result, they struggle with social relationships finding it hard to make sense of the rules of social interaction that others take for granted.

Objectives:

The current study aims to introduce and evaluate a new unobtrusive and enjoyable intervention model primarily designed to provide children on the autism spectrum with the motivation to engage in the social world so that they can avail from learning opportunities in their environment. The model is based on a problem solving methodology, using the art-form of drama as a pretext to motivate participants to engage in target behaviours, as opposed to instructing them to do so. The method involves using the participants' strengths and special interests in devising fictional scenarios and posing problems that they would feel compelled to solve. Once the participants' motivation in solving these problems is established the target behaviours are introduced in the form of elements indispensable for their resolution.

Methods:

Eight children aged between 6 to 13 years, diagnosed with Asperger participated in the study. The study involved two separate interventions and employed both single case and group designs.The participants attended weekly one hour group sessions over a period of 12 weeks. Outcomes were evaluated using pre and post intervention measures. These included: first and second order theory of mind tests, executive functioning tests, standardised social responsiveness questionnaires for parents and teachers, direct in session behavioural observations, parental reports.

Results:

Collectively, the results indicated positive changes in the self esteem and social functioning of all eight participants. In particular improvements in the ability to solve theory of mind tasks were noted in the younger group; and qualitative improvements in social communication, in terms of verbal (content) and non verbal expression (body posture, vocal expression, fluency, eye contact, reduction of ritualistic mannerisms) were noted in the older group,. Reliable changes in the standardized measures of social competence were not observed.

Conclusions:

The findings from the applications of the CBD model on a number of problems associated with Asperger syndrome suggested its potential in bringing about positive changes in all participants behaviour and self esteem. However, there are a number of limitations in the current study, such as the small size of the sample, the lack of control groups and inadequacy of impact measures that need to be addressed in future research in order to establish the methodological validity of the CBD model as evidence based practise.

105.052 52 Cognitive Behaviour Drama: A Novel Intervention Model Designed to Address Fears In Children with Asperger Syndrome. K. Tierney* and H. Karnezi, *Trinity College Dublin*

Background:

Childhood fears that persist over time and interfere with the children's normal functioning may have detrimental effects on their social and emotional development (Strauss, Frame & Forehand,1987). It has been well documented in the literature that children with autism suffer from intense fears more than their typically developing peers (Matson & Love, 1990). Yet, research on the treatment of fears in this population is scarce.

Objectives:

The purpose this study was to implement and evaluate a new intervention model specifically designed to address the issue of phobias in high functioning children with autism. Taking into consideration that most children with phobias have no desire to overcome their fears, and that oppositional behaviour is the greatest obstacle encountered in therapy; providing the participants with the motivation to wish to confront their fears was the prime objective of the proposed methodology.

Methods:

The method involved leading the participants through a series of belief building tasks to invest in the fictional context, so that when the fictional problem was introduced they would feel compelled to solve it. Once motivation was established, the feared stimuli were introduced symbolically as one more challenge amongst many others that the participants had to surmount to get to their fictional objectives. The study examined the application of the model in three single cases. Two high functioning children with autism participated in the study: an 11-year old boy who had a fear of hand-driers, and a fear of being touched; and a 7-year-old boy with a fear of hair-dressers. The sessions were one hour long and ran on a weekly basis until the treatment objectives were achieved. Measures included in session observation of the participants'

behaviour and parental reports of their behaviour prior to, during and following the interventions.

Results:

Treatment objectives were met within five to nine weeks. Results from all three interventions suggested that the model was successful in producing the complete elimination of fear related behaviour, generalisation of the adaptive behaviour outside the therapeutic setting and maintenance of the behaviour in a 3 year follow up period.

Conclusions:

Despite the methodological limitations of this study such as lack of control groups and small size of sample, there are two aspects of the results that justify further evaluation of this method in dealing with childhood fears. First, lifelong fears that had shown no indication of spontaneous remission receded in the course of a short term intervention. Second the changes observed in the participants behaviour mapped onto the changing demands placed on them through-out the programme, indicating a causal relationship between the children's increased tolerance towards the fear stimuli and the set tasks. Importantly, the validity of the model primarily lies in: its potential to reach younger children who may not benefit from traditional CBT, the inherently enjoyable and unobtrusive nature of the dramatic activities, the time efficiency and durability of outcomes.

105.053 53 Cognitive Orientation for Daily Occupational Performance (CO-OP) with Children with Asperger Syndrome: Enabling Achievement of Social and Organisational Goals. S. Rodger*,

Background:

Children and young people with Asperger Syndrome (AS) are frequently challenged by motor, social and organisational difficulties that impact on their performance in life roles (such as player, school student, self carer) and hence their participation in important life contexts and situations. Cognitive Orientation for daily Occupational Performance (CO-OP), an intervention developed and researched by occupational therapists will be described. CO-OP is effective in assisting children with motor issues achieve their occupational goals including children with Asperger Syndrome (Rodger & Brandenburg, 2009; Rodger, Pham & Mitchell, 2008).

Objectives:

The key features of CO-OP will be outlined (global problem solving framework, domain specific strategies [DSSs], and guided discovery) using case examples of this intervention with children with AS who have social and organisational goals.

Methods:

Detailed case study methodology was utilised to investigate the use of CO-OP with children with AS. This paper specifically focuses on goals associated with self management, organisation and managing school and playground social situations (Rodger et al., 2007, 2008a, Rodger & Vishram, 2010). Two children with pseudonyms Charlie and Thomas with AS aged 10 and 12 years diagnosed by paediatricians according DSM IV TR and with Asperger's Disorder Quotient greater than 80 on the Gilliam Asperger's Disorder Scale (GADS) (Gilliam 2001), participated in 10 sessions of CO-OP intervention. The Canadian Occupational Performance Measure and the Social Skills Rating Scale were used to determine goal achievement pre-intervention and post-intervention. Two randomly chosen 5 minute segments from each of the 10 sessions were coded by dividing these into 15-s intervals. At the end of each 15-s interval, the coder recorded the occurrence of the Global and Domain Specific Strategies used.

Results:

For Charlie, the COPM showed a clinically significant increase in performance and satisfaction scores across all goals. With respect to the SSRS, according to his teacher, Charlie's social skills remained the same post-intervention. His mother's social skills rating indicated an improvement from 'fewer than expected' to 'average social skills'. Charlie's self-report indicated an improvement in social skills post-intervention. According to the COPM, Thomas's performance in three out of his five goals (managing anger, getting to sleep and making his bed) improved post-intervention. Thomas's teacher's pre-intervention and post-intervention rating scores on the SSRS remained the same post-intervention. Thomas's mother's post-intervention SSRS scores showed that she perceived that Thomas's social skills improved; however, his score remained in the range of having fewer social skills than children his age. Thomas consistently rated himself higher than his teacher and mother.

Coding of the videotaped CO-OP sessions suggested that both children utilized all the Global strategies, particularly "understanding the context" and "plan, and used six common DSS, namely transitional supports, affective supports, attending, task-specification, task modification, and

supplementing task knowledge, with task-specification being most prominent.

Conclusions:

Both boys improved in social and organisational skills. Modifications to CO-OP for children with AS, study limitations and recommendations for future research are discussed.

105.054 54 Delivering Psychosocial Interventions Through Videoconferencing: Pilot Efforts to Reach Rural Families. S. Hepburn*[1], J. Reaven[2], A. Blakeley-Smith[3], B. Wolff[4] and K. Kaiser[5], (1)*University of Colorado / JFK Partners*, (2)*Univ. of Colorado Denver-JFK Partners*, (3)*Univ. of Colo. Denver-JFK Partners*, (4)*University of Colorado Denver School of Medicine*, (5)*JFK Partners/University of Colorado*

Background: Families who live in rural areas face significant obstacles in accessing skilled mental health care (Office for the Advancement of Telehealth, 1998). Over the past two decades, researchers have examined the feasibility, acceptability and effectiveness of various telehealth approaches to reaching underserved families in need of mental health support (Stamm & Cunningham, 2005). As a result, telehealth applications have become more affordable, accessible, flexible, and more appropriate for clinician-to-family interactions. Finding ways to harness this technology in order to improve access to quality mental health supports for youth with ASD and their families is an important goal.

Objectives: The present study is an examination of the development and piloting of a telehealth version of a manualized, empirically-supported intervention designed to promote adaptive coping in youth with ASD and significant fears and anxieties (Facing Your Fears Program, Reaven et al, 2009). We plan to describe the challenges in developing and executing the program, summarize the feedback from families in rural areas, and present data from two parent-child dyads who completed an individual treatment course during this piloting phase.

Methods: Beginning with a qualitative discussion of clinician and family perceptions of the credibility, feasibility, and acceptability of using videoconferencing to connect clinical specialists with families, a case study approach will be used to illustrate the challenges and potential advantages of delivering psychosocial treatment through videoconferencing. Youth engagement in the intervention (among other variables) will be examined by coding level of participation via interval recording using a NOLDUS coding system. Behavioral coders will be blind to the research questions.

Results: Impact of the intervention on youth anxiety, parent sense of competence, and youth quality of life will be discussed. Limitations and obstacles faced in these early piloting efforts will also be shared.

Conclusions: There are many challenges inherent to translating a psychosocial intervention package into a format that is appropriate for telehealth delivery. Potentially an innovative way to increase access to specialized mental health care, there is much to be learned about how to modify practice models, prepare clinicians, and orient families to use technology to engage in psychosocial interventions.

105.055 55 Dr Ailsa J Russell. A. J. Russell*[1], A. Jassi[2], M. Fullana[1], D. G. Murphy[3], H. Mack[4], K. Johnston[1] and D. Mataix-Cols[1], (1)*Kings College London, Institute of Psychiatry*, (2)*South London and Maudsley NHS Foundation Trust*, (3)*Institute of Psychiatry, King's College London*, (4)*Starship Hospital*

Background: Anxiety disorders, particularly Obsessive Compulsive Disorder (OCD), are commonly reported in young people and adults with Autism Spectrum Disorders (ASD). Psychological treatment has been shown to be effective in treating OCD in the general population but little is known about its effectiveness for people with ASD. A pilot study of Cognitive Behaviour Therapy (CBT) for OCD adapted for adults with ASD showed promising results and suggested that a randomised controlled trial of this intervention was merited.

Objectives: To conduct a systematic treatment study of CBT for OCD in young people and adults with ASD.

Methods: Participants were young people (age 14 and older) and adults with ASD and co-morbid OCD who were randomly allocated to 1 of 2 treatments (1) Manualised CBT for OCD adapted for people with ASD (CBT) and (2) Anxiety Management (AM). Treatments were matched with respect to therapist contact and duration. The primary outcome measure was the total severity rating on the Yale Brown Obsessive Compulsive Scale (Y-BOCS) which was clinician administered blind to treatment group. Informant and self-report symptom measures were also obtained. Follow-up ratings were made at 1, 3, 6 and 12 months post-treatment.

Results: 46 people were randomised to treatment with 20 treatment completers in each group. There was a significant effect of treatment on the primary outcome measure but not of treatment group. Treatment effect sizes on the primary

outcome measure were large and could be considered clinically meaningful in the CBT group (0.8-1.1) and medium in the AM group (0.6). Forty five % of the CBT group were classed as treatment responders compared with 20% in the AM group. Those with mild symptom severity responded well to AM. Almost 40% of people in the AM group opted to try the CBT treatment at 1 month follow-up which differed significantly from the proportion of people in the CBT group choosing to try AM. Secondary analyses indicated that AM might augment the effects of later CBT. None of the variables predicted to be moderating factors (Theory of Mind, Verbal and planning abilities and scores on the Autism Diagnostic Observation Schedule) were associated with treatment outcome.

Conclusions: Psychological treatment in the form of cognitive and behavioural therapies are effective in treating co-morbid OCD in people with ASD. Further investigations should seek to refine treatment protocols to consider the precise adaptations to conventional psychological treatment which are most effective for this group.

105.056 56 Effects of Group Therapy on Anxiety for Adults with Autism Spectrum Disorders. Y. Kawakubo*, H. Kuwabara, A. Todokoro, H. Yamasue, Y. Kano and K. Kasai, *University of Tokyo*

Background: Adults with autism spectrum disorders (ASD) often exhibit one or more comorbid disorders such as anxiety and depression. Some studies have reported the effectiveness of a CBT intervention for anxiety with children with ASD. However, there is little study for adults with ASD.

Objectives: The purpose of this pilot study is to investigate the efficacy of group therapy for adults with ASD. Our primary hypothesis is that adults with ASD will demonstrate reductions in their secondary symptom such as depression.

Methods: Participants were 6 adults with ASD (female 2, mean age=30.3, mean FIQ=98.8, VIQ=99.6, PIQ=95.3, education level=13.5 years, GAF score=40.7, mean AQ score=36.0). All participants gave written informed consent. Group therapy was conducted over a 10-week period (1 session/week) with each session lasting approximately 90 min. Each session was constructed mainly from the sections of gymnastic exercises, group game, psychoeducational therapy and relax. The psychoeducational therapy is focused on understanding of the characteristic of ASD, understanding and identify emotions based on the physiological reactions, thoughts, behaviour, and speech and coping skills. Participants responded to self-completed questionnaire for depression (Center for Epodemilogic Studies Depression scale; CES-D) and for the quality of life (WHO QOL 26) at pre- and post-therapy.

Results: The mean CES-D score was decreased at post-therapy although the score remained over the cut-off points of depression (mean pre=29.3 and mean post=22.6). The QOL score was increased at post-therapy and at the same level as general populations (mean pre=2.7 and mean post=3.1).

Conclusions: These pilot results suggest that group therapy for adults with ASD reduce their secondary symptom such as depression and increase their quality of life.

Sponsor: Pfizer health research foundation

105.057 57 Effects of the Observed Consequence on Skill Acquisition Following Video Modeling for Individuals with Autism. J. B. Plavnick*, *University of North Carolina*

Background: Video modeling has recently become a popular method for delivering instruction to individuals with autism spectrum disorders (ASD). Despite many positive applications, several researchers report ineffective outcomes following video modeling interventions (see Rayner, Denholm, & Sigafoos, 2009 for a review). It has been suggested that the absence of potential prerequisite skills or severity of impairment may influence video modeling outcomes (Delano, 2007; McCoy & Hermansen, 2007). Another potential reason for this variability is that video sequences do not always incorporate consequences following the modeled behavior; the observer is therefore not able to identify potential benefits of performing the target response. Though a critical component of observational learning theory (Bandura, 1977), the observed consequence is often ignored in video modeling interventions.

Objectives: The purposes of this research were a) to determine whether video modeling could be used to teach communicative behavior to individuals with severe autistic symptoms and b) to examine the importance of the observed consequence when using video modeling as an instructional methodology for this sub-group.

Methods: A single-case experimental research methodology was used to identify functional relations between two experimental conditions and the acquisition of communicative behavior for young children (N=4) dually diagnosed with autism and speech and language impairment. Specifically, an alternating treatment design was embedded within a multiple probe across behaviors design to examine and compare the effects of two video modeling conditions on the acquisition and generalization of communicative targets for each participant. In

one condition, participants observed a peer request an item or event that had previously been identified as a high preference consequence for the observer. During a second condition, participants observed a peer request an item or event that had previously been identified as a low preference consequence for the observer. The conditions were administered to each participant in an alternating manner allowing for a direct comparison of language acquisition under each condition.

Results: All participants acquired multiple communicative targets when the model obtained consequences that were highly preferred by the observer. Participants rapidly acquired each response, generalized the behavior to classroom settings, and maintained the behavior after the intervention was terminated. Conversely, none of the participants acquired communicative targets when the model obtained consequences that were identified as low preference for the observer.

Conclusions: The rapid acquisition and generalization of communicative targets suggests children who demonstrate greater severity of autistic symptoms can learn from video modeling interventions. However, incorporating consequences that are known to be preferred by the observer within the video sequences appears to be especially important for this sub-group. These outcomes have implications for designing video sequences when video modeling is used to teach new behaviors to individuals with autism.

105.058 58 Efficacy of a Facial Expression Recognition Training Software for Taiwanese School-Aged Children with Asperger's Disorder. C. C. Chao*[1], L. Y. Wang[2], Y. Y. Wu[3], S. R. Lee[3], M. Y. Hsu[3], Y. C. Tu[1] and S. Y. Wu[1], (1)*Taipei Municipal University of Education*, (2)*Chang Gung University*, (3)*Chang Gung Memorial Hospital*

Background: Asperger‘s disorder is characterized by the notable difficulties in social interactions. Previous researches have suggested that such impairment in social interactions is probably due to some deficits in their theory of mind. There have been various methods and materials developed internationally for training the theory of mind. Among them, some are computer software specially designed for improving facial expression recognition ability.

Objectives: To evaluate the applicability and effect of a software designed for children with Asperger‘s disorder to improve their ability to recognize human facial expression.

Methods: Nine Taiwanese boys with Asperger‘s disorder (aged 9 to 12) received the facial expression recognition training. A pre- and post-test design was used to compare the performance of the participants on various outcome measures including: (1) Facial Expression Recognition Task built in the training software; (2) Diagnostic Analysis of Non-Verbal Accuracy II-Taiwan Version (DANVA 2-TW); (3) Children‘s version of the Reading the Mind in the Eyes Test (Eyes Test); (4) Advanced Theory of Mind Test (ToM Test). Each participant‘s data were presented individually for direct comparison and the Wilcoxon signed-rank tests were used for group analysis.

Results: The results showed that this training software can partially improve the ability of facial expression recognition for the participants. There were significant improvements in the accuracy of the Facial Expression Recognition Task after the training. However, no significant pre-post differences were found in the participant’s performance on the DANVA 2-TW, Eyes Test, and ToM Test.

Conclusions: The computer assisted training software used in our study is applicable for children with Asperger‘s disorder to improve their ability to recognize facial expression during the training. Despite its convenience, cost-effective, and immediate effect at the time of training, however, the training effect failed to generalize to other tasks. Thus, it is suggested that it might be useful to include training software as an adjunct in a comprehensive multi-component training programs, but not use such a tool as an intervention alone. Future studies are needed to develop more effective software.

105.059 59 Evaluating the Components of a Social Stories Intervention Package for Children with Autism. J. Vogel*, K. Imlay, A. Finch and D. Berry Malmberg, *California State University Northridge*

Background: Autism spectrum disorder is marked by impairments in social interactions, communication, and imaginative play (APA, 2000). These impairments affect the child’s ability to understand nonverbal communication, engage in reciprocal social interactions, and develop relationships with peers. Social Stories have become a widely adopted intervention to teach social skills and to address maladaptive behaviors of children with autism. Social Stories are brief first person narratives that describe appropriate responses and behaviors in social contexts (Gray & Garand, 1993). Findings regarding the effectiveness of Social Story interventions have been mixed, and many studies have methodological concerns (Kokina & Kern, 2010; Rust & Smith, 2006). Another concern with prior research is that Social Stories are frequently presented in an intervention package with other behavioral interventions, such as prompting (Swaggart et al., 1995), role-play (Chan & O’Reilly, 2008), and feedback (Thiemann &

Goldstein, 2001). Therefore, the components of this study were studied in isolation rather than with other behavioral interventions (Kokina & Kern, 2010; Rust & Smith, 2006).

Objectives: The goal of this study was to examine the effectiveness of two components of Social Story interventions, the Social Story and prompting, in isolation to determine their unique contributions to social skill acquisition of children with autism.

Methods: A single-subject component analysis design was used to determine the critical element of the intervention responsible for behavior change. Two children, ages 6 and 9, with a diagnosis of Autistic Disorder participated in this study. For each child, target behaviors were randomly assigned to one of two conditions, either Social Stories or prompting. Target behaviors included reciprocal conversation, sharing, empathy, and congratulations. In the Social Story condition, children listened to a Social Story describing their individualized target behavior. If the participant engaged in the target behavior, the experimenter provided verbal praise. During the prompting condition, the experimenter verbally prompted the participant to engage in the appropriate behavior, which the experimenter reinforced through verbal praise upon demonstration.

Results: Results indicate that the isolated Social Story component did not lead to acquisition of children's target social behaviors; however, the prompting phase resulted in rapid skill acquisition, as well as retention of the skill at follow-up.

Conclusions: By isolating the Social Story component, we were able to determine that Social Stories alone were not responsible for the acquisition of social behaviors for these children with autism. Further research of the isolated components of social skill interventions would aid in the identification of critical elements in social skill acquisition and assist in providing evidence-based treatments to teach social skills to children with autism.

105.060 60 Evaluating the Effectiveness of a Behavioral Summer Treatment Program for Children with High Functioning Autism Spectrum Disorders. E. H. Sheridan*[1], S. Mrug[1], J. B. Hodgens[1], C. S. Patterson[1] and K. J. Bailey[2], (1)*University of Alabama at Birmingham*, (2)*Glenwood Autism and Behavioral Health Center, Inc.*

Background: Children with high-functioning autism spectrum disorders (HFASD) demonstrate a number of core social and behavioral deficits that affect their ability to interact effectively with peers. Despite recommendations to improve intervention programs for children with HFASD, few empirical studies have evaluated the efficacy of specific behavioral interventions. 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 behavior and social functioning in four boys with Asperger's Disorder. Over the course of the STP, the boys decreased their rates of negative behaviors that are typically associated with peer dislike, and also made significant gains in their social relationships with peers. However, a quantitative examination with a larger sample is needed to more reliably determine the effectiveness of STP on the behavioral and social functioning of children with HFASD.

Objectives: The present study will examine the effectiveness of the STP on specific positive and negative behaviors of children with HFASD.

Methods: The participants in the study were 15 boys with HFASD who attended the STP between 2004 and 2010. All participants were between 6 and 11 years (M = 8.9 years, SD = 1.75) and were diagnosed with a HFASD by a licensed mental health professional. The STP is an intensive, 6-week-long daily behavioral program that is conducted 5 days per week for 9 hours each day. A comprehensive behavioral management system is administered during the majority of the group activities, during which children earn points for positive behaviors and lose points for negative behaviors. Each day, the following positive behaviors were measured: following activity rules, attention, compliance, helping a peer, sharing with a peer, and contributing to group discussion. Additionally, the following negative behaviors were measured: intentional aggression toward a peer or staff member, name calling/teasing, cursing/swearing, interruption, and complaining/whining.

Results: Average daily frequencies for the behavioral point system categories will be analyzed over three time periods (Weeks 1 and 2; Weeks 3 and 4; and Weeks 5 and 6) using repeated measures analysis of variance. It is hypothesized that the frequency of negative behaviors will decrease as STP progresses, while the frequency of positive behaviors will increase. Any significant main effects will be tested using one-tailed tests due to the clear directional nature of these hypotheses. The data are currently being compiled from STP records in preparation for data analysis.

Conclusions: The STP offers a unique opportunity to target behavioral functioning and social skills of children with HFASD within the context of a naturalistic, summer camp setting. A

better understanding of the effectiveness of STP on specific aspects of behavioral and social functioning of children with HFASD will have important implications for development and refinement of future intervention programs.

105.061 61 Evaluation of the "Dependence Trap" Intervention Protocol for Parents of Young Adults with High Functioning Autism Spectrum Disorders. H. Shilo*[1], O. Golan[1] and H. Omer[2], (1)*Bar-Ilan University*, (2)*Tel-Aviv University*

Background:

Research has shown that young adults with High Functioning Autism Spectrum Disorders (HFASD) experience difficulties achieving age appropriate goals, such as having peer or intimate relationships, providing for themselves or living independently. As a result, many of them rely on the support of their families. We view this as a "dependence trap", in which the son/daughter's adjustment difficulties coincide with parents' concerns and sense of responsibility, thus leading parents to take a major role of assistance that often leaves them distressed and hampers their son/daughter's independent functioning. In terms of intervention, we find that parents' feelings and their contribution to their son/daughter's dependence are often overlooked. In our formulation of such an intervention we utilized core principals of the Non-Violent Resistance (NVR) approach, shown to be effective in guiding parents of adolescents with challenging behavior and children with anxiety disorders.

Objectives:

This study includes a formulation and trial run of the "dependence trap" intervention protocol with parents of young adults with HFASD. In implementing this protocol, we aim to alleviate the "dependence trap", meaning to help parents recognize specific areas in which they could promote their son/daughter's independence by not providing the same level of assistance they used to, but rather to make themselves available for support as their son/daughter takes charge in those areas. We studied possible shifts following the intervention, such as: parent's emotional state, their sense of capability, the extent of cooperation between parents, the level of assistance they make available for their son, and the son's level of dependence.

Methods:

Parents of 4 young men (aged 20-26) diagnosed with HFASD, took part in a 10 week intervention. Each couple attended weekly sessions with a psychologist, and duo-weekly telephone conversations with a trained supporter. Evaluation of the intervention was gathered through 2 semi-structured interviews with the parents – pre and post intervention. In addition, parents filled out questionnaires (VABS-II, BDI, a hopefulness scale, a dependence behaviors checklist).

Results:

Analysis of the gathered data reveals encouraging shifts in the families' functioning and everyday routine. Parents decreased their assistance in certain areas, offering their son support, yet not caving in by allowing him extensive services as they did before. The young adults, in turn started taking responsibility in those areas. Also, we witnessed a change in the familial atmosphere, as conflicts became less frequent, and cooperation between parents increased. Some parents showed a decrease in depressive symptoms, and an increase in their hopefulness level. One couple dropped out of the intervention plan, as their son needed psychiatric attention, for an ongoing condition.

Conclusions:

Parenting a young adult with HFASD is a complex task. Parents' worries for their son's well-being, may lead them to provide him with extensive everyday assistance, thus experiencing emotional distress, and holding back the son's independent functioning. NVR appears to be an effective approach in guiding those parents in dealing with their son and allowing him areas of independence. It also seems to have positive effects on both parents' and son's welfare.

105.062 62 Examining the Impact of Cognitive Behavioral Group Therapy on Quality of Life In Adolescents with High Functioning Autism Spectrum Disorders. A. Blakeley-Smith*[1], S. Hepburn[2] and J. Reaven[3], (1)*Univ. of Colo. Denver-JFK Partners*, (2)*University of Colorado / JFK Partners*, (3)*Univ. of Colorado Denver-JFK Partners*

Background: Adolescents with autism spectrum disorders (ASD) are at increased risk for anxiety (Farrugia & Hudson, 2006; White et al., 2010). High levels of anxiety often result in avoidance and withdrawal, potentially exacerbating the core deficits of ASD and impacting quality of life. The purpose of the present study was to determine if a family-focused cognitive behavioral group treatment (Facing Your Fears (FYF), Adolescent Version, Reaven et al., 2009) designed to reduce symptoms of anxiety would also result in changes in adolescent quality of life. Quality of life is a critical variable to explore given that it may be a more socially valid and functional way of understanding outcome than anxiety reduction alone. It is

hypothesized that improvements in quality of life will correspond with reductions in anxiety.

Objectives: To determine if there are significant changes in adolescent quality of life following the 14 week FYF intervention

Methods: Twenty four adolescents ages 13-18 participated in the FYF program and: (a) met criteria for an ASD, as confirmed by the ADOS (Lord, et. Al, 2002); (b) had a Verbal IQ of 70 or above; and (c) exhibited clinically significant symptoms of anxiety, as measured by Anxiety Disorders Inventory Schedule for Children, Parent Version (ADIS-P; Silverman & Albano, 1996). Parents and adolescents were also administered the Quality of Student Life Questionnaire (QSLQ; Keith & Schalock, 2003). Parent ratings were based on their perception of their teen's quality of life. The QSLQ contains four subscales (Satisfaction, Well Being, Social Belonging, and Empowerment/Control). Both the ADIS-P and the QSLQ were administered pre/post intervention.

Results: Overall, results from the ADIS-P indicated that the majority of adolescents were "much improved" post treatment (see Reaven et al.,IMFAR abstract submission, 2011). Furthermore, parents' ratings yielded significant improvements on Satisfaction ($t = -2.702$; $p = .013$), Well Being ($t = -2.528$, $p = .02$), and Social Belonging: ($t = -2.977$; $p = .007$). However, there were no significant differences in adolescent ratings on the QSLQ subscales post-treatment. The relationship between quality of life and symptom improvement is important to consider and will also be presented (analyses ongoing).

Conclusions: Parent report indicates significant reductions in anxiety and significant improvement in quality of life post treatment. On the other hand, adolescents' report does not indicate change in quality of life. It is not surprising that there is disagreement between parents and adolescents, given the difficulty individuals with ASD have in introspection and emotion identification (Baron-Cohen et al., 1985). While it is unclear what underlies the change in quality of life scores reported by parents (i.e., anxiety symptom reduction, group membership, etc.), it is believed that as anxiety lessens, opportunities increase for adolescent engagement in the world, thus improving quality of life. However, further study is needed to explore potential mechanisms for change in addition to socially valid outcomes of intervention. Study limitations include the lack of a comparison group and small sample size.

105.063 63 Examining the Use of Turn Taking In Pivotal Response Training: Adaptations for Classroom Environments. S. Reed*[1], J. Suhrheinrich[2], A. C. Stahmer[1], L. Schreibman[2], J. Wilson[2] and B. Ross[2], (1)*Rady Children's Hospital, San Diego*, (2)*University of California, San Diego*

Background: Pivotal Response Training (PRT) utilizes turn taking as one tool to target communication, play, and social goals for children with autism. The therapist takes a turn in PRT for two reasons: (1) to model appropriate language, play and social skills for the child (modeling) and (2) to provide an opportunity for the child to produce a behavior (independently or with a prompt). When the child engages in the behavior, the adult can then provide reinforcement by returning the materials to the child (contingency). Unlike other components of evidence-based interaction, the use of turn taking with children with autism has not been individually empirically validated in the scientific literature. Teachers using PRT in applied settings have consistent difficulty using turn taking, and often exclude this point in their implementation with students.

Objectives: The function and necessary components of turn taking in PRT will be evaluated and discussed to inform the adaptation of PRT for classroom environments.

Methods: Participants included six children with ASD, ages 3 to 5 years. Children received two, 90-minute sessions of PRT per week for a period of three weeks with a trained therapist. Therapists systematically varied the turn taking component of PRT among four conditions: modeling only, contingency only, modeling and contingency independently, and modeling and contingency together. All other components of PRT were held constant. Children's language and play behavior were behaviorally coded for frequency, complexity, function, and type. Results were compared among conditions.

Results: Results indicate that both modeling and contingency components of turn taking are necessary to optimally promote children's use of more complex language and play skills. For example, preliminary data indicate subjects engaged in approximately 40% more discrete play actions during conditions involving both modeling and contingency than either modeling or contingency alone. Similarly, the total duration of functional play was 30% longer for the combined conditions. Though both modeling and contingency are necessary, there appears to be limited difference between the simultaneous use of these components and the independent use of both strategies throughout the intervention session. Additionally, the initial skill level of the child may differentially effect which components are most successful in promoting skill use.

Conclusions: Findings indicate that PRT protocol may be simplified for classroom implementation by separating the turn

taking components of modeling and contingency. Future research will test the effect of this PRT adaptation in applied settings, whether separation of the components affects child engagement, and whether teacher's implementation of PRT is improved by this alteration

105.064 64 Executive Functions as Outcome Measure In Adults with Pervasive Developmental Disorders: An Italian Experience with BRIEF-A After 1 Year of Farm-Community Intervention. G. La Malfa*[1], C. Del Furia[2], M. Venturi[3], M. Innocenti[3] and A. Narzisi[4], (1)*University of Florence*, (2)*C.T.E. Firenze*, (3)*AGRABAH Parent Association for Parents*, (4)*University of Pisa - Stella Maris Scientific Institute*

Background:

Individuals with Pervasive Developmental Disorders (PDD) commonly show deficits in many neuropsychological measures and the executive dysfunction is thought to be primary to autism. Appropriate assessment of these complex functions is critical to develop necessary interventions and it represents a challenge to our traditional methodologies. Ecological validity has become an important focus in neuropsychological assessment with particular relevance for the executive functions (EF), which coordinate one's cognitive and behavioral capacities with real-world demand situations. The Behavior Rating Inventory of Executive Function-Adult version (BRIEF-A) was developed to capture the real-world behavioral manifestations of executive dysfunctions. It's composed of nine theoretically and empirically derived clinical scales that measure various aspects of executive functioning (EF): Inhibit; Self-Monitor; Plan/Organize; Shift; Initiate; Task Monitor; Emotional Control; Working Memory; Organization of Materials.

Objectives:

To study the EF pre and post Farm-Community intervention in adults with PDD in everyday environment through BRIEF-A.

Methods:

We examined intra-group differences in executive functioning of 17 adults men with PDD (mean age: 24, 80; ds: 7,78; range: 15,1-42,7) diagnosed with ICD-10. Executive Functioning at baseline (T0) and after 1 year (T1) from the Farm-Community intervention using BRIEF-A was evaluated. T-test was used for statistic data analysis (p<.005 was established as significant).

Results:

T-tests revealed significant differences in the follows scales: Emotional Control *(T0: mean T score = 56,11; T1: mean T score = 50,29; p = .003)*; Working Memory *(T0: mean T score = 74,94; T1: mean T score = 66,70; p = .005)* and Plan/Organise *(T0: mean T score = 74,88; T1: mean T score = 66,82; p = .005).* Further, there were also significant differences in Behavioral Regulation *(T0: mean T score = 60,47; T1: mean T score = 54,29; p = .000o significant differences were found in the Self-Monitor (p = .010); Initiate (p = .140); Task Monitor (p = .007); and Organisation of Materials (p = .084) scales.)* and Metacognition *(T0: mean T score = 71; T1: mean T score = 63,70; p = .005)* indexes and in the Global Executive Composite *(T0: mean T score = 67,35; T1: mean T score = 60,17; p = .000 In contrast, n)*.

Conclusions:

Data indicate that after 1 year of Farm-Community intervention, individuals obtained a positive outcome in many executive functions studied. Particularly, in Metacognition index and Global Executive Composite they pass from a clinically elevated scores (defined as a T score ≥ 65) to underclinical cutoff. Working Memory and Plan/Organize scales were impaired at T0 and these data were confirmed also at T1 but with lower scores. Emotional Control scale and Behavioral Regulation index were no impaired at baseline and this trend continues at T1. Further, findings indicate that the BRIEF-A is sensitive to subtle executive changes in adults with PDD. Current study also calls attention to the ecological assessments of neuropsychological profiles in fact the novelty of BRIEF-A is that it is focused on EF in everyday environment.To conclude we suggest the opportunity to use BRIEF-A as outcome measure in clinical settings for adults with PDD.

105.065 65 Helping Students Self Regulate: The Effect of A Relaxation Program on Autonomic Function and Behavior In Children with ASD In the Classroom. E. London*[1], J. Foster[2] and T. Hamlin[3], (1)*NYS Institute for Basic Research in Developmental Disabilities*, (2)*Institute For Basic Research*, (3)*Center for Discovery*

Background: The autonomic nervous system (ANS) regulates the activity of the major organ systems of the body, and mediates both homeostasis via the parasympathetic nervous system (PNS) and the fight-or-flight stress response via the sympathetic nervous system (SNS). Recent research suggests that ANS dysregulation is a common feature in children with ASD, especially over-activity of the SNS (Althaus, Van Roon, Mulder, Mulder Aarnoudse & Minderaa, 2004; Groden, Goodwin, Baron, Groden, Velicer, Lipsitt, Hofmann & Plummer, 2005; Anderson & Colombo, 2008). Autonomic dysregulation

can affect social engagement, attention, auditory processing as well as other sensory processing functions. (Hirstein, Iverson & Ramachandran, 2001; Schoen, Miller, Brett-Green & Hepburn, 2008). Self regulation, or, externally aided regulation of the ANS by means of improving PNS function, may improve a student's ability to cope with stress, improve behavior and possibly improve learning. At the Center for Discovery, we have created and implemented a procedure for students with ASD to achieve deep relaxation as a treatment modality. This procedure has been implemented successfully with all of the ASD students thus far, including very low functioning and behaviorally challenging stude

Objectives: 1-To assess whether the intervention achieves relaxation as measured by a reduction of greater that 15% for heart rate (HR) and a 30% increase in Respiratory Sinus Arrhythmia (RSA). 2-To assess the duration of the effects of the relaxation program on autonomic functioning as measured by HR and amplitude of RSA. 3-To asses the effects of the intervention on behavioral expression, defined by frequency of three individualized target behaviors per student collected for 15 seconds every minute for three hours post intervention.

Methods: In a repeated A-B-A-B design 15 students with ASD are being studied on 5 relaxation program (RP) days, verses 5 other days consisting of typical classroom activities (TCA) as a control condition. Heart rate monitoring takes place for the duration of the school day on RP and TCA days, and behavioral observations by blind raters for three hours following the procedure is collected. An activity monitor will be used to correct for changes in heart rate due to physical movement.

Results: We have successfully collected data on the first 5 subjects. Preliminary measures have indicated a significant reduction in heart rate from baseline to treatment, $t(2) = -4.72$, $p < .05$, compared with a control period of similar duration. This suggests that the program is effective in reducing cardiovascular arousal during the intervention. Reporting on the results of the ongoing effects is deferred pending the completion of the study.

Conclusions: We have developed a cost effective, easy-to-implement intervention that has a beneficial effect on autonomic regulation and putatively for behavior in classroom settings. This intervention does not require extensive staff training, carries no risk of side effects and would be easy to introduce to other school programs if proved to be beneficial.

105.066 66 Improved Reading and Math Skills Using a Computer-Based Early Learning Program. J. Palilla*[1], M. South[1], T. Newton[1], K. Brown[2], E. Johnson[3] and H. Shamir[4], (1)*Brigham Young University*, (2)*University of Utah*, (3)*Waterford Institute*, (4)*Waterford Institute*

Background: In addition to core impairments in social communication and repetitive behavior, children diagnosed with Autism Spectrum Conditions (ASC) frequently struggle with basic academic skills, such as reading comprehension and word reading (Whalon et al., 2009).

Previous research indicates that ASC children are more willing to spend time reading material accessed on computer than a book (Williams et al., 2002). This suggests that a computer-reading program may be an effectual tool for teaching children with ASC. The Waterford Early Reading Program (ERP) software - The Rusty and Rosy Learn with Me™ program - has demonstrated effectiveness in early education classrooms. Students using the program consistently outperform children not using the program in basic literacy skills. Anecdotal reports suggest that young children diagnosed with ASC may benefit from the ERP software, but it has never been formally tested using a rigorous scientific design.

Objectives: We hypothesized that ASC children would improve on basic reading skills in response to 5 months of consistent use of the ERP software, significantly more than children with similar usage of the Waterford Early Math Software (EMS). We predicted that the level of improvement would be associated with age, extent of program usage, and severity of autism symptoms.

Methods: Participants were 25 children between the ages of 4 to 7 (mean = 5.68) and diagnosed with an ASC. Each participant received assessments of math and reading skills at baseline, at 5-month crossover of the software assignments, and at the end of the 10-month study. Assessments include reading assessments using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), which measures the acquisition of early literacy skills in children; and the Waterford Assessment of Core Skills (WACS). Math assessment is done using the math portion of the Iowa Test of Basic Skills (ITBS). After baseline assessment children were randomly assigned to begin at-home instruction with either the ERP or EMS for 15 minutes a day/5 days a week. After 5 months of lessons with one program, each child returned for a second assessment then began instruction with the alternate program for the following five-month period.

Results: Data for the first 5-month follow-up show significant improvement on average for math skills for EMS users and reading skills for ERP users. For 16 users who have complete, 10-month data available, reading scores improved significantly

more than math scores did during the corresponding software assignment. Baseline test performance was correlated with age but not autism symptom severity. Follow-up performance was associated with age and usage time.

Conclusions: The Waterford ERP software offers potential as a tool for assisting early academic instruction in young children diagnosed with ASC. Follow-up to the cross-over instruction as well as analysis of math improvement in response to the EMS program will provide more knowledge about the possible effectiveness of computer-assisted instruction for ASC.

105.067 67 Improvements in Executive Function Associated with Participation in Social Skills Intervention. K. E. Bodner*[1], J. P. Stichter[2], K. V. O'Connor[2], A. Moffitt[2], M. Herzog[2] and S. E. Christ[2], (1)*University of Missouri, Columbia*, (2)*University of Missouri*

Background:

Difficulties with executive function likely contribute to the social and communicative challenges faced by individuals with autism spectrum disorder. Within this context, effective social skills interventions such as the Social Competence Intervention (SCI) program (Stichter et al., 2010, in press) are targeting executive function (along with theory of mind and emotion recognition) as a key construct in addressing social competence deficits in these children. The precise relationship between intervention-related improvements in day-to-day social competence and changes in underlying neurocognitive processes (e.g., executive function), however, remain unclear.

Objectives:

To evaluate the impact of social skills intervention on three different core components of executive function (i.e., inhibitory control, working memory, and cognitive flexibility)

Methods:

Executive function data was collected on 35 children (age range = 11 to 15 yrs) with high functioning autism or Asperger's Syndrome (HFA/AS) prior to participating in the SCI program (i.e., a short-term social skills intervention) and then again shortly after completion of the intervention. The SCI program is based on cognitive behavioral principles and has been shown to be effective at improving social skills in adolescents with HFA/AS. It is delivered over the course of 10-12 weeks (45-60 minutes twice per week; total = 20 hours of intervention). At both time points (pre- and post-intervention), participants completed digit and spatial memory span tasks assessing verbal and non-verbal working memory, respectively. Inhibitory control was also assessed using a flanker visual filtering task, which required participants to respond to a centrally-presented visual stimulus while ignoring other distracting stimuli on the display. Lastly, a novel task requiring participants to quickly shift back and forth between categorizing stimuli based on shape or color was used to assess cognitive flexibility.

Results:

As anticipated, participation in the intervention was associated with a significant decrease in problematic social behaviors/issues (as measured by parents' reports on the Social Responsiveness Scale), $p < .001$. In addition, pre- to post-intervention improvements were also observed on the working memory and inhibitory control tests. There was an overall improvement in forward spatial span performance on the non-verbal working memory tasks, $t(34) = 3.61$, $p < .001$. On the inhibitory task, participants were more effective at resisting distracter interference post-intervention as compared to pre-intervention, $t(33) = 2.28$, $p < .05$. On the switching tasks, participants generally responded faster post-intervention as compared to pre-intervention, $t(26) = 4.50$, $p < .001$; however, no other intervention-related improvements were evident on this task, all ps $> .05$.

Conclusions:

Pre- to post-intervention improvements were observed for 2 of the 3 executive function components that were assessed. The present findings provide preliminary support for the hypothesis that participation in the SCI program is accompanied by improvements in underlying neurocognitive processes such as executive control. Additional data collection (including recruitment of a non-intervention comparison group) remains ongoing.

105.068 68 Increasing Social Interactions Between High School Students with Intellectual Disabilities and Autism and General Education Peers. N. Brigham*[1], C. Hughes[2], M. Golas[2] and J. C. Cosgriff[2], (1)*Vanderbilt University Medical Center*, (2)*Vanderbilt University*

Background: Effective social skills are critical to successful school performance, including classroom participation, academic engagement, and social interaction; yet, as core limitations, these skills often elude students with intellectual disabilities and autism. Observational studies conducted in high school settings indicate that programming to increase communication and social interaction among general education students and their peers with intellectual disabilities and autism rarely occurs and that intervention efforts to increase students'

active engagement in general education settings are similarly scarce.

Objectives: To increase social interactions between high school students with intellectual disabilities and autism and general education peers through the use of communication books.

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. 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 collected four months following the termination of the communication book use condition.

Results: Communication book use was associated with increases in conversational initiations and responses of five high school students identified with intellectual disabilities and autism with their general education peers across school settings. Following intervention, all participants indicated that they met their pre-intervention social goals of having more friends at school. In addition, general education conversational partners generally indicated that they enjoyed interacting with participants and they perceived that participants had increased their conversational skills.

Conclusions: Conversational skills instruction is a first step toward increasing social interaction among students with intellectual disabilities and autism and their peers. By itself, however, instruction is not enough. Creating opportunities to interact socially with peers and providing peer support training must be part of any intervention to teach social skills to students with intellectual disabilities and autism.

105.069 69 Intrapersonal and Interpersonal Synchrony In Typically Developing Children and Children with Autism Spectrum Disorders (ASDs)/ADHD Between 4-10 Years of Age. K. Palatinus*, P. Menacherry, T. Gifford, K. Marsh and A. Bhat, *University of Connecticut*

Background: Dual-limb coordination such as clapping and marching emerges earlier in development than multilimb coordination, for example marching while clapping (Getchell, 2007). In addition, the difference between self-coordination (actions performed on your own) and social coordination (joint actions done as one follows a leader) within such multilimb motions is unknown. Currently, we are evaluating whether imitation training within a robot-adult-child context facilitates self and social coordination of typically developing children and children with ASDs/ADHD between 4-10 years of age.

Objectives: To examine the effects of robot-adult-child interaction training on the self and social coordination of typically developing children and high-functioning children with ASDs/ADHD between 4-10 years of age during dual and multilimb motions.

Methods: Eight, 4-6 year olds (group 1) and seven, 6-8 year olds (group 2) were observed before and after training during three conditions: only clap, only march, clap and march and across two contexts: self and social. The training involved eight, 30-minute sessions of robot-adult-child interactions. During the sessions, each child practiced complex movement patterns based on karate and dance themes demonstrated by a 7-inch tall, humanoid robot. Mean and coefficient of variation (CV) of amplitude and duration of clap and march motions were compared across conditions, across contexts, between groups, and before and after training. A higher CV indicated greater movement variability.

Results: During the self context, we replicated the findings of increased movement variability in amplitude (group 1 and 2, $p<0.05$) and duration (group 2, $p<0.05$) during multilimb motions (march and clap) of the hands as compared to dual-limb motions (only clap). Moreover, the variability was greater for the post-test than the pretest in group 1 ($p<0.05$). During the social context, there were no differences between dual and multilimb motions due to increased overall variability in the social context. In terms of social versus self contexts, the social context was more variable than the self context for both groups during dual-limb motions only. There were no clear differences between the pre and posttests for the TD children. On the other hand, one child with ASD and another child with ADHD showed reduced variability in the posttest as compared to the pretest for both dual- and multilimb motions of the self context. In contrast, social context significantly increased the movement variability of the child with ASD whereas it reduced the variability and improved the motor performance of the child with ADHD.

Conclusions: The march-clap paradigm findings were replicated for both TD children and those with ASDs/ADHD. Among TD children, multilimb motions were more variable than dual-limb motions. During dual-limb motions like clapping, social context increased movement variability as compared to the self context. Interestingly, the social context significantly impaired the motor performance of the child with ASD whereas it enhanced the motor performance of the child with ADHD.

Overall, there were no training effects in the TD children whereas both children with ASD/ADHD reduced movement variability and showed better motor performance after training.

105.070 70 Marquette University PEERS Pilot: A Replication and Extension of An Empirically Validated Treatment for Adolescents with Autism Spectrum Disorders. J. S. Karst*[1], A. Meyer[1], K. Schohl[1], B. Dolan[1], E. Beste[1], M. Houge[1], E. A. Laugeson[2] and A. V. Van Hecke[1], (1)*Marquette University*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background:

This study investigated a replication and extension of the PEERS (Program for the Enrichment and Education of Relational Skills) program originally developed and implemented at the University of California – Los Angeles (UCLA) for adolescents with Autism Spectrum Disorders (ASDs). This social skills program was implemented at Marquette University and the researchers utilized both the original assessment and outcome measures used by researchers at UCLA as well as evaluations in two other domains related to the development of social skills and competency.

Objectives:

1) To replicate the implementation and evaluation of the PEERS program in a medium-sized midwestern city through utilization of pre- and post-treatment measures of social functioning completed by adolescents with ASDs and their parents.

2) To extend research on PEERS outcomes by including evaluation of changes in neurological and physiological functioning and in vivo social interactions.

Methods:

Five adolescents enrolled in the PEERS program pilot completed an initial intake process and were assessed on cognitive functioning (via the KBIT-2) and tested for autism spectrum disorders (via the ADOS-G). Teens and parents then participated in 14 weeks of PEERS, which included one 1.5-hour didactic session per week. Follow-up data was assessed at completion of PEERS.

The replication component included evaluation of social skills in adolescents through parent, teacher, and self-report measures administered at intake and follow-up. Caregiver forms included the Adolescent Autism Spectrum Quotient, Vineland Adaptive Behavior Scales-II, Social Communication Questionnaire, Social Skills Improvement System-Parent (SSRS-P), Social Responsiveness Scale (SRS-P), and Quality of Socialization Questionnaire-Parent. Teacher forms included the SSRS-T and the SRS-T. Child forms included the Teen Mental Status Checklist, Test of Adolescent Social Skills Knowledge, Social Interaction Anxiety Scale, Friendship Qualities Scale, Quality of Socialization Questionnaire – Adolescent, Piers-Harris Children's Self-Concept Scale – 2nd Edition, and Social Anxiety Scale for Adolescents.

The extension components of the study were investigated at intake and follow-up as follows:

A) Neurological and physiological functioning was assessed through completion of a baseline electroencephalogram coherence between frontal and temporal cortex in two conditions: eyes open and eyes closed (3 minutes each), and a measure of heart rate regulation, respiratory sinus arrhythmia.

B) In vivo social interactions were investigated through a 10-minute unstructured interaction between the adolescents and a typically developing peer confederate. These interactions were coded using the Friendship Observation Scale for Teens [adapted from the Friendship Observation Scale (FOS) by Bauminger, Aviezer, & Rogers, 2005)].

Results:

Results are pending the conclusion of this program and follow-up measures. Due to the pilot nature of the small sample, results will be presented qualitatively and highlight individual change between pre- and post-assessments.

Conclusions:

It is important to understand the effectiveness of the PEERS intervention in a setting outside of its original development. Further, both extension domains of treatment outcome are thought to be imperative for understanding the way in which social skills training impacts adolescents with ASDs. Future additions to evaluate the PEERS program will be discussed, include assessing parenting competency, stress, and mental health outcomes.

105.071 71 Measuring the Efficacy of Social Skills Interventions for Children with Autism. E. Rotheram-Fuller*[1], D. Seiple[1], M. Kim[1] and J. J. Locke[2], (1)*Temple University*, (2)*University of Pennsylvania*

Background: Impairments in social functioning are a hallmark of autism spectrum disorders, and represent an area of great

need within this population. Currently there are many interventions available to improve the social skills of children with autism. However, these interventions are paired with an equally diverse number of outcomes used to measure social gains. Because of this diversity, it is difficult to compare outcomes across studies to determine the best interventions for specific children.

Objectives: The range of outcome measures used to evaluate the efficacy of social skills interventions for children with autism will be explored. Recommendations for systematic measurement of intervention gains will also be discussed.

Methods: Literature on social skills interventions was reviewed from 1992 to 2010. Studies were included in the review if they utilized a school-based, social skills focused intervention for children with autism. A total of 48 studies were evaluated. Each study was assessed to determine the type of intervention, as well as the specific outcome measures used to investigate social progress or success. Outcomes were grouped into three discrete categories, including observations, standardized reporting measures, and non-validated surveys. The range of outcomes included in each of these categories was analyzed to get an overall estimate of the variety of measures being used to calculate social success. The number of studies that employed probes to assess generalization and maintenance of skills was also examined.

Results: Preliminary results suggest that over 171 discrete outcomes were used across the 48 studies reviewed. These outcomes varied from informal self-report measures to standardized test scores, with 73% of the studies focusing on observational data, 25% using standardized measures, and 2% using non-validated rating scales. There were 35 unique categories of skills measured using observational data, ranging from specific verbal social interaction skills to nonverbal behaviors. There were 3 categories of non-validated rating scales, and 33 standardized measures used. The standardized measures appeared most frequently in the studies that included larger sample sizes. Only 17 of the 48 studies assessed generalization of skills across settings, and just 4 studies measured maintenance of skills up to 2 months after the end of treatment.

Conclusions: Although there is a considerable need for social skills interventions for children with autism, the variety of outcomes used across studies means that we are unable to compare interventions conducted by independent researchers. Given the heterogeneity within the population of children with autism, there is a critical need to be able to identify which interventions will be the most successful with specific children. The current review suggests that broader social skills outcomes may be needed in order to systematically compare outcomes across studies.

105.072 72 Mindfulness-Based Stress Reduction In Adults with ASD. A. A. Spek*[1] and N. C. van Ham[2], (1)*Mental Health Institution Eindhoven*, (2)*GGZ Eindhoven*

Background:

Individuals with autism spectrum disorders (ASD) are at increased risk for comorbid psychiatric disorders. Research shows that depressive symptoms are the most common psychiatric concern in ASD, especially in higher functioning adults and adolescents. Up to 50 % of individuals with ASD meets criteria for depression. Ruminative thinking has frequently been associated with depression in general, but seems particularly relevant in autism, given their tendency to perseverate.

Treatment opportunities for co-morbid depression in adults with autism spectrum disorders (ASD) are limited and lack scientific proof. Mindfulness-based stress reduction (MBSR) is a relatively new form of treatment that has been found particularly effective in treating mood disorders in clinical populations. Since MBSR requires few communication and theory of mind skills, it may be a promising therapy for individuals with ASD.

Objectives:

To examine the effectiveness of MBSR in adults with ASD on symptoms of depression, rumination and general well-being.

Methods:

21 adults with ASD and full scale IQ > 85, received 9 weekly MBSR sessions. The results of each group were compared with those of a matched control group of individuals. The diagnoses of the individuals were based on the ADI-R and a structured DSM-IV interview. Symptoms of depression, rumination and general well-being were assessed by the use of questionnaires.

Results:

Data of the first 11 adults have been analyzed and results show a significant improvement in symptoms of depression ($p < .0005$, partial eta squared .676) and rumination ($p < .0005$, partial eta squared .910). Furthermore, a near significant decrease in negative affect was found, but no significant change in positive affect. At the end of December 2010, the data-collection will be finished and final conclusions will be drawn.

Conclusions:

MBSR is a patient-friendly method that appears valuable in the treatment of comorbid depression and rumination in high functioning adults with ASD. Apparently, high-functioning adults with ASD are able to acquire meditation skills and apply those in there home environment in a manner that diminishes their symptoms of depression and rumination. This finding is particularly hopeful since it stresses opportunities of these individuals.

105.073 73 Program for the Education and Enrichment of Relational Skills (PEERS): Effectiveness In a Community-Based Mental Health Setting. B. Harrison*[1], M. W. Demarse[2], R. Worden[2], L. Alpert-Gillis[2], E. Smith[1] and E. S. Kuschner[3], (1)*University of Rochester*, (2)*University of Rochester Medical Center*, (3)*Children's National Medical Center*

Background:

Social skills training attempts to address one of the core deficits exhibited by individuals with autism spectrum disorders. The Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010) is a parent-assisted intervention for teens with autism that teaches social rules and routines to foster friendships. PEERS focuses on strategies for developing and maintaining friendships as a way to buffer the deleterious effects of social difficulties. The efficacy of the PEERS intervention was demonstrated by an increase in social knowledge and interactions for teens enrolled in PEERS relative to teens in a delayed treatment control group (Laugeson, Frankel, Mogil, & Dillon, 2009).

Objectives:

This study examined the effectiveness of PEERS in a community-based mental health setting.

Methods:

Participants included seven adolescents (range: 13-18 years old; four males) and their parents. Inclusion criteria were less restrictive than those used in Laugeson et al. (2009), so participants in the group included teens with an autism spectrum disorder, ADHD, apraxia, major depression, anxiety, and adjustment disorder. Four therapists with graduate training implemented the intervention and fidelity was maintained through weekly supervision with one therapist who is a clinical psychologist trained by the developers of PEERS to administer the intervention. Teens and parents completed the four outcome measures that yielded significant differences in the initial efficacy study. Teens completed the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson & Frankel, 2006), Friendship Qualities Scale (FQS; Bukowski, Hoza, & Boivin, 1994), and the Quality of Socialization Questionnaire for Adolescents (QSQA; Frankel & Merkel, 2008), and parents completed the Social Skills subscale of the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008). Parents also completed the TASSK as an additional measure of social skills knowledge gained during PEERS.

Results:

Results reflect within-subjects outcome data at the end of the 14-week intervention. Paired *t*-tests were conducted with a correction for multiple comparisons (a=.01). Results revealed that teens (p=.004, Cohen's d=1.30) and parents (p<.001, d=2.7) showed an increase in their knowledge of social skills on the TASSK. In contrast, there was no significant change (all ps>.1) reported for general social skills (SSIS Social Skills subscale, d=.7), quality of friendships (FQS, d=.03), and frequency of social get-togethers hosted by teens (QSQA, d=.8).

Conclusions:

This study demonstrated that the PEERS model could be applied in a clinical, community-based mental health setting with a heterogeneous group of teenagers with impairments in social functioning. Preliminary findings suggest that teen and parent participants reported an increase in their knowledge of social skills (TASSK), but the quality (FQS/SSIS Social Skills) and quantity (QSQA) of social interactions did not show significant improvement post-intervention. Effect sizes for the SSIS Social Skills subscale and QSQA suggest that failure to detect differences on these measures may have resulted from the small sample size and lack of statistical power. Furthermore, while teens may have learned the skills presented during the PEERS intervention, additional practice with

generalization may be needed to facilitate an increase in the quality and quantity of real world, social experiences.

105.074 74 The Effects of Robot-Child Interactions on Imitation and Praxis Performance of Typically Developing (TD) Children and Children with Autism Spectrum Disorders (ASDs) Between 4-10 Years of Age. S. Srinivasan*, K. Lynch, T. Gifford, D. Bubela and A. Bhat, *University of Connecticut*

Background:

While social communication delays are the primary impairments of Autism Spectrum Disorders (ASDs), motor impairments are quite frequent. Motor impairments in ASDs include incoordination and dyspraxia, namely difficulties in performing complex actions like skilled gestures. Traditional autism interventions address social communication impairments; they are intensive (30-40 hours/week) and socially demanding. However, motor impairments are rarely addressed in these contexts. In contrast, an interaction game with a robot could be a highly motivating context and a simpler social interaction for children with ASDs. We are currently developing a novel embodied social intervention involving robot-adult-child interactions during which children copy various complex actions performed by the robot based on karate or dance themes.

Objectives: To examine the effects of a novel robot-child intervention program on praxis and imitation performance in typically developing children and children with ASDs/ADHD.

Methods: Fifteen typically developing children and four children with ASDs/ADHD were examined. Each child received eight, 30-minute sessions of robot-adult-child interaction training across four weeks. The postural praxis subtest of Sensory Integration and Praxis Testing (SIPT) is a normed and standardized measure of gross-motor praxis and was used to examine generalized changes in praxis. We also examined task-specific improvements in imitation within the training context by offering five novel actions during a pretest and a posttest, before and after the training period. Dependent variables for SIPT included errors in modulation, directness, use of body part, as well as spatial aspects of movement. Percent imitation error for each robot action was also measured. Pre and posttest measures were obtained for each variable.

Results: In terms of generalized SIPT performance, Wilcoxon non-parametric tests showed an effect of training with a decrease in spatial ($p<0.05$), body part ($p<0.05$) and total ($p<0.1$) errors in the posttest compared to the pretest. In terms of task-specific performance during robot imitation, a two-way repeated measures ANOVA showed a significant effect of training with lower errors in the posttest as compared to the pretest ($p<0.05$, effect size=0.362). Case reports on two high-functioning children with ASDs and one high-functioning child with ADHD reveal improvements in both SIPT as well as task-specific robot imitation. Moreover, one child with low-functioning ASD dramatically improved his performance in the SIPT as well as task-specific, robot-imitation.

Conclusions: Our first study on robot-child interactions was a proof of concept study and helped develop a structured training paradigm and a sound testing protocol. Our results suggest moderate improvements in the posttest scores of TD children and the majority of the children with ASDs/ADHD. The moderate improvements may be attributed to a short-training period (i.e., only 8 sessions of training). Our future research proposal is to conduct a randomized controlled trial in children with ASDs who receive robot-child interaction training in addition to the traditional interventions for an extended period while being compared to a comparison group. Thus, our preliminary data suggest that the robot-adult-child interaction context appears to be a promising tool for facilitating imitation and praxis in children with ASDs.

105.075 75 The Effects of Robot-Child Interactions on Patterns of Joint Attention and Verbalization of Typically Developing (TD) Children and Children with ASDs/ADHD Between 4-10 Years of Age. A. Bhat*, C. Susca, M. Lally and K. Marsh, *University of Connecticut*

Background: Verbal and nonverbal communication delays are hallmarks of Autism Spectrum Disorder (ASD) and are often addressed by traditional autism interventions. However, motor impairments in coordination, praxis, and imitation are often present yet seldom addressed through intervention. Currently, we are evaluating how an embodied social intervention that involves an imitation game between a robot, an adult, and a child affects the social skills of typically developing (TD) children and children with ASD and Attention Deficit Hyperactivity Disorder (ADHD) between 4-10 years of age. Specifically, we would like to see whether such a motivating context enhances the nonverbal and verbal communication of the child with the adult controlling the robot.

Objectives: To examine the effects of robot-adult-child interaction training on the rates of joint attention bids and duration of verbalization in typically developing children and children with ASDs/ADHD between 4-10 years of age.

Methods: Fifteen typically developing children and four children with ASDs/ADHD were examined. Each child received eight, 30-minute sessions of robot-child interaction training across four weeks. During the training, each child copied a 7-inch tall, humanoid robot that performed four to five actions based on a karate or dance theme. We examined the rates of joint attention bids to the adult as well as the percent duration of verbalization directed to the adult during the first, mid, and last sessions. We also examined the same during the pre and posttests involving imitation of five novel actions. We divided each code into spontaneous as well as responsive forms of communication.

Results: In terms of verbalization, our preliminary analysis of six children suggests that percent of spontaneous verbalization was greater for the last session (25.0±2.0) as compared to the first session (8.0±2.0). No clear differences were observed for responsive verbalizations. In terms of non-verbal communication, analysis of the entire dataset suggests that total rates of joint attention bids to the tester increased significantly during the baseline and robot-imitation conditions of the posttest as compared to the same in the pretest ($p<0.001$). These trends were not observed during training due to increased complexity of actions in the latter sessions as compared to the earlier sessions. We are coding the looking durations to the robot, adult, or other to confirm our hypothesis. Moreover, children with ASDs/ADHD showed small improvements to no change in terms of verbal and nonverbal communication.

Conclusions: TD children showed enhancements in social communication as seen by increased spontaneous verbalization durations as well as total rates of joint attention bids after training as compared to their baseline. Relatively, small to no improvements were seen in the children with ASDs/ADHDs. This could be attributed to the short training period of eight sessions. Our future studies will focus on extended periods of robot-child interaction training using a more capable robot.

105.076 76 The Effects of the Pace of Instruction During Structured Teaching with Children Diagnosed with Autism. M. D. Adams*, C. N. Bowen, A. L. Valentino and M. A. Shillingsburg, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Discrete trial teaching is often used to improve language skills for children diagnosed with autism. Although there is research to support the use of DTT, there is little research on specific parameters of this kind of teaching. Important variables to consider are those that result in efficient teaching sessions with minimal problem behavior. Literature suggests that manipulation of the Inter-trial Interval (ITI) or pace of instruction may be an important variable of a teaching session. Research has shown that faster paced instruction has been effective in increasing rates of acquisition and reducing problem behavior in individuals with learning disabilities and off-task behavior, however, little is known about the effects of fast or slow paced instruction when teaching children with autism.

Objectives: The objective of the current study was to examine the effects of the pace of instruction during a structured teaching session on rates of problem behavior in children with autism and related disabilities. Furthermore, the current investigation examined the influence of rate of reinforcement during fast and slow paced instruction.

Methods: Five children diagnosed with developmental delays (three of which had a formal autism diagnosis) served as participants in the study. Sessions were conducted in five minute blocks during instruction. The pace of instruction was systematically controlled and included a fast paced condition (1 sec ITI) and a slow paced condition (5 sec ITI). In order to control for the effects of the rate of reinforcement, which would presumably be higher in the fast paced condition, a condition consisting of slow paced instruction with a rate of reinforcement yoked to the fast paced instruction condition was also included. In each condition, mastered targets were presented with either a 1 s or 5 s ITI. The dependent variable was problem behavior, which was individually defined for eah participant but included aggression, disruption, and elopement. The effects of pace of instruction on problem behavior were assessed using a reversal and multi-element experimental design.

Results: Outcomes indicated that fast paced instruction resulted in lower levels of problem behavior for two participants and yielded no difference in levels of problem behavior between the fast, slow, and yoked conditions for three participants. Results are discussed in terms of selecting the optimal inter-trial interval for teaching children with autism.

Conclusions: In conclusion, inter-trial intervals during discrete instruction may reduce the opportunity for problem behavior to occur, which may facilitate learning for some children. The fact that some children are sensitive to inter-trial intervals makes it important to assess the effects of pace of instruction on problem behavior for individuals involved in discrete trial teaching prior to beginning teaching in this format.

105.077 77 The feasibility and preliminary effectiveness of a school-based, blended developmental and behavioral

parenting intervention for children with ASD. B. Ingersoll*, *Michigan State University*

Background: Despite the acknowledged benefits of parent training for children with ASD, parent training interventions are rarely implemented in public special education settings for children with ASD. Project ImPACT is 12-session parenting training program that teaches parents to improve their child's social communication during daily routines and activities. The intervention utilizes a novel blend of developmental and behavioral techniques that are designed to promote social engagement, language, imitation, and play in children with ASD.

Objectives: This study investigated the feasibility and preliminary effectiveness of Project ImPACT in public early intervention and early childhood special education (EI/ESCE) programs serving students with ASD.

Methods: Eleven teachers representing three intermediate school districts were trained by the intervention developers to implement the intervention with 28 students and their parents. At pre- and post-treatment, parents and teachers completed measures of child social communication skills, autistic symptomatology, parenting stress, and treatment acceptability. Parents were also observed in their homes interacting with their child during free play and a daily routine. Paired t-tests were used to examine changes in parent and child functioning from pre- to post-treatment.

Results: Parents of 24 children (86%) completed the program. Parents and teachers reported significant gains in child mastery of social communication skills on the *Social-Communication Checklist*. Teachers, but not parents, also reported a significant decrease in autistic symptomatology on the *Social Responsiveness Scale*. Parents improved their use of the treatment strategies and children increased their rate of appropriate language during a parent-child interaction in their home. Parents also reported a significant decrease in parenting stress on the child domain, but not the parent domain, of the *Parenting Stress Index*. Both parents and teachers rated the intervention highly in regards to treatment acceptability and usability.

Conclusions: The moderate to high completion rate and positive ratings by parents and teachers indicate that this intervention can be feasibly implemented in public EI/ECSE settings, filling a significant gap in services for public preschool intervention programs serving children with ASD. Improvements in child and parent functioning provide preliminary evidence for the effectiveness of this intervention approach.

105.078 78 Unstuck and On Target: An Executive Functioning Intervention for Children with High-Functioning Autism Spectrum Disorders. L. G. Anthony*[1], L. Cannon[2], K. Alexander[2], M. A. Werner[2], M. C. Wills[1], J. L. Sokoloff[1], C. Sharber[1], J. Wintrol[2] and L. Kenworthy[1], (1)*Children's National Medical Center*, (2)*Ivymount School*

Background:

Difficulties with executive functioning are a commonly observed associated feature of high-functioning autism spectrum disorders (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:

1) Develop an innovative classroom intervention targeting flexibility in children with ASD

2) Evaluate the feasibility of the intervention by examining preliminary data collected during the development trial

Methods:

The intervention was developed through the participatory method, including a feasibility trial with 13 children in a special education program for children with ASD. The intervention was delivered by school staff during the children's social skills groups in about 35 sessions of 40 minutes each. The intervention teaches what flexibility is, why it is important to be flexible, how to be flexible, goal-setting/prioritizing and coping skills. As part of this feasibility trial, we gathered extensive feedback from the teachers, students and parents and revised and streamlined the intervention significantly. We also conducted a preliminary test of the intervention as it was being developed, comparing the change in multi-modal assessments from pre- to post-intervention. Data was collected via parent and teacher questionnaires (BRIEF, Flexibility Questionnaire), and a new group measure assessing EF, especially flexibility, in a socially-demanding context (observing groups of four children working together to complete tasks).

Results:

The resulting intervention is feasible and acceptable to participants (90% enrollment rate; no children dropped out or refused, though 2 left the school for other reasons, and 1 child did not complete the intervention before the end of the school year because of a late start).

The children who have completed the intervention demonstrated significant change in flexibility as rated by teacher (t=2.23; df=10) and by parent (t=2.54; df=9). The children also showed some change in EF as rated by parent: BRIEF Shift (t=23.81; df=9) and Plan/Organize (t=2.03; df=9; p=.07 trend). On a blind coded group-based assessment of EF skills (N=8), the children were significantly more collaborative with each other after the intervention (t=-3.00), but also made fewer positive comments to each other (t=6.28). On this same measure, the children trended towards used fewer coping strategies after the intervention (t=1.96; p=.09 trend) and receiving an overall rating of flexibility reflecting an improvement in flexibility (t=-1.99; p=.09 trend).

Conclusions:

These results suggest that an EF intervention implemented in schools is feasible and acceptable by school staff and students with ASD. Further, parents and teachers see promise in such a program, and a blind rater also detects differences. The next step in this intervention development process is currently underway to evaluate the effectiveness of this curriculum in mainstream schools with a comparison group. We are also developing a companion parent manual and training program to be used in conjunction with the school-based intervention.

105.079 79 Using Group Function-Based Cognitive Behavioural Therapy for Children with High Functioning Autism and Obsessive-Compulsive Behaviours. N. Neil*, L. Lam, H. Yates, M. Fleishman, T. Vause and M. Feldman, *Brock University*

Background: Researchers have conceptualized repetitive behaviours in individuals with Autism Spectrum Disorder (ASD) on a continuum ranging from lower-level, motoric, repetitive behaviours to higher-order, obsessive-compulsive like, repetitive behaviours (Hollander, Wang, Braun, & Marsh, 2009). Although obsessional, ritualistic, and stereotyped behaviours are a core feature of ASD, individuals with ASD frequently experience obsessions and compulsions that meet the DSM-IV-TR criteria (American Psychiatric Association, 2000) of Obsessive-Compulsive Disorder. Given the acknowledged difficulty in differentiating between OCD and Autism-related Obsessive-Compulsive phenomena, the present study will use the term Obsessive Compulsive Behaviour (OCB) to represent both phenomena.

Objectives: This study examines the effectiveness of a function-based Group Function-Based Cognitive Behavioural Therapy (GCBT) program in reducing OCBs in children with High Functioning Autism using a single-case research design.

Methods: A multiple probe design and a multiple baseline design across behaviours will be used to investigate if function-based GCBT decreases OCB in seven children (7-12 years of age) with High Functioning Autism. Children met criteria for Obsessive Compulsive Disorder using the Anxiety Disorders Interview Schedule – Parent Version (ADIS-P) and the Children's Yale Brown Obsessive Compulsive Scale (CY-BOCS). All participants scored ≥ 70 on measures of intellectual abilities. The function-based GCBT protocol (Vause, Neil, & Feldman, 2010, in progress) will consist of awareness/cognitive training, behavioural skills training, and graded exposure plus response prevention. The Questions about Behavioural Function (Matson & Vollmer, 1995) will be used to identify hypothesized functions of OCB, which will be addressed throughout treatment.

Results: Targeted OCBs include, but not limited to: cleaning rituals, checking, inflexible routines, hoarding, and repeatedly seeking reassurance. Data collection is ongoing and includes both video and voice recorded probes accompanied by daily caregiver ratings of OCBs. Groups are expected to be completed in the beginning of April 2011.

Conclusions: Similar to pilot studies the function-based GCBT program is expected to reduce the severity of targeted OCBs. Strengths and weaknesses of the methodology and implications for future research will be discussed

105.080 80 Cognitive-Behavioral Group Therapy for Children with Autism Spectrum Disorders and Anxiety: The Moderating Influence of Negative Cognitions. E. Leuthe*[1], A. Blakeley-Smith[2], B. Wolff[3], S. Hepburn[4] and J. Reaven[5], (1)*University of Colorado Denver School of Medicine - The Children's Hospital Denver*, (2)*Univ. of Colo. Denver-JFK Partners*, (3)*University of Colorado Denver School of Medicine*, (4)*University of Colorado Denver, Anscutz Medical Campus*, (5)*Univ. of Colorado Denver-JFK Partners*

Background: Anxiety disorders are relatively common in children with Autism Spectrum Disorders (ASD) (White et al., 2009) and modified Cognitive Behavioral Therapies (CBT) for children with ASD have demonstrated promising results (Chalfant et al., 2007; Reaven et al., 2009). In examining the

initial efficacy of modified CBT for youth with ASD and anxiety it is important to examine who may respond best to these interventions. Multiple variables may determine who best responds to treatment. Attention to cognitions is a central element of CBT interventions; therefore, pre-treatment levels of negative cognitions may be one such factor that may determine treatment response. This is an especially interesting variable to consider, given questions raised in the literature about the role of cognitions in intervention programs for children with ASD (e.g., Lang et al., 2010).

Objectives: The current study examined whether pre-treatment negative cognitions moderated the relationship between treatment condition (i.e., *Facing Your Fears* (FYF) vs. Treatment-as-Usual in the community (TAU)) and outcome (i.e., anxiety symptom improvement) among children with ASD. We hypothesized that youth with relatively high levels of negative cognitions would respond better to active treatment than children presenting with low levels of negative cognitions.

Methods: The sample was well-characterized using gold standard measures of autism and anxiety (e.g., ADOS, SCARED, ADIS-P). The current sample of 30 children was a subsample from a larger randomized control trial for the FYF program (Reaven et al., in preparation); a 12-week manualized group CBT program designed for children ages 8-14 with ASD and anxiety (Reaven et al., in press). Children were randomized into one of two conditions: TAU (n=13) and FYF Intervention (n =17). No significant differences were found between groups on participant's age or overall cognitive functioning, and most participants were male (n=29). Negative cognitions were measured using the four subscales of the Children's Automatic Thoughts Scale (CATS; Schniering & Rapee, 2002): Hostility, Social Threat, Physical Threat, and Personal Failure. Symptom improvement was measured by the Clinical Global Impression Scale - Improvement (CGIS-I; Guy & Bonato, 1970), assigned by an Independent Clinician blind to group assignment.

Results: For each CATS subscale a linear regression analysis was used to assess main and interaction effects of treatment condition and negative cognitions on anxiety symptom change. The interaction terms for two subscales were significant predictors of anxiety symptom change: Hostility β=-0.62, p<.05 and Social Threat β=-0.52, p<.10, with R^2 increasing by .17 and .10, respectively. Plots revealed children with relatively high levels of pre-treatment Hostility or Social Threat who received FYF showed better CGIS-I ratings relative to children in the TAU group. There was no difference in CGIS-I ratings for children with relatively low levels of pre-treatment negative cognitions across groups.

Conclusions: For children with ASD and clinical anxiety, pre-treatment levels of certain negative cognitions may be important predictors of who will benefit most from CBT. Limitations include a lack of an attention control group and a limited understanding of the stability of negative cognitions over time.

105.081 81 Cognitive Behavioral Therapy for Anxiety for a Child with Autism Spectrum Disorder and Intellectual Impairment: A Case Study. M. E. Ames* and J. A. Weiss, *York University*

Background:

Cognitive behavioral therapy (CBT) is the primary psychosocial therapy for treatment of mood and anxiety disorders in typically developing children. There is emerging literature on interventions for anxiety disorders in children with ASD, with the majority focused on providing modified CBT. Two randomized controlled trials have shown potential for the use of CBT in the treatment of children with ASD who have average to above average intellectual and verbal abilities. However, children with ASD who are higher functioning may be better able to understand the cognitive components of CBT than children with cognitive impairments, and less work has discussed how to address the needs of youth with ASD and intellectual impairment.

Objectives:

The purpose of the present case study is to describe the use of modifications to *The Coping Cat Workbook* in the treatment of anxiety of an 8-year-old boy, Chris, with ASD and mild intellectual impairment. The objective of the case study is to provide a description of a number of modifications used to assist Chris in maintaining a relationship with peers with ASD with average IQ within the group intervention, while at the same time learning the Coping Cat material in a way that would help him control his anxiety.

Methods:

Chris and his family were recruited through a community-based program offered to children with ASD to partake in a CBT program for children aged 8-12. At intake, Chris met clinical cut-off for autism on the ADOS-G and had an estimated Full Scale IQ of 81, with notable difficulties in receptive and expressive language. When anxious, Chris would become verbally and physically aggressive. Due to behavioral

difficulties, Chris participated in a modified group therapy that included a substantial individual therapy component. Modifications included the introduction of visual aids as the primary method of treatment delivery, the inclusion of special interests in therapy, physical play activities, and parental involvement. The CBCL and two measures of anxiety (e.g., SCARED, RCMAS-2) were administered pre- and post-treatment to assess treatment effects.

Results:

Chris' initial scores for the CBCL internalizing, externalizing, and total problems subscales were within the clinical range. Scores were within the borderline range for anxiety/depressed syndrome scales and within the clinical range on all other syndrome scale scores (excluding somatic complaints). Following treatment, scores for the internalizing, externalizing, and total problems subscales remained in the clinical range. However, scores on the social problems, rule-breaking behaviour, and attention problems decreased, although all other scores either remained the same or increased.

Conclusions:

In general, many of Chris' scores seemed to increase over time, although initial levels were already quite elevated. Limitations of the CBT intervention and the need for tailoring supports to meet the cognitive needs of youth with ASD and intellectual impairment are discussed.

105.082 82 Long Term Outcomes of a Parent-Assisted Social Skills Intervention for Adolescents with Autism: The UCLA PEERS Program. J. Mandelberg*, E. A. Laugeson, F. Frankel, A. Gantman and S. Bates, *UCLA Semel Institute for Neuroscience & Human Behavior*

Background: It is estimated that nearly 50% of teenagers with autism do not have a friend. The Program for the Education and Enrichment of Relational Skills (PEERS) is a parent-assisted social skills intervention for adolescents with autism that specifically targets ecologically valid friendship skills. There is limited research in the literature regarding the long term outcomes of social skills training programs.

Objectives: The major treatment goal for PEERS patients 1-5 years post-treatment would be having true friendships. In prior research on the PEERS program, we found an increase in the frequency of hosted get-togethers, improved social skills knowledge, significant differences in quality of friendships and improvement in teen's overall level of social skills at the end of treatment compared to wait-list control. In this long term outcome study, we aimed to establish whether the intervention had long term positive social benefits for participants.

Methods: All teenage participants in the previous treatment outcome research with PEERS had a diagnosis of an autism spectrum disorder. Participants received 12-14 weekly 90-minute sessions in which parents and teenagers were seen concurrently for social skills training. For the current study, families who completed the PEERS program 1-5 years prior were recruited through mail, phone and email. Data collection consisted of online questionnaires and an interview over the phone. Differences in frequency of peer contacts and social skills measured over time were analyzed by pair-wise t-test. Data was evaluated before the intervention (T1), immediately following the intervention (T2) and at long-term follow-up (T3).

Results: Preliminary analysis of 34 subjects out of 83 potential PEERS completers who were at least 12 months since completing treatment (41% response rate) reveal maintenance of treatment gains. Participants were an average of 27 months post intervention at the time of follow up. The mean age of the teen participants was 17.1 years and grade level was 11.0 at follow-up. Pre- and post-test comparisons revealed significantly improved standard scores on the Social Skills Rating System for overall social skills (T1=78, T2=91, $p<0.01$) and problem behaviors (T1=113, T2=106, $p<0.01$). These gains were maintained at long term follow up for both social skills (T3=93, $p<0.01$) and problem behaviors (T3=97, $p<0.01$). Pre- and post-test comparisons of the frequency of peer contacts revealed significantly more get-togethers in the prior month (T1=1.6, T2=4.0, $p<0.01$) following treatment. The number of get-togethers remained significantly improved at long term follow up (T3=3.4, $p=0.01$). Pre- and post-test comparisons revealed significantly improved scores on the Test of Adolescent Social Skills Knowledge (T1=13.1, T2=22.0, $p<0.01$). While there was a slight decline from post-test findings, long term follow-up showed knowledge remained significantly improved from baseline (T3=18.6, $p<0.01$).

Conclusions: Assessment of the maintenance of social skills gains and frequency of peer contact 1-5 years post-treatment appear to suggest that the PEERS intervention is successful in maintaining treatment gains over time. Reasons for continued benefit will be discussed, including parent involvement in the treatment, as well as developmental maturation.

105.083 83 Pilot Study of Emotion-Focused Social Skills Interventions for Children with ASDs. S. Teitelbaum*[1], H. Crain[2], R. Schmitt[2], L. V. Soorya[2] and A. T. Wang[2], (1), (2)*Mount Sinai School of Medicine*

Background: Social deficits in HFA or AD are apparent in many domains including emotion perception, reciprocal communication skills, and understanding others' intentions (Bauminger, 2002). Evidence is emerging to suggest individuals with ASD can show normal levels of activity in important regions if task demands allow for explicit processing of key social stimuli (e.g., facial expression, tone of voice) (Wang, et al., 2006). Here we present a sub-analysis of outcomes from a larger trial evaluating neural and behavioral outcomes of two models of a 12-session, outpatient social skills intervention for high functioning children with ASDs targeting improvements in nonverbal communication, emotion recognition, and empathy. The main study compares child-directed vs. adult-led social skills interventions, and utilizes direct assessments, behavioral observation data, and neuroimaging of key social cognitive regions to evaluate outcomes. The present analysis is evaluating the short-term effects of directed, intervention approaches on children's emotion recognition skills.

Objectives: To evaluate preliminary outcomes of interventions targeting emotion-learning in school-aged children with ASDs.

Methods: Twenty-four children, 8-11 years old with autism spectrum disorders, confirmed by comprehensive diagnostic evaluations utilizing DSM-IV, ADOS, and ADI were included in the present analysis. Children were randomized into one of two conditions, with 4-6 children per group, 1 lead therapist and 1 assistant. Sessions were 90-minutes in length and included concurrent child therapy and parent education sessions. The two treatment models included an adult-directed, cognitive-behavioral therapy based program and a child-led, play-therapy based program. Both models included curricula focused on building emotion recognition and empathy skills. Children were evaluated at baseline, 12-weeks, and 3 months post-intervention on all outcome measures.

Results: This preliminary analysis collapses data across treatment conditions and evaluates outcomes on two behavioral measures at the 12-week endpoint. Across treatment groups, paired sample t-tests yielded significant improvement on emotion perception in voices, as measured by the Diagnostic Analyses of Nonverbal Behavior 2 (DANVA2). Improvement in direct assessment of emotion perception was also supported by parent reports on measures of affective empathy.

Conclusions: These initial results suggest that the interventions as a whole produced significant changes in children's perceptions of emotions on social cognitive tasks as well as parent ratings of empathetic behaviors. While data is currently being collected on the larger trial and analysis of group differences are not yet available, the results of this sub-analysis suggest the potential for improvement of affective perception and empathy from brief social skills interventions delivered in a small group setting.

105.084 84 Social Preference In Children with ASD: Exploring the Gray Area. M. C. Dean*, S. Mahjouri and C. Kasari, *University of California, Los Angeles*

Background: Children with ASD experience complex social difficulties in school. Research suggests that inclusion may not be sufficient to fully integrate them into the classroom social structure. This often results in higher rates of isolation, and less reciprocal friendships when compared to typically developing peers.

Objectives: This paper analyzed the social network status of 60 fully included elementary school children with ASD and 60 of their matched peers. The study aim was to examine the reliability of peer nomination methodology and compare social impact, social preference and social network scores.

Methods: Children were asked to list all children in their class that they liked to play with as well as children they did not like to play with. Indegree scores were obtained for each child with ASD and a matched peer from their class, by tallying how many times the child was nominated as a friend. Rejections were tabulated in the same fashion, using the responses from the "children I do not like to play with" question. Social impact score (SI) was determined by standardizing the indegrees and rejections, and adding the two. Social preference score (SP) was determined by subtracting the standardized rejection score from the standardized indegree score. Asking children to list groups of children that play together in their class, and then analyzing the co-occurrences for statistical significance determined social Network Centrality score (SNC). Children were grouped into four categories: isolate, peripheral, secondary, and nuclear.

Results: Children with ASD differed in their SNC, SI, and SP scores than matched peers ($p<.05$). The greatest difference was found in SNC and SP scores ($p<.001$). Further analyses indicated that across the full sample, SI and SP accounted for 29% of the variance in SNC score, with varying contributions (SI $r^2=.252$; SP $r^2=.334$). However, when children with ASD were compared to their matched peers, it was found that SI and SP were only predictors of SNC in children with ASD ($p<.001$).

Conclusions: Examining the relationship between SI, SP and SNC scores gives a complete picture of classroom social

structures. Our data indicate that for children with ASD, being well liked by classmates was an important predictor of group centrality, or connection with peers. It appears that typically developing children may have more ways to connect with peers, beyond being well liked, than children with ASD. Therefore it is important for school-based interventions for children with ASD to facilitate connection and engagement with peers, which could potentially compensate for lower social preference. Additionally, our findings highlight the social roles of colleagues and acquaintances, which may be underdeveloped in children with ASD. These data indicate that social structures in elementary school can be multifaceted, and perhaps children with ASD falter by missing the gray areas of friendships.

105.085 85 Generalization of SOCIAL SKILLS FOLLOWING A Computer BASED INTERVENTION for Elementary SCHOOL Aged Children. L. M. Rice*, *Moorpark Unified School District*

Background:

Autistic spectrum disorders are conceptualized as a spectrum of developmental disabilities caused by neurological impairment. Deficits within the social cognitive domain, including challenges with social/emotional reciprocity, emotion/affect recognition and expression are considered hallmark characteristics resulting in the inability to recognize, interpret and utilize emotions and subsequently developing and maintaining relationships with others.

Research has shown various treatment modalities to be effective however; emerging technology-based treatments focused on emotion recognition (ER) are relatively new and cost effective. A number of studies suggest positive results utilizing this technology to teach basic and sometimes complex ER however, the major limitation has been the lack of generalizing the learned skills to natural settings.

Objectives:

This study examined the extent to which a computer based intervention program called *FaceSay* could increase the affect recognition skills and theory of mind skills of school aged children with ASD as well as to determine if collateral social skills and behaviors would generalize to the school environment.

Methods:

The study involved the use of a 2 x 2 mixed factorial design. The within factor, time, had two levels, pre- and post-intervention; the between factor, training, also had two levels, experimental and control groups. Participants included 31 school-aged children attending a public school, and placed in regular education classrooms who met the educational criteria for autism. Pre- and post-intervention data was collected via standardized neuropsychological assessment, evaluating the participant's ability to accurately identify emotions in others and to understand other's perspectives, and social interactions were assessed via teacher questionnaire and blinded social skills observations on the playground. The participant's in the experimental group underwent 10 weeks of computer based intervention while those in the control group utilized another type of program.

Results:

Analysis results indicate that by practicing simulated activities addressing eye gaze, joint attention skills, emotional cognition and facial recognition skills on the computer the participant's in the experimental group were able to significantly (p = .000) increase their affect recognition capabilities and their theory of mind skills. Although these improvements were noted in the participant's emotion recognition and social cognition skills, based upon standardized assessment, the hypotheses that improved social interactions in the school environment would also occur were not fully supported. Standardized teacher report measures did approach significance (p = .06) suggesting that some generalizability to the school environment occurred.

Conclusions:

Besides adding to the general body of literature on this subject the results of this study can be useful for parents, psychologists, educators, and specialists who live and work with children on the autistic spectrum. As the prevalence of ASD increases, the identification of more evidence-based and cost effective teaching methods is warranted. This study demonstrated that the use of computer technology in helping ASD children understand the social world is highly effective. The computer software program, *FaceSay* definitively increases the ability of children on the autistic spectrum how to recognize emotions and understand another's perspective as well as showing great promise in increasing their ability to generalize these skills in their school environment.

105.086 86 Get Fresh: Evaluation of A Healthy Lifestyles Group for Teens with ASDs and Their Parents. S. Nichols*[1], S. Pulver Tetenbaum[2], L. Adamek[3], L. Perlis[4], E. M. Mansdorf[5] and G. Reilly[6], (1)*Fay J. Lindner Center*

for Autism, (2)*ASPIRE Center for Learning and Development*, (3)*UC San Diego*, (4)*Fay J. Lindner Center for Autism and Developmental Disabilities*, (5)*Hofstra University*, (6)*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). People with autism spectrum disorders (ASDs) may have difficulty achieving healthy lifestyles due to limited interest in physical play, lack of motivation to engage in social fitness activities, limited self-awareness, and restricted food interests. Further, youth with ASDs exhibit a higher prevalence of gross motor deficits (Freitag, Meser, Schneider, & Von Gontard, 2007). Thus, education and intervention are needed in this area. Health and fitness programs with neurotypical children have generated a variety of positive outcomes in academic performance, attention, sleep, self-esteem, motor skills, and externalizing behaviors. A recent review of physical exercise with individuals with ASDs demonstrated decreases in child problem behaviors (Lang et al, 2010). To date, no projects have investigated the efficacy of a comprehensive, group, health and fitness curriculum for youth with ASDs. The development and evaluation of such a curriculum will enable professionals to best understand how to teach health and fitness concepts and activities to adolescents with ASDs.

Objectives: The aim of the current study was to evaluate the effectiveness of a group-based parent and teen curriculum designed to (a) increase adolescents' fitness-related motor skills, (b) improve adolescents' sleep, (c) increase adolescents' healthy eating, (d) improve adolescents' relaxation skills, (e) increase parents' confidence in being able to create healthy lifestyle changes at home, and (f) increase families' reported 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). Preliminary analyses of pre and post group measures included parent reports of individualized goal attainment.

Results: Data analysis is currently underway. Results suggest that parents made progress towards accomplishing their personal goals for participation in the group; 85% of parents (n = 20) indicated a rating of 3 or higher on a 5 point likert scale for goal accomplishment at post-group. Parents were also asked to identify a specific goal prior to the start of group and indicate their child's level of goal attainment pre- and post-group. Goal attainment ratings (0-5 scale) were high for all parents post-group (t (18) = -7.52, p < .0001), though specific goals varied greatly across families. Common themes arose as issues facing youth with ASDs (e.g., motivation to exercise and variety of food choices). Further analyses will compare pre-post changes in adolescent's quality of life, social functioning, activity level, and problem behavior.

Conclusions: Preliminary findings demonstrate the appropriateness of group-based parent and teen psycho-education and activity programming for addressing health and fitness for youth with ASDs. Limitations and recommendations for future research directions in health and fitness will be discussed.

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105.135 135 Aggression In Children and Adolescents with ASD: Prevalence and Risk Factors. S. M. Kanne*[1] and M. O. Mazurek[2], (1)*Thompson Center for Autism and Neurodevelopmental Disorders*, (2)*University of Missouri - Columbia*

Background:

Although aggression is generally understood to be a common problem among individuals with autism spectrum disorders (ASD), there have been no studies examining the prevalence of and risk factors for aggression among children and adolescents with a diagnosis of an ASD. Rates of aggression in ASD have ranged from 15% to 36% depending on how aggression was defined and in what age range, and some researchers have found that the presence of aggression was associated with lower IQ, poorer expressive and receptive language, and restricted and repetitive behaviors.

Objectives:

The current study is the first to report prevalence rates of and risk factors for aggressive behaviors among a large, national sample of children and adolescents with well-characterized diagnoses of ASD. In addition to examining whether aggression was related to risk factors observed in non-ASD children (e.g., age, level of income, level of parental education, parental marital status, gender, cognitive and adaptive functioning, language and communication), we also examined whether ASD phenotypic variables, such as level of severity and specific ASD symptoms, were predictive of aggression.

Methods:

The sample included 1380 participants between the ages of 4 and 17 who had participated in the Simons Simplex Collection (SSC). The SSC is a North American multi-site, university-based research study that includes families with only one child with an ASD. Phenotypic information was gathered via the ADI-R, ADOS, SRS, RBS-R, PPVT-4, CBCL, various IQ measures, and the Vineland II. Four individual ADI-R item scores from the ADI-R were used to assess both current and historical aggression directed toward both caregivers and non-caregivers. In addition to correlational analyses, logistic regression examined whether specific variables were significantly related to the presence of aggression (N = 633).

Results:

Over half (56%) of the respondents were currently engaging in some form of aggressive actions towards caregivers, with fewer (32%) engaging in aggressive behaviors towards non-caregivers. Sixty-eight percent had demonstrated some form of aggression at some point to a caregiver, and 49% to non-caregivers. Aggressive behaviors were more likely with increases in repetitive behaviors, higher income, and increasing levels of ASD related social and communicative deficits. A significant effect for age was found with aggressive behaviors becoming less likely with increasing age. Repetitive behaviors that were significant predictors were self injurious behaviors, ritualistic behaviors, and resistance to change.

Conclusions:

The results reflect a high prevalence of aggressive behaviors in individuals with ASD. Aggression in the current sample was not associated with clinician observed severity of ASD symptoms, level of intellectual, language or communication skills, gender, level of parental education, or parent marital status. Those individuals who were younger, whose parents reported more ASD related social and communication difficulties, who engaged in more severe restricted and repetitive behaviors, and who had higher levels of family income were more likely to demonstrate aggression. Given the significant impact of aggression on individual and family outcomes, it is hoped that this knowledge will inform more targeted intervention efforts.

105.136 136 Psychiatric Symptoms and Psychotropic Medication Use In Children with Autism: Findings From the Simons Simplex Collection. O. Y. Ousley*[1] and S. M. Kanne[2], (1)*Emory University*, (2)*Thompson Center for Autism and Neurodevelopmental Disorders*

Background:

Recent systematic investigation of clinical populations of children with autism spectrum disorders (ASD) has identified the presence of co-morbid psychiatric symptoms which are often the target of clinical intervention, including use of psychotropic medication. Frequently, these symptoms include inattention and hyperactivity, anxiety, irritability, self-injury, and depression, and in some instances, symptoms of psychotic illness. Factors such as age and cognitive ability, as well as the presence of co-morbid psychiatric symptoms, appear to be related to medication use; however, no clear recommendations have been provided in the research and clinical literature that guide the use of psychotropic medications in children with ASD and related symptoms. Understanding the patterns of current medication use is a necessary first step towards developing standards of care for children with ASD.

Objectives:

Data from the Simons Simplex Collection (SSC) will be presented to characterize the presence of co-morbid psychiatric symptoms in a large sample of children with autism spectrum disorders, to identify which psychotropic medications are used in treating children with autism, and to determine which individual factors are related to psychotropic medication use.

Methods:

This study focuses on two primary measures from the SSC phenotypic battery, including the Achenbach Child Behavior Checklist and a medical history interview administered to parents. Descriptive statistics are reported for these measures as a way to characterize level of co-morbid psychiatric symptoms and use of psychotropic medication. In addition, a series of regression analyses are reported to explore how individual factors are associated with medication use. A total of 1423 children between the ages of 6 to 17 years are included in this data analysis.

Results:

Results of this study show that children with ASD experience moderate to high levels of affective, anxiety, and ADHD-related symptoms [CBCL T-scores = 61.6 (SD=8.5), 61.8 (SD=8.7), 61.9 (SD=8.0), respectively], and that children with ASD often take ADHD medications, (25.7%), antidepressant medications (14.4%), and/or mood stabilizers (12.3%). Regression analysis exploring the relation between individual factors and psychotropic medication use indicates that 1) ADHD medication use is associated with older age and higher levels of ADHD and somatic symptoms, 2) antidepressant use is associated with

older age, increased autism severity, and increased levels of affective and anxiety symptoms, and 3) mood stabilizer use is associated with older age, lower nonverbal IQ, and increased levels of anxiety, ADHD symptoms, and conduct problems.

Conclusions:

Identifying psychiatric and behavioral problems that co-occur with ASD and identifying current patterns of medication use may lead to greater anticipatory guidance for parents and clinicians. Furthermore, future studies that examine co-morbid psychiatric symptoms in children with ASD may help identify the presence of phenotypic subgroups, and may lead to more precise characterization of the underlying biology of autism, and ultimately improved treatment.

105.137 137 The Effects of Problem Behavior on Parenting Stress In Young Children with ASD Over a 2-Year Period. P. Mirenda*[1], A. Zaidman-Zait[1], S. Georgiades[2], 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], E. Duku[2] and A. Thompson[2], (1)*University of British Columbia*, (2)*Offord Centre for Child Studies, McMaster University*, (3)*Dalhousie University/IWK Health Centre*, (4)*Montreal Children's Hospital*, (5)*University of Toronto*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*

Background: Parents of children with autism spectrum disorder (ASD) experience higher levels of stress than parents of children who are either typically developing (Rao & Beidel, 2009) or have other disabilities (Baker-Ericzen, Brookman-Frazee, & Stahmer, 2005). Links between parenting stress and child behavior problems have been well established (Hastings et al., 2005). However, most of the research to date has involved participants with ASD who are school-aged or older and has utilized data collected at one time point to examine this relationship. This limits our ability to understand the parenting stress-child behavior problem relationship over time in very young children with ASD.

Objectives: The purpose of this study was to examine the effect of child internalizing and externalizing behavior problems on parenting stress over a 2-year period in a large inception cohort of young children with ASD.

Methods: Data were drawn from the Canadian *Pathways in ASD* study and included 178 children with ASD. At the time of the initial data collection, which occurred within 4 months of diagnosis, the children's mean age was 36.7 months. The children's parents completed the Child Behavior Checklist 1.5-5 (CBCL; Achenbach & Rescorla, 2000), which measures both internalizing and externalizing behavior problems, at baseline and at 6 and 12 months post-diagnosis. Their parents also completed the Parenting Stress Index-Short Form (PSI-SF; Abidin, 1995) at baseline and 24 months post-diagnosis. The PSI-SF factor structure reported by Zaidman-Zait et al. (2010) was used for the analysis. Structural equation modeling was employed to conduct a path analysis using LISREL 8.80 (Joreskog & Sorbom, 2006).

Results: At baseline, all of the PSI-SF subscales and both types of child behavior problems were significantly correlated. Externalizing behavior at 12 months post-diagnosis was a significant predictor of both parenting distress and general distress at 24 months post-diagnosis (ß=0.18-0.20, *t*=2.01-3.03, p<.05). However, internalizing behavior was not predictive of either type of parental distress at 24 months (ß=0.06-0.15, *t*=.67-1.7, p>.05). Finally, both externalizing and internalizing behavior at 12 months were predictive of parents' perceptions of child demandingness and of the extent to which the child was difficult to manage at 24 months (externalizing ß=0.32-0.36, *t*=3.15-3.99, p<.05; internalizing ß=0.25-0.31, *t*=2.05-3.73, p<.05).

Conclusions: Even in very young children with ASD, child behavior problems have a significant impact on parenting stress over time. In particular, over a 24-month period, parents whose child had high scores for externalizing behavior problems experienced significant general distress as well as distress related to their role as parents. Even parents of young children with internalizing behaviors believed that their children were unusually demanding and difficult to manage. The results emphasize the importance of early intervention that are designed to ameliorate child behavior problems as well as to teach parents the skills that are required to cope with and resolve behavior problems in effective ways.

105.138 138 Reliability and Validity of the Positive and Negative Affect Schedule (PANAS) for Individuals with Autism Spectrum Disorders. E. Buvinger*[1] and C. Lord[2], (1)*University of Michigan Autism and Communication Disorders Center*, (2)*University of Michigan*

Background: Individuals with autism spectrum disorders (ASD) present a higher prevalence of internalizing symptomatology (i.e. depression and anxiety) than the general public (Mattila et al., 2010). The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) was created to measure affective states using a dimensional approach. The authors of the measure assert that positive items are specifically related to depression and not anxiety, and that negative items are highly related to

both depression and anxiety (tripartite model). The PANAS has been widely used in both clinical and non-clinical populations (Crawford & Henry, 2004; Tuccitto et al., 2009), but very few researchers have utilized it in a population of individuals with ASD.

Objectives: Because the measure has not previously been validated for the ASD population, this study investigated the reliability and validity of the PANAS for this population.

Methods: The PANAS consists of 10 negative and 10 positive mood questions, rated on a 5-point scale (0=not at all, 4=extremely). The two subscales have been shown to have sound psychometric properties, and to have high levels of internal consistency and convergent validity. Inclusion in an ongoing longitudinal study at the University of Michigan indicated that parents were able to complete this measure on their child, regardless of level of functioning. Participants for this study were selected from a database of an ongoing longitudinal study based at The University of Michigan Autism and Communication Disorders Center (UMACC). In this study, parents completed the PANAS with regard to their child for up to 4 waves [Parent N=520; Proband M age=17.8 (SD=1.8); Proband M VIQ=53.9 (SD=40.9)]. In addition, more able (MA) probands (VIQ>=70) completed the PANAS about themselves at up to 5 waves [N=145; M age=18.2 (SD=1.4); M VIQ=99.8 (SD=17.0)].

Results: Internal consistency of the scale was computed for both the parent (α=.80) and proband (α=.82) versions of the PANAS. Test-retest reliability on positive (Parent *r*=.62-.76; Proband *r*=.16-.57) and negative (Parent *r*=.56-.65; Proband *r*=.53-.90) items was good. To test convergent validity, correlations with the PANAS scores were computed for parent-report measures: Children's Depression Inventory (CDI; Functional Pos *r*= -.57*, Neg *r*=.47*; Emotional Pos *r*= -.55*, Neg *r*=.65), Adult Manifest Anxiety Scale (AMAS-A; Pos *r*= -.07; Neg *r*=.53*), and the Quality of Life Questionnaire (QoL-Q; Pos *r*=.52*; Neg *r*= -.22*). Correlations for MA self-report scales were as follows: BDI-II (Pos *r*= -.30*; Neg *r*=.65*), AMAS-A (Pos *r*= -.24*; Neg *r*=.63*), QoL-Q (Pos *r*=.22*; Neg *r*= -.43*), and the Well-being Scale (Pos *r*=.10; Neg *r*=.18).

Conclusions: The tripartite model of the PANAS was supported for the parent-report PANAS (PANAS-P). Positive items on the PANAS-P correlated significantly with QoL and Well-being questionnaires in the expected direction. The tripartite model was mostly supported for the MA self-report PANAS, but the total anxiety score correlated significantly with the positive items of the PANAS-MA. QoL scores, but not Well-being scores, correlated significantly with positive items on the PANAS-MA. This measure also showed high internal reliability, and is appropriate to use with ASD populations. Factor analysis results will also be reported.

105.139 139 Confirmatory Factor Analysis of the Child Behavior Checklist—Preschool Version In a Sample of Children with Autism Spectrum Disorders.

A. V. Snow*[1] and C. A. Farmer[2], (1)*Yale University*, (2)*Nisonger Center*

Background: The Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) is an empirically-derived checklist completed by caregivers that measures behavior and emotional problems in children. In children with Autism Spectrum Disorders (ASDs), the CBCL has been used to identify problem behaviors and emotional problems, and measure autism symptomology (e.g., Hurtig et al., 2009). Additionally, the CBCL has been used to demonstrate the construct validity of other measures of autism symptoms (e.g., Bolte et al., 2008). Despite its widespread use in the ASD population, few studies have examined the validity of the CBCL in children with ASDs. Only one study has examined its factor structure in this population, yet suffered from methodological limitations (Pandolfi et al., 2009).

Objectives: The goal of this study was to evaluate the validity of the preschool version of the CBCL in children with ASD using confirmatory factor analysis (CFA). Separate analyses were performed on the factor-analytically-derived Syndrome Scales, and the DSM-Oriented Scales, which were derived originally using clinical judgment.

Methods: The current sample included 155 children with ASDs (*n*=98 Autism, *n*=52 PDD-NOS, *n*=5 Asperger Syndrome) between the ages of 18 and 73 months (*M*=43.8, *SD*=14.1). Polychoric correlation matrices and robust diagonally weighted least squares estimation procedures were employed using LISREL 8.8 (Jöreskog & Sörbom, 2007). Three indices of fit were of particular interest in evaluating the fit of the models: the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Root Mean Square Residual (RMR).

Results: Indices of fit were mixed for the Syndrome Scales. The CFI was in the "good" range (0.98), the RMSEA was in the "acceptable" range (90% CI 0.047, 0.056; $p = 0.287$), and the RMR was outside of the "acceptable" range (0.11). The DSM-Oriented Scales yielded similar results: the RMSEA (90% CI 0.061, 0.072; $p = 0.00$) and CFI (0.96) were in the "acceptable" range, while the RMR was not (0.12). In general, factor loadings were moderate. On the Syndrome Scale, *Somatic*

Complaints had the lowest mean loading (*M* = 0.55, *SD* = 0.17) and *Aggressive Behavior* had the highest (*M* = 0.73, *SD* = 0.08). Of the DSM Scale, *Pervasive Developmental Problems* had the lowest mean loading (*M* = 0.58, *SD* = 0.11), while *Oppositional Defiant Problems* had the highest (*M* = 0.79, *SD* = 0.05).

Conclusions: These results tentatively support the use of the CBCL Syndrome Scales in children with ASDs. Although the DSM-Oriented scales were not derived through factor analysis, the structure of these scales also performed reasonably well. Interestingly, the DSM scale tapping ASD symptoms had the lowest mean factor loadings. This may reflect less variability on this subscale in this sample than would be present in a typically-developing sample. The sample used in this study was quite small according to CFA standards. However, the largely "acceptable" indices of fit, despite the small sample size, suggest that the factor structure is robust. Future analyses with a larger sample are planned.

105.140 140 Emotional Health of Adults with High Functioning Autism. J. A. McGillivray*[1], D. I. Hamilton[2] and H. T. Evert[1], (1)*Deakin University*, (2)*Australian Catholic University*

Background:

It is widely accepted that stress, anxiety, and depression are elevated in individuals with autism spectrum disorder (ASD). For example, Hofvander et al. (2009) reported that among a referred sample of adults, 53% met criteria for a mood disorder and 50% for an anxiety disorder. As suggested by Lainhart and Folstein (1994), under-diagnosis may occur due to the overlap between the characteristics of anxiety and mood disorders and those of ASD, as well as the possibility that symptoms may be masked by impaired verbal and non-verbal communication (Stewart et al., 2006). Individuals with high functioning autism (HFA) may be at particular risk for anxiety and depression due to awareness of their social difficulties and differences (Ghaziuddin et al., 2002). However, individuals with HFA may be able to self-report stressors and symptoms, enabling early identification and intervention.

Objectives:

The aims of our study were to: determine whether symptoms of mood, anxiety and stress, as well as sources of stress and extent of negative thinking are measurable through self-report by individuals with HFA using available instruments; and to ascertain the incidence, characteristics and relationships between these variables in this population.

Methods:

A sample of 95 individuals (69 males; 26 females) with HFA (mean age = 32.6; SD=13.9) completed the following instruments via self report, using either electronic or paper versions: The Stress Survey Schedule for individuals with autism (adapted for self-report by adults) (SSS; Groden et al., 2001); the Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995); and the Automatic Thoughts Questionnaire (ATQ; Hollon & Kendall, 1980).

Results:

On the DASS, symptoms of anxiety were reported by 54.7% of the sample, with 28.4% of these in the 'severe' or 'extremely severe' range; symptoms of depression were reported in 59.6% (28.8% severe or extreme); and symptoms of stress were reported in 61.3% (26.9% severe or extreme). Co-morbidity was common and females were significantly more impaired than males. Most people experienced a range of stressful events as measured by the adapted SSS, with 34.1% rated in the moderate to severe range. Negative automatic thoughts were also common, with the majority of participants reporting that these occurred 'moderately often' or 'all the time'. Significant correlations were obtained between scores on the DASS subscales and both the SSS and the ATQ.

Conclusions:

It is important that individuals with HFA are screened for stress and for symptoms of anxiety and depression and it appears that they are able to self report using existing instruments. There is a need for more research into the apparent relationships between symptoms, as well as predictors of risk in this population. Findings about specific stressors and negative thoughts may inform the development of targeted intervention programs.

105.141 141 Comparison of the Sensory Profile and the Sensory Processing Measure In a Cohort of Children Diagnosed with Autism Spectrum Disorders. M. N. Simard*[1], E. Fombonne[2], E. Gisel[3] and M. Couture[4], (1)*CHUQ Research Center*, (2)*Montreal Children's Hospital*, (3)*McGill University*, (4)*Laval University*

Background: Parents of children diagnosed with autism spectrum disorders often report presence of sensory processing difficulties in their children. According to recent studies, prevalence of sensory processing abnormalities range between 45% and 95% in cohorts of children with autism spectrum disorders. These difficulties can be defined as dysfunctions occurring during the processing of discrimination,

interpretation, modulation and organization of sensory stimulations in the central nervous system. Because of these neurological dysfunctions, the child cannot adequately respond to sensory stimulations and consequently, difficulties during daily activities and socio-emotional problems could easily occur. Due to the high prevalence in children with autism spectrum disorders of such difficulties, there is a crucial need for standardized and validated tools to assess their presence. In this perspective, two questionnaires, the *Sensory Profile* and the *Sensory Processing Measure*, have been developed. For clinicians and parents, both tools seem to consider similar behaviors to assess the children's sensory processing. To our knowledge, these two assessment tools used with children diagnosed with autism spectrum disorders have not been compared.

Objectives: To compare results obtained with the *Sensory Profile* and the *Sensory Processing Measure* from a cohort of children with autism spectrum disorder aged 4 to 7 years old, in order to assess if both questionnaires filled by parents identified the same sensory processing difficulties.

Methods: Children recruited for this study were part of a longitudinal study on the impact of sensory-motor difficulties on daily living skills. Thirty-five children diagnosed with autism spectrum disorders and aged between 4 and 7 years old were assessed with both tools. Parents of these children completed both questionnaires at home and brought them to the clinic at the time of the motor assessment. The scoring was done by an occupational therapist. According to the similarities in objectives and items from both tools, six domains, or sections with available total scores, were retained for the comparison. The sections compared were respectively for the *Sensory Profile* and the *Sensory Processing Measure*: *Auditory* VS *Hearing, Visual* VS *Vision, Tactile* VS *Touch*, *Oral* VS *Taste and Smell*, *Vestibular* VS *Balance and motion*, and *Body Position and Movement* VS *Body Awareness*.

Results: According to Spearman's Correlation, raw scores of sections paired together are significantly associated with coefficient ranging from -.354 to -.547 (p ranging from .037 to .001). When the results obtained by the children in each section were categorized according to the respective three categories based on standard deviation (0 to 1 SD = normal, -1 to -2 SD = probable difference and <2 SD = definite difference), Kappa coefficients revealed "poor" to "fair to good" agreement between both tools (Kappa ranging between .091 to .517).

Conclusions: Results from this study reveal differences in the way the questionnaires, both mainly used in clinical and research settings, assessed sensory processing difficulties in a cohort of children with autism spectrum disorders. Professionals have to be cautious in their choice of a tool versus another one and base their selection upon the clinical and specific needs of their cohorts.

105.142 142 Fears of Humiliation and Rejection Predict Aggressive Behavior In Children with HFASD. C. E. Pugliese*, B. A. White, S. W. White and T. Ollendick, *Virginia Polytechnic Institute and State University*

Background: The co-occurrence of social anxiety and aggression has been documented in HFASD (Farrugia & Hudson, 2006) but the nature of this relationship has not been empirically investigated. Many individuals with HFASD desire more peer interaction, but are more likely than their typically developing peers to be rejected (Sebastian et al., 2009), which may contribute to the development of fears of social humiliation and rejection (H/R fears).

Objectives: The objective was to examine the predictive value of H/R fears on aggressive behavior in children with HFASD compared to children with social anxiety disorder (SAD) without HFASD. Because social anxiety is inversely related to aggression in some individuals but positively related in others (Kashdan et al., 2009), and because we propose this pattern may be especially evident in HFASD, curvilinear relations between constructs were examined in both groups.

Methods: Participants were children and their parent(s) evaluated in a university-affiliated clinic. The HFASD sample (n = 20; 2 females) and the SAD sample (n = 20; 5 females) were comprised of children aged 7 to 15 without co-occurring intellectual disability. Self-reported H/R fears were measured with the Multidimensional Anxiety Scales for Children and mother-reported aggression was measured using the Child Behavior Checklist for Children.

Results: There were no significant differences in H/R fears between the groups; however, children with HFASD were significantly more aggressive. For the HFASD group, there was a significant curvilinear effect of H/R fears on aggression (b = .05, p < .05; $F(3,15) = 4.39$, p < .05), explaining 47% of the variance. For the SAD group, there was only a linear effect on aggression (b = -.24, p < .05), explaining 19% of the variance ($F(2,17) = 3.77$, p < .05).

Conclusions: Results suggest that clinically referred children with HFASD exhibit similar levels of H/R fears to children with SAD, but significantly more aggression. A moderate level of H/R fears predicted lower aggression in children with HFASD, whereas both relatively low *and* relatively high levels

(borderline clinical) of such fears were associated with higher levels of aggressive behavior in these children. This may indicate an optimal level of concern about how one is viewed by peers in youth with HFASD; too little or too much social-evaluative anxiety may lead to problems with aggression This pattern is different from the inverse relationship between H/R fears and aggression in the SAD group.

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105.143 143 Predictors of Peer Victimization In Adolescents with and without An Autism Spectrum Disorder. E. A. Kelley*[1], P. Kloosterman[1], J. Parker[2], W. `. Craig[1] and C. Javier[3], (1)*Queen's University*, (2)*Trent University*, (3)*Laurier University*

Background: Physical aggression, name calling, intimidating gestures, spreading of rumours, and exclusion from the group by powerful others are all examples of behaviours that comprise peer victimization. Surprisingly, little research has explored the prevalence of peer victimization in adolescents with an Autism Spectrum Disorder (ASD). Results from a handful of existing studies clearly indicate that children and adolescents with an ASD are at much greater risk of peer victimization than their typically developing classmates (Carter, 2009; Little, 2002).

Objectives: The aim of this study was to investigate how deficits in various social and cognitive factors may relate to peer victimization in adolescents with and without an ASD.

Methods: Participants were 68 adolescent boys ranging in age from 11 to 18 years of age (M = 14.60; SD = 1.89) and their parents. Thirty-one adolescents had a primary diagnosis of an ASD and 37 were typically-developing (TD). ASD diagnoses were confirmed using the ADOS-G. All adolescents were administered the *Wechsler Abbreviated Scale of Intelligence* (Wechsler, 1999) and the pragmatic judgement subtest of the *Comprehensive Assessment of Spoken Language* (Carrow-Woolfolk, 1999). As well, adolescents completed the self-report *Emotional Quotient Inventory: Youth Version* (Bar-on & Parker, 2000) as a measure of emotional intelligence (EI) along with a questionnaire regarding their experiences of peer victimization (World Health Organization, 2003). Parents completed the *Behavior Rating Inventory of Executive Function* (BRIEF; Gioia, Isquith, Guy, &Kenworthy, 2000) to provide a measure of executive functioning for their child.

Results: The two groups of adolescents did not differ in age, however the ASD adolescents had significantly lower (yet in the average range) IQ scores than the TD adolescents [$t(66) = 2.18$, $p < .05$]. As a result, IQ was considered a covariate in all analyses. With age as an additional covariate, the ASD adolescents were found to have significantly poorer pragmatic judgement [$F(1,67) = 13.68$, $p < .05$] and total EI [$F(1,67) = 7.90$, $p < .05$] in comparison to the TD adolescents. In contrast to their typical peers, significant cognitive impairments in executive functioning for the ASD adolescents were found across both the behaviour regulation [$F(1,64) = 45.63$, $p < .05$]and metacognition [$F(1,62) = 36.33$, $p < .05$] subtests of the BRIEF. A series of multiple regressions were conducted to determine whether these social and cognitive deficits might predict peer victimization. Results revealed that the stress management domain of EI ($p = .004$) and the emotional control domain of the BRIEF ($p = .045$) were significant predictors of peer victimization for both ASD and TD adolescents. Pragmatic judgement failed to emerge as a significant predictor of peer victimization.

Conclusions: ASD adolescents displayed deficits in many areas of social and cognitive functioning in comparison to TD adolescents. Difficulty modulating emotional responses appropriately and a lack of ability to cope with stress appear to place adolescents with and without an ASD at risk for peer victimization.

105.144 144 Parent Reported Symptoms of Attention Deficit Hyperactivity Disorder In Children with and without Autism Spectrum Disorders. P. A. Rao* and R. J. Landa, *Kennedy Krieger Institute*

Background:

A growing number of researchers are reporting symptoms meeting DSM-IV criteria for Attention Deficit Hyperactivity Disorder (ADHD) in a significant number of children diagnosed

with Autism Spectrum Disorders (ASD). Moreover, among children with ASD, those with clinically significant ADHD symptoms have been found to be more impaired in social and adaptive functioning than those without ADHD symptoms.

Objectives:

The goals of the current study were to investigate parent reported symptoms of ADHD in children with and without ASD enrolled in a prospective study of child development, and to examine whether there are additive effects of ADHD on the severity of symptoms associated with ASD.

Methods:

Participants included 162 children (100 males), ages 4 - 8 years (X = 5.6, SD = 1.27), with and without ASD enrolled in a prospective study of child development, including: a) n=102 younger siblings of children with autism; (b) n = 35 children diagnosed with ASD participating in early intervention programs; (c) n = 12 control children with no known family history of ASD and; (d) n = 13 children with specific language delay.

Parents completed the *Behavior Assessment Scale for Children*, *second edition* (BASC-2), and the *Social Responsiveness Scale* (SRS). Clinicians completed the *Autism Diagnostic Observation Schedule-Generic* (ADOS) and the parent-interview version of the *Vineland Adaptive Behavior Scale-second edition* (VABS-II).

Classification of ADHD and Grouping of Participants. Children were classified as ADHD positive (ADHD +) if they scored at or above the clinical threshold (> 70) on either the *Hyperactivity or Attention Problems* subscales on the BASC-2. Children were placed into one of four diagnostic classification groups: No ADHD or ASD; ADHD Only; ASD Only; or ASD+ADHD.

Results:

Rates of ADHD in Children with and Without ASD. A Chi-Square analysis revealed that a significantly higher percentage of parents of children with ASD rated their child at or above the clinical cutoff on at least one of the two ADHD subscales of the BASC-2 compared with children without ASD (29% vs 9%, respectively; X = 11.06, p = .001).

Additive Severity of ADHD on ASD. One-Way ANOVAs revealed significant differences in social and adaptive functioning (ps < 0.001), with the ASD+ADHD Group rated by parents as significantly more impaired in social responsiveness and adaptive functioning on the SRS and the VABS-II than the ASD Only group (post-hoc comparisons, ps < 0.05).

Conclusions:

The current study adds to the growing body of literature documenting an increased risk of ADHD in children with ASD. As expected, compared with children without an ASD, parents rated a significantly higher percentage of children with ASD with clinically significant symptoms of ADHD. Moreover, children identified with ASD and ADHD, as compared with children with ASD only, were rated by their parents as significantly more impaired in social and adaptive functioning. Future research is needed so that specialized treatments and interventions can be designed to target impairments associated with this subgroup of children comorbid with ASD/ADHD.

105.145 145 Arithmetic Abilities of Children with Autism Spectrum Disorder. D. Titeca*, H. Roeyers, A. Desoete and S. Pieters, *Ghent University*

Background: Up till now, studies in the domain of cognitive and academic functioning in children with autism spectrum disorder (ASD) are relatively scarce, and results are inconsistent. According to recent estimations, approximately 70% of the children with ASD may have intellectual abilities in the normal range – and should therefore be able to follow a regular educational program. This seems however in contrast with the experience of practitioners. Regarding the field of arithmetics, many children with ASD seem to have difficulties with the mathematical techniques used in mainstream schools. In the current literature on ASD, only a few studies have examined this topic. Further investigation is needed to get a more detailed overview of the field.

Objectives: The present study wants to examine to what extent children with ASD experience difficulties with arithmetics and what kind of mathematical problems can be detected. The aim of this study was to investigate the arithmetic abilities of children with autism spectrum disorder (ASD) in comparison to children with mathematical learning disability (MLD) and age-matched control children without ASD and MLD.

Methods: Twenty-two children with ASD, 22 children with MLD and 22 control children without ASD or mathematical problems participated in this study (M = 8.5 years; SD = 1.0 years). All 66 children were at least of average intelligence. To examine the arithmetic abilities, all children were assessed on number fact retrieval (with the Arithmetic Number Facts Test; TTR) and on the different aspects of the Triple Code Model (visual identification of Arabic numbers, verbal processing of

number words and quantity representation; with the TEDI-MATH).

Results: Given the small group sizes, non-parametric analysis were conducted. Group comparisons revealed a trend on number fact retrieval (Kruskal-Wallis $\chi^2_{(2)} = 5.90$, $p < .10$), and a significant difference on visual identification of Arabic numbers and verbal processing of number words (Kruskal-Wallis $\chi^2_{(2)} = 6.13$ and 8.88 respectively, $p < .05$). Post-hoc analyses revealed that children with ASD and children with MLD performed significantly worse than the control children, whereas the two clinical groups did not differ from each other.

Conclusions: Children with ASD show mathematical difficulties on the domain of number fact retrieval and on several aspects of the Triple Code Model. This finding underscores the importance of following up the mathematical abilities of this group of children. The results of this study suggest that adjustments in educational techniques should be based on a profound analysis of the strengths and weaknesses in mathematics so as to meet the specific needs of children with ASD. A clear understanding of the specific mathematical difficulties also aims at the development of an appropriate STICORDI-advice (STImulation, COmpensation, Remediation and DIspensation). Future research should assess the mathematical abilities of children with ASD more extensively, so that more aspects of the arithmetic field are included in the assessment and more subtle problems can be detected as well. In addition, it will be important to investigate the underlying processes thoroughly. Such studies are currently being prepared.

105.146 146 A Comparison of Psychiatric Problems In Children with Autism, Prader-Willi Syndrome and Age, Gender and IQ Matched Control Group. N. Skokauskas*, J. Meehan and L. Gallagher, *Trinity College Dublin*

Background: Comorbid psychiatric disorders complicate the course of both Autistic spectrum disorders (ASD) and Prader-Willi Syndrome (PWS) by affecting detection, therapeutic interventions, and outcome. The better understand of comorbid psychiatric disorders in ASD and PWS may facilitate more specific treatment potentially limiting negative outcomes.

Objectives: to examine comorbid psychiatric problems in a sample of children with ASD and PWS and their parents compared with an age, gender and IQ matched control group and their parents.

Methods: *Subjects*

Children with genetically confirmed PWS and their parents participating in the First National Irish PWS study were invited to participate. Children with ASD participating in the Irish Autism Genetics Study were also invited to participate: inclusion criteria for the present study were diagnosis of autism based on the Autism Diagnostic Interview-Revised (ADI-R), a diagnosis of autism or autism spectrum disorder based on the Autism Diagnostic Observational Schedule (ADOS). The age, gender and IQ matched control group was collected through Special Schools.

Assessment Instruments

The Child Behavior Checklist 6-18 (CBCL/6-18) was used to assess behavioral/emotional problems in children. Parents reported their own psychological distress using the Brief Symptom Inventory (BSI). Cognitive assessment was based on assessment with the Leiter International Performance Scale-Revised (Leiter-R).

Results:

All groups (PWS, ASD and controls) were comprised of 24 children. In all groups there were 11 (45%) girls and 13 (55%) boys. The groups did not differ significantly on mean age, mean IQ scores, gender, and parents mean age.

Results of the CBCL/6-18 revealed that the majority of parents reported their child with ASD or PWS as having either internalizing (ASD: clinical range-41.6%; borderline range-20.84%; PWS: clinical range-37.5%; borderline range-8.3%) or externalizing problems (ASD: clinical range-8.3%; borderline range-20.3% PWS: clinical range-8.3%; borderline range-16.6%). In the control group more parents reported their children having externalizing (clinical range- 37.5%; borderline range-16.6%) than internalizing problems (clinical range-16.6%; borderline range-4.1%).

Clinically significant difficulties were not reached for any of CBCL DSM orientated subscales in PWS group. Borderline difficulties were detected for the affective, somatic and ADHD CBCL DSM orientated subscales in PWS group with PWS children having significantly more somatic (mean T=63.05 SD=8.33 vs. 52 SD=6.48, P<.05) and affective (mean T=66.22 SD=8.51, vs. 60.08 SD=6.829 P<.05) problems than controls. Almost one third of the ASD group met CBCL DSM criteria for clinically significant ADHD (37.5 %) and anxiety (29.1%) problems.

The presence of BSI T-scores greater than 63 on two or more BSI subscales indicates possible psychopathology. Based on

this criterion one third of ASD children's mothers (33.3%) and fathers (20.8 %) screened positive for psychopathology with obsessive-compulsive and phobic anxiety being most common. Based on the same criterion, 16.6% of PWS fathers and 37.5% of mothers screened positive for psychopathology with depression being most common.

Conclusions: Both PWS and ASD represent complex neurodevelopmental disorders with multiple areas of disturbances.

105.147 147 An Examination of the Prevalence of Attention Deficit/Hyperactivity Disorder In a Sample of Individuals with An Autism Spectrum Disorder. B. M. Cerban*, C. M. Slater, L. M. Caccamo, E. Hanson, E. Chan and J. Bacic, *Children's Hospital Boston*

Background: A likely change in DSM-V will be the ability to diagnose - Attention Deficit/Hyperactivity Disorder (ADHD) in children who present with a Pervasive Developmental Disorder (American Psychiatric Association, 2010). However, reliable prevalence rates of co-morbidity are lacking, with estimates ranging from 28% to 78% in ASD populations (Ronald, Edelson, Asherson, & Saudino, 2009). In addition, little is known regarding the mutual impact of ADHD and ASD on clinical symptoms and function.

Objectives: The goal of this study is to assess the prevalence of ADHD in a sample of individuals with an ASD, as well as the characteristics of these Individuals. Our specific aims are:

1. To replicate previous findings documenting the existence of comorbid ASD-ADHD in a population of individuals with an ASD.

2. To describe the relationship between comorbid ADHD and ASD severity and/or IQ. Specifically, we hypothesize that, among individuals with ASD:

a) Those with comorbid ADHD have lower IQ, compared to those without ADHD.

b) Those with comorbid ADHD have more severe ASD (as determined by the Calibrated Severity Score; Gotham, Pickles, & Lord, 2009) than those without ADHD.

c) Those with both higher ASD severity and lower IQ are more likely to have comorbid ADHD.

Methods : We propose to test these hypotheses in a sample of children with an ASD who participated in a study through the Simons Simplex Collection (SSC). ASD diagnosis was established using the Autism Diagnostic Interview – Revised and the Autism Diagnostic Observation Schedule. Cognitive, adaptive and behavioral testing was administered, including the Child Behavior Checklist (CBCL) and the Teacher Report Form (TRF). The comorbidity rate will be established by counting the number of individuals in the clinical range on the ADD/ADHD subscale of both the CBCL and TRF. The CSS will be used to calculate symptom severity. Individuals will be categorized into Clinical, Sub-Clinical, and Non-Clinical ADHD groups; differences between groups will be calculated for ASD severity and IQ.

Results: In preliminary analysis, using a local sample of 309 individuals with an ASD at Children's Hospital Boston, we found that 29 (9.4%) fell in the ADHD clinical range per the CBCL (TRFs were not available for the majority of this sample). There was a trend for individuals in the Clinical group to have lower IQ (p= 0.29) and higher severity (p= 0.25), although differences were not significant.

Conclusions: Prevalence rates in our sample suggest that ASD-ADHD comorbidity may not affect as many individuals as found in previous research. This variability may be due to inconsistencies in ADHD classifications. Thus it is critical that stringent criteria be set for assigning ADHD status, which we will do using TRFs in the SSC sample. In addition, we found differences in IQ and severity that showed a trend in the predicted direction. Even though these did not reach significance, we expect that they will in the full SSC sample, in which ADHD classification can be confirmed with TRFs. These data will be analyzed in January 2011.

105.148 148 The Association Between Maternal Depression and Comorbid Psychopathology In Children with Autism Spectrum Disorders. B. Zablotsky*[1], L. Kalb[2] and P. A. Law[2], (1)*Johns Hopkins Bloomberg School of Public Health* , (2)*Kennedy Krieger Institute*

Background: The majority of children and adolescents with Autism Spectrum Disorders (ASDs) present with comorbid psychopathology (Brereton et al. 2006; Joshi et al., 2010). As the presence of psychiatric comorbidity has been noted to worsen ASD symptomatology (Wozniak et al., 1997), parents raising children with multiple psychiatric disorders are likely to experience tremendous amounts of stress that may be further compounded by other child-related factors (e.g. ASD symptom severity) (Benson, 2006) along with a parent's own diathesis towards psychopathology. These factors may result in an increased risk for parental depression (Abbeduto et al., 2004; Bromley et al., 2004). The present study explores the

association between parental depression and the presence of comorbid psychopathology in children with an ASD.

Objectives: 1) Identify predictors of maternal depression in a sample of ASD children with comorbid psychopathology. 2) Evaluate the potential for increased risk of parental depression as the number of comorbid psychopathology disorders increase.

Methods: A restricted sample of 1270 mothers of children with an ASD was obtained from the Interactive Autism Network (IAN). IAN is an online, national voluntary registry of families who have children with an ASD, consisting of over 10,000 children with an ASD and 20,000 family members. A self-reported clinical diagnosis of depression was selected as the outcome of interest, with number of child comorbid psychiatric conditions serving as the main predictor.

A three-stage sequence of multiple logistic regression models was developed to estimate the Odds Ratios (ORs) for the association between a maternal report of clinical depression and the number of comorbid diagnoses possessed by her child with ASD. Model 1 controlled for basic child demographics (age, gender, race, ethnicity), Model 2 controlled for parent and family demographics (number of children, parental education level), and Model 3 added the child's ASD diagnosis.

Results: An adjusted model revealed significantly increased ORs for parental depression for children with 1 comorbid diagnosis (OR=1.43, 95% CI: 1.16, 2.04, p=0.003), 2 comorbid diagnoses (OR=2.44, 95% CI: 1.61, 3.69, p<0.001), and 3 comorbid diagnoses (OR=2.87, 95% CI: 1.46, 5.62, p=0.002) when compared to children with no comorbid diagnoses. These associations remained significant across all three models, as well as with the unadjusted model. Parents of older children were less likely to experience depression (OR=0.64, 95% CI: 0.41, 0.99, p=0.045).

Conclusions: Unique to the literature, this study demonstrates a significant increased risk of parental depression accompanying an increase in the number of child comorbid disorders. These results align with previous studies indicating increased levels of parental stress, along with the presence of behavioral problems in children with ASDs (Davis & Carter, 2008; Lecavalier, Leone, & Wiltz, 2006). Taken together, these results highlight a real risk for the development of clinical depression for already stressed parents of children with ASDs. Future research should continue to evaluate risk and protective factors for parental depression; incorporating the role additional child psychopathology may play.

105.149 149 Characteristics of Anxiety Disordered Children with Symptoms of Autism. C. Puleo*[1], R. T. Schultz[2] and P. C. Kendall[3], (1), (2)*Children's Hospital of Philadelphia*, (3)*Temple University*

Background: The prevalence of anxiety disorders in children with high functioning autism is estimated to range from 35 – 84.1% (White et al., 2009), rates that have garnered attention and sparked efforts to adapt cognitive-behavioral therapies (CBT) for use in youth with autism spectrum disorders (ASD; MacNeil et al., 2009). In contrast, research on the converse of this comorbidity, the presence of ASD symptoms in children with primary anxiety disorders, is lacking, though such symptoms may be particularly elevated in children with non-ASD psychopathology (Constantino, Lajonchere, Lutz et al., 2006) and may influence the effectiveness of individual CBT (Puleo & Kendall, 2010).

Objectives: To evaluate demographic and diagnostic characteristics of youth with principal anxiety disorders and elevated autism-related symptoms.

Methods: The sample consisted of 100 clinic-referred youth (ages 7- 18 years) who met diagnostic criteria for a principal diagnosis of social phobia, separation anxiety or generalized anxiety disorder (as determined by the Anxiety Disorders Interview Schedule for Children, ADIS-C/P; Silverman & Albano, 1996). A series of ANOVA, t-test and chi-square analyses examined the participant characteristics (age, race, gender, SES), diagnostic profiles (number and type of diagnoses), self- and parent-reported coping skills (Coping Questionnaire; CQ-C and CQ-P; Kendall, 1994), and clinician rated distress (i.e., ADIS-C/P severity rating scores and Children's Global Assessment Scale; CGAS; Shaffer et al., 1983) of youth with or without elevated levels of ASD symptoms (i.e. a T-score ≥ 60 on the Social Responsiveness Scale-parent version).

Results: A substantial number (N = 42) of anxious youth endorsed elevated levels of ASD symptoms. The demographic and diagnostic profiles of these youth largely resembled those of youth without elevated ASD symptoms in terms of presentation, principal and comorbid diagnoses, and anxiety severity. However, youth with elevated ASD symptoms had more diagnoses, $t(98) = -2.08$, $p = .04$, particularly more specific phobias, $t(98) = -2.07$, $p = .04$, and were more likely to present with social phobia, χ^2 (1, N = 100) = 4.84, $p = .03$. Further, after controlling for the presence of social phobia, youth with elevated ASD symptoms were more likely to list social concerns among their top fears than youth without such symptoms, χ^2 (2, N = 100) = 5.59, p =.03; Nagelkerke $R^2 = .32$.

Conclusions: Some important distinctions in the presentation of anxious youth with and without elevated ASD symptoms were identified: youth with elevated ASD symptoms had more complex diagnostic profiles, characterized by more specific and social phobias. However, limited other differences between groups suggests that children with elevated ASD symptoms may not be easily distinguished from children without such deficits in clinical practice. Given evidence that family CBT may be more effective than individual CBT for youth with anxiety disorders and elevated ASD symptoms (Puleo & Kendall, 2010), more routine screening of ASD symptoms in anxious youth seems warranted.

105.150 150 Posttraumatic Stress Disorder In Individuals with Diagnosis of Autism Spectrum Disorders. N. M. Mukaddes*[1] and M. Mehtar[2], (1)*Istanbul University,Istanbul Faculty of Medicine*, (2)*Istanbul University*

Background: Studies with youth with developmental disabilities show higher risks of abuse, trauma and Post-Traumatic Stres Disorders (PTSD) than with typically developing individuals. However; there is lack of studies in specific groups such as individulas with Autism Specturm Disorders (ASD).

Objectives: To assess the prevalance, types, associated risk factors with trauma and PTSD and its clinical presentation in a group with ASD.

Methods: Study includes 69 individuals with diagnosis of ASD who were consecutively followed up at our autism spectrum disorders clinic and met DSM-IV criteria. Assessment was achieved using semi-structured forms such as the Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version, Post Traumatic Stress Disorder scale (K-SADS-PL, PTSD scale). The Aberrant Behavior Checklist (ABC) was filled by parents. A checklist form outlined by the authors and called 'Trauma symptoms Investigation Form in Autistic Spectrum Disorders' (TIF-ASD) was filled by the researchers to examine the course of symptoms in subjects with positive history of trauma.

Results: 26.1% (n:18) had history of trauma and 17.1% (n:12)were diagnosed with PTSD. Witnessing or being a victim of accidents/disasters /violence was the most common type of trauma. Interestingly, the rate of physical and /or sexual abuse was less than that in the general population. Trauma history and PTSD rates were higher in girls than in boys. Deterioration in social and communicative abilities, increase in stereotypies, aggression, distractibility, sleep problems, agitation, hyperactivity, self-injury and loss of self-care skills were the most common symptoms detected following trauma.

Conclusions: The relatively lower rate of trauma in our group could be related to the selection bias. The clinical presentation of PTSD in this group underscore the importance of detailed assessment of behavioral and emotional problems in individuals with ASD by rulling out any trauma history at periods which might otherwise be misdiagnosed as an exacerbation of symptoms of ASD.

105.151 151 The Evaluation of Pervasive Developmental Disorders and Developmental Delay In Infants and Toddlers Based on DC:0-3 R. A. Bilgic*[1], R. Uslu[2] and O. Özalp Kartal[2], (1)*Malatya Government Hospital*, (2)*Ankara University*

Background: The diagnosis of PDD or DD in infants and toddlers should be based on multiaxial classification systems which equally emphasize all axes. Because, when evaluating PDD or DD, in addition to reliable diagnosis, the assessment of other clinical variables is also important in early childhood.

Objectives: The present study was designed to investigate sociodemographic, clinical and parental characteristics of infants and toddlers with pervasive developmental disorders (PDD) and developmental delay (DD) by using the Diagnostic Classification: 0-3 Revised (DC:0-3 R) and to determine the similar and different features of these two conditions.

Methods: The sample consisted of 35 PDD and 29 DD cases aged 17 to 45 months and of their parents. Cognitive and emotional development of infants and toddlers were assessed using the Vineland Adaptive Behavior Scales and the Ankara Development Screening Inventory. Mother-infant interactional patterns were assessed by the Clinical Problem-Solving Procedure. The Diagnostic Classification: 0-3 Revised was used for multiaxial diagnostic classifications. The Mc Master Family Assessment Device (FAD) and the General Health Questionnaire (GHQ) were also administered to parents.

Results: The age at initial evaluation was lower in children with PDD than those with DD. The proportion of single parent families in the DD group was higher than the PDD group. "Speech delay" was the foremost complaint regarding children with both disorders. Children with DD had more comorbid diagnoses than those with PDD. Families with psychosocial stress factors were 69% in the PDD group and 76% in the MR group. There were no significant differences in mothers and fathers GHQ ratings between the two groups. FAD ratings

showed that mothers' and fathers' affective responsiveness ratings and mothers' communication ratings were significantly higher in the DD group. Children with DD had better scores than children with PDD in all of the emotional and social functioning (ESF) subscales. In the DD group, a significant negative correlation was detected between mothers' GHQ ratings and ESF scores.

Conclusions:

The present study considered that DD determined in infancy and early childhood may frequently be based on environmental factors which cause emotional deprivation. Similar to other childhood mental disorders, the diagnosis and treatment processes of infants and toddlers with PDD and DD should completed in parent-infant relationship context.

105.152 152 Risk Factors for Aggressive Behavior In Youth with Autism Spectrum Disorder. L. Kalb*[1], A. Keefer[1], C. Foster[2], R. A. Vasa[1], B. H. Freedman[1] and B. Zablotsky[3], (1)*Kennedy Krieger Institute*, (2)*Kennedy Kreiger Institute*, (3)*Johns Hopkins Bloomberg School of Public Health*

Background: Children with autism spectrum disorders (ASD) frequently exhibit aggressive behavior (Fox et al., 2007), demonstrating higher prevalence rates than typically developing or intellectually disabled individuals (Kanne & Mazurek, 2010). In youth with ASD, research has linked aggressive behavior to deleterious sequelae such as poorer quality-of-life (Gardner & Moffatt, 1990) and greater family stress (Lecavalier et al., 2006). Despite this burden, there is a dearth of research identifying risk factors for aggression in the ASD population. The few studies that have examined determinants of aggression have yielded inconsistent findings. Surprisingly, this body of research has paid little, if any, attention to the role of other psychiatric comorbidities in the development of aggression in this population.

Objectives: To examine the demographic, cognitive, linguistic, and psychiatric risk factors for aggression in youth with an ASD.

Methods: Cross-sectional data were derived from the a local registry project housed in an urban outpatient pediatric clinic. Children were evaluated by trained diagnosticians using DSM-IV-TR criteria and the Autism Diagnostic Observation Schedule (ADOS; Lord et al, 2002).The sample consisted of 170 children, ages 2 to 17.9 years (M = 6.26).

After bivariate relationships were established, stepwise multiple linear regression analyses, using the stepwise regression function in Minitab 15.0 (State College, PA), were performed to identify predictors of aggressive behavior. Aggression, including both verbal and physical, was measured as a continuous variable using the aggressive behavior syndrome scale raw score from the Child Behavior Checklist - Parent version (CBCL-P; Achenbach and Rescorla, 2001). Six predictors were examined:1) demographics, 2) standardized IQ scores, 3) expressive language as measured by the Vineland Adaptive Behavior Scale II (Sparrow et al., 2005), 4) psychiatric comorbidities as assessed by the CBCL-P, 5) repetitive behaviors as measured by the ADOS, and 6) ASD severity using ADOS raw scores (see Gotham et al., 2006). Analyses were conducted separately for children < 6 (n = 96) and 6-18 years given the separate CBCL modules for each age group.

Results: Lower parental education in the < 6 group and younger age in the 6-18 group were associated with increased aggressive behavior (both $p < .05$). For both age groups, repetitive behaviors, ASD severity, expressive language, and IQ were not associated with increased aggressive behaviors (all $p > .05$). Results from the multivariate model indicated that anxious/depressed, attention, and somatic problems were associated with increases in aggression among children < 6 years. For children 6-18, significant predictors included anxious/depressed, attention problems, and younger age (all $p < .05$).

Conclusions: Unique to the literature, this study demonstrates the role of internalizing and attention problems, as well as somatic complaints in younger children, in the development of aggressive behavior in youth with ASD. No significant associations were found between factors widely assumed to contribute to aggression in youth with ASD (i.e., ASD severity, cognitive, and language factors). Taken together, these data highlight the need for both further research and a thorough psychiatric evaluation and intervention plan to prevent or diminish aggressive behavior in children with ASD.

105.153 153 Teasing Apart Psychiatric Misdiagnoses From Comorbidity and Implications for Psychotropic Medication Use In Adolescents with High-Functioning ASDs. C. A. Mazefsky*[1], D. P. Oswald[2], S. M. Eack[1], N. J. J. Minshew[1] and J. E. Lainhart[3], (1)*University of Pittsburgh*, (2)*Commonwealth Autism Service*, (3)*University of Utah*

Background:

Clinical anecdotes suggest that high-functioning individuals with ASD often first receive psychiatric misdiagnoses, which may interfere with the correct identification of their ASD. This

problem is further complicated by high rates of psychiatric comorbidity in ASD and difficulty differentiating when a true comorbid disorder is present. The medication implications of many psychiatric disorders underscores the importance of better understanding diagnostic practices.

Objectives:

This study's overall goal was to highlight the complexity inherent in the proper diagnosis of higher-functioning individuals with ASD, particularly related to characterizing their emotional and behavioral dysregulation. Two specific aims were: 1) To document the lack of concordance between lifetime history of community-based psychiatric diagnoses among children with high-functioning ASD and their "true" psychiatric comorbidity history established via a structured psychiatric interview modified for ASD; and 2) To investigate the relationship between community psychiatric diagnosis patterns and psychotropic medication use.

Methods:

Participants included 35 10 – 17 year old children with an ASD (confirmed with the ADOS and ADI) and without mental retardation. Lifetime comorbid psychiatric diagnoses were established via the *Autism Comorbidity Interview* (ACI). These "gold-standard" diagnoses were compared to parent report of prior psychiatric diagnoses that the participant had received in the community. The relationship between prior diagnoses and number of psychotropic medications attempted was determined.

Results:

ADHD, anxiety disorders, and depressive disorders were the three most common diagnoses for *both* prior community diagnoses and based on the ACI (though in different orders and magnitudes). Especially for prior community diagnoses, rates of diagnoses in this sample were higher then national prevalence rates for U.S. adolescents; for example 14.3% (n = 5) had received a bipolar disorder diagnosis at some point in their lives, compared to a national lifetime average for adolescents of 2.6% (Merikangas et al., 2010). Although there was significant psychiatric comorbidity in this sample, the mean number of prior community psychiatric diagnoses (2.15, SD = 1.88; range 0-7) was significantly higher then the mean number of lifetime psychiatric disorder diagnoses supported by the ACI (0.88; SD = 2.2; range 0-4), $p < .001$. The vast majority of prior diagnoses were false positives in comparison to the ACI results. The number of prior psychiatric diagnoses was significantly correlated with the number of psychotropic medications attempted, $r(35) = .781$, $p < .001$. Medication use was high overall, and especially pronounced among participants who had been previously diagnosed with bipolar disorder or oppositional defiant disorder, yet most of these diagnoses were not supported on the ACI.

Conclusions:

Many participants received incorrect prior psychiatric diagnoses, which could delay or interfere with the proper identification of their ASD. Although a substantial number of children met ACI criteria for comorbid psychiatric disorders, there was also a high rate of previous false positive psychiatric diagnoses. The strong relationship between prior community psychiatric diagnoses and psychotropic medication use highlights the importance of increasing awareness and understanding of high-functioning ASDs (including the associated emotional and behavioral dysregulation) in general psychiatric clinics in order to promote faster identification and appropriate treatments.

105.154 154 Effects of Social Skills Deficits and Psychological Issues on Friendship Quality In Young Adults with Autism. A. Gantman*[1], S. K. Kapp[2], K. Orenski[3] and E. A. Laugeson[1], (1)*UCLA Semel Institute for Neuroscience & Human Behavior*, (2)*University of California, Los Angeles*, (3)*Alliant University*

Background: Like children and teens with autism spectrum disorders (ASD), young adults with ASD continue to experience social deficits that impair their ability to develop and maintain social relationships. Already challenged by poor social skills in such basic areas as using social cues and entering, engaging in, and exiting two-way conversations, many young adults with ASD further limit their opportunities for social success by making few social initiations or withdrawing from social interactions or settings. Social skill deficits and social disengagement weaken friendship quality, due to the fact that most young adults with ASD do not participate regularly in social activities and few have any close reciprocal friendships. Furthermore, psychological factors such as high rates of anxiety and mood disorders are frequently correlated with social deficits, which may present additional barriers to young adults with ASD in developing high-quality relationships.

Objectives: Correlations between friendship quality and psychosocial factors in young adults with ASD were explored to better understand their relationships.

Methods: 34 young adults with high-functioning ASD were assessed using a battery of self-report psychosocial measures to determine current psychological, adaptive, and social

functioning. Correlations between the Friendship Questionnaire (Baron-Cohen & Wheelwright, 2003) and the Social Skills Index (SSI; Riggio, 1986), Social Skills Rating System (SSRS; Gresham & Elliot, 1990), Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004), Social Anxiety Scale (SAS; La Greca & Lopez), and Social and Emotional Loneliness Scale for Adults (SELSA; DiTomasso & Spinner, 1993) were explored using Pearson correlations in order to derive a better understanding of the differences between these factors.

Results: SSI results revealed that friendship quality on the FQ is strongly correlated with overall social skills (r=.716), and is related to Social Expressivity (r=.667), Emotional Sensitivity (r=.699), and Social control (r=.472). Similarly, the FQ had moderate correlations with Empathy (r=.565) and Assertiveness (r=.472) on the SSRS. Better friendship quality on the FQ was also correlated to factors such as: decreased social loneliness on the SELSA (r=.-540) and decreased social anxiety on the SAS (r=-.366). Analyses of the EQ provided further positive correlations with the FQ in Cognitive Empathy (r=.577) and Emotional Reactivity (r=.555).

Conclusions: Findings suggest that powerful correlations exist between social skill deficits and friendship quality, which may relate to poorer psychological well being in young adults with ASD. These findings clearly highlight the need for social skills interventions that not only address social deficits, but may also address other psychological factors which may be adversely affect social functioning. Furthermore, studies of social skills treatments would do well to assess not only social skills and friendship quality changes post-treatment, but investigate broader psychological domains that may be affected by such interventions.

105.155 155 Social Anxiety Partially Mediates the Relationship Between Autism Spectrum Symptoms and Hostility. N. L. Kreiser*[1], C. E. Pugliese[1], A. Scarpa[2] and S. W. White[1], (1)*Virginia Polytechnic Institute and State University*, (2)*Virginia Polytechnic Institute & State University*

Background: Emerging research shows that social anxiety may be related to aggression in children and adolescents with high-functioning autism spectrum disorders (HFASD) (Pugliese et al., 2010). Social anxiety, in neurotypical populations, is associated with specific cognitive biases, such as assuming others will judge them negatively, and a tendency to interpret ambiguous interpersonal interactions negatively (Clark, 2001; Mohlman et al., 2007). These biases can lead to angry feelings, hostility, and possibly aggression. In individuals with HFASD, it has been theorized that anxiety related to the experience of social exclusion may lead to increased anger and hostility (Attwood, 2007). Although not previously assessed in adults, it is possible that social anxiety may contribute to hostility, at least partially, in people with symptoms of ASD.

Objectives: This study was conducted to determine if symptoms of social anxiety mediate the relationship between ASD symptoms and hostility in neurotypical (non-ASD) college students.

Methods: Undergraduate students (n = 685) from a large public university were enrolled in the study, using an online database through which students could earn class credit. Participants completed measures of aggression/hostility (BPAQ; Buss & Perry, 1992), symptoms of autism (AQ; Baron-Cohen et al., 2001), and social phobia (SPAI-23; Roberson-Nay et al., 2007).

Results: ASD symptoms were associated with social phobia symptoms (r = .54, p < .001). Based on partial correlations, hostility was correlated with both symptoms of ASD (pr = .24, p < .001 and social phobia (pr = .26, p < .001). Baron and Kenny's (1986) procedure was used to examine mediation. When ASD and social anxiety symptoms were included simultaneously in the model that predicted hostility, each predictor was significant, but the predictive coefficient for ASD reduced significantly (Preacher & Hayes, 2004; z = 6.17, p < .001).

Conclusions: In a neurotypical sample of college students without diagnosed ASD, symptoms of ASD and social anxiety were correlated, and both were associated with increased hostility. Social anxiety partially mediated the effect of ASD symptoms on hostility. Thus, ASD symptoms both directly and indirectly impacted hostility. Although these results shed light on the role of social anxiety in the relationship between ASD symptoms and hostility, generalization to young adults with confirmed ASD diagnoses requires replication with participants with confirmed ASD diagnoses. If this model holds for individuals with ASD, intervention targeting social anxiety may be one effective method of reducing problems with hostility or anger.

105.156 156 Social Impairment, Social Anxiety, and Loneliness In High-Functioning Adolescents with Autism and Social Phobia. B. B. Maddox*[1], N. L. Kreiser[1] and S. W. White[2], (1)*Virginia Tech*, (2)*Virginia Polytechnic Institute and State University*

Background: Social anxiety is a commonly reported problem among adolescents with high-functioning autism spectrum disorder (HFASD; Bellini, 2004). The relationship between

social anxiety and social impairment in adolescents with HFASD, however, is not fully understood. Some research suggests that greater social skills deficits lead to increased anxiety due to experiences of rejection and social isolation (Tantam, 2000). Other researchers emphasize that awareness of social difficulty, not actual degree of social disability, may be the impetus for the development of social anxiety, which is consistent with findings that higher functioning youth with ASD experience more anxiety than lower functioning youth with ASD (Sukhodolsky et al., 2008). This relationship has not yet been explored in individuals with HFASD and diagnosed comorbid Social Phobia (SoP).

Objectives: The purpose of this study was to investigate the relationship between generalized (i.e., interaction-based) social anxiety and degree of social impairment in a sample of adolescents with HFASD and comorbid SoP. A related purpose was to explore if greater social interaction-based anxiety is related to greater feelings of loneliness. Self-reported loneliness may reflect cognitive awareness of one's social impairments by portraying insight into the consequences of social rejection and isolation (Bauminger & Kasari, 2000).

Methods: Twenty-three adolescents (12-17 years old; 7 females) with confirmed ASD diagnoses, based on the ADOS (Lord et al., 2002) and the ADI-R (Lord et al., 1994), met diagnostic criteria for SoP, based on the ADIS-C/P (Silverman & Albano, 1996). The adolescents completed self-report measures of anxiety (MASC-C; March, 1997) and loneliness (Loneliness Questionnaire; Bauminger et al., 2003). All participants were cognitively higher functioning (i.e., IQ > 70).

Results: Bivariate correlations among social interaction-based anxiety (MASC-C Humiliation/ Rejection subscale score), social impairment (Reciprocal Social Interaction ADOS score), and loneliness (Emotional and Social subscale scores of the Loneliness Questionnaire) were examined. A significant negative relationship was found between clinician-rated social impairment and youth-reported social interaction-based anxiety (r = -.416, p < .05). Youth-reported social interaction-based anxiety was also related to youth-reported emotional loneliness (r = .556, p < .01) and social loneliness (r = .475, p < .05).

Conclusions: In this sample of adolescents with HFASD, adolescents who were less socially impaired tended to report more social anxiety, and those with more social anxiety tended to report more loneliness. This finding suggests that, among higher functioning adolescents on the spectrum, those with less ASD-related social impairment may be more aware of their social deficits, and consequently feel more anxious in social interactions. Although more socially impaired adolescents may objectively experience greater interpersonal difficulties, they may lack the insight to self-report on anxiety. The results are consistent with previous research showing that youth with ASD and elevated anxiety experience greater loneliness (White & Robertson-Nay, 2009), which may reflect a greater degree of insight into their personal difficulties related to ASD-related social deficits.

105.157 157 Associations Between Repetitive Behaviors and Anxiety Symptoms In Children with Autism Spectrum Disorders. R. A. Libove*[1], J. M. Phillips[2], K. J. Parker[1] and A. Y. Hardan[1], (1)*Stanford University School of Medicine*, (2)*Stanford University School of Medicine/Lucile Packard Children's Hospital*

Background: Anxiety symptoms and repetitive/restricted behaviors are commonly reported in individuals with autism spectrum disorders (ASD). Generalized anxiety, panic attacks, phobias and obsessions/compulsions have all been reported. While repetitive behaviors have been well investigated, the other anxiety symptoms have received limited attention. Additionally, little is known about the relationships between the severity and type of repetitive behaviors and anxiety symptoms in children with ASD.

Objectives : The purpose of this investigation is to examine anxiety symptoms in a well-characterized sample of children with ASD and to determine if there are associations between repetitive/stereotyped behaviors and specific anxiety symptom domains.

Methods : Participants included children with ASD between the age of 3 and 12 years. ASD diagnosis was based on the Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview Revised (ADI-R) and expert clinical opinion. Parents completed the Repetitive Behavior Scale-Revised (RBS-R) and behavioral measures assessing anxiety symptoms including the Spence Children's Preschool Anxiety Scale (SCPAS) or Spence Children's Anxiety Scale (SCAS), and the Early Childhood Inventory- 4 (ECI-4) for ages 3 to 5 or Child Symptom Inventory-4 (CSI-4) for ages 6 to 12. Spearman's rho correlations were performed to examine associations between specific anxiety symptoms and repetitive behaviors.

Results : To date, behavioral data and anxiety symptom measures have been collected on 48 children with ASD (mean age: 7.7 ± 2.4). All of the RBS-R subscales were significantly associated with at least one anxiety domain. Stereotyped Behavior was positively associated with Specific Phobia

(r=.334; p=.008), Injury Fears (r=.251; p=.049) Separation Anxiety (r=.310; p=.014), Generalized Anxiety (GAD) (r=.523; p=<.001), Social Phobia (r=.330; p=.008) and Compulsions (r=.408; p=.001). Self-Injurious Behavior was correlated with GAD (r= .405; p= .001), Obsessions (r=.301; p=.017), and OCD (r=.269; p=.034). Compulsive Behavior, as measured by the RBS-R, was associated with dimensional scoring of the CSI-4/ECI-4 on GAD (r=.289; p=.022) and Compulsions (r=.431; p=<.001). Additionally, Ritualistic Behavior was associated with several domains including Injury Fears (r=.261; p=.040), Generalized Anxiety on both the SCAS/SCPAS (r=.284; p=.025) and on the CSI-4/ECI-4 (r=.388; p= .002). Interestingly, Restricted Behaviors were only associated with GAD (r=.313; p=.013) and Compulsions (r=.388; p=.002). Finally, Sameness Behaviors was associated with several symptoms including higher Panic (r=.477; p=.001); Injury Fears (r=.275; p=.031) and GAD on the SCAS/SCPAS (r=.408; p= .001) and on CSI-4/ECI-4 (r=.555; p=<.001), Social Phobia (r=.333; p=.008) and Specific Phobia (r=.338; p=.007). In contrast, the Separation Anxiety domain on the SCAS/SCPAS was not significantly associated with any of the RBS-R subscales.

Conclusions: These preliminary data suggest that many anxiety symptom domains are correlated with repetitive behaviors in children with ASD supporting the hypothesis of a common pathogenic mechanism for these clinical features. Overall, severe stereotyped, sameness, and restricted behaviors may be better predictors of higher anxiety symptoms. Further studies with larger sample sizes and a wider age range are warranted to determine the correlates of repetitive behaviors and co-occurring anxiety symptoms which may allow for more targeted diagnostic tools and treatments for individuals with these debilitating symptoms.

105.158 158 Parental Intrusiveness and Separation Anxiety In Children with High-Functioning Autism. I. A. Rystad*, C. Fujii and J. J. Wood, *University of California, Los Angeles*

Background: Children with high-functioning autism are at heightened risk of developing anxiety disorders compared to typically developing (TD) children (de Bruin et al. 2007). Several studies have examined the relationship between low adaptive skills and anxiety (e.g., Sukhodolsky et al., 2008), while parenting styles have often been overlooked in the literature. However, there has been some indication that heightened anxiety may be the result of an intrusive parenting style associated with low adaptive skills. Wood (2006) found that parents whom were intrusive limited their child's mastery experiences, which predicted the presence of child separation anxiety disorder (SAD) for TD children.

Objectives: The current study examined whether parental intrusiveness was correlated with SAD for high-functioning children with autism, and if so, whether parental intrusiveness could predict SAD above and beyond the child's age and adaptive functioning.

Methods: Participants included 77 children (56 males), primarily white, between the ages of 7 and 13, drawn from a larger intervention study for children with high-functioning autism and at least one co-morbid anxiety disorder. SAD was assessed using the SAD subscale of parent- and child-reported scores from the Multidimensional Anxiety Scale for Children (MASC; March, 1998), a standardized 39-item self-report measure of anxiety. Adaptive behavior was measured using the daily living skills subscale from the Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984), a semi-structured interview administered to parents. Finally, parental intrusiveness was determined using child- and parent-reported total scores on the Parent-Child Interaction Questionnaire (PCIQ; Wood, 2002), a questionnaire containing 35 items rating parent-child interactions in day-to-day life. Regression analysis was used to determine whether parental intrusiveness predicted SAD above and beyond age and adaptive functioning.

Results: Preliminary analyses revealed that parent- and child-reports of anxiety were statistically significantly correlated (r=.50, p<.01), as were parent- and child-reportsof parental intrusiveness (r=.64, p<.01). Hence, composite anxiety and parental intrusiveness scores were created. Further analyses indicated that parental intrusiveness was statistically significantly associated with child SAD (r=.53, p<.01). Additionally, parental intrusiveness accounted for a significant unique variance in SAD above and beyond that accounted for by child's age and adaptive behaviors (ΔR^2=.12, p<.01).

Conclusions: Given the fact that anxiety is a prevalent problem for children with high-functioning autism, finding predictors of this problem is highly relevant. These factors can then be targeted during interventions for this population. Our results confirmed previous results that SAD is associated with parental intrusiveness, and that this can partly explain the relationship between low adaptive functioning and anxiety. Further, our study added on previous findings by investigating this unique relationship for children with high functioning autism. Because our results indicated that parental intrusiveness predicted SAD for this population, it will be beneficial for treatment of SAD in children with high functioning autism to include components targeting parental intrusiveness. Hence, interventions that do not solely focus on the child's deficits, but also focus on

changing parents' behaviors with their children may yield greater benefits than interventions excluding this component.

105.159 159 Suicidality In Patients with Autism Spectrum Disorders. D. Tutkunkardas*[1], S. Karakoç Demirkaya[1] and N. M. Mukaddes[2], (1)*Istanbul University, Istanbul School of Medicine*, (2)*Istanbul University,Istanbul Faculty of Medicine*

Background: Autism spectrum disorders are known to be associated with deficits in social interaction, lack of empathy and poor emotional regulation which might render them vulnerable to self destructive behaviors, especially suicide. Although self mutilating behaviors are not uncommon in patients with autism spectrum disorders, suicidal behaviors and ideation have not been studied in this group.

Objectives: The present study aimed a) to assess the prevalence of suicidal behaviors in individuals with a diagnosis of high functioning autism spectrum disorder, b) to evaluate the risk factors associated with suicidality in this group and c) to define the characteristics of suicidal ideation and behaviors in this group.

Methods: Fifty-five individuals, 49 of which were male and 6 were female, and were aged between 7-20 years old, with the diagnoses of Asperger's disorder (n=26, 47.3%), high functioning autism (n=24, 43.6%) and pervasive developmental disorder-not otherwise specified (n=5, 9.1%) were included in our study. All were verbal individuals with IQ in non-retarded range. Participants were patients of Autism Spectrum Disorders Clinic of Child Psychiatry Department in Istanbul School of Medicine whom were at regular psychiatric follow-up. They were evaluated with Beck Depression Inventory, Suicide Probability Scale and Suicidal Ideation Scale and K-SADS-PL Affective Disorders- Depression Supplement. As all participants were regular patients of our clinic, any lack of clarity was eliminated by reviewing patients' charts. Statistical analyses were performed with SPSS version 16.0.

Results: Sixteen patients (29.1%) were suicidal, with 7 (12.7%) having only suicidal ideation and 9 (16.4%) showing suicidal behaviors. Suicidal patients were not different from non-suicidal patients in terms of age and gender, as well as rates of suicide among autism spectrum disorder subgroups. Scores of Beck Depression Inventory (p=0.001), Suicide Probability Scale (p=0.005) and Suicidal Ideation Scale (p=0.01) were all significantly higher in the suicidal group, whereas in contrary to expected, rates of depression, bipolar disorder and attention deficit hyperactivity disorder were not different between the two groups. Yet interestingly the rate of psychosis, both due to a primary psychotic disorder or a mood disorder, was significantly higher in the suicidal group (p=0.02). Finally there was a trend towards significance between the suicidal and non-suicidal groups in terms of completed suicide in first and second degree family members (p=0.069).

Conclusions: In this group, suicidality – and especially suicidal behaviors – was found to be higher than healthy population rates in our community. Suicidality should be kept in mind in autism spectrum disorders, particularly in psychotic patients with depressive symptoms.

105.160 160 Emotional and Behavioral Problems In Prescholars Children with Autism and PDD NOS: Prevalence and Risk Factor. G. Valeri*[1], L. D'Elia[2], N. Mirante[1] and S. Vicari[2], (1)*Children's Hospital Bambino Gesù*, (2)*Children's Hospital Bambino Gesù*

TITLE:

Emotional and behavioral problems in prescholars children with autism and PDD NOS: prevalence and risk factor

Background:

Children with autism spectrum disorders (ASD) often exhibit behaviour and emotional problems that negatively impact everyday activities. Maladaptive behaviours can also interfere with intervention efforts and thereby impact the long-term prognosis of children with ASD.

Objectives:

The purpose of this study is to identify:

(1) the prevalence of Clinically Significant maladaptive behaviours through parent report on the CBCL of 101 children diagnosed with AD and PDD NOS aged 2.2 to 5.11 years and determine the similarities or dissimilarities;

(2) subject characteristic risk factors for maladaptive behaviours (such gender, age, expressive language, severity of autistic behaviours, adaptive behaviour and regression of language or social skills);

(3) parent-factors, such age, cultural and socioeconomic differences, family characteristic, influenced parent ratings of maladaptive behaviours.

Methods:

101 children, aged 2.2 to 5.11 years, were recruited consecutively at the Children's Hospital Bambino Gesù in

Rome between May 2009 and July 2010 and diagnosed with PDD (Pervasive Developmental Disorders) based on criteria of DSM-IV TR.

Parents completed the Child Behavior Checklist for ages 1.5 through 5 years (CBCL, Achenbach & Rescorla 2000) and the short form Italian version of the MacArthur Communicative Development Invertories (PVB, Caselli et al. 2007); they also participated in the Vineland Adaptive Behaviour Scales, Interview Form (VABS, Sparrow et al. 2005) and the Autism Diagnostic Interview-Revised (ADI-R, Lord et al. 2000).

Children were individually administered the Autism Diagnostic Observation Schedule-Generic (ADOS-G, Lord et al. 2000) by licensed professionals.

Results:

One-third of young children with ASD (AD and PDD NOS) had a CBCL Total Problems score in the Clinically Significant range. The highest percentage of Clinically Significant scores were in the Withdrawal, Attention, and Somatic Complaints CBCL syndrome scales.

We performed univariate logistics to estimate association between each single CBCL subscale and groups (AD or PDD-NOS): only one univariate logistic was statistically significant, and show that AD group have 80% lower probability than PDD-NOS group to have affective problems

We have also identified several subject and parent characteristic risk factors for maladaptive behaviours: children's age, expressive language and severity of autistic behaviours, and mother's education and occupation.

Conclusions:

An investigation of the subject characteristic correlates of maladaptive behaviours in young children with ASD is needed to identify at-risk subgroups. This research must be extented to which parent-factors, such as cultural and socioeconomic differences, influenced parent ratings of maladaptive behaviours.

105.161 161 Anxiety In People Diagnosed with Autism and Intellectual Disability: Recognition and Phenomenology. S. B. Helverschou*[1] and H. Martinsen[2], (1)*The National Autism Unit, Oslo University Hospital*, (2)*University of Oslo*

Background:

Anxiety seems to occur frequently in individuals with autism, but varying prevalence estimates indicate uncertainties in identifying anxiety, especially in those with intellectual disability (ID).

Objectives:

The study explores the recognition of anxiety symptoms, and aims to provide suggestions for the assessment of anxiety in individuals with autism and ID. The main research question is whether physiological arousal, which was the assumption, was more easily recognized than the cognitive aspect of anxiety in these individuals. Moreover, in comparing assessment by checklist and reports on anxiety symptoms obtained in a comprehensive diagnostic process, the aim was twofold: 1) to explore whether assessment by a screening checklist is sufficient to identify the individuals with anxiety problems, and 2) to examine in more detail how anxiety is manifested in these individuals.

Methods:

Two separate samples, a community sample (62 individuals with autism + ID) and a clinical sample (9 individuals with autism + ID + psychiatric disorders) were assessed with anxiety items and general adjustment problems items from a screening checklist, the Psychopathology of Autism Checklist, PAC. In addition, in the clinical sample checklist results were compared with clinical assessments.

Results:

The scores on the general anxiety items in the PAC, which are supposed to assess the cognitive aspect of anxiety, were higher than the scores on the specific items, which assess physiological arousal. The similar pattern was demonstrated in the total community sample, in the anxiety group (i.e. the group screened with anxiety problems), and in the clinical sample. Twenty-three participants (37.1 %) in the community sample were screened to have anxiety problems.

Comparison between clinical assessment and assessment by the PAC in the clinical sample revealed diverging reports in four participants. In the clinical anxiety assessment, anxiety symptoms were reported in all nine participants, but only seven of nine participants obtained an anxiety score above cut-off on the PAC.

The anxiety symptoms reported in the clinical assessment include 36 different symptoms and most of the symptoms described are typically anxiety symptoms, i.e. anxiety

symptoms often described in individuals without autism. Only nine idiosyncratic symptoms were reported, i.e. unusual expressions of anxiety.

Conclusions:

The results indicate that physiological arousal may not be as readily observable as assumed in individuals with autism and ID. The results also indicate that anxiety occurs frequently in this population, and support previous findings that the close association between anxiety and other psychiatric disorders also applies to individuals with autism and ID. Moreover, anxiety may be recognized in this group by similar symptoms as in individuals without autism, but the difficulties in recognizing signs of physiological arousal indicate the importance of increased clinical awareness toward such symptoms. To be able to identify individuals in need of further psychiatric examinations by using screening checklists, anxiety signs as well as signs of general adjustment problems probably have to be included. However, for diagnostic purposes and for monitoring treatment, individual anxiety assessment conducted in cooperation between professionals and care staff and family who know the individual well seems indicated.

105.162 162 Anxiety, Arousal, and Sensory Processing In Children with ASD. S. J. Lane* and S. E. Reynolds, *Virginia Commonwealth University*

Background: Neither anxiety or sensory processing are used in diagnostic characterization of ASD, although both are highly prevalent[1,2,3,4]. While far from established, deficits in the ability to modulate incoming sensation have been linked with anxiety[5]. Sensory over-responsivity (SOR) to environmental stimuli has been documented in children with ASD[6,7], and there is an indication that SOR and anxiety may be linked in both children and adults with ASD[1,7]. Finally, ASD response to sensory challenge has been characterized by altered arousal[4]. Further examination of the link between anxiety, disordered sensory processing, and electrodermal activity (EDA) in children with ASD was the basis for this study.

Objectives: Further examine the anxiety, SOR, and arousal relationship in children with ASD.

Methods:

- **Participants-** Children ages 6-12 (ASD=27; TYP=28), no other impairments; IQ> 70
- **Design**- Cross sectional repeated measures to assess electrodermal response (EDR) and cortisol response to sensory challenge; between group differences were examined for behavioral measures
- **Measures-** Short sensory profile (SSP); Reynolds Child Manifest Anxiety Scale (RCMAS) (total and subscales); Child Behavioral Checklist (CBCL) DSM Anxiety Scale, baseline EDA and non-specific responses.

Results: Children with ASD showed significantly greater total anxiety and more frequent clinically significant total anxiety than TYP. Further, ASD and TYP groups differed significantly on RCMAS subscales of worry/over-responsiveness and social concern and concentration. Children with ASD had significantly higher baseline EDA and non-specific responses than TYP children, indicating higher baseline arousal. Children with ASD also demonstrated SOR across tactile, movement, visual/auditory, and taste/smell domains of the SSP, along with sensory seeking. Tactile and visual/auditory sensitivity significantly correlated with CBCL DSM anxiety.

Conclusions:

Elevated anxiety is documented in ASD[1]. High arousal levels identified here further supports the high anxiety. SOR has been recognized by other investigators [4,8,9,]. Here, we linked SOR to both anxiety and EDR patterns suggestive of elevated arousal. While such a link has been questioned by some[3], others [7] have suggested that some children with ASD have faulty arousal mediation systems, interfering with optimal environmental interaction. Increased arousal, sensory sensitivities, and anxiety can interfere with participation in many daily activities. Further investigation of the link between anxiety, arousal and participation in ASD is warranted. Better understanding the features of ASD, their inter-relationship and impact on participation in daily activities, will allow definition of the issues and improve our ability to provide intervention.

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105.163 163 Co-Occurrence of Behavioral, Psychiatric, and Medical Issues In Families Ascertained for Autism and Language Learning Impairment. Z. Fermano*[1], J. Flax[1], C. Bartlett[2], L. Hou[2], A. Hare[1], S. Buyske[1], B. Zimmerman-Bier[3] and L. Brzustowicz[1], (1)*Rutgers University*, (2)*The Research Institute at Nationwide Children's Hospital & The Ohio State University*, (3)*Saint Peter's University Hospital*

Background:

Converging evidence suggests that in a number of families, relatives of individuals with autism exhibit behavioral, medical, and/or psychiatric characteristics that are milder but qualitatively similar to the defining features of autism. Furthermore, research suggests that these conditions occur more frequently in families where there is an individual diagnosed with autism when compared to control families. An approach to phenotypic characterization in these families includes exploring family members who exhibit elevated scores on ratings of (1) language deficits, (2) rigid personality traits/social aloofness, and (3) medical and psychiatric inventories, yet, do not meet any of the criteria for autism. Over the past seven years, The New Jersey Language and Autism Genetics Study (NJLAGS) has studied families ascertained through (at least) one proband with *autism* and a second proband with a significant *language learning impairment*, while each family member has also been directly assessed for measures from the three domains addressed above with the goal of identifying phenotypes and behavioral biomarkers related to language and other conditions associated with autism.

Objectives:

In this presentation we examine the rates and co-occurrence of related behavioral, psychiatric, and medical conditions in family members ascertained due to the presence of an autism proband and a second proband with a significant language learning impairment.

Methods:

Potential Autism probands are diagnosed using the *Autism Diagnostic Interview- Revised*, the *Autism Diagnostic Observation Schedule*, and a comprehensive medical examine including the DSM-IV. Potential language-learning impaired probands are diagnosed by a licensed Speech-Language Pathologist. Once it is determined that there are two probands, the nuclear and extended family complete a comprehensive neuropsychological battery of standardized and experimental measures and questionnaires delineating language deficits, social and behavioral traits, as well as psychiatric, and medical comorbities. Additionally, each individual contributed a DNA sample for genetic analyses.

Results:

Since families were preselected for having at least one family member with a history of language learning problems, the rates of language, reading, and spelling are significantly higher than what would be expected in the general population. One-third of the families in our sample have at least one other family member, independent of the autism proband and language learning impaired proband, with a language-based learning disability. The rates of several other behavioral and psychiatric disorders (i.e. obsessive compulsive disorder, social impairment) were greater in family members (including and excluding the autism probands) than rates of these disorders in the general population. Certain medical conditions such as gastrointestinal problems and allergies were reported at higher rates based on family history questionnaire data. Moreover, there were a number of non-spectrum family members who exhibit more than one behavioral, psychiatric, or medical condition.

Conclusions:

Ongoing results from our study suggest that in families who were collected for a history of autism and language disorders, there is a greater risk for other behavioral, psychiatric, and medical disorders in comparison to the general population. These findings support the theory of a broader view of autism in families and the notion of a greater genetic risk for certain disorders.

105.164 164 ADHD Subtypes In a Large ASD Mexican Clinical Sample. H. Padilla-Amezcua*[1], O. Roldan-Ceballos[2], O. Nafate-Lopez[3], W. O. Lopez Martinez[3], P. Zavaleta-Ramírez[4], D. C. Melchor Contreras[3], G. Villarreal-Valdes[5] and L. Albores-Gallo[5], (1)*Hospital Psiquiatrico Infantil Dr. Juan N. Navarro*, (2)*Asociacion Mexicana de Ninos con TDA y trastornos asociados A.C.*, (3)*Hospital Psiquiatrico Infantil*, (4)*Instituto Nacional de Psiquiatria Ramon de la Fuente*, (5)*Hospital Psiquiatrico Infantil*

Background:

In the last decade several authors have investigated the co-morbidity of ADHD in ASD population. Concurrent diagnosis of ADHD and PDD is not allowed in the Diagnostic and Statistical

Manual of Mental Disorders, Fourth Edition (DSM-IV). Although differences in ADHD subtypes among PDD and non PDD samples have been investigated previously, fewer studies have done comparisons with ADHD population.

Objectives: To investigate ADHD subtypes in a large ASD and ADHD clinical population.

Methods: Children admitted to the outpatient developmental behavioral Clinic of Psychiatric Hospital Dr. Juan N. Navarro were recruited for this study. Measures: ADI-R routinely performed to this population was use as gold standard diagnosis. A semi structured interview was conducted to assign subtypes for ASD (Autism, Asperger and PDDNOS) and ADHD DSM-IV diagnosis (Inattentive, Combined and Hyperactive-Impulsive). These interviews were done by senior board certified child psychiatrist LAG.

Results:

The study sample consisted of 218 children aged 2-17 years old (M 7.68, SD 3.29), 82.6% were masculine. Within this sample 50.5% of the children (n=110) were diagnosed with Autism, (15.1%) were Asperger (n=33) and 6% had PDDNOS (n=13). The Non ASD sample 28.4% (n=62) was identified as ADHD. The ADHD prevalence in the ASD sample was 80.01% which was higher for Autism 81.8% and Asperger 78.8% compared to PDDNOS 69.2% but differences were non-significant (p=.54). In the ADHD sample, 31children (50.0%) had the inattentive type, 27 (43.5%) had the combined type and 4 (6.5%) had the hyperactive-impulsive type of ADHD. Subtypes prevalence between ASD and ADHD sample was very similar. Through multinomial logistic regression the risk for ADHD was higher for autism OR 2.0 (CI 95% 0.56-7.00).14 and for Asperger OR 1.61 (CI 95% 0.39-6.99) although non-significant.

Conclusions:

These results show that ADHD prevalence is higher in ASD samples. The subtype pattern of prevalence in ASD is similar to ADHD clinical samples.

105.165 165 IQ, Age, and Internalizing Disorders In Autism Spectrum Disorders. T. Ward*, B. Reilly and R. A. Bernier, *University of Washington*

Background: Individuals with autism spectrum disorder (ASD) who possess relative strengths in cognitive and language abilities are at risk for internalizing psychiatric disorders (Ghaziuddin, et al, 2002). Studies also suggest that in ASD, the risk of developing anxiety and depression increases with age (Kim, J. et al, 2000; Ghaziuddin et al., 1998). Increased mental faculties and social insight have been theorized to account for this finding. However existing studies have relied on limited sample sizes and restricted age ranges. Given the wide variability of symptom presentation in ASD, information describing risk factors for the co-morbidity of internalizing disorders obtained from a wide age range and large sample of children with ASD is needed.

Objectives: The purpose of this study is to examine the relationship between clinically relevant internalizing symptoms, cognitive abilities, and age in a large, well-characterized sample of children with ASD.

Methods: Participants (N= 1657) included children (ages 4-17:11 years) meeting ADI-R and ADOS cutoff criteria for ASD who are participating in the ongoing Simons Simplex Collection Project (SSC; Distribution 8.2; http:SFARI.org). As a measure of internalizing symptoms, the internalizing subscale of Achenbach's Child Behavioral Check List (CBCL) was utilized. Participants were divided into 2 groups based on CBLC cut-offs for clinically significant symptom levels (T > 61, clinically significant). Nonverbal and verbal intelligence quotient estimates (assessed with the DAS-2, WISC, WASI, and Mullen) were used as a measure of cognitive abilities and age at testing was recorded.

Results: The sample consisted of 1433 males and 224 females (M = 8.9 years). Over 50% of the sample (52.3%) met cutoffs for clinically significant internalizing symptoms. Mean Full Scale IQ was estimated at 83.4. MANOVA results compared individuals with clinically significant internalizing symptoms to those below the clinically significant threshold on cognitive abilities indicated significant main effects in both the verbal and nonverbal domains. Individuals falling in the clinical range for internalizing disorder symptoms on the CBCL had a significantly higher standardized VIQ scores (F(1, 1656) = 38.18, p < .001) and NVIQ scores (F(1,1656) = 15.41, p < .001).

Conclusions: Results indicate that individuals with ASD who scored in the clinical range for internalizing disorders on the CBCL had a higher IQ across both the verbal and nonverbal domains and were older than individuals who scored in the normal range. These findings in a large, well-characterized sample lend support to previous work indicating a relationship between IQ, age, and internalizing disorders in ASD. Better developed cognitive abilities may provide an individual with tools that allow for greater insight to social awareness, interest in relationships, and the understanding of repeated negative

social experiences and isolation. Given the potential for elevated risk for co-morbidity of internalizing disorders in individuals with ASD with a higher IQ, consideration of cognitive abilities is necessary for treatment planning.

105.166 166 Home Sweet Home? Families' Experience with Aggression In Autism. S. Hodgetts*[1], D. B. Nicholas[2] and L. Zwaigenbaum[1], (1)*University of Alberta*, (2)*University of Calgary*

Background: There are numerous anecdotal reports of aggression in persons with autism, and there is a considerable dearth of research in this area, including the effects of aggression on families (Dominick, Davis, Lainhart, Tager-Flusberg & Folstein, 2007; Gupta & Singhal, 2005).

Objectives: This qualitative study examined the lived experiences of 9 families with a young person with autism and aggression. Research aims included: (1) an examination of how aggression influences the daily lives of families, and (2) how aggression influences the supports and services that the young person with autism and his or her family received.

Methods: This qualitative descriptive study (Sandelowski, 2000) was conducted as part of a larger, mixed-methods study investigating the processes by which families navigate systems of care for young persons with autism. Participants for this analysis included parents of 9 males with autism, who ranged in age from 6 to 29 years. The person who self-identified as the primary caregiver (8 mothers, 1 father) participated in all interviews, and a spouse also participated in 4 of the interviews. An in-depth, semi-structured interview was conducted with each family. Interviews were audio-taped, transcribed verbatim, and subjected to content analysis. The interviewer also observed the physical environment in which the 8 families for whom the interview took place at home lived. Triangulation of data, including information from home observations, frequency of occurrences of codes, and quotes from interview data provided corroborating evidence for established themes (Creswell, 1998).

Results: Participants conveyed a range of experiences associated with having a child with autism and aggression. Data fell into three broad categories, reflecting the impact of aggression on (1) the daily lives, routines and well-being of immediate family members, (2) finances, and (3) availability and access to supports and services. Key themes included: social isolation; exhaustion from a constant state of 'high alert'; safety of family members; out-of-pocket expenses for repairs and home adaptations; the immense need for, but lack of, respite; limited availability of professional supports to decrease or deal with aggression; and the assumption that the young person with autism will always live with the parents because of a lack of appropriate and safe alternatives.

Conclusions: Persons with autism are not inherently aggressive. However reports of aggression are relatively common, and those individuals that are aggressive do present unique and pervasive challenges to families, which have been overlooked in the literature. This exploratory examination provides unique information about families experiences living with someone with autism and aggression, and the impact that aggression has on the supports and services that families receive. The process of listening to the experiences and challenges of families living with someone with autism and aggression constitutes an important step in tailoring resources to best meet families' needs.

105.167 167 Association Between Regression and Self Injurious Behaviors Among Children with ASD. E. Lance*[1], J. York[2], L. C. Lee[3] and A. W. Zimmerman[1], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins School of Public Health*, (3)*Johns Hopkins Bloomberg School of Public Health*

Background: Self injurious behaviors (SIB) are challenging clinical issues in individuals with autism spectrum disorders (ASD). McDermott, et al (2008) found that the relative risk of SIB in autism was 7.6 times greater than in typical children. Risk factors for SIB in developmentally disabled children include male gender, severe intellectual disability, an ASD, and communication disorders (McClintock, et al 2003). Previous studies show that children with increased severity of autism, lower levels of speech, adaptive skills and younger age are more likely to have SIB (Baghdadli et al 2003). Developmental regression has not been previously studied as a potential risk factor in self injury. This study is one of the first and largest to utilize inpatient data to look at risk factors, specifically regression, associated with different types of SIB.

Objectives: The objectives of the study are to describe the frequency, type and severity of SIB in children with an ASD, and to examine the association of SIB and regression in ASD.

Methods: Patients were eligible if they were treated as inpatients on the neurobehavioral unit (NBU) between January 1995 to December 2004. Subjects included were between three and seventeen years of age. Charts were reviewed if they included admitting diagnoses of SIB and a diagnosis of autism or ASD. Medical records of 132 patients were reviewed; data were collected on the type and frequency of SIB and presence of language, social, or behavioral regression. Other

information gathered were global assessment scale scores, level of intellectual disability, and other medical diagnoses.

Results: Of the 132 patients, 97 (73.5%) had a diagnosis of autistic disorder and 35 (26.5%) of ASD. Information on language regression was available for 105 patients, social regression for 81, and behavioral regression for 79. Among those with data on regression, 42 (31.8%) reported language regression, 26 (19.7%) had social regression, and 22 (16.7%) had behavioral regression. SIB were not significantly associated with language regression; however, patients with social regression were more likely to have skin picking/pinching (Odds ratio (OR) = 3.11, 95% CI: 1.03-9.36), but less head banging (OR = 0.27, 95% CI: 0.08-0.90), as compared to those who did not have social regression. Those with behavioral regression showed significantly less hitting (OR = 0.34, 95% CI: 0.12-0.96), elopement (OR = 0.30, 95% CI: 0.10-0.94), and aggression (OR=0.03, 95%CI: 0.003-0.22) as compared to those without behavioral regression.

Conclusions: In children with autistic disorder or an ASD, children with a history of language regression did not have a significant association with SIB. Children with a history of social regression were more likely to have SIB of skin picking/pinching. Children with a history of behavioral regression had significantly less hitting, elopement, and aggression. In our continuing studies, we will look at the frequencies and subtypes of SIB and other medical diagnoses in autism and ASD.

105.168 168 Sensory Features and Caregiver Accommodations for Children with Autism and Developmental Disorders. L. M. Little*[1], A. C. Freuler[2], J. H. Sideris[3] and G. T. Baranek[1], (1)*University of North Carolina at Chapel Hill*, (2)*UNC Chapel Hill*, (3)*Frank Porter Graham Institute*

Background: Sensory features are highly prevalent, although not universal, among young children with ASD, and are characterized by at least three patterns of response: hyporesponsiveness, hyperresponsiveness and sensory seeking. Research has shown that caregivers implement accommodations to activities based on their children's impairments. However, there is a dearth of research on the association of parent adaptations and sensory patterns, as well as how parent accommodations differ among children ASD versus those with other developmental disabilities (DD), or those with typical development (TD).

Objectives:

1) Determine to what extent groups differ on rate of caregiver accommodation for overall sensory features as well as across three sensory patterns.

2) Determine how types of caregiver accommodations qualitatively differ between groups.

Methods: This mixed methods study used the Sensory Experiences Questionnaire Version 2.1 (Baranek et al., 2006), a 43 item caregiver report that quantifies children's responses to sensory experiences and qualitatively describes caregivers implementation of accommodations. The sample (n=214) consisted caregivers of children with ASD (n=94), DD (n=62), and TD (n=58). A concurrent triangulation mixed methods approach was used to analyze data (Creswell, 2009). Quantitative data were analyzed using a hierarchical linear model with sensory pattern nested within child. Thematic analysis was used to analyze qualitative data on a subgroup (n=30) to classify common themes into descriptive categories. Qualitative analysis will be available for the full 214 participants by May 2011.

Results: The three groups significantly differed on main effects of caregiver accommodations to sensory experiences ($F[1,183]=58.54$, $p<.001$) and sensory patterns ($F[2,368]=34.22$, $p<.001$). Two and three way interactions between diagnosis, caregiver accommodations, and sensory patterns were not found to be significant. Thematic analysis revealed six themes: verbal and physical redirection, verbal and physical attempts to increase or maintain engagement, implementation of rewards and environmental accommodations. Caregivers of children with ASD utilized the most physical attempts to maintain engagement and made the most environmental modifications. Caregivers of children with DD reported the highest rates of verbal attempts to increase engagement.

Conclusions: The findings suggest that caregivers of children with ASD demonstrate the highest rates of accommodations to sensory activities in the presence of the highest rates of sensory symptoms, as compared to those of DD and typically developing children. The qualitative differences in caregiver accommodations suggest that caregivers of children with ASD utilize strategies that may reflect a transaction with other core features (e.g., communication difficulties) of ASD. Accommodations reported by caregivers of children with ASD are characterized by a combination of strategies, or longer sequences of accommodations to maintain their child's engagement, as compared to DD and TD. These results have important clinical implications for assessment and intervention.

105.169 169 Schizophrenia and ASD – Is It Really a Comorbidity?. P. W. Gorczyca*[1] and A. Kapinos-Gorczyca[2], (1)*Medical University of Silesia,*, (2)

Background: Autism spectrum disorders (ASD) and schizophrenia are both neurodevelopmental disorders that are associated with impairments in functional brain connectivity. The two disorders share many similar features, such as perceptual abnormalities, thought disorders or deficiencies in reality testing.

Objectives: Infantile autism used to be described as the earliest manifestation of infantile schizophrenia, a subtype of infantile schizophrenia, and a syndrome having no relationship to schizophrenia. Identification of psychosis in individuals with ASD supposed to be challenging and controversial. The relationship between ASD and schizophrenia is a matter of continuing debate.

Methods: In our study we described four patients (one girl and three boys, age from 12 to 18) with present diagnosis of acute schizophrenia; all of them earlier fulfilled the criteria of ASD.

Results: One boy was diagnosed as Asperger syndrome, the others as high functioning autism (HFA). All of them were treated neuroleptics without full remission. After some years all these patients developed symptoms of schizophrenia with less noticeable symptoms of ASD.

Conclusions: In our opinion the presence of some neurodevelopmental abnormalities connected with ASD could represent an alternative “entry point” to a final common pathway of psychosis.

105.170 170 Social Anxiety Disorder In Adults with High-Functioning Autism Spectrum Disorders. D. Spain*[1], P. Johnston[1], K. Glaser[2], K. Lovell[3], D. G. Murphy[4] and M. R. C. AIMS Consortium[5], (1)*King's College London*, (2)*Kings College London*, (3)*University of Manchester*, (4)*Institute of Psychiatry, King's College London*, (5)*University of Oxford, University of Cambridge, Institute of Psychiatry*

Background: Psychiatric co-morbidity occurs commonly in Autism Spectrum Disorder (ASD). High rates of social anxiety are consistently found in children and adolescents with ASD. Few studies have sought to investigate whether this is also the case for adults with ASD, despite the fact that social anxiety disorder (SAD) can be chronic and debilitating. Furthermore, adults with high-functioning ASD are known to be at risk of developing anxiety disorders, which likely impede on social functioning and quality of life.

Objectives: The primary objective of this study was to determine the point prevalence of SAD in adult males with high-functioning ASD. Secondary aims included exploring whether there were associations between SAD and low mood, SAD and general anxiety, and severity of ASD and social anxiety.

Methods: An observational, cross-sectional study design was used. A community sample of adult males with high-functioning ASD was recruited. Participants and their informants (a parent) completed several validated self-report questionnaires via a postal survey.

Results: Fifty-one individuals participated in the study. Point prevalence of SAD was 52%. Sample characteristics did not differ significantly between groups scoring above and below the SAD clinical threshold. Higher rates and levels of low mood and general anxiety were found in the group scoring above the SAD clinical threshold. Significant associations were found between SAD and low mood, and SAD and general anxiety. Correlations between severity of ASD and social anxiety were not significant.

Conclusions: SAD appears to be highly prevalent in this population. Anxiety symptoms may be ‘masked’ due to relatively high-functioning abilities, and core ASD symptoms may render it difficult for individuals to seek support spontaneously. A more proactive approach to the assessment of SAD is indicated, which could include the use of self-report questionnaires. Further research is needed into understanding the phenomenology and aetiological factors associated with social anxiety in this population, with a view to informing the development of evidence-based interventions.

105.171 171 Predictors of Comorbid Psychopathology for Toddlers with ASD. L. L. Christensen*[1], L. Berkovits[2], M. Sigman[2] and T. Hutman[3], (1)*UCLA*, (2)*University of California, Los Angeles*, (3)*UCLA Center for Autism Research and Treatment*

Background:

Children with autism spectrum disorders (ASD) show elevated rates of comorbid mental illness compared to typically developing peers with rates between 10% and 81% (De Bruin et al., 2007; Levy et al., 2010; Matson, Hess & Boisjoili, 2010). Disruptive behavior disorders and anxiety disorders appear to be the most common forms of mental illness for children with ASD (De Bruin et al., 2007). However, it remains unclear why these disorders are the most prevalent. Some investigators have posited a relationship between the symptoms of ASD and later psychopathology, with particular attention given to repetitive/stereotyped behaviors as a mechanism to reduce

arousal (Hutt & Hutt, 1965; 1970; Turner, 2003 for a review). Nevertheless, there is inconsistent support for a relationship between autism symptomatology and anxiety (De Bruin et al, 2007; Sukhodolsky et al., 2008) and further research is needed.

Objectives:

The objective of the current study is to examine predictors of later psychopathology in children at risk for ASD. The current study will examine ASD symptoms as predictors of psychopathology, with particular attention given to repetitive/stereotyped behaviors.

Methods:

Participants for the current study included infant siblings of children with autism diagnosed with ASD or other related deficits (ASD/Concerns; n = 21) and typically developing controls (TD; n =72). There were no significant group differences in gender, family income or mother's education. Slightly more than half of the participants were male and most had family incomes at or above $75,000. Likewise, most mothers had graduated from college. Scores on the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) administered at 36 months of age measured the propensity towards comorbid psychopathology. Scores on the social communication and repetitive behaviors domains of the Autism Diagnostic Observation Schedule (ADOS: Lord et al., 2000) at ages 18, 24 and 36 months of age were used as predictors of psychopathology. Repetitive play behaviors from an observed free-play task at 18, 24 and 36 months of age were also used as predictors of psychopathology.

Results:

Preliminary results demonstrate significant group differences in repetitive/stereotyped behaviors on the ADOS at 18, 24, and 36 months of age (p = .055, p=.00, and p=.00, respectively). Negative binomial regression analyses were used to account for the positive skew and high frequency of zeros in the CBCL data. Results support significant group differences in attention problems (p=.065), with ASD toddlers demonstrating more difficulties with attention than TD children. Results also suggest a relationship between sleep problems on the CBCL and repetitive behaviors on the ADOS at 36 months of age (p=.073), although this relationship is independent of group membership.

Conclusions:

Children with ASD demonstrate a greater propensity towards psychopathology than typically developing children and they may have elevated problems with attention. This is notable given the deficits in attention associated with ASD and the possibility of shared genetic influences with ADHD (Reiersen & Todd, 2008; Ronald et al., 2008). Furthermore, there may be a relationship between symptoms of autism and sleep problems, although this link appears to be independent of ASD outcome.

105.172 172 A Family History Study of Autism and Epilepsy.

M. L. Cuccaro*[1], R. Tuchman[2], E. R. Martin[1], K. L. Hamilton[1], H. H. Wright[3], R. K. Abramson[3], J. R. Gilbert[1], J. L. Haines[4] and M. A. Pericak-Vance[1], (1)*John P Hussman Institute for Human Genomics*, (2)*Dan Marino Autism Center*, (3)*University of South Carolina*, (4)*Vanderbilt University*

Background: Previous studies have found similar rates of epilepsy among family members of individuals with and without autism. However, when epilepsy status of the person with autism is considered, higher rates of epilepsy are found in family members of individuals with co-occuring autism and epilepsy vs. autism only. There is increasing evidence that both autism and epilepsy are associated with a host of other developmental, psychiatric, and medical comorbidities. We propose to study the prevalence of these comorbidities in family members of individuals with autism and epilepsy.

Objectives: This objective of this study was to examine family history data in an autism dataset as a function of the epilepsy status of the proband. We hypothesized that there would be a greater rate of developmental, psychiatric, and medical comorbidities in first-degree family members of individuals with autism and epilepsy.

Methods: We collected standard family history data for 506 autism families (98 multipex/408 simplex); 11% of our probands had epilepsy based on parent report and medical record review. We examined 9 family history traits: seizures/epilepsy, migraines, gastrointestinal problems, OCD, schizophrenia, depression, bipolar disorder, dyslexia, and learning disabilities. Groups were defined using epilepsy status of affecteds (epilepsy/non-epilepsy) based on informant report. We examined group differences in the presence/absence of each trait in first-degree family members as a function of epilepsy status of the proband using logistic regression. Next, we investigated the frequency of first-degree family members positive, again by epilepsy status of the proband, for each variable adjusting for intra-familial correlations using Poisson regression. All analyses were adjusted for family type (multiplex vs. simplex), age at examination, and sex.

Results: Adjusting for family type, age at examination, and sex, we found significantly higher rates of dyslexia (p=0.03; OR=2.8) and learning disability (p=0.04; OR=2.3) in family members of the autism-epilepsy group. In our second analysis, using a GEE approach to correct for intra-familial correlation, we found a significantly greater frequency of first-degree family members positive for dyslexia in the autism-epilpsy group (p=0.02) as well as a borderline significantly greater frequency of first-degree family members positive for learning disability (p=0.06) in this same autism-epilepsy group.

Conclusions: Our results suggest an increased rate of learning problems in first-degree family members of individuals with co-occurring autism and epilepsy. Previous reports have cited an increased risk of various cognitive and learning problems in relatives of individuals with autism; our findings suggest that this risk in autism may be heightened in the presence of epilepsy. To our knowledge, this is the first study to test this hypothesis. Our results are intriguing in that increasing evidence suggests that genetic variants which confer risk to autism may also yield other neurobehavioral phenotypes in both individuals affected with autism as well as family members (Miller 2009). Since our results are based solely on informant report they must be interpreted cautiously. However, this exploratory study provides new clues regarding the autism-epilepsy relationship and extends the range of neurobehavioral phenotypes that may be tied to potential underlying genes when autism and epilepsy co-occur.

105.173 173 Cortisol Levels In Adolescents with ASD and Typical Development. A. M. Estes*[1], J. Munson[1], L. Tsui[2], D. Antovich[1], B. King[3] and G. Dawson[4], (1)*University of Washington*, (2), (3)*University of Washington and Seattle Children's Hospital*, (4)*Autism Speaks, UNC Chapel Hill*

Background: Research suggests that anxiety, depression and behavioral difficulties may increase during adolescence for some individuals with ASD. Hypothalamo-pituitary-adrenal (HPA) system dysregulation is a general risk factor for psychopathology in typically developing populations. Patterns of cortisol secretion are one way to assess HPA function. Alterations in expected circadian rhythm of cortisol secretion have been observed in children with ASD and an abnormal suppression of the typical pattern of cortisol release after waking has been reported in one study of adolescents with ASD. However, additional studies are needed to understand the potential for cortisol measurement to inform psychopathology risk or presentation in this population.

Objectives: We aim (1) to compare levels of cortisol in adolescents with ASD vs. typical development (TYP), (2) to compare variability in cortisol levels across two days in ASD vs. TYP groups, (3) to investigate the relationship of ASD symptom severity, associated symptoms, and behavioral functioning with cortisol levels.

Methods: In the context of a longitudinal study, salivary cortisol samples were collected via Salimetrics home collection kits from adolescents with ASD (n=16 males, 4 females) and those with a history of typical development (TYP; n=13 males, 5 females). Cortisol was measured as nanograms per milliliter (ng/mL) three times; upon awakening (wake), 30-minutes after awakening (30-min), and 12 hours after awakening (12-hrs) across two days. The groups did not differ significantly by age (ASD M=14.72, SD=1.13; TYP M=14.68, SD=1.49), or gender. The TYP group had higher general cognitive ability scores on the DAS-II (ASD M=96.95; range=30-127; TYP M=123.72, range=104-150, F(1,39)=14.33, p<.001). Autism symptom severity was assessed with the ADOS and associated symptoms and behavioral functioning with the CBCL through parent report.

Results: (1) Cortisol levels did not significantly differ between the ASD and TYP groups at any point of the day (ASD M(SD) wake=3.10(1.47), 30-min=3.70(1.09), 12-hrs=0.62(0.39); TYP M(SD) wake=3.19(1.48), 30-min=4.27(1.87), 12-hrs=0.66(0.35); all F tests n.s.). (2) Cortisol levels at 30-min showed significantly less day-to-day stability in the ASD (r=0.04) compared with the TYP (r=0.70) group via multiple regression analysis (t=2.47, p=0.019). (3) The ASD group showed a significant correlation between parent-reported internalizing problems and the 30-min cortisol level (r=0.52, p=0.49). Although larger, this relationship was not significantly different from the TYP group (r=0.29, p=0.25) group (t=-1.47, p=0.15). ASD symptoms did not correlate significantly with cortisol level in the ASD group.

Conclusions: This study found that adolescents with ASD demonstrated patterns of cortisol secretion consistent with typically developing adolescents. However, they demonstrated more variability in cortisol levels 30 minutes after awakening compared with typically developing adolescents across two days. Inconsistent cortisol levels 30 minutes after awakening may indicate HPA dysregulation under stress. Evidence was also found for an association between 30-min cortisol and parent report of internalizing problems in the ASD and TYP groups. Investigating cortisol in adolescents with ASD may offer insight into the development of associated psychiatric conditions in ASD.

105.174 174 Problem Behavior In Young Children with Autism Spectrum Disorder. K. E. Pelzel*[1], D. P. Wacker[1], S. D. Lindgren[1], T. G. Kopelman[1], J. F. Lee[2], Y. C. Padilla[2] and D. B. Waldron[1], (1)*University of Iowa Hospitals and Clinics*, (2)*University of Iowa*

Background: Problem behavior (e.g., aggression toward others, self-injurious behavior, property destruction) is recognized as 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 more effective, reinforcement-based treatments (Pelios et al., 1999). Investigation of FA results for individuals with autism spectrum disorders (ASDs) who engage in problem behaviors has been limited. In a review of 32 youth with ASDs, Love et al. (2009) reported social-positive reinforcement (i.e., attention and tangible reinforcement) was the most common function.

Objectives: We aim to better understand the function of problem behavior displayed by children with ASDs, with the following variations to the Love et al. (2009) methodology:

- All participants will be aged 18 months to 6 years.
- "Gold standard" diagnostic measures will be used to confirm diagnosis.
- Extended FAs (Iwata et al., 1982/1994) will be conducted via telehealth with all participants.
- "Social-positive reinforcement" will be separated into attention and tangible categories to isolate the role of these functions in maintaining behavior.
- Participants living in relatively rural locations will be included.

Methods: Thirty children aged 18 months to 6 years diagnosed with ASD (confirmed with ADOS and ADI-R) will complete extended FAs 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 hospital with a regional university 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.

Results: To date, 22 children have been identified for study, and 12 have completed the FA (6 with Autistic Disorder and 6 with PDD-NOS). Another 5 participants are currently completing their FA. FA results to date are presented in Table 1.

Table 1

Number of Participants with Problem Behavior Maintained by Identified Functions

	Diagnosis		
Function	Autistic Disorder	PDD-NOS	Combined
	n =6	n =6	n=12
1) Attention	0	0	0
2) Tangible	1	1	2
3) Escape	0	1	1
4) Automatic	0	0	0
5) Attention & Escape	1	0	1
6) Tangible & Escape	4	2	6
7) Attention, Escape, & Tangible	0	1	1
8) No Identified Function	0	1	1

Conclusions: Results to date suggest multiple functions, particularly a combination of tangible and escape functions, most frequently maintain problem behavior among young children with ASD. With respect to social-positive reinforcement, problem behavior was more often maintained by tangible reinforcement than attention.

105.175 175 Autistic Traits In a ADHD Clinical Sample Vs. Control Group. P. Zavaleta*[1], W. Lopez-Martinez[2], D. C. Melchor Contreras[3], O. Nafate Lopez[2], H. Padilla-Amezcua[4] and L. Albores-Gallo[2], (1)*Instituto Nacional de Psiquiatria*, (2)*Hospital Psiquiatrico Infantil* , (3)*Hospital Psiquiatrico Infantil*, (4)*Hospital Psiquiatrico Infantil Dr. Juan N. Navarro*

Background:

Autism traits in ADHD have received recent attention. Few studies have examined autistic symptoms in ADHD clinical samples finding prevalence rates between 65 to 80%. Since autism traits are normally distributed in general population, it is important to study autism traits in ADHD vs. general population samples

Objectives:

To examine social reciprocity problems in a clinical ADHD sample and a control group without ADHD.

Methods:

The sample consisted of 60 children who seek psychiatric treatment in the outpatient ADHD clinic of Hospital Psiquiatrico Infantil Dr. Juan N. Navarro and 40 children from the general population. Parents completed a semi-structured DSM-IV oriented interview by a senior board certified child psychiatrist to assign a “pure” ADHD diagnosis (without ASD) Measures: The Social Reciprocity Scale (SRS) was completed by the parents.

Results:

Overall the age range of the whole sample (N=100) was between 3 to 17 years old with a mean age of 9.19 (SD 3.32), 68.6% were males. The Control group (Co) had a higher SES (15.7vs.8.6) compared to the ADHD group (p<.0001), and the proportion of males was higher in the ADHD vs. control group (86.7% vs. 42.5% p <.0001). The ADHD DSM-IV subtype composition was Combined type (C) (63.3%) Inattentive (I) (23.3%) and Hyperactive-impulsive type (H/I) (13.3%). The SRS mean total score for the ADHD group was 86.67± 26.99 vs. 47.58 ± 7.6 for the Control group t(98)=8.90, p<0.0001. In the ADHD sample a SRS cutoff ≥ 85 identify 45% children with autistic traits, in contrast no children from the control group met the cutoff ≥85 or 65 (suggested in some studies for community samples). By ADHD subtypes the prevalence for autistic traits was higher for the combined type (81.5%) followed by the inattentive (14.8%) and the Hyperactive-impulsive type (3.7%) had the lowest prevalence. Analysis of variance (ANOVA) indicated significant mean differences in mean SRS scores among ADHD subtypes: C>I>H/I/>Co ($F(3,99) = 34.75$, p<0.0001). Dunnet C post hoc analyses revealed that compared to the Control group children in the Combined and the Inattentive ADHD subtypes groups had higher autistic traits measured by SRS (mean difference of 46.50, and 29.06 respectively vs. control group p=.05)

Conclusions:

Compared to children from the general population patients with ADHD have more autistic traits, the prevalence (48%) is even higher than ADHD samples from the general population reported in previous studies.

105.176 176 Association of SRS Score with Other Phenotypic Variables In ADHD and ASD. A. M. Reiersen*[1] and S. H. Mostofsky[2], (1)*Washington University in St. Louis School of Medicine*, (2)*Johns Hopkins School of Medicine, Kennedy Krieger Institute*

Background: Co-occurrence of Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism symptoms has previously been demonstrated in clinic- and population-based samples (Grzadzinski et al., 2010; Reiersen, Constantino, & Todd, 2008; Reiersen, Constantino, Volk, & Todd, 2007). The Social Responsiveness Scale (SRS) has been previously used to measure autistic symptoms in children with ADHD and other psychiatric disorders(Grzadzinski et al., 2010; Reiersen et al., 2008; Reiersen et al., 2007; Towbin, Pradella, Gorrindo, Pine, & Leibenluft, 2005). In a population-based sample, SRS score was higher in combined type ADHD than in the inattentive subtype(Reiersen et al., 2007). Previous studies of autistic symptoms in ADHD samples have shown association of the SRS with parent-reported motor coordination problems (Reiersen et al., 2008)as well as co-occurring psychopathology, including oppositional behavior(Grzadzinski et al., 2010).

Objectives: To investigate the association of SRS score with motor function, co-occurring psychopathology, and other phenotypic variables within clinically ascertained children and adolescents diagnosed with ADHD or Autism Spectrum Disorder (ASD).

Methods: Subjects include 242 individuals recruited for participation in studies of ADHD or ASD (61 with ADHD, 74 with Autism, 107 control subjects with neither diagnosis). The Social Responsiveness Scale was available as a measure of autistic traits in all subjects. Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R) data were available on ASD subjects. Several measures of motor function and co-occurring psychopathology

were available on all subjects. We examined the mean and distribution of SRS scores in each subject group and investigated the association of SRS score with other phenotypic variables within each subject group.

Results: Mean SRS scores were moderately elevated in ADHD and higher in ASD subjects, but similar between combined and inattentive ADHD subtypes. Within the ADHD and ASD groups, parent-rated SRS score was significantly associated with a parent-rated questionnaire-based measure of motor function (the Developmental Coordination Disorder Questionnaire), but not with several exam-based measures of motor function. Some subscales from a questionnaire-based measure of anxiety (the SCARED) were also significantly associated with SRS score. There appeared to be a slight distributional shift toward increased (more severe) SRS scores among subjects with ADHD or ASD who had an additional diagnosis of oppositional defiant disorder (ODD), but a statistically significant relationship between the categorical measure of ODD and the total SRS score was not found in either of the clinically affected groups.

Conclusions: The findings are largely consistent with some previous studies suggesting association of parent-reported motor coordination problems and ODD symptoms with SRS score in children whose primary diagnosis is ADHD. Mean SRS scores in the ADHD group were similar to those reported for inattentive ADHD in a previous sample. The lack of ADHD subtype differences in mean SRS score may be due to differences in ascertainment method (i.e., clinical sample vs. population sample and efforts to obtain a relatively "pure" ADHD group without evidence of ASD).

105.177 177 Bidirectional Relationship Between Anxiety Symptoms In Mothers and Young Children with Autism and the Moderating Effects of Sensory Over-Responsivity. T. W. Soto*[1], F. Martinez[2] and A. S. Carter[2], (1)*University of Massachusetts, Boston*, (2)*University of Massachusetts Boston*

Background: There is a paucity of research examining bidirectional relationships between parent and child affective symptoms. Research examining the unidirectional relationship between parental well being and child ASD symptoms tends to implicitly and often explicitly suggest one of the family members as the impetus for dyadic partner's distress (Tehee, Honan, & Hevey, 2009). Of particular interest is the relationship between parental anxiety and child anxiety, since anxiety problems can be especially debilitating to individuals with ASD (Greig & MacKay, 2005) by adversely impacting school performance, peer relationships, family functioning, and further exacerbating the core deficits of ASD (Bellini, 2004; Sze & Wood, 2007). Exploring the bidirectional relationship of anxiety symptoms in mothers and their young children presents the issue in a family systems context, as opposed to assuming unidirectional causality. In addition, given the association between anxiety disorders and sensory over-responsivity (SOR) in children with ASD (Ben-Sasson et al., 2008; Liss et al., 2006), we further examined the role of SOR in the relationship between maternal and child anxiety.

Objectives: 1) To examine bidirectional relationship of maternal and child anxiety symptoms across three time points; 2) To explore moderating effects of the level of the child's SOR (high vs. low) on the relationship between maternal and child anxiety.

Methods: Mothers (n = 167) of young children with ASD (n = 177; mean age = 28 months at baseline) that participated in a longitudinal study examining developmental trajectories of toddlers newly diagnosed with ASD and family adjustment and well-being, completed the Beck Anxiety Index (Beck et. al, 1988), the Infant Toddler Social Emotional Assessment (ITSEA; Carter & Briggs-Gowan, 2003), and the Infant Toddler Sensory Profile (ITSP; Dunn, 2002) at three different time points (baseline, 12-month follow-up, and 24-month follow-up). The ITSEA's General Anxiety scale was used as a measure of child anxiety.

Results: A cross-lagged panel model was used to test the bidirectional relationship between maternal anxiety and anxiety in young children with autism. Sensory over-responsivity (SOR) was tested for its moderating effect of child and maternal anxiety. Model fit was good (RMSEA=0.042; SRMR= 0.037; CFI=0.966), with relationships between maternal and child anxiety being strongest in the SOR group ($\beta = 0.25$)

Conclusions: Results suggest that there is a bidirectional relationship between maternal and child anxiety, and that this relationship is moderated when the child with ASD has SOR. This study provides evidence for further exploration of interventions focusing on addressing maternal and child anxiety as a correlated construct.

105.178 178 Differences In Symptom Presentation In Children with ASD with and without Co-Morbid Behavior Disorders. M. E. Behen*, A. Veenstra, C. Wolfe Christensen, M. Palance, B. Patel and B. Gorka, *Children's Hospital of Michigan*

Background:

Up to 65 % of children with autism spectrum disorders have been reported to have co-occurring psychiatric problems

(Simonoff et al., 2008). Less is known about the developmental historical factors, level of intellectual and adaptive behavior functioning, and magnitude of autistic symptoms associated with the presence of co-morbid behavioral disorders in children with autism spectrum disorders.

Objectives:

The goal of the present study was to investigate whether children with autistic spectrum disorder with and without co-morbid behavioral problems have different patterns of demographic/developmental histories, levels of intellectual and adaptive behavior functioning, and magnitude of autistic symptoms.

Methods:

Participants were 200 children (161 males) who were referred for psychological assessments in order to rule out ASD. Children ranged in age from 48 to 206 months (mean = 81.2, SD = 31.4). Children and their primary caregivers participated in a comprehensive neuropsychological evaluation. All participants had met DSM-IV TR and ADI-R criteria for an autism spectrum disorder. Eighty-six (43%) of these children also met DSM-IV TR criteria for a co-morbid behavioral disorder (ASD+BD) as assessed by structured interview. Demographic/developmental history, diagnostic information (ADI-R), magnitude of autistic symptoms (Social Responsiveness subscales), and magnitude of associated symptoms (CBCL) were also acquired for each child. Group differences were tested via six separate one-way MANOVAs, one each for demographic/ developmental historical variables (age, gender, birthweight, age walked, age of single words, age of phrases), ADI-R domains, intellectual functioning (FSIQ, VCI, PRI), adaptive behavior (VABS-2 subdomains), SRS subdomains, and CBCL subscales (Anxiety/Depression, Somatic Complaints, Attention Problems, Aggressive Behavior, Affective Problems).

Results:

The groups did not differ on age or gender. Not unexpectedly, the overall test for associated symptoms (CBCL subscales) was significant ($F(5, 194)=11.97$; $p<0.001$). Follow up tests revealed that the ASD+BD group had increased problems on all of the subscales except for Attention Problems. The only other significant overall test was for magnitude of autistic symptoms (SRS subscales, $F(5, 194)=3.65$; $p=0.007$). Follow up tests revealed that the ASD+BD group had significantly increased scores (increased caregiver-reported symptoms) on the Social Motivation ($p=0.029$) and Autistic Mannerisms ($p<0.001$) subscales. There were no significant between-group differences on any of the developmental variables, intellectual functioning, ADI-R subscales, or adaptive behavior subdomains.

Conclusions:

Results revealed few differences between children with an autism spectrum disorder with and without a co-occurring behavior disorder. Other than increased behavior problems, the latter group was distinguished by the presence of elevated problems in social motivation and increased autistic mannerisms. Future studies will investigate whether specific behavioral diagnoses (i.e., oppositional defiant disorder) are associated with distinct patterns on neuropsychological and behavioral assessment.

105.179 179 Sensory-Motor Features of Infants with and without Risk Factors for Autism. A. E. Lane*[1], J. Heathcock[1], D. Robson[2] and R. L. Young[2], (1)*The Ohio State University*, (2)*The Flinders University of South Australia*

Background:

Identification of early signs of autism is a priority for the field as it provides therapeutic targets for early intervention. As it is difficult to detect clinically meaningful variation in language, social and cognitive development in very young children, sensory-motor differences may offer a better means of evaluating autism risk in the first year of life. Children with autism demonstrate sensory-motor difficulties that are associated with the core deficits in autism. Variations in sensory-motor performance are reliably observed during infancy.

Objectives:

The purpose of this study was to characterize sensory-motor features of infants in their first year of life with and without risk factors for autism.

Methods:

Standardized video footage and early autism screening test scores from 39 infants was used. Participants included a high-risk infant group (SIB-ASD) comprising of 24 infants with a sibling or close relative diagnosed with an ASD. A second group consisted of 15 infants with no known family history of ASD (NO-ASD).

Infants were videotaped while being assessed using early autism screening tools and developmental evaluations at ages 2, 4 and 6 months. Videotapes at each time point were coded using an observation protocol of sensory-motor features. Blinded researchers identified head lag, symmetrical posture, grasp and release, midline, mouthing, response to touch, and scored motor development using the AIMS (Alberta Scale of Infant Development).

Results:

Preliminary data analysis has been conducted on grasp and release behaviors and AIMS scores for 2 and 4 month old participants (n=22). Preliminary results are as follows:

- NO-ASD (n=10) participants spent more time with their hands in the midline (mean proportion of total time observed = 6%, SD=12%) than SIB-ASD (n=12) participants (mean proportion = 0.6%, SD=1%) with a trend for the NO-ASD group having more midline behaviors (p=0.10).
- NO-ASD participants were slightly more successful in retrieving objects presented to them (mean rate of retrieval = 0.16, SD=0.12) than SIB-ASD (mean retrieval rate = 0.12, SD=0.11) but the difference is not statistically significant (p=0.42).
- There were no differences in AIMS scores at 2 months of age.
- At 4 months, NO-ASD participants had higher AIMS scores (mean = 11.73, SD 2.7) than SIB-ASD (mean 10.73, SD 2.28) with a trend for the NO-ASD group having better motor skills (p=0.10).

Conclusions:

Two month old infants with and without risk factors for autism demonstrate high variability in sensory-motor skills. A trend for decreased midline behavior at 2 months was observed for infants with risk factors for autism. Further, 4 month old infants with risk factors for autism performed less well on the AIMS. These trends will be examined further at the 6-month time point alongside results from early autism screening assessments and reported in the full paper.

105.180 180 Sensory Responsiveness In Sibling Pairs Concordant and Discordant for ASD. C. L. Hilton*[1], A. Babb[2], Y. Zhang[3] and J. N. Constantino[3], (1)*Washington University*, (2), (3)*Washington University School of Medicine*

Background: For children with autism spectrum disorders (ASD), atypical sensory responsiveness is much more common than among children unaffected with ASD. Although numerous studies have examined the social abilities of siblings of children with ASD, none have examined their sensory characteristics. An aggregation of sub clinical autistic social impairment traits have been found in unaffected family members of children with ASD, suggesting that such impairment constitutes an autism endophenotype (trait that is associated with a diagnosis, is heritable, and manifests in family members with or without the diagnosis). It is important to better understand if patterns of atypical sensory processing occur in unaffected members of ASD families to better understand the heritability of this trait.

Sensory scores have been shown to improve with increased age in previous studies that included children under the age of 18 years with ASD, but not in studies of adults. Most studies have concentrated on either children under or over age 10 because of separate sensory assessments that were standardized for those age groups, while other studies have used assessments well above their standardized age range, so the trajectory of sensory responsiveness is not clear.

Objectives: This study examined the sensory responsiveness of sibling pairs in children from families with ASD to better understand the heritability of atypical sensory responsiveness in these families. In addition, differences in sensory responsiveness patterns were examined across ages.

Methods: Sensory Profile Child Questionnaires or Adolescent/Adult Sensory Profile Questionnaires were completed by parents of 146 children between age 4 and 23 (96 with an ASD diagnosis, 50 unaffected siblings; 30% African American, 69% Caucasian, 1% Asian). Z-scores were used for statistical analyses. Levels of responsiveness for the four sensory quadrants (overall patterns of responses: low registration, sensation seeking, sensory sensitivity, sensation avoiding) and five sensory domains (responses to specific types of sensory input: auditory, visual, touch, vestibular, taste/smell) were compared between siblings and across ages.

Results: Sensory responsiveness quadrant and domain Z-scores of ASD-affected children substantially deviated from published norms, but those of unaffected siblings did not. Sensory quadrant scores significantly improved as a function of advancing age across all 4 quadrants among children with ASD.

Conclusions: Atypical sensory responsiveness is a developmentally-sensitive trait marker in ASD, but does not appear to constitute an endophenotype.

Invited Educational Symposium Program
106 Imaging Genetics In ASD
Moderators: S. Y. BookheimerD. H. Geschwind *University of California, Los Angeles*

Combining in vivo brain imaging with genetics is a power research tool that can reveal how genes relate to differences in brain development, structure and function, relevant to human neuropsychiatric disorders. The purpose of this symposium is to introduce the principles behind imaging genetics for discovery of gene-brain pathways, and to demonstrate methods through the use of examples in research on autism supporting this line of research. These approaches include both human and animal imaging, and examples from each will be discussed. The educational goals of the symposium will include learning methods for choosing genes appropriate for imaging genetics studies, interpreting imaging-genetics data, and demonstrating several approaches through specific examples in both human and animal studies.

106.001 Introduce Theories Supporting Imaging-Genetic Research. D. H. Geschwind* and S. Y. Bookheimer, *University of California, Los Angeles*

Drs. Bookheimer and Geschwind (UCLA) will introduce the theories supporting imaging-genetic research and outline the goals, promises and pitfalls of these approaches, And will present approaches to identifying valid candidate genes appropriate for study in imaging genetics, including multiple sources of evidence and gene expression data.

106.002 Methods for Imaging Dendritic Growth In Vivo. J. Trachtenberg*, *UCLA*

Dr. Joshua Trachtenberg (UCLA) will show data on a PTEN model of autism and present methods for imaging dendritic growth in vivo.

106.003 Serotonin Transporter Genes. D. G. Murphy*, *Institute of Psychiatry, King's College London*

Dr. Declan Murphy (KingsCollege, London) will discuss serotonin transporter genes and imaging-genetic approaches combining structural MRI data and fMRI with serotonin risk polymorphisms.

106.004 CNTNAP2 Risk Gene. A. A. Scott-Van Zeeland*, *Scripps Translational Science Institute*

Dr. Ashley Scott-VanZeeland (Scripps Translational Science Institute) will discuss the CNTNAP2 risk gene and integrating genetic risk with imaging of functional connectivity using fMRI data.

Medical, Psychiatric, and Behavioral Co-morbidities Program
107 Medical, Psychiatric, and Behavioral Co-Morbidities

107.001 Iron Status In Children with Autism Spectrum Disorders. A. M. Reynolds*[1], C. A. Molloy[2], S. J. James[3], C. Johnson[4], T. Clemons[5] and S. L. Hyman[6], (1)*University of Colorado Denver*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*University of Arkansas for Medical Sciences*, (4)*University of Pittsburgh*, (5)*EMMES Corp*, (6)*University of Rochester School of Medicine*

Background: Children with Autism Spectrum Disorders (ASD) have a high rate of food selectivity and restricted diets which puts them at risk for nutritional deficiencies (Schreck, 2004). Understanding iron status in children with ASD is important because there is mounting evidence that iron deficiency can have a negative impact on development and may be associated with sleep disorders such as restless leg syndrome. Children with ASD have a high rate of sleep disorders (Richdale, 2009). One study (Latif, 2002) found high rates of iron deficiency anemia (11.5%) and low ferritin (52%) in children with ASD. Another study found low ferritin in children with ASD and restless sleep (Dosman, 2007). The diagnosis of iron deficiency is complex, however, major breakthroughs in understanding iron metabolism have occurred over the last several years. Biomarkers such as hepcidin and soluble transferrin receptor (sTfR) have been found to play an important role in iron absorption and transport into red blood cells. Unfortunately, normal values for these markers in children are lacking. The National Health and Nutrition Examination Survey (NHANES) uses the “ferritin model” to define iron deficiency which is defined as low levels on 2 of 3 measures: ferritin, transferrin saturation, and erythrocyte protoporphyrin. The “body iron model” uses ferritin and sTfR (Cogswell, 2009). The World Health Organization (2005) recommends evaluation of iron status for population studies to include CBC, transferrin saturation, ferritin, and sTfR.

Objectives: To determine the rate of iron deficiency in children with ASD.

Methods: Children ages 2-10 years, enrolled in the Autism Treatment Network at 5 sites were eligible. All had a clinical diagnosis of ASD, confirmed by the Autism Diagnostic Observation Schedule. A 3 day diet record, ferritin, CBC, iron, total iron binding capacity (TIBC), and transferrin saturation were collected for each child. Hepcidin, sTfR, and c reactive protein (CRP) were collected from subjects who consented to an ancillary study.

Results: Preliminary data are available for 131 subjects (101 with autism, 8 with PDD, 22 with Asperger) who have had blood drawn for iron studies. Twenty-six (20%) had low ferritin and 41 (33%) had low transferrin saturation, however only 10 (8%) were low for both. There were only 3 subjects with low hematocrit associated with iron deficiency (2%). Iron deficiency defined by low ferritin and transferrin saturation was found in 10 children (8%) with ASD, of those 3 had evidence of mild iron deficiency anemia. This is in contrast to NHANES which found that 3% of 3-5 year olds in the general population have iron deficiency defined by the ferritin model.

Conclusions: While the determination of iron status is complex, children with ASD may be at risk for iron deficiency without anemia at a higher rate than the general population. Once more data are available, iron status will also be evaluated using transferrin receptors, CRP, and hepcidin. Iron status will then be compared to iron intake from both heme and non-heme dietary sources, and to clinical symptoms as measured by the Children's Sleep Habits Questionnaire and the Child Behavior Checklist.

107.002 Co-Morbid Hearing Loss and Autism: Complex Presentation and Diagnosis. C. A. Szymanski, Ph.D.*[1] and P. J. Brice, Ph.D.[2], (1)*University of Rochester Medical Center*, (2)*Gallaudet University*

Background: Research has shown that autism can exist with co-morbid conditions such as Down Syndrome, Intellectual Disabilities, Seizures, vision loss and hearing loss. Despite higher prevalence rates of autism in children with hearing loss (estimated to be 1 in 81) there exists little research pertaining to diagnostic, intervention, and characteristics of these children. Objectives: To develop a functional understanding of key characteristics of children with co-morbid hearing loss and autism. Methods: A national sample (n = 52) of children with hearing loss and autism was recruited to complete several autism screeners including the Social Responsiveness Scale, Social Communication Questionnaire, and the Gilliam Autism Rating Scales- 2nd edition. Of those children, in-depth one-on-one interactions were conducted with 17 children with previous diagnoses of autism. All interactions were videotape and behaviors coded (e.g., eye contact, spontaneous language, aggression, self-injurious behaviors). Professionals reviewed videotapes with specialized training in hearing loss and those without to confirm autism diagnosis. Results: As a whole (n = 52) approximately 50% of the sample did not meet diagnostic criterion on the autism screeners for possible autism, nor meet DSM-IV TR criterion. Scores were also not in the clinical range. One-on-one interactions of children with a previous autism diagnosis did not yield behaviors often associated with autism. Instead many children engaged in reciprocal conversations, initiated conversations, and maintained eye contact for extended periods of time. Review of videotape data also suggested that professionals specializing in hearing loss and those without specialized training did not agree on diagnosis for all children. Children suspected to have an autism diagnosis by professionals trained in hearing loss had significantly higher scores on the SRS, SCQ, and GARS-2 than those without. Scores for those children were within the clinical range and thus consistent with a previous diagnosis of autism. Children suspected of autism by professionals not trained in hearing loss did not have mean scores on the SRS, SCQ, or SCQ that were within the clinical range. Conclusions: Characteristics of autism (e.g., lack of response to name, delays in expressive language, difficulties with socialization) are often considered characteristics of typical development in children with hearing loss. The confusion in presentation of deafness and autism for those professionals not trained in hearing loss may contribute to the lack of consensus of diagnosis. Results may also suggest that conventional screeners for autism may not be valid tools for children with co-morbid hearing loss and suspected autism (approximately 50% of children did not score in the clinical range). It may also be possible to suggest that while autism is believed to have innate genetic causes, external factors such as a child's language (e.g., sign language), hearing status, cultural associations (e.g., member of the deaf community or school), and other unique characteristics (e.g., parents who are also deaf) may directly impact the child and his/her autism, thus causing autism to be expressed differently in these children. Results warrant future research across cultures and co-morbid conditions.

107.003 Medical Comorbidities In Children with Epilepsy and Autism Spectrum Disorders. G. Barnes*[1], D. L. Coury[2], A. Loh[3], N. Sidhu[4] and T. Clemons[5], (1)*Vanderbilt*, (2)*Nationwide Children's Hospital*, (3)*Surrey Place*, (4)*Columbia University Medical Center*, (5)*EMMES Corp*

Background: While prior research has shown a relationship between sleep disturbance and daytime behavioral problems in autism spectrum disorders (ASD), the relationship of ASD individuals with epilepsy to sleep, behavior, cognition and medical concerns has not been well characterized.

Objectives: We examined possible links between epilepsy, sleep, GI symptoms and behavior/cognition in a well characterized population of individuals with ASD.

Methods:

Children and adolescents with a diagnosis of ASD (autism, Asperger disorder, or PDD-NOS) confirmed by ADOS, age 2 – 18 years were enrolled into the Autism Treatment Network (ATN) Registry which collects data on children with ASD at 14 sites across the US and Canada. Upon entry into the registry, parents complete a medical history questionnaire, GI Symptom Inventory, Children's Sleep Habits Questionnaire (CSHQ) and Child Behavior Check List (CBCL). Subjects also undergo a battery of assessments including cognitive testing, Vineland Adaptive Behavior Scales and detailed neurologic examination.

Results: Data was available on 2573 children. Of these, 423 (16%) reported a history of seizures. For the 1280 children (202 with history of seizures) with a completed CBCL (ages 1 to 5), children with a history of seizures had significantly higher mean scores on the total CBCL and all subscales, when compared to children without seizures. Similarly, for the 1055 children (173 with a history of seizures) with a completed CBCL (ages 6 to 18), children with a history of seizures had significantly higher mean scores on the total CBCL and all subscales. A total of 2,120 (345 with a history of seizures) had a completed CSHQ evaluating sleep problems. Children with a history of seizures had significantly higher proportion of parent reported sleep problems (CSHQ) compared to children without a history of seizures (74.2 versus 64.8, p-value = 0.000). A total of 2,421 (397 with a history of seizures) had a completed GI form. Children with a history of seizures had a higher proportion of GI problems compared to children without a history of seizures (63.2% compared to 49.8%, p-value = 0.000). A total of 1921 (302 with a history of seizures) had a completed cognitive battery. Children with a history of seizures had a higher proportion with lower cognition compared to children without a history of seizures, but this did not reach significance (60% compared to 65.5%; p-value = 0.07). For the 962 children (161 with a history of seizures) with a completed Vineland, children with a history of seizures had significantly lower mean scores for the overall score and its subscales.

Conclusions: Children with ASD and a history of seizures have increased rates of GI problems, sleep problems, and daytime behavior problems compared to children with ASD and no seizures. Greater understanding of these relationships could lead to better interventions for this population.

Support from Autism Speaks/Autism Treatment Network and UA3MC11054 (MCHB).

107.004 The relationship of abnormal sensory responses and self-regulatory deficits to developmental delay in young children. L. M. Silva*, *Western Oregon University*

Background: In developmentally delayed (DD) children, abnormal sensory responses characterized by hyper and hypo-reactivity, are commonly reported. They are of varying severity/frequency, and may involve one or more senses. In autism, they are more severe than other disabilities, and are classified as co-morbid symptoms of unknown etiology. Recently two RCTs of a massage methodology based on Chinese medicine (Qigong Sensory Training, or QST) designed to improve sensory nervous system function in children with ASD under age six, demonstrated robust improvement of abnormal sensory responses following a five-month course of treatment, as well as improvement in measures of self-regulation and autism. Chinese medicine asserts that timely achievement of self-regulatory milestones is dependent upon normal function of the senses. To further evaluate the relationship between sensory and self-regulatory impairment in young children under age 6, the Sense and Self-Regulation Checklist (SSC) was developed and validated.

Objectives: To explore the relationship between abnormal sensory responses and self-regulatory difficulties in 265 children under age six, with and without developmental delay; and to see how the scores changed for the autism group following QST treatment.

Methods: SSC data from three groups under age six are compared: children with autism, children with other reasons for DD, and typically developing children. Children with autism received the five-month QST treatment methodology.

Results: A strong and linear relationship between abnormal sensory responses and self-regulatory difficulties was found in all groups of children ($B = .801$, $p < .001$). The typically developing group was differentiated by mild, single-sense findings; the other DD group was differentiated by moderate multi-sensory findings; and the autism group was differentiated by severe, multi-sensory findings and a diffuse tactile abnormality with hypo and hyperesthesia ($F < 122$, $p<.001$). The mean SSC score for the group with autism was twice as high as the mean score for the typical group, and on the scatterplot, there was a sharp line of demarcation between the two groups. Following five months of treatment for the autism group, scores moved in the direction of the typical group with mean sensory scores decreasing by 22 %, and mean self-regulatory scores improving by 18%.

Conclusions: Abnormal sensory responses occur in a spectrum of severity/frequency and uni/multi-sensority that appears directly, linearly related to difficulties achieving self-regulatory milestones. Furthermore, they are treatable, and

with treatment, self-regulatory abilities improve. Given that self-regulatory abilities are foundational for social, emotional and cognitive development, this elevates the importance of early identification and treatment of abnormal sensory responses in children with developmental delay. It appears that moderately and severely abnormal sensory responses may be as clinically relevant to the developmental trajectory as actual loss of hearing and vision.

107.005 Autism Behavioral Pheotype and Health Across the Life Span. M. M. Seltzer*, *Waisman Center, University of Wisconsin-Madison*

Background: Little is known about adults with autism spectrum disorders during the midlife and aging stages of the life course, as few in these age groups were correctly diagnosed with autism. Yet the baby boom generation of individuals who warrant an autism diagnosis is now well into midlife and some are approaching old age, with a concomitant increase in the need for health care and services.

Objectives: The goal of the present study is to describe the behavioral and health profile of autism in later life, drawing upon the available data from a 10-year longitudinal study of autism during adolescence and adulthood.

Methods: The present sample included 406 individuals with autism spectrum disorders who were age 10-52 when the study began and are currently 10 years older. Data have been collected six times over the 10 year period, making it possible to examine age-related changes in health, medications, functional abilities, behavioral problems and autism symptoms, and adult outcomes. The present analysis includes three methodological approaches: (1) cross-sectional comparisons with adults who do not have disabilities, drawn from a nationally-representative sample, and adults with Down syndrome, (2) semi-longitudinal trajectories estimated by Friedman's "supersmoother" (a non-parametric regression approach implemented in *R*, and (3) examination of mortality in adults during the 10-year study, including causes of death.

Results: In comparison with age peers who do not have disabilities, adults with ASD were significantly more likely to be in poor health and less likely to be in excellent health. Semi-longitudinal regressions revealed a pattern of slow age-related decline in health with more rapid decline after age 45, an increase in prescription medications (again more sharply after age 45), a steady decline in behavior problems during adulthood, and stability in functional abilities. Eleven adults died during the 10-year study period, with four deaths caused by heart attacks and three as a result of accidents. Adults with ASD who do not have an intellectual disability (ID) had better adult outcomes (residential independence, vocational independence, and social contact with friends) than adults with ASD and ID, or than adults with Down syndrome.

Conclusions: These findings suggest that adults with ASD have a long-term reliance on the public service system and the family, with limited profiles of independence in midlife. The baby boom generation with ASD (who may or may not be diagnosed with ASD) is approaching old age and many will need long-term care services. The need for planning for the future in terms of adult sibling involvement and other services is evident in the data. The heterogeneity of ASD is evident in the later years of the life course, just as it characterizes children with ASD. Finally, the data offer implications for health surveillance and accident prevention in adults with ASD.

107.006 Behavior and Sleep - Associations Across Childhood and Adolescence In Autism Spectrum Disorder. S. E. Goldman*[1], S. G. McGrew[2], A. L. Richdale[3], T. Clemons[4] and B. A. Malow[1], (1)*Vanderbilt University*, (2)*Monroe Carell Children's Hospital at Vanderbilt*, (3)*La Trobe University*, (4)*Emmes Corporation*

Background: Autism Spectrum Disorder (ASD) is characterized by deficits in three major domains: social interaction, communication, and sensory issues, restricted interests and/or stereotyped and repetitive behaviors. Sleep concerns are common, with prevalence rates estimated to range from about 50-80%. Sleep problems persist into adolescence with adolescents experiencing problems with sleep onset, shorter sleep duration and daytime sleepiness. The magnitude of the association of sleep problems and problematic daytime behaviors across the age span remains unclear.

Objectives: To determine the magnitude of sleep and behavior problems across childhood and adolescence in a large cohort. To estimate the relative risk and 95% CI of poor sleepers having a behavioral problem, and to identify variations in the sleep-behavior paradigm across this age-span.

Methods: We assessed the relationship between behavior and sleep in 1784 children, ages 3–18, mean (standard deviation) 6.7 (3.5) years, with confirmed diagnosis of ASD participating in the Autism Treatment Network. The Parental Concerns Questionnaire (PCQ), a validated questionnaire specific to ASD, was used to evaluate behavioral concerns and to define good or poor sleepers. Sleep was evaluated using the Children's Sleep Habits Questionnaire (CSHQ). Log-binomial models were used to evaluate relative risk (95% confidence

intervals) and stepwise logistic regression analysis to determine which CSHQ subscales were the most predictive of being a poor sleeper.

Results: Parents of 1200 (67%) children reported their child to be a good sleeper, and 584 (33%) reported their child as a poor sleeper. Over 60% of the children had problems with language use and understanding, attention span, and social interactions. Poor sleepers had a higher percentage of problems on all PCQ scales than good sleepers. Over 75% had problems with attention span and social interactions. In age adjusted log-binomial models, good sleepers (compared to poor sleepers) had a lower likelihood of being reported as having problems with a specific behavior on the PCQ for all behaviors except language use and understanding. A poor sleeper had a 10% higher likelihood of having problems with self-injurious behavior, and a 6 % higher likelihood of mood swings, aggression and compulsive behavior problems. The effect of age in the models was significant with language, anxiety, aggression, hyperactivity, and eating problems. In all cases except anxiety problems, older children had fewer problems.

In age adjusted multivariate logistic regression models, the CSHQ parasomnia scale was the one scale that most consistently remained as a sleep problem. For a one-unit increase on the parasomnia scale, there was 20% increase in the odds of the parent reporting a problem on the anxiety, sensory issues, aggression, hyperactivity, attention span, mood swings, and self injurious behavior questions when all other variables in the model were held constant.

Conclusions: Across childhood and adolescence poor sleepers are at higher risk for behavioral problems than good sleepers. Future work should focus on refining the sleep-behavior phenotypes to provide the foundation for focused studies targeting treatment of sleep and behavior in ASD.

107.007 Prevalence of Anxiety and Associated Psychiatric Comorbidities Among Children with Autism Spectrum Disorder: An Autism Treatment Network Study.

R. A. Vasa*[1], L. Kalb[1], T. E. Clemons[2], B. H. Freedman[1], A. Keefer[1], S. M. Kanne[3], M. O. Mazurek[4] and D. Murray[5], (1)*Kennedy Krieger Institute*, (2)*Emmes Corporation*, (3)*Thompson Center for Autism and Neurodevelopmental Disorders*, (4)*University of Missouri - Columbia*, (5)*Cincinnati Children's Hospital Medical Center*

Background: Anxiety disorders and symptoms are highly prevalent in autism spectrum disorders (ASD), although estimates vary widely from 11% to 84% depending on the study methods (see review by White et al., 2009). Moreover, few, if any, studies have examined anxiety across development. There are also scant data on the psychiatric comorbidities associated with anxiety in ASD. A greater understanding of the prevalence and risk factors of anxiety in ASD is therefore critical for developing targeted treatments that can reduce the burden of suffering for children and their families.

Objectives: a) To observe the prevalence of parent-reported anxiety symptoms among youth with an ASD across development, and b) to examine what psychiatric comorbidities, if any, are associated with increased anxiety symptoms.

Methods: Data from 1,316 children were obtained from the Autism Treatment Network (ATN) registry, a multi-site collaboration among 14 leading 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. Children also undergo standardized cognitive testing. Upon enrollment, parents complete many questionnaires including the Child Behavior Checklist (CBCL; Achenbach and Rescorla, 2001), an established measure of psychopathology in youth. The CBCL Anxiety Problems scale was used to categorize children into three groups: little or no anxiety (T score < 65), subclinical anxiety (T-score of 65-69), and clinical anxiety (T-score > 69). Multivariate analyses were performed to examine the psychiatric comorbidities, as measured by the CBCL, and demographic characteristics associated with increased anxiety. Analyses were conducted separately for children < 6 years and 6-18 years given the different CBCL modules for each age group.

Results: For children < 6 years (n = 716), 19% of children had clinical anxiety, and 6% had sub-clinical anxiety. No differences in age, race, parental education, or IQ emerged among the three anxiety groups. Results from the multiple linear model indicated that increased PDD, Affective, ADHD, and ODD problems were strongly associated with increased anxiety (all p < .001). For children 6-18 years (n = 600), 30% and 22.5% had clinical and subclinical anxiety, respectively. In this group, increased anxiety was associated with older age and Caucasian ethnicity (all p < .05), although these variables were not significant in the multivariate analysis. Similar to the younger children, increases in all comorbidities (Affective, Somatic, ODD, ADHD, and Conduct problems) were associated with increases in anxiety (all p < .001).

Conclusions: The prevalence of parent-reported anxiety in children with ASD is high, with nearly 20% of young children and over 50% of older children experiencing clinical or subclinical anxiety. In each age group, anxiety was significantly associated with multiple psychiatric comorbidities. These data indicate the need for comprehensive care of children with ASD and anxiety. Further research is needed to determine whether anxiety and associated psychiatric comorbidities represent distinct clinical entities or one complex clinical syndrome.

107.008 Physiological Characteristics Associated with Anxiety In Adolescents with Autism Spectrum Disorders. L. Sterling*[1], A. M. Estes[2], M. Murias[2], S. J. Webb[2], J. Munson[2], B. King[3] and G. Dawson[4], (1)*UCLA Semel Institute*, (2)*University of Washington*, (3)*University of Washington and Seattle Children's Hospital*, (4)*Autism Speaks, UNC Chapel Hill*

Background: Adolescents with autism spectrum disorders (ASD) are at increased risk for the development of associated psychiatric symptoms, particularly anxiety. Such symptoms can further impair functioning and quality of life. There is considerable symptom overlap between anxiety and ASD, and it is unclear whether they represent separate disorders in affected individuals. Elucidating biological underpinnings of such symptoms has the potential to clarify this phenomenon. Psychophysiological methodologies, such as fear potentiated startle response, are non-invasive measures that have been widely utilized in the non-ASD population to facilitate better understanding of neural and physiological correlates (e.g., amygdala function) of anxiety. Such techniques can be applied to the ASD population to elucidate biological underpinnings of reported symptoms or to characterize clinical subgroups within ASD.

Objectives: To investigate the relationship between anxiety symptoms and physiological response, as measured by eye blink intensity (electromyographic activity; EMG) and skin conductance level (SCL) during a fear potentiated startle paradigm, among adolescents with ASD and typically developing adolescents; and, to determine whether this relationship differs as a function of group.

Methods: Twenty adolescents (ages 13-17.5 years) with ASD and 22 typically developing adolescents underwent diagnostic and cognitive assessment as part of the Autism Center of Excellence study at the University of Washington. Presence of anxiety symptoms was assessed using parent-report (Child Behavior Checklist) and child-report (Revised Children's Manifest Anxiety Scale). Eyeblink response (EMG) and SCL were collected during a fear potentiated startle paradigm. The relationship between symptoms of anxiety and physiological response was investigated for both groups using hierarchical linear modeling.

Results: As expected, adolescents with ASD displayed significantly more anxiety symptoms than typically developing adolescents. No group differences were found in overall SCL or EMG response over time, or baseline SCL. Both groups showed potentiated conditioning according to EMG, evidenced by larger response to threatening stimuli. However, only teens with ASD demonstrated this enhanced physiological response based on SCL. For individuals with ASD, higher levels of reported anxiety symptoms were associated with larger initial and overall EMG response, which tended to decrease over time.

Conclusions: Findings suggest that adolescents with ASD with high reported levels of anxiety symptoms exhibit enhanced physiological response compared to typically developing teens, most likely reflecting hyper-responsivity of the amygdala. This propensity for hyperarousal may contribute to the expression of anxiety in individuals with ASD.

Treatments Program
108 Interventions: Controlled Treatment Trials
Moderator: A. Y. Hardan *Stanford University School of Medicine/Lucile Packard Children's Hospital*

108.001 Social Cognition and Interaction Training In Autism (SCIT-A): Development, Feasibility and Preliminary Findings with Adolescents. L. Turner-Brown*, A. B. Ratto, B. M. Rupp and D. L. Penn, *University of North Carolina*

Background: Social Cognition and Interaction Training for Autism (SCIT-A; Turner-Brown et al., 2009) is group intervention that has shown promise for improving social-cognitive functioning for adults with ASD. SCIT-A utilizes cognitive and behavioral techniques to target underlying deficits thought to lead to impairments in social functioning autism, such as emotion perception, theory of mind, as well as social attention. SCIT-A has not yet been evaluated with adolescents with ASD.

Objectives: The objectives of this study were to develop a comprehensive treamtent manual and conduct a small randomized trial to test initial efficacy of SCIT-A and estabilsh effect sizes for adolescents with ASD.

Methods: The SCIT-A manual was developed based upon pilot study results, focus group feedback, and expert panel review.

The resulting manual describes a 12-week group therapy program for adolescents with accompanying parent education to focus on social attention, social cognition and social skills. Participants in the initial efficacy study included adolescents with ASD meeting the following criteria: a) age 15 – 22; b) Verbal IQ >= 80, c) ASD cutoff on ADOS, d) no visual/hearing impairment. Baseline assessments included measures of social cognition, social functioning, and well-being, and included a combination of estabilshed and newly developed measures tapping parent report and adolescent performance for each construct. Participants were randomized into the SCIT-A condition or a Treatment as Usual (TAU) condition. Twelve adolescents were randomized into the SCIT-A condition and ten into the TAU condition across two cohorts. No significant differences between SCIT-A and TAU groups for gender, ethnicity, age, IQ, or baseline functioning were present. Participants returned for post- and 3-month follow-up assessments.

Results: *Feasibility.* Group attendance was very high; no participant missed more than one session in either cohort. *Satisfaction.* Satisfaction ratings for adolescents and their parents were positive in both cohorts. *Social cognition.* Within group effect sizes for SCIT-A participants from baseline to post-SCIT-A were medium (*d* = .78*)* for parent report of social cognition, while no effects were found for performance on social cognitive tasks (*d*s = .07 - .18). *Social Functioning.* Within group effect size for SCIT-A participants from baseline to post-SCIT-A were large for social functioning (*d*s = .96 – 1.29) and medium for self-reported perceived well being (*d* = .78). Similar results were found at 3-month follow-up. Changes in all measures were not statistically different from changes noted in the TAU condition. However, within group effect sizes for the TAU condition for all measures indicated no effect to small effects across all measures at post- and 3-month follow-up assessments.

Conclusions: Results of this small randomized trial were encouraging. SCIT-A was feasible and acceptable to families, and parents found the intervention to be useful for their adolescents. Effect sizes for social cognition and functioning were medium to large for SCIT-A participants, as were self-reports of perceived well being, suggesting SCIT-A holds promise as a group-based intervention for adolescents with ASD. Given the lack of significant differences found between SCIT-A and TAU, replication with a larger sample size is warranted. Future directions will be discussed.

108.002 Efficacy of CBT-BASED SOCIAL SKILLS INTERVENTION. C. Koning*[1], J. Magill-Evans[2] and J. Volden[2], (1)*Glenrose Rehabiliation Hospital*, (2)*University of Alberta*

Background:

School-aged children with Autism Spectrum Disorder (ASD) experience significant difficulty with peer interaction (Lord & Bishop, 2010), an important aspect of childhood. Unresolved social skills difficulties lead to continued dysfunction in relationships which influence long term success. Research into the most effective strategies has increased but several questions remain. One approach that appears to help school-aged children is Cognitive Behavior Therapy (CBT) which focuses on changing how a person thinks about specific social situations as well as how they behave.

Objectives:

This study evaluated a 15-week CBT-based social skills group intervention for boys aged 10-12 years diagnosed with an Autism Spectrum Disorder by comparing a waitlisted group with an immediate intervention group and by comparing the waitlisted group across 3 timepoints, before beginning the waitlist period, before beginning the group, and after completion of the group.

Methods:

Boys with average or better receptive language skills and IQ attended weekly 2 hour sessions focused on teaching self-monitoring skills, social perception and affective knowledge, conversation skills, taking another person's perspective, social problem-solving, and friendship management skills. Parents were given weekly "homework assignments" to work on with their child. These were directly related to the group activity and application of social skills at home and in the community. Group size varied from four to six participants. The intervention was based on two intervention programs available commercially and was manualized. Eight of the fifteen participants were waitlisted (Delayed Treatment group) while the remaining participants began 15 sessions of intervention immediately (Immediate Treatment group). A repeated measures ANOVA was used to compare the Delayed Treatment group to the Immediate Treatment group on pre and post measures of social perception, peer interaction, social knowledge, social responsiveness and general socialization skills. Scores for the group that was waitlisted were also examined across three time points using a repeated measures ANOVA.

Results:

Compared to the Delayed Treatment group, the Immediate Treatment group showed significant improvements after intervention in social perception, peer interaction, and social knowledge. The Delayed Treatment group was also examined on all measures at three time points: prior to the waitlist time, pre-intervention, and post-intervention. Significant improvements only after intervention were present for peer interaction and social knowledge, similar to the results of the Immediate Treatment group. They also showed improvements on a parent report measure of socialization.

Conclusions:

The findings are discussed in relationship to a model of social information-processing. Cognitive behaviour therapy techniques show promise for social skills intervention for children with ASD who have IQ and language skills that are low average and above. The intervention used in this study now needs replication with larger samples.

108.003 The Abc's of Meeting PEERS and Making Friends: Teaching Social Skills to Adolescents with ASD In the Classroom. E. A. Laugeson*[1], R. Ellingsen[2], S. Bates[3], A. Baron[4], C. Koeffler[3] and J. S. Sanderson[1], (1)*UCLA Semel Institute for Neuroscience & Human Behavior*, (2)*UCLA PEERS Program*, (3)*UCLA Semel Institute*, (4)*UCLA Semel Institute*

Background:

Social skills training is a common treatment method for youth with ASD, yet very few evidence-based interventions exist to improve friendship skills for adolescents with ASD. Furthermore, little to no research has examined the effectiveness of teaching social skills in the classroom – arguably the most natural social setting of all.

Objectives:

This study examines change in social functioning for adolescents with high functioning ASD following the implementation of a school-based teacher-facilitated social skills intervention known as PEERS.

Methods:

Under the auspices of The Help Group – UCLA Autism Research Alliance, 73 middle school students with ASD and their parents participated in the study through the Village Glen School, a non-public school for students with ASD. 38 participants were assigned to the PEERS treatment condition, while 35 participants were assigned to an alternative social skills curriculum. Participants received daily social skills instruction in the classroom for 20-30 minutes, five days per week, for 14 weeks. Instruction was provided by classroom teachers and teaching assistants.

Skills focusing on friendship development were targeted in the PEERS treatment group, including: verbal and nonverbal communication; electronic communication and online safety; appropriate use of humor; expanding and developing friendship networks; peer entry and exiting strategies; good host/guest behavior during get-togethers; good sportsmanship; methods for resolving peer conflict; and strategies for handling rejection. Skills were taught through didactic instruction using concrete rules and steps of social etiquette with role-play demonstrations. Students practiced newly learned skills during behavioral rehearsal exercises and weekly socialization homework assignments.

Students in the active treatment control group received the customary social skills scope and sequence curriculum taught at the Village Glen School. Targeted skills included: conversational skills, peer entry strategies, and conflict resolution.

Results:

Preliminary results reveal improvement in social functioning along multiple domains for the PEERS treatment group. Teacher-reports reveal significant decreases in Problem Behaviors on the Social Skills Rating System (SSRS; $p < 0.05$), particularly with regard to decreased Internalizing ($p < 0.05$). Improvement in teacher-reported overall Social Responsiveness was also observed on the Social Responsiveness Scale (SRS; $p < 0.01$) in the areas of improved Social Awareness ($p < 0.05$), Social Cognition ($p < 0.05$), Social Communication ($p < 0.01$), Social Motivation ($p < 0.01$), and decreased Autistic Mannerisms ($p < 0.05$). Results further suggest improved Social Cognition ($p < 0.05$), according to parent-report. Teen self-reports of social functioning revealed improved knowledge of social skills on the Test of Adolescent Social Skills Knowledge (TASSK; $p < 0.01$), improved friendship quality on the Friendship Quality Scale (FQS) in the areas of Helpfulness ($p < 0.05$) and Security ($p < 0.05$), and increased frequency of hosted get-togethers with friends on the Quality of Socialization Questionnaire (QSQ; $p < 0.05$).

Conclusions:

Results suggest the use of PEERS, a manualized school-based teacher-facilitated social skills program for adolescents, is effective in improving the social functioning of youth with ASD.

This research represents one of the few teacher-facilitated treatment intervention studies aimed at improving the friendship skills of adolescents with ASD in the classroom.

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

Background: With rates of autism on the rise and children being diagnosed as young as 18 months of age, there is an increasing need for effective and efficient service delivery models. Previous studies of Pivotal Response Training (PRT) have demonstrated that parents can learn this evidence-based treatment using a family therapy model; however, few studies have looked at other models, particularly those that may increase efficiency and allow more families to be served (e.g., group treatment models).

Objectives: This investigation is a randomized controlled 12-week trial, currently underway, which examines the effectiveness of Pivotal Response Treatment Group (PRTG) in targeting language deficits in young children with autism. PRTG teaches parents PRT strategies in a group format and will be compared to parents who are participating in a psychoeducational group (PEG). The research hypothesis is that parents participating in PRTG will demonstrate evidence of targeted 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 according to age, gender, and intensity of behavioral treatment. The PRTG includes weekly group therapy sessions designed to provide systematic instruction in implementation of PRT to facilitate language development. The PEG consists of group educational sessions which discuss general topics related to the assessment and treatment of children with autism. Standardized and video-taped assessments, including 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 ongoing. Preliminary findings suggest that group parent education is an effective method for teaching parents to implement PRT with their children. The majority of parents were able to implement the procedures with fidelity following 12 weeks of training. Children whose parents participated in the PRTG also made significant gains in frequency and variety of utterances and 3 out of 4 subjects were judged to be either much improved or very much improved as assessed by the clinical global impression-improvement subscale. In contrast 1 out of 4 children whose parents participated in the PEG were judged to be much improved. Parents report high levels of satisfaction with both types of training.

Conclusions: Since recruitment is ongoing, additional data will be available in the near future. 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 will be discussed in relation to the growing need for efficient dissemination of evidence-based parent education models for providing early interventions to children with autism.

108.005 Randomized Comparison of a Peer-Mediated Social Intervention to 'Business as Usual' Social Programming for Young Elementary Students with Autism. K. Thiemann-Bourque* and D. Kamps, *University of Kansas*

Background: This proposal presents results of a randomized control trial comparing a Peer-Mediated Intervention (PMI) to a business as usual social curriculum on children's social communication in early primary grades. Research over several decades has shown positive effects of PMI's for improving social communication and interactions between children with autism and peers without autism (Chan et al., 2009; Strain et al., 1979). The majority of research to date has been single-subject designs. Exemplary models exist for (a) teaching social-communication using modeling, picture cues, and scripts; (b) use of naturalistic strategies such as joint action routines; and (c) the inclusion of peers as change agents (Goldstein, 2002; Goldstein, Schneider & Thiemann, 2007; Kamps et al., 2002). Unfortunately, a large number of children with ASD continue to be served in segregated special education settings; and when they do have access to typically developing peers it is generally during settings that are less structured and therefore more difficult to socially navigate (e.g., recess, lunch, and PE).

Objectives:

(1) To conduct a randomized trial to determine if students with ASD who experience a PMI have higher levels of social-communication with peers than a group of children with ASD who receive the usual school curriculum.

(2) To measure generalization of social communication to non-treatment settings.

Methods:

Fifteen students with autism, and 34 peers were enrolled in year 1. The PMI includes: (1) direct teaching of communication targets (e.g., ask and share, comments); (2) child-adult practice; (3) child-peer practice with adult feedback; and (4) play activities with peer and adult prompts. Each lesson includes written and picture cues of social language targets. Groups meet for 30 min, 3 times/ week, and include one child with ASD and 2 peers. School staff is trained on implementation of the PMI. Fidelity measures are used to monitor teacher implementation across schools. Rates of behaviors in treatment sessions and generalization settings are collected through direct observation three times per year.

Results:

Nineteen of the 21 school staff trained as implementers had treatment fidelity averages above 80%. Data analyzed from year 1 showed the children receiving the PMI increased their rates of initiations and responses from an average of 10 to 22 during 10 min probes, and peer rates increased from 9 to 24. Generalization data in non-treatment settings was less compelling. Higher functioning students showed steady improvement in skill use during treatment; adaptations for lower functioning students were necessary. Social validity ratings measuring teacher perceptions of changes in social behaviors improved for 10 of 13 children in the PMI group. The 'business as usual' group showed minimal changes in social communication skills across the pre- mid- and post-social probes.

Conclusions:

The PMI was effective in increasing communication between children with autism and peers without disabilities. Modifications are necessary for some students with lower language. Generalization to unstructured free-play or center activities was limited. Solutions for this challenge have included (a) mini- whole class social lessons, (b) decreasing group structure, (c) posting scripts in non-treatment settings.

108.006 Psychological Treatment for Co-Morbid OCD In Young People and Adults with Autism Spectrum Disorders. A. J. Russell*[1], D. Mataix-Cols[1], A. Jassi[2], M. Fullana[1], H. Mack[3], K. Johnston[1] and D. G. Murphy[4], (1)*Kings College London, Institute of Psychiatry*, (2)*South London and Maudsley NHS Foundation Trust*, (3)*Starship Hospital*, (4)*Institute of Psychiatry, King's College London*

Background: Anxiety disorders, particularly Obsessive Compulsive Disorder (OCD), are commonly reported in young people and adults with Autism Spectrum Disorders (ASD). Psychological treatment has been shown to be effective in treating OCD in the general population but little is known about its effectiveness for people with ASD. A pilot study of Cognitive Behaviour Therapy (CBT) for OCD adapted for adults with ASD showed promising results and suggested that a randomised controlled trial of this intervention was merited.

Objectives: To conduct a systematic treatment study of CBT for OCD in young people and adults with ASD.

Methods: Participants were young people (age 14 and older) and adults with ASD and co-morbid OCD who were randomly allocated to 1 of 2 treatments (1)Manualised CBT for OCD adapted for people with ASD (CBT) and (2) Anxiety Management (AM). Treatments were matched with respect to therapist contact and duration. The primary outcome measure was the total severity rating on the Yale Brown Obsessive Compulsive Scale (Y-BOCS) which was clinician administered blind to treatment group. Informant and self-report symptom measures were also obtained. Follow-up ratings were made at 1, 3, 6 and 12 month post treatment.

Results: 46 people were randomised to treatment with 20 treatment completers in each group. There was a significant effect of treatment on the primary outcome measure but not of treatment group. Treatment effect sizes on the primary outcome measures were large and could be considered clinically meaningful in the CBT group (.88-1.15) and medium in the AM group (0.6). Forty five % of the CBT group were classed as treatment responders compared with 20% in the AM group. Those with mild symptom severity responded well to AM. Almost 40% of people in the AM group opted to try the experimental treatment at 1 month follow-up which differed significantly from the proportion of people in the CBT group choosing to try the other treatment. Secondary analyses indicate that AM might augment the effects of later CBT. None of the variables predicted to be moderating factors (Theory of mind, Verbal and planning abilities and scores on the Autism Diagnostic Observation Schedule) were associated with treatment outcome.

Conclusions: Psychological treatment in the form of cognitive and behavioural therapies are effective in treating co-morbid OCD in people with ASD. Further investigations should seek to refine treatment protocols to consider the precise adaptations

to conventional psychological treatment which are most effective for this group.

108.007 Results of a Group Comparison Study of the Joint Attention Mediated Learning Early Intervention for Toddlers with Autism Spectrum Disorders. H. Schertz*[1], S. Odom[2] and K. Baggett[3], (1)*Indiana University*, (2)*University of North Carolina*, (3)*University of Kansas*

Background:

Findings from a small randomized group study of the Joint Attention Mediated Learning (JAML) intervention for toddlers with high risk for autism spectrum disorders (ASD) are presented. JAML is a developmentally ordered parent-mediated intervention to promote preverbal social communication for toddlers with ASD. This research was funded by Autism Speaks.

Objectives:

To conduct a preliminary assessment of JAML's effects on toddlers' demonstration of joint attention in parent-child interaction and on receptive and expressive language measures.

Methods:

Participants: 24 parents and their toddlers with high risk for ASD were recruited with eligibility determined by failure on the M-CHAT questionnaire and follow-up interview.

Research procedures: Participants were evenly divided between randomly assigned intervention and control conditions. Eleven intervention and twelve control participants completed the study. Assessment data and video of parent-child interaction were gathered in three pre-intervention and three post-intervention sessions and additional video data were collected in 4- and 8-week follow-up sessions.

Intervention procedures: Intervention Coordinators met weekly with parents to provide guidance on promoting the current targeted outcome focusing on faces (FF), turn-taking (TT), responding to joint attention (RJA), or initiating joint attention IJA), in order) through five mediated learning principles: focusing, organizing and planning, encouraging, giving meaning, and expanding. Parents were asked to facilitate daily planned and incidental JAML-focused interaction with their toddlers. Videos of parent-child interaction, recorded weekly, were used for parent reflection at weekly sessions. New targeted outcomes were illustrated with video examples and parents reviewed print materials and video examples of other parents promoting the targeted outcome using one of five mediated learning principles.

Results:

A hierarchical linear model (HLM) was used to estimate the effects of change over time and intervention between the randomly assigned intervention and control groups. Measures were the number of observations for each of the four targeted outcomes: FF, TT, RJA, and IJA from 10-minute videos of parent-child interaction taken from the pre-intervention, post-intervention, and follow-up sessions. A strong response to the intervention was shown for FF and RJA. Group differences for TT and IJA in this small sample were not statistically significant.

An HLM analysis of the Mullen and Vineland assessments showed interaction effects for the Vineland Expressive V-Score by time and treatment and the Mullen Receptive Language by treatment and time, (all $F > 4.6$, all $p<.05$). In all cases the change in the treatment group was significant, but the change in the control group was not.

Conclusions:

Findings support the viability of the JAML intervention for toddlers with early signs of ASD and their families. The intervention builds on theoretical precursors (FF and TT) to promote engagement in joint attention, a known precursor of verbal forms of social communication. JAML promotes preverbal social communication learning from within the parent-child relationship and is integrated within planned and routine activities, targeting approximately 30 minutes of focused interaction daily. It requires professional and parent conceptual clarity on JAML's content (current phase of intervention) and process (mediated learning) components, which are defined and illustrated in JAML materials.

108.008 A Randomized Controlled Double-Blind Trial of N-Acetylcysteine In Children with Autism. A. Y. Hardan*[1], L. K. Fung[2], R. A. Libove[1], T. V. Obukhanych[1], S. Nair[2], T. W. Frazier[3], L. Herzenberg[1] and R. Tirouvanziam[1], (1)*Stanford University School of Medicine*, (2)*Stanford University*, (3)*Cleveland Clinic*

Background:

Causes of autism remain elusive yet clearly combine genetic, developmental, and environmental factors. Several neurobiologic models have recently been proposed including the existence of a glutamatergic dysfunction and excessive oxidative stress. These models have sparked hope for the

development of targeted therapeutic agents leading to disease-specific interventions.

Objectives:

The goal of this study was to conduct a double-blind randomized controlled 12-week trial of N-acetylcysteine (NAC), a glutamatergic modulator and an antioxidant known to replete glutathione, in children with autism. Specific aims were to assess the tolerability of NAC and its effectiveness in the treatment of behavioral deficits in children with autism.

Methods:

The present investigation is a 12-week, double-blind randomized, placebo-controlled study of NAC in children with autistic disorder who are between the ages of 3 and 12 years. Randomization was based on age and gender. Subjects randomized to the active drug were initiated at the dose of 900 mg every day for the first 4 weeks, then 900 mg twice daily for 4 weeks and 900 mg three times daily for 4 weeks. If subjects could not tolerate a specific dose, s/he would be maintained at the lowest tolerated dose. Subjects were evaluated at baseline, week 4, week 8 and week 12. The Aberrant Behavior Checklist (ABC), the Clinical Global Rating Scale (CGRS), and a side effects rating scale were obtained in each visit. Other clinical measures, including the Repetitive Behavior Scale-Revised (RBS-R) and the Social Responsiveness Scale (SRS), were also obtained at baseline and at the end of the trial at week 12. Analyses were completed using a mixed effects regression model.

Results:

Thirty-three subjects representing 31 males and 2 females were included in the study. When examining all randomized participants, improvement with NAC was observed compared to placebo on the irritability subscale of the ABC ($F(3,75)=5.25$, $p=.002$) beginning in week 4 and continuing through the end of the study. The same pattern was present for ABC-Total Scores ($F(3,75)=3.11$, $p=.031$). NAC treatment improved stereotypic/repetitive behavior on the ABC (ABC-Stereotypy $F(3,76)=2.87$, $p=.042$), but these reductions were no longer significant when ABC-irritability was included as a time-varying covariate. In spite of limited scaling and sensitivity of the CGI-S, there was a trend toward improvements in global severity across the study ($F(3,75)=2.47$, $p=.068$). Improvements with NAC were observed on RBS-R and SRS but differences with placebo did not reach statistical significance. Minimal side effects were encountered with mild gastro-intestinal symptoms being reported.

Conclusions:

This preliminary randomized, placebo-controlled, double-blind trial provides the first evidence in the usefulness of NAC in treating irritability and disruptive behaviors in children with autism. While benefits are being observed in associated behaviors, it remains unclear if NAC is beneficial in treating the core features of autism. Although this current report has shown substantial magnitude of desirable effects, these data have to be used with caution as it represents a preliminary analysis of a relatively small study. Replication of these data in a larger study is warranted to confirm these findings.

Clinical Phenotype Program
109 Onset, Clinical Phenotype and Quantitative Traits
Moderator: J. N. Constantino *Washington University School of Medicine*

109.001 Gesture and Autism: Functional Relationships to Both Motor Skills and Autistic Symptomotology. K. Sullivan*[1], J. Gerdts[2] and R. A. Bernier[2], (1), (2)*University of Washington*

Background: Researchers have taken several different behavioral approaches to examine deficits in imitation and gesture. For example, some suggest that impairments in motor skills underlie imitative and gestural deficits in autism spectrum disorders (ASD) and have examined motor abilities related to coordination, speed, balance, and abnormal gait. Complimentary neurological data is also available that supports motor skills deficits in ASD. Dewey and colleagues (2007) and Dziuk and colleagues (2007), however, provide evidence that gestural deficits in children with ASD are not solely attributable to these isolated deficits in motor coordination skills. Instead, they suggest that such gestural deficits may be better explained through their functional relationship with associated social, communicative, and behavioral impairments (Dziuk et al., 2007).

Objectives: The purpose of the current study is to examine the relationship between motor skills and autism symptom severity on the gesture use of children with ASD.

Methods: The current sample consists of 1191 children diagnosed with ASD (*M* CA = 8 years, 10 months; *SD* = 40.90, range 4 years, 0 months-17 years, 11 months; 1031 M, 160F) who participated in the Simons Simplex Collection (data release 10; SFARI.org). Participants met ASD criteria on the ADI-R and ADOS-WPS as well as strict DSM-IV criteria by an experienced clinician. Parent report and observational measures of gesture use (ADI-R and ADOS), parent report of

symptom severity (Social Responsiveness Scale (SRS)), and an observational measure of motor skills (Purdue Pegboard Test) were collected. To test the competing hypotheses that gesture use in ASD is driven by motor impairment or social impairment a median split was created for both variables: the overall SRS T score and the dominant hand score of the Purdue Pegboard test. Current gesture use was represented by averaging the gesture item from the ADOS-WPS (#A8 on Modules 1 and 2; #A9 on Modules 3 and 4) and the ADI-R "current" gesture item (#45).

Results: In the sample of children, the main effect of social impairment was significant $F(1,15.74)=40.70$, $p<.001$. This indicates that participants with greater social impairment had significantly lower gesture use ($M=70.79$, $SD=8.28$) than participants with less social impairment ($M=87.93$, $SD=2.75$), a medium effect size (partial $\eta^2=.033$). The main effect of dominant hand performance on the Purdue Pegboard Test was not significant, $F(1,0.29) = 0.74$, $p=0.39$, thus the overall gesture use of high and low motor skills performers were similar.

Conclusions: The preliminary findings in the current sample support the theory that gesture deficits in autism may be part of more global impairments related to ASD (e.g. social, communicative, and behavioral) than to specific deficits in motor skills coordination. This information may be useful when developing comprehensive intervention programs that target social communication in children with ASD. For example, treatment programs addressing symptom severity in ASD may be more effective than motor skills training to promote the integration of gesture use with spoken language.

109.002 Onset Patterns: Correspondence Between Home Video and Parent Report. S. Ozonoff*[1], A. M. Iosif[2], G. S. Young[3], S. Hepburn[4], M. R. Thompson[5], C. Colombi[6], E. Werner[7], S. Goldring[1], F. Baguio[1], I. Cook[1] and S. J. Rogers[1], (1)*UC Davis MIND Institute*, (2)*UC Davis*, (3)*UC Davis M.I.N.D. Institute*, (4)*University of Colorado Denver, Anscutz Medical Campus*, (5)*Boston University*, (6)*University of Michigan*, (7)*Penn State University*

Background:

The onset of behavioral signs of autism is thought to occur in two patterns, an early onset and a regressive course. Recently, significant concerns about this two-category onset classification have been raised.

Objectives:

To compare two methods of defining onset, parent report and coded home video, and examine the number of categories that best describe onset.

Methods:

Participants were children with Autistic Disorder ($n=52$) and typical development ($n=23$). Home movies from 6 through 24 months were collected ($n=3199$ segments). Four social-communication behaviors were coded: looks at people, smiles at people, language (e.g., simple babble, complex babble, words, and phrases), and joint attention. These were combined into a composite score reflecting social-communication frequency per minute. Individual trajectories of social-communication from 6 to 24 months were grouped into interpretable classes using latent class modeling.

Results:

Bayesian Information Criteria were used to select the number of trajectories that best fit the data. There was strong support from coded home video for 3 onset trajectories. The first "early onset" trajectory ($n = 20$) displayed low rates of social-communication behavior at all ages. The second "regression" trajectory ($n = 20$) displayed high levels of social-communication behavior early in life and significantly declined over time. The third "plateau" trajectory ($n = 12$) was similar to the typical children early in life but did not progress as expected. There was no support for a mixed (early signs + regression) trajectory.

Conclusions:

This work suggests that traditional two-group models for classifying onset are insufficient to describe all the patterns in which symptoms emerge. It also raises significant concerns about the methods used to classify onset for research purposes.

The ADI-R was used to create parent-report onset types. Given the lack of support from the trajectory analyses for a mixed onset group, participants with this parent-reported pattern were collapsed with those whose parents reported regression alone. This resulted in three categories of parent-reported onset: PR_Early Onset ($n = 18$), PR_Regression ($n = 24$), and PR_Plateau ($n = 10$).

There was poor correspondence between parent report and home video classifications (kappa = .11, $p = .30$). Only 9 of 20

participants whose home video displayed clear evidence of a major decline in social-communication behavior were reported to have had a regression by parents. Only 8 of 20 participants with evidence of early delays in social-communication on video were reported to demonstrate an early onset pattern by parents. Of the 10 whose parents described a plateau, only 3 had home video consistent with this pattern.

Onset was also classified using parent report, based on the ADI-R. Four onset categories were defined: Early onset – symptoms present in the first year of life and no skill loss; Regression – no symptoms in the first year of life, followed by loss of skills; Plateau – no symptoms in the first year and no skill loss; Mixed – both symptoms in the first year and later skill loss. The correspondence between these categories and those derived from coded home movies was then examined.

109.003 Early Generalized Overgrowth In Boys with Autism. D. Campbell*[1], L. Chen[1], F. Shic[2], A. Klin[3], J. Chang[1] and K. Chawarska[2], (1)*Yale University*, (2)*Yale University School of Medicine*, (3)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Reports of atypical head circumference (HC) overgrowth in infants later diagnosed with autism resulted in concerted efforts to identify factors responsible for brain overgrowth and their association with etiology of autism. Thus far, however, no mechanisms of HC overgrowth have been identified. Moreover, considering several divergent reports, it is also not clear whether this phenomenon is independent of overall body growth and whether it is associated with specific social or cognitive features.

Objectives: To examine the trajectory of early HC growth from birth to 24 months in autism compared to control groups; to assess whether HC growth in autism is independent of height and weight growth during infancy; and to examine HC growth patterns in relationship to social, verbal, cognitive, and adaptive functioning levels.

Methods: We compared growth trajectories from birth to 24 months of boys with autistic disorder (N=64), pervasive developmental disorder-not otherwise specified (PDD-NOS) (N=34); non-autistic developmental delays (DD) (N=31); and typically developing boys (TD) (N=55). Bayesian multi-level growth curve models were used to analyze the growth measurements. The effects were modeled as low-rank thin-plate splines. Splines were chosen as they allow for fitting diverse growth functions. Considering that the true forms of the morphological growth functions are unknown, this controlled flexibility in modeling was preferable. Estimated mean curves for each group were calculated along with 95% credible bands. After models were fit for HC, height, and weight individually, principal components analysis was used to generate combinations of the three variables that could be meaningful in explaining trends seen in the sample. Measures derived from principal component scores were modeled in the same way as HC, height, and weight.

Results: Growth curve modeling suggests that by 4.8 months of age (p=.05), boys with autism were significantly longer than TD controls; by 9.5 months (p=.05), had larger head circumferences; and by 11.4 months (p=.05), they weighed more. None of the other clinical groups showed a similar overgrowth pattern. In the autism group, boys who were in the top 10% of overall physical size between 6 and 12 months of age exhibited greater severity of social deficits (p=.009) and lower adaptive functioning (p=.034).

Conclusions: While boys with autism experience accelerated HC growth rate in the first year of life, this phenomenon reflects a generalized process affecting other morphological features including height and weight. Presence of more severe symptoms and lower adaptive functioning in the boys with the most extreme overgrowth suggests a possible link between factors involved in the atypical physical growth and the severity of social impairment in autism. When considering potential underlying mechanisms for enlarged total brain volume and acceleration of head circumference growth in autism, most researchers to date have focused on factors affecting neuronal development. However, considering the present findings, efforts should be advanced to examine factors responsible for the entire constellation of neural and non-neural growth-related phenotypic traits as it is possible that these two phenomena share common etiology.

109.004 Behavioral Signs of Autism In Premature Infants: Findings From the Autism Observation Scale for Infants and Autism Diagnostic Observation Schedule. C. Roncadin*[1], S. Jilderda[1], J. Brian[2], W. Roberts[2], I. M. Smith[3], S. E. Bryson[3], A. Niccols[4], P. Szatmari[5], T. Vaillancourt[6] and L. Zwaigenbaum[7], (1)*Peel Children's Centre*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*Dalhousie University/IWK Health Centre*, (4)*Hamilton Health Sciences Centre*, (5)*Offord Centre for Child Studies, McMaster University*, (6)*University of Ottawa*, (7)*University of Alberta*

Background: The Autism Observation Scale for Infants (AOSI) is a direct rather than parent report measure of early signs of autism spectrum disorder (ASD). It reliably distinguishes infant

siblings who are later diagnosed with ASD from both non-ASD siblings and controls with no family history of ASD. Premature infants are also at increased risk for ASD. We previously found that 12-month AOSI scores of premature infants were similar to those of infant siblings later diagnosed with ASD (*ASD-Sibling*), although the specific items contributing to total scores differed between the groups.

Objectives: To evaluate group differences (Premature versus ASD-Sibling versus Control) in AOSI scores at 18 months, determine which AOSI items distinguish the ASD-Sibling group from the Premature group, and examine whether, within each group, 24-month ADOS scores are correlated with AOSI scores at 12 and 18 months.

Methods: AOSI Total Scores (higher values indicate increasing deviation) and Total Marker Counts (items with non-zero scores) were computed at 12 and 18 months for 45 premature infants (<37 weeks gestation; no ASD diagnosis at 24 months), 49 infant siblings with ASD (diagnosed by age 3 by experienced clinicians blind to prior study data, based on the ADI-R, ADOS, and clinical judgment using DSM-IV criteria), and 75 control infants (none with ASD). All participants also completed the ADOS (Module 1) at 24 months.

Results: Kruskal-Wallis tests were significant for 18-month AOSI Total Score ($H_{(2,169)} = 44.88$, $p<.001$) and Total Marker Count ($H_{(2,171)} = 49.74$, $p<.001$). All groups differed on both Total Score and Total Marker Count (ASD-Sibling>Premature>Control). Compared to the Premature and Control groups, the ASD-Sibling group tended to have inconsistent response to name, decreased social babbling, inconsistent eye contact, extreme reactivity, and difficulty with transitions, the last three items of which were also more prevalent in the ASD-Sibling group at 12 months. In the Premature and Control groups, 12-month AOSI Total Score was correlated with 24-month ADOS Total Score (.45 and .32, respectively); 18-month AOSI Total Score was uncorrelated with the other two scores. ADOS scores ranged from 0-13 in the Premature group (4 were above the Autism cut-off and 10 were above the ASD cut-off), while scores ranged from 0-10 in the Control group (2 were above the ASD cut-off). By contrast, AOSI and ADOS scores were inter-correlated (.41-.64) in the ASD-Sibling group.

Conclusions: At 18 months, premature infants have more elevated AOSI scores than controls, although not as high as siblings with ASD. Importantly, there are specific AOSI items that distinguish siblings with ASD from premature infants and controls, suggesting that these markers may be more predictive of ASD. The correlation findings may indicate that the AOSI is a more effective ASD screening tool at 12 months than at 18 months when used with clinical populations other than infant siblings. We plan to ascertain diagnostic outcomes at age 3 in our premature group, particularly because over 30% scored above the ASD cut-off on the 24-month ADOS, in order to appraise how well the AOSI identifies premature infants with ASD.

109.005 Quantitative Autism Traits In First Degree Relatives of Children with ASD. W. De la Marche*[1], I. L. J. Noens[2], J. Luts[2], E. M. Scholte[3], S. Van Huffel[2] and J. Steyaert[4], (1)*UPC-K.U.Leuven, campus Gasthuisberg*, (2)*K.U.Leuven*, (3)*Universiteit Leiden*, (4)*University Hospital Maastricht*

Background:

Autism spectrum disorders (ASD) are highly heritable. Relatives of individuals with ASD can share a part of the symptoms, without developing the full disorder. Autism symptoms are also present in individuals from the general population. Recent research has focused on the presence of quantitative autism traits (QAT) measured by questionnaires in parents and siblings of children with ASD, compared to QAT in the general population. Results are inconclusive however, on whether unaffected relatives have higher levels of QAT or not. This might be due to differences in research populations, since behavioral data as well as molecular genetic research suggest that the genetic etiology of ASD is different in multiplex (MPX) and simplex (SPX) families.

Objectives:

1) To assess if siblings and parents of children with ASD show more QAT than general population controls; and 2) to assess if relatives from MPX families show more QAT than relatives from SPX families.

Methods:

We compared 117 unaffected siblings (39 boys, 78 girls) with 280 general population control children (100 boys, 180 girls) on the presence of QAT using the Social Responsiveness Scale (SRS), filled out by the parents. 276 parents with at least one child with ASD (132 fathers, 143 mothers) were also compared with 595 adults from the general population (300 men, 295 women), using the adult partner-report version of this questionnaire. Mixed models were constructed to analyze the effect of group (relatives vs. controls) and family type (MPX vs.

SPX) on SRS scores, accounting for age, gender and family of origin.

Results:

Mean SRS scores for siblings, control children, parents and control adults were 25.4, 26.6, 33.7 and 32.9 respectively, compared to 98.0 and 88.8 for children and adults with ASD. There appeared to be no statistically significant difference in total SRS scores between unaffected siblings and general population control children, nor between mothers of children with ASD and women from the general population. Only fathers of children with ASD expressed higher levels of QAT compared to controls. In neither siblings nor parents we could detect a statistically significant difference in SRS scores between SPX and MPX families.

Conclusions:

These results do not support the theory of differential (genetic) etiology in multiplex and simplex families, nor are they in favor of the hypothesis that unaffected relatives (except fathers) express potential genetic risk factors for ASD. We argue that it is important in future studies to give adequate information about the diagnostic status of the relatives that are focus of the research question, since this might explain the inconsistencies between research results. Further genetic and phenotypic research is really needed to elucidate the hypothetical difference between SPX and MPX families, if there is one, and on how to define the difference.

109.006 Evidence That Phenotypic Variation In Individuals with ASD Is Associated with Behavior Profiles In Nuclear Family Members. E. Robinson*[1], A. Duda[2], N. Coggins[2], R. Droms[2], M. Galdston[2], A. Gates[2], S. Kleinfelder[2], J. A. Lomibao[2], R. J. Luyster[3], D. Stein[4], R. Travolta[2], B. Winklosky[2] and S. L. Santangelo[2], (1)*Harvard School of Public Health*, (2)*Psychiatric and Neurodevelopmental Genetics Unit, Center for Human Genetic Research, Massachusetts General Hospital*, (3)*Harvard Medical School/Children's Hospital Boston*, (4)*Childrens Hospital Boston*

Background: Although autism spectrum disorder (ASD) diagnoses are qualitative, a number of behavioral domains characteristic of the condition can be assessed quantitatively. Two of the most common are a) autistic traits, those behaviors that reflect social impairment, communication impairment, and restricted and repetitive behaviors and interests and b) functional status or adaptive behavior, a measure of limitation in daily activities. Studies have long suggested that the family members of individuals with ASD (probands) manifest a greater number of autistic traits than expected in the general population. However, the degree to which variation in family traits is related to variation in proband traits is less clear. Similarly, there is little information regarding the expected correlation between the functional status of probands and functional status in their unaffected family members.

Objectives: To our knowledge, this is the first analysis to investigate the relationship between multi-domain phenotypic variation in probands and behavioral variation in their relatives. The purpose of this study was to evaluate whether a) autistic traits in parents and unaffected siblings and b) functional status in unaffected siblings are related to proband variation in the same characteristics.

Methods: This analysis employed data from the Autism Consortium (AC) funded Phenotypic and Genetic Factors in ASD Study, which recruited over 500 families from 5 clinical sites and the community over three years. Autistic traits were measured using the parent Social Responsiveness Scale (SRS) in probands and their siblings; the adult SRS was employed for parents. Functional status was assessed with the Vineland Scales of Adaptive Behavior, administered by a trained clinical interviewer. The association between family members was assessed through bivariate correlations and multiple linear regressions which conditioned on sex and age of the proband.

Results: The SRS correlations between all family members are shown in Table 1. The significant, positive correlations between parents and probands suggest that parent traits are related to phenotypic severity in offspring with diagnosed ASD. Significant correlations between parents suggest assortative mating. All familial SRS associations remained significant after adjustment for age, sex, and proband functional status. Proband and unaffected sibling functional status were significantly associated (p=0.003). A one unit increase in proband functional status scores predicted a 0.25 point increase in that of their unaffected sibling.

Conclusions: These preliminary analyses of the AC study phenotyping data provide new insights into ASD familial relationships. Given evidence that autistic traits in family members of probands are related to case severity, family characteristics may be useful in future efforts to identify subgroups of affected individuals. Further, this study suggests that similarity within ASD families is not limited to autistic traits. Siblings of probands with adaptive behavior impairments are more likely to experience functional limitations themselves,

suggesting developmental monitoring may be even more warranted in the siblings of individuals with severe ASD.

1. SRS Total Score Correlations

	Proband	UA Sib	Mom	Dad
nd	1			
ib	n=140, r=0.24 (p=0.005)	1		
n	n=203, r=0.15 (p=0.03)	n=115, r=0.32 (p=0.0004)	1	
l	n=199, r=0.24 (p=0.001)	n=111, r=0.35 (p=0.0002)	n=260, r=0.30 (p<0.0001)	1

109.007 A Sparse Panel of Biomarkers In Blood Distinguishes Children with Autism Spectrum Disorder From Typically Developing Children. S. Letendre*[1], W. Thompson[1], D. Rosario[1], L. Lopez[1], C. Carter[1], M. Weinfeld[1], S. Spendlove[1], N. Schork[2], E. Courchesne[1] and K. Pierce[1], (1)*University of California, San Diego*, (2)*The Scripps Translational Research Institute*

Background: Despite being a clear neurobiological disorder, no medical tests to detect autism in infants and toddlers exist. Currently, the disorder is identified based solely on the presence of clinical symptoms, and considerable expertise is required to identify autism during the first 1-3 years of life. Blood tests are routine in medical offices, and as such, hold promise as a method to identify autism prior to the onset of clinical symptoms. Evidence of an immune system dysfunction in autism has risen rapidly to the research fore and markers such as those in the interleukin family have been implicated in autism. However, biomarkers may play different roles at different times in development. For example, sFas and TNF-α are involved in early brain development, although they are commonly thought of as involved in immune function in the mature brain. As such, it may be possible to develop a combination of biomarkers that discriminates toddlers with an autism spectrum disorder (ASD) from those that are typically developing (TD) or developmentally delayed (DD).

Objectives: To determine if biomarker levels can accurately classify toddlers with an ASD from those that are TD or DD during the first 3 years of life.

Methods: Nine biomarkers (TNF-α, IL-6, IL-10, IP-10, sIL-6R, sFas, VEGF, sVEGFR-1 and tPAI-1) were measured in the blood plasma of two separate, independent samples of toddlers. In sample 1, the training sample, 142 toddlers between the ages of 12 and 48 months participated (49 ASD, 66 TD and 27 DD; mean age 23.5 months). In sample 2, the test sample, 78 toddlers participated (39 ASD and 39 TD). Biomarkers were measured in duplicate using multiplex bead suspension array assays with a Luminex 100 platform (Bio-Rad, Hercules, CA). Classification and regression tree analyses were performed on both the training and test samples. The markers that most clearly discriminated between groups in the training sample were used as predictor variables to classify subjects in the test sample.

Results: The training sample identified that lower levels of IL-6 and TNF-α and higher levels of sFas discriminated ASD from TD toddlers. Overall, the classifiers achieved 80% accuracy on the training dataset. Using bootstrap methods and evaluating the classifier on the the test set, the classification accuracy was 60%. The accuracy of prediction on the test dataset was 63%. Using a permuation test, the classification accuracy was significantly better than chance on the test dataset (p=0.004).

Conclusions: Abnormalities in biomarker profiles may signify abnormal brain growth and function commonly found in autism by disrupting the balance between the immune system, neural growth factors, neural stem cells, and neurotransmitters in the developing brain. Results indicate that it may be possible to detect these abnormalities in blood and to develop a simple and inexpensive early diagnostic test for ASD.

109.008 Inherited ASD Susceptibility In Never-Diagnosed Females: Implications for Intergenerational Transmission, Gender Ratio, and the Diagnosis of Autism. J. N. Constantino*[1] and P. A. Law[2], (1)*Washington University School of Medicine*, (2)*Kennedy Krieger Institute*

Background: Traditional diagnostic paradigms for social-communicative impairment result in the most severe 1.4% of the male population distribution being categorized as having an Autism Spectrum Disorder (ASD) in childhood. The same paradigms result in only the most severe 0.5% of the female population distribution being categorized as ASD.

Objectives: To ascertain the range of phenotypic severity that encompasses inherited ASD symptomatology among females, and to explore whether latent ASD susceptibilities are as likely to be transmitted by undiagnosed sisters of individuals with ASD as by their undiagnosed brothers.

Methods: We analyzed parent-report data on the autistic symptomatology of siblings of children with ASD enrolled in a national volunteer register (the Interactive Autism Network, IAN, http://ianproject.org) to determine the range of standardized cutoff scores over which prevalence among females (n=854) represents a significant departure from general population prevalence. Next we explored intergenerational transmission in 209 pedigrees of ASD-affected children in a longitudinal sibling study at Washington University in St. Louis, specifically addressing the question of whether ASD susceptibility represented by clinical-level affectation status of uncles (full biological male sibs of the parents) occurred more commonly in maternal versus paternal lines. ASD status of uncles was reported by parents of probands, operationalized by DSM-IV diagnostic criterion endorsement, and confirmed by standardized symptom severity ratings.

Results: When considering a series of standardized severity cutoffs for designation of affectation status, prevalence among female siblings of ASD probands significantly exceeded general population prevalence through the 5th percentile cutoff. Relative risk (RR) of sisters of ASD probands exceeding a 1st percentile cutoff was 8.0 (eight times the general population risk for girls); RR for exceeding the 5th percentile cutoff was 2.0 ($p < .001$); these figures are conservative given rater contrast effects which tend to reduce severity scores of presumed-unaffected siblings in ASD-affected families. With respect to the pedigree data, 3.1 per cent of uncles of ASD probands were reported to have clinical-level ASD symptomatology (representing at least triple the general population prevalence for ASD in *adult* males; $p < .01$)—this proportion was not significantly different between paternal and maternal lineages.

Conclusions: Use of arbitrary, non-standardized cutoffs for case designation (as occurs when using traditional diagnostic assessments for ASD) results in marked underestimation of ASD-related-susceptibilities in females and inflates estimation of the male:female gender ratio for autism, which may, in part, be explainable by a subtle shift (0.25 SD) in the population distribution for social communicative impairments between boys and girls. Undiagnosed mothers are at least as likely as undiagnosed fathers to transmit to their offspring that aspect of familial ASD susceptibility represented by affectation status of their own siblings. These data warrant revisions to the manner in which ASD-related susceptibility and symptomatology are ascertained and characterized among females.

Animal Models & Cell Biology Program
110 Biomarkers, Cell Biology and Animal Models

110.001 1 Synaptic Causes for Autistic Regression: A Neural Network Model. Y. S. Bonneh*[1], S. Romani[2], Y. Adini[3] and M. Tsodyks[2], (1)*University of Haifa*, (2)*The Weizmann Institute of Science*, (3)*Vision Research Inst.*

Background: One of the most puzzling phenomena associated with the autism spectrum disorder (ASD) is the high incidence (15-40% reported) of a significant behavioral regression. In its strongest form, a 2 or 3 years of apparently normal development, terminate with a partial or full loss of speech, receptive-language, social skills, visual recognition, and more. Reversible regression on a short time scale was also reported, i.e. large fluctuations in performance within short time periods.

The neural mechanisms involved in regression are currently unknown. One important clue is the high incidence of epilepsy or epileptiform activity found in children with ASD, although the evidence for a link between epilepsies and regression is inconclusive.

Objectives: to develop a simple neural-network model of autistic regression at the synaptic and local network level.

Methods: We rely upon an existing recurrent network model with short term synaptic depression, which implements a memory completion network. The model produces a sharply tuned response from a partial or noisy input and switches rapidly into a bursting regime depending, for instance, on the strength of the external input. We explored the regressive effect of the bursting regime as a model for autistic regression.

Results: The model showed degraded memory completion during the bursting regime. On a short term, this resulted in a partial loss of the "weaker" memories which were fully recovered when shifting out of the bursting regime. However, long term bursting is expected to produce long-term damage due to Hebbian synaptic changes that can only be recovered by retraining. The model thus demonstrates that a reversible short-term regression and a long-term regression could have the same origin.

Conclusions: Autistic regression could be linked to the frequently observed spiking or epileptic activity via a recurrent network model that enters a bursting regime. The model demonstrates several features that can inspire further investigation.

110.002 2 Evaluation of Cytokine Expression In Cerebral Cortex and Blood Plasma of Autistic Patients. M. C. Mott*, F. Crespo, G. R. Fernandez, L. L. Sears, P. G. Williams and M. F. Casanova, *University of Louisville*

Background: Autism is an idiopathic pervasive neurodevelopmental disorder associated with an atypical immunological response evidenced by an altered systemic immunological profile and a neuroinflammatory process in the CNS of autistic individuals. Cytokines are involved in the regulation of inflammatory responses, and increased levels of subsets of cytokines have been demonstrated in the PBMC, sera, CSF, brain tissue and intracellularly in ASD patients. Genotypic analysis of polymorphic sites in some cytokine genes of autistic individuals has yielded significant results, but the picture is still incomplete. Cytokine expression analyses in autism should provide a better understanding of the potential role of the immune system in this disease.

Objectives: The current study has two main objectives. The first objective is to perform transcriptional profiling of a panel of cytokine and chemokine genes in different regions of post-mortem brain tissues of autistic subjects and controls. The second objective is to perform translational profiling of a panel of cytokine and chemokine genes in the blood plasma of autistic subjects.

Methods: Post-mortem brain tissue samples were provided by the Autism Tissue Program. After RNA extraction, transcriptional profiling was performed by reverse transcription - real time PCR in 5 cortical regions: BA 4, 9, 17, 22 and 46. Blood plasma samples were provided by the Kosair Children's Hospital Pediatric Clinical Research Unit. Protein expression analysis was performed using LUMINEX technology.

Results: Preliminary transcriptional analysis revealed that cytokine (TNFα, IL-6, TGFβ1, IL-1β), and chemokine (IL-8) transcripts were increased in all brain regions (especially BA 46, dorsolateral prefrontal cortex) except BA 22 (superior temporal gyrus/Wernicke's area) in autism as compared with controls. Preliminary plasma analysis revealed an altered expression of cytokine and chemokine regulation systemically in autistic patients when compared to literature values for controls.

Conclusions: This study reveals an up-regulation of cytokine and chemokine expression in autism in various cortical regions and an altered expression of these proteins systemically. The current data suggest a heterogeneous regulation of cytokine gene transcription in the cerebral cortex of autistic patients, where different brain regions show a differential cytokine transcription profile. Additionally, this data suggests an atypical expression of cytokines in blood plasma of autistic individuals.

110.003 3 Brain Region-Specific Decrease In the Activity of Protein Kinase C, and Increase In Activated MAP Kinases In Regressive Autism. V. Chauhan*, L. Ji and A. Chauhan, *NYS Institute for Basic Research in Developmental Disabilities*

Background: Autism is a severe neurodevelopmental disorder that is characterized by impaired language, communication and social skills. In regressive autism, children first show sign of normal social and language development but eventually lose these skills and develop autistic behavior. Calcium and phospholipid-dependent protein kinase C (PKC) and mitogen-activated protein (MAP)-kinases are involved in receptor-coupled signal transduction, and participate in neuronal functions, gene expression, memory, and cell differentiation.

Objectives: The aim of this study was to compare the activity of PKC and the levels of activated MAP-kinases, namely c-jun N-terminal kinase (JNK), MAPK/extracellular signal-regulated kinase-1 (MEK 1) and P38 kinase in postmortem brain tissue samples from individuals with regressive autism, autistic subjects without clinical history of regression, and age-matched control subjects.

Methods: The postmortem frozen brain regions, i.e., cerebellum, and cortices from frontal, temporal, parietal and occipital regions of brains from autism and control subjects were obtained from NICHD Brain and Tissue bank for Developmental Disorders at the University of Maryland. The tissues were homogenized (10% w/v) in cold buffer containing 50 mM Tris-HCl (pH 7.4), 8.5% sucrose, 2 mM EDTA, 10 mM b-mercaptoethanol and protease inhibitor cocktail in a Downs homogenizer with 5 strokes at 4 ^{0}C. The protein concentration was assayed by the Bradford method. Activity of PKC and the levels of MAP kinases (JNK, MEK 1 and P38) were measured by enzyme linked-immunosorbent assay kits.

Results: The activity of PKC was significantly decreased in the frontal cortex of individuals with regressive autism compared to developmentally normal subjects and autistic individuals without regression. Such changes were not observed in temporal cortex, parietal and occipital cortices and cerebellum in subjects with regressive autism. Further studies in the frontal cortex showed that the levels of non-phosphorylated forms of MAP kinases (JNK, MEK 1 and P38) were not affected in individuals with regressive and non-regressive autism. However, the levels of activated forms of these MAP kinases, i.e., their phosphorylated forms were increased in regressive autism. It is known that activated MAP kinases are increased under oxidative stress conditions.

Conclusions: These results suggest that regression in autism may in part, be associated with oxidative stress and altered

PKC-mediated phosphorylation of proteins involved in cell signaling.

110.004 4 Up-Regulation of Ras/Raf/ERK1/2 Signaling In the Frontal Cortex of Autistic Subjects and BTBR Mice. H. Zou*[1], K. Yang[1], A. Sheikh[1], M. Malik[2], G. Y. Wen[1], K. Chadman[1], Y. Yu[3], 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*, (3)*Southern Medical University*

Background: Autism is a neurodevelopmental disorder characterized by impairments in social interaction, verbal communication and repetitive behaviors. BTBR mice are a model for understanding mechanisms that may be responsible for the pathogenesis of autism, since they exhibit many autism-like behaviors. A number of studies have shown that the Ras/Raf/ERK1/2 signaling pathway plays important roles in the genesis of neural progenitors, learning, and memory. Ras/Raf/ERK1/2 and ERK5 have also been shown to have death-promoting apoptotic roles in neural cells. Recent studies have demonstrated a possible association between neural cell death and autism. In addition, two recent studies reported that a deletion of a locus on chromosome 16, which included the MAPK3 gene that encodes ERK1, is associated with autism. We thus hypothesized that Ras/Raf/ERK1/2 signaling and ERK5 could be abnormally regulated in the brain of autistic subjects and the abnormality could be modeled in BTBR mice.

Objectives: The aim of this study is to determine how Ras/Raf/ERK1/2 signaling pathway is regulated in the brain of both autistic subjects and BTBR mice.

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. Six female BTBR T+tfJ (BTBR) and six B6 were obtained from Jackson Laboratories (Bar Harbor, ME). All procedures were conducted in compliance with the NIH Guidelines for the Care and Use of Laboratory Animals. In this study, Western Blot Analyses were used to detect the protein expression and activity levels of Ras, A-Raf, B-Raf, C-Raf, MEK1/2 and ERK1/2. Immunohistochemistry studies were carried out to determine the protein expression and phosphorylation of MEK1/2. Enzyme-linked Immunosorbent Assay (Elisa) was carried out to determine the activity level of ERK1/2.

Results:

We show that expression of Ras protein was significantly elevated in the frontal cortex of autistic subjects and BTBR mice. C-Raf phosphorylation, as well as both B-Raf and C-Raf phosphorylation were increased correspondently in autistic subjects and BTBR mice. ERK1/2 and ERK5 protein expression were significantly up-regulated in autistic frontal cortex, and the kinase activities of MEK1/2 and ERK1/2 were found to be increased in the frontal cortex of BTBR mice. These results suggest that Ras/Raf/ERK1/2 signaling activities are up-regulated in the frontal cortex of autistic subjects and BTBR mice as compared with their controls. Furthermore, we also examined the Ras/Raf/ERK1/2 pathway in the cerebellum of autistic subjects and BTBR mice. We did not detect significant changes in the protein expression and activities of MEK1/2 and ERK1/2 in autistic cerebellum, as well as in the cerebellum of BTBR mice, which indicates that this pathways is not abnormally regulated in the cerebellum of autistic subjects and BTBR mice.

Conclusions:

Our findings suggest that up-regulated Ras/Raf/ERK1/2 signaling and ERK5 activities in the frontal cortex could be one of the cellular mechanisms responsible for the autism phenotype.

110.005 5 Up-Regulation of á-Catenin In the Glial Cells of Autistic Brain and Its Possible Effect on Glial Cell Development and Functions. A. Sheikh*[1], X. Li[1], Z. Tauqeer[1], M. Malik[2], A. Nagori[1], G. Y. Wen[1] and W. T. Brown[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*New York State Institute for Basic Research in Developmental Disabilities*

Background:

Autism is a neurodevelopmental disorder characterized by impairments in social interaction, verbal communication and repetitive behaviors. Recent studies suggest that one of the major pathways to the pathogenesis of autism is reduced cell migration. The cadherin family of transmembrane glycoproteins plays an essential role in the initiation and stabilization of cell–cell contacts, thus significantly involved in the regulation of cell adhesion and migration. Classical cadherins, including E-cadherin, bind to either β-catenin or γ-catenin (plakoglobin), which links this complex to α-catenin. Without α-catenin, cells

do not associate tightly with each other despite the expression of cadherins.

Objectives: The aim of this study is to determine whether cadherins and catenins are altered in the autistic brain

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 and Immunohistochemistry studies were used to detect the protein expression levels of E-cadherin, P-cadherin, α-catenin and β-catenin. Immunohistochemistry studies have also been used to examine the morphology of neural glial cells.

Results:

With western blot analysis, we show that the expression of α-catenin is significantly increased in both frontal cortex and cerebellum of autistic brain as compared with the age-matched controls. To further confirm this results, we carried out immunohistochemistry studies. We detected that the increased α-catenin expression is restricted in the glial cells of autistic brain. We did not detect significant differences in the expression of E-cadherin and P-cadherin between autistic and control brains. The determination of β-catenin is not yet completed. Since we found that α-catenin expression was significantly increased in the glial cells of autistic brain, we further examined whether glial cells in autistic brain are different from the controls. Using anti-GFAP (glial fibrillary acidic protein) antibody, our pilot study showed that the branching of glial cells (astrocytes) in autistic brain is significantly decreased as compared with the controls.

Conclusions:

Our findings suggest that the up-regulation of α-catenin in the glial cells of autistic brain could affect the structure and function of glial cells, which may contribute to the pathogenesis of autism

110.006 6 Changes In Proteolytic Processing Lead to Increased Pro-Brain-Derived Neurotrophic Factor Levels In Fusiform Gyrus of Subjects with Autism. M. Fahnestock*[1], K. L. Garcia[1], G. Yu[1], B. Michalski[1], D. J. Garzon[1], V. S. Chiu[1], E. Tongiorgi[2] and P. Szatmari[3],

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Background:

Recent genetic studies suggest defects in synaptic development and plasticity may lead to autism. Brain-derived neurotrophic factor (BDNF) is secreted at synapses in an activity-dependent fashion and plays a critical role in synaptogenesis, differentiation of excitatory and inhibitory circuits, synaptic function and plasticity. BDNF is synthesized as a large precursor, proBDNF, which can be processed into either a truncated form or into mature BDNF, which is neurotrophic. ProBDNF and mature BDNF have opposing activities and roles in the brain, but truncated BDNF has unknown biological activity. Previous studies reported increased BDNF-immunoreactive protein in autism, although neither the mechanism of this increase nor the responsible BDNF protein isoform was investigated.

Objectives:

The purpose of this study was to compare BDNF mRNA and protein isoforms in post mortem brain tissue from autism and control subjects.

Methods:

Fusiform gyrus is a cortical area that has been implicated in the impairments in face recognition and perception of autism. We assayed BDNF mRNA using real-time RT-PCR in fusiform gyrus from nine subjects with autism and fourteen control samples. We assayed BDNF-immunoreactive protein by ELISA and BDNF protein isoforms by Western blotting in fusiform gyrus from nine subjects with autism and nine controls.

Results:

BDNF mRNA levels were unchanged in the autism group compared to controls. However, BDNF-like immunoreactive protein, as measured by ELISA, was increased in autism samples compared to controls, in agreement with previous studies. Western blotting revealed increased proBDNF, reduced truncated BDNF and a trend towards increased mature BDNF levels in autism samples compared to controls.

Conclusions:

Our data demonstrate that increased levels of BDNF-immunoreactive protein in autism are not transcriptionally driven. In contrast, increased proBDNF and reduced truncated BDNF implicate defective processing of proBDNF to its

truncated form. This leads to distortion of the balance between the three isoforms of BDNF which could lead to changes in connectivity and synaptic plasticity and hence behavior. Our results focus attention on defective proteolytic maturation as a possible new mechanism for altered synaptic plasticity leading to autism.

110.007 7 Dietary Choline Intake by Children with Autism Is below the Recommended Dietary Reference Intake (DRI) Established by the IOM. S. J. James*[1], M. Pauly[1], S. Melnyk[1], P. A. Stewart[2], B. L. Schmidt[2], N. Lemcke[2], A. M. Reynolds[3], C. A. Molloy[4], C. Johnson[5], T. Clemons[6] and S. L. Hyman[7], (1)*University of Arkansas for Medical Sciences*, (2)*University of Rochester*, (3)*University of Colorado Denver*, (4)*Cincinnati Children's Hospital Medical Center*, (5)*University of Pittsburgh Medical Center*, (6)*EMMES Corp*, (7)*University of Rochester School of Medicine*

Background: Choline is an essential dietary nutrient that is required for normal neurodevelopment and is a precursor for membrane phosphatidlycholine, neurotransmitter acetylcholine, and the methyl donor betaine. Choline is important for normal membrane signaling and integrity, synaptic plasticity, and is an important precursor for maintenance of DNA methylation and epigenetic regulation of gene expression. Inadequate intake of choline has been associated with abnormal neurodevelopment, increased anxiety, and inflammation in humans.

Objectives: To examine the dietary intake of nutrients required for normal methylation and phosphatidylcholine metabolism to determine whether nutritional deficits may be related to low methylation capacity previously observed in children with autism.

Methods: Five national sites (AR, NY, CO, OH and PA) participated in data collection as part of the Autism Intervention Research Network for Physical Health (AIR-P) study on Diet and Nutrition in children with Autism. The cohort consisted of 127 children with autism between ages 2 to 11 who had participated in the Autism Treatment Network (ATN) registry. At each site, a three-day food record was completed by the participant's caregiver in order to obtain a snapshot of the participant's normal diet. The Nutrition Data System for Research© (NDSR) software was used to analyze nutrient content of foods. Macro and micronutrients from the diet record, with and without supplements, were calculated from the three-day record. The Dietary Reference Intakes (DRI) determined by the Food and Nutrition Board of the IOM were used for the age-specific recommended dietary nutrient intake for healthy children. For this study, the mean intakes of choline, betaine, methionine, folate and B12 were calculated based on each child's food and supplement ingestion as analyzed with the NDSR software.

Results: Using the age-adjusted DRI for choline recommended by the IOM, 80% of the autistic children were below recommended intake for choline and 40% consumed less than 2/3 of the DRI. The age-specific choline intakes are presented in the table below.

Age Group	Dietary Reference Intake	Mean Intake of Children with ASD (± SE)
1-3 y	200 mg/day	179 ± 8 mg/day
4-8 y	250 mg/day	196 ± 9 mg/day
9-11 y	375 mg/day	244 ± 28 mg/day

The mean betaine intake among the children with autism was 114 mg/day. Although the DRI for betaine for children has not been established, average intake in healthy adults is ~300 mg/day. Further, 38% of the autistic children had both choline intake less than the DRI and betaine intake less than 100 mg/day. The mean dietary intake of folate, B12 and methionine was above the DRI for these nutrients independent of supplement use. Plasma levels of choline and betaine on a subset of participants will be presented.

Conclusions: The low dietary intake of choline and betaine in children with autism may contribute to reduced methylation capacity in some children with autism.

Acknowledgements: This study was conducted at five sites participating in the ATN and was funded by a cooperative agreement from HRSA to Massachusetts General Hospital.

110.008 8 Distinct Profile of Glutamate, Leucine, and Polar Neutral Amino Acids In Children with Autism Spectrum Disorders. T. V. Obukhanych*[1], R. Tirouvanziam[1], J. Laval[1], P. A. Aronov[2], R. A. Libove[1], A. Goswami[1], K. J. Parker[1], R. O'Hara[1], L. Herzenberg[1], L. Herzenberg[1] and A. Y. Hardan[1], (1)*Stanford University School of Medicine*, (2)*Stanford University*

Background: Autism Spectrum Disorders (ASD) are heterogeneous neurodevelopmental disorders of unknown etiology affecting social, communication, cognitive, and behavioral skills. Preliminary studies suggest that amino acid (AA) balance in the brain may be implicated in the pathophysiology of ASD.

Objectives: The goals of this study were: (i) to determine whether children with ASD have altered levels of plasma AA compared to neuro-typically developing (NT) children; (ii) to assess differences in developmental regulation of plasma AA levels between children with ASD and NT children; (iii) to examine correlations between plasma AA levels and clinical features in children with ASD; and (iv) to determine whether children with ASD can be distinguished from NT children based on their plasma AA profile.

Methods: Twenty-seven children with ASD and 20 unrelated age-matched NT children were recruited for this study. ASD diagnosis was based on the Autism Diagnostic Interview-Revised, the Autism Diagnostic Observation Schedule, and expert clinical opinion. Behavioral characterization included the Social Responsiveness Scale and the Sensory Profile Questionnaire. Levels of 20 AA were measured in platelet-poor plasma fraction prepared by dual centrifugation. A quantitative liquid chromatography-mass spectrometry method based on optimized AA separation and derivatization was used to ensure increased sensitivity and reliability of AA measurements.

Results: After controlling for multiple comparisons, levels of glutamine, threonine, asparagine, citrulline, serine, and tyrosine (all of which are polar neutral AA), and of the essential AA leucine were lower in the ASD group when compared to the control group (P<.0025 for all). Glutamate was the only AA, for which levels were slightly higher in the ASD group when compared to the control group (P=.02), although the difference did not reach statistical significance per our stringent statistical criteria. A lack of the typical decrease of glutamate (and aspartate) with age was found in the ASD group. In contrast, a non-typical increase with age for isoleucine and lysine was observed. Associations were identified between plasma levels of glutamate, leucine, serine, and asparagine and clinical features involving sensory deficits. Finally, glutamine levels yielded high predictive values for discriminating between children with ASD and NT children, either alone or in combination with other polar neutral AA (area under the receiver operating characteristics curve of .87 versus .92-.96, P<.0001 for all).

Conclusions: Preliminary findings from this pilot study suggest that children with ASD might have reduction in plasma levels of most polar neutral AA as well as leucine. This AA profile appears to distinguish ASD from NT subjects. Future studies, including larger cohorts, are warranted to confirm these findings.

110.009 9 Plasma Oxytocin and Vasopressin Concentrations In Autism Spectrum Disorders. K. J. Parker*[1], R. A. Libove[1], S. A. Hyde[1], K. B. Hornbeak[1], K. W. Yuen[1], C. S. Mich[1], N. C. Ray[2], S. S. Shen-Orr[1], J. M. Phillips[3] and A. Y. Hardan[3], (1)*Stanford University School of Medicine*, (2)*Stanford University*, (3)*Stanford University School of Medicine/Lucile Packard Children's Hospital*

Background: The neuropeptides oxytocin and vasopressin are critically involved in social behavior and social cognition in animals. Impairments in social functioning are the defining, core feature of autism spectrum disorders (ASD), but at present, no widely applicable neurochemical markers with diagnostic or prognostic utility have been identified. Preliminary research using small study samples of mostly male participants suggests that plasma oxytocin and vasopressin levels are abnormal in individuals with ASD compared to typically developing control individuals. Here we extend this initial work to investigate plasma concentrations of both neuropeptides in a large and well characterized case-control study cohort which includes female subjects and siblings of individuals with ASD.

Objectives: The aims of this research were two-fold: (1) test whether abnormalities in plasma neuropeptide levels were most pronounced in children with ASD compared to typically developing control children, and intermediate in their siblings, consistent with the notion of a broader autism phenotype and (2) test whether plasma neuropeptide levels were associated with social functioning.

Methods: Participants included children with ASD (N=50 males and 16 females), their siblings (N=36 males and 19 females), and typically developing control children (N=29 males and 25 females) between 3 and 12 years of age. An extensive behavioral phenotype battery was completed on all subjects. Autism diagnosis was based on the Autism Diagnostic Observation Schedule, Autism Diagnostic Interview-Revised, and expert clinical opinion. Blood samples were collected from all subjects and oxytocin and vasopressin concentrations were subsequently quantified using commercially available enzyme immunoassays after solid phase extraction.

Results: There was a significant difference in plasma oxytocin concentrations between experimental groups (p=0.02). Specifically, male children with ASD exhibited elevated plasma oxytocin concentrations compared to male control children (p=0.04). Oxytocin levels in male siblings were intermediate, and did not differ from either group. No significant group differences in plasma oxytocin levels were found for female subjects, nor were any group differences observed for plasma vasopressin concentrations. We performed sparse canonical correlation analysis between neuropeptide levels and behavioral phenotypes and identified a set of social variables

that were maximally correlated with neuropeptide levels in all study subjects.

Conclusions: This research implicates a possible role for oxytocin, but not vasopressin, as a neurochemical marker of the social impairments in ASD. While our experimental findings need to be replicated in a larger cohort of female subjects, these preliminary findings suggest that a better understanding of oxytocin biology may ultimately lead to improved diagnostic and possibly therapeutic approaches for children with autism.

110.010 10 Absence of Cradling Bias In Autism Spectrum Disorders. L. A. Pileggi*, S. Malcolm-Smith, M. Robberts and K. Thomas, *University of Cape Town*

Background: Autism spectrum disorder (ASD) is a known disorder of emotional relatedness – one in which ineffective social skills and deficits in empathy are considered defining features. With regards to ASD, researchers have generally focused on deficits in higher-order aspects of empathy such as Theory of Mind, but have relatively neglected more basic difficulties with social reciprocity exhibited by these individuals. More attention should be directed at deficits in the basic innate capacity for one human being to relate to another. A well-established social phenomenon, namely cradling bias (i.e., the preference to cradle an infant to the left of the body midline) is argued to be facilitated by a capacity for empathy. Previous studies provide reason to suspect that this phenomenon taps into innate, basic empathic processes of relating to and bonding with another human being.

Objectives: Direct systematic observation was employed to compare the occurrence of cradling bias in children diagnosed with autism spectrum disorders (ASDs), typically developing (TD) children, and mentally handicapped (MH) children. Standardized tests were employed to determine the influence of higher-order cognitive processes on cradling bias.

Methods: This study was a cross-sectional comparison of three groups: an ASD, a MH, and a TD group. Twenty ASD and 20 TD children, aged 5-15, and 16 MH children, aged 7-13, were asked to cradle a doll as if it was an infant he/she wanted to soothe or put to sleep. This was done on three separate occasions. Cradling bias was determined by the side preferred. All three groups were matched on gender (3:1 male to female ratio) and age (i.e., similar age ranges). A standardized test measuring intellectual functioning was administered.

Results: As hypothesized, cradling bias was found to be absent in the ASD children, compared to the leftward bias present in the TD and MH children. A chi-squared test of contingency revealed a significant result ($\chi^2(2) = 7.98$, $p = 0.019$), indicating that cradling side was contingent on group membership. Further analysis by partitioning indicated a significant difference between the ASD and TD groups ($\chi^2(1) = 7.62$, $p = 0.007$, $R = 9.00$), but no difference between the TD and MH groups ($\chi^2(1) = 1.45$, $p = 0.230$, $R = 0.33$).

Conclusions: Findings support the argument that this phenomenon taps into innate, basic empathic processes, as this bias is present in both neurotypical and mentally handicapped children, but not in the ASD children. This is the first human population found not to have the leftward cradling bias, echoing Kanner's (1943) original description of ASD individuals as "having come into the world with an innate inability to form the usually biologically provided affective contact with other people" (p. 250). Focused investigation of particular aspects of empathy may allow for a more nuanced understanding of the nature of the empathy deficits by which this disorder is characterised, which has implications for the management and treatment of affected individuals.

110.011 11 The Role of Protein Breakdown and Utilization In Children with Autism Spectrum Disorder. J. Fallon*,

Background: Autism spectrum disorder (ASD) is a behavioral disorder with no definitive etiology. The various etiologies explored range from environmental to genetic, with no determinant. In some patients with ASD, primary GI immuno-pathology 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.

Objectives: To determine if there is a statistical difference in the levels of fecal chymotrypsin between children with autism ages 24 months to 8 years and the same aged children who are neurotypical.

Methods: 463 children aged 24 months to 8 years of age; 266 diagnosed with autism and 197 neurotypical children were examined for levels of fecal chymotrypsin. The measurement was via enzymatic photospectroscopy method.

Results: Of the 266 children diagnosed with autism, 203 had abnormal levels of fecal chymotrypsin (<8.4 U) $p<0.001$. Of that group with abnormal levels, 129 of them have severely pathological low levels of chymotrypsin (<1.4U). Of the 197 neurotypical children, 3 tested below 8.4 U of chymotrypsin $P<0.001$.

Conclusions: These findings indicate that a subset of children with autism have an endogenous lack of chymotrypsin, a pancreatic enzyme, which cleaves only essential amino acids in the digestive process. The three major digestive proteases include trypsin, elastase and chymotrypsin. While elastase and trypsin cleave only one essential amino acid, chymotrypsin cleaves five essential amino acids including: tryptophan, tyrosine, phenylalanine, leucine, and methionine. Of note methionine serves as the initiation codon for all vertebrate proteins including those of the CNS and the PNS. Further it has been demonstrated that a lack of certain amino acids can turn on and off genes, specifically, methionine is one of the amino acids, which is involved in turning on and off genes. Specifically a lack of methionine is involved in turning on the CHOP gene, which is involved in apoptosis of the cells of the CNS. The dearth of available amino acids and especially essential amino acids, potentially exists due to a lack of chymotrypsin, may leave the child with an amino acid prioritization problem, and potentially an inability to synthesize certain necessary proteins, including those such as neurotransmitters and neurotransmitter receptors. The abnormal levels of fecal chymotrypsin may leave the child with autism with a potentially devastating dearth of amino acids and especially essential amino acids from which to assimilate, utilize and synthesize new proteins. Thus the lack of chymotrypsin potentially leaves the child with digestive dysfunction as well as a neurological deficit

110.012 12 Increased Copper In Individuals with Autism Normalizes Post Zinc Therapy More Efficiently In Individuals with Concurrent GI Disease. A. J. Russo*, *Health Research Institute*

Background: Because of the potential association between Zn and Cu levels and neurological disease, including autism, we tested patients with autism for plasma concentration of these elements and then compared those levels with severity of disease symptoms.

Objectives: To assess plasma zinc and copper concentration in individuals with autism.

Methods: Plasma from 79 autistic individuals (diagnosed by the Autism Diagnostic Interview-Revised - ADI-R), and 18 age and gender similar neurotypical controls, were tested for plasma zinc and copper using inductively-coupled plasma-mass spectrometry.

Results: Autistic individuals had significantly elevated plasma levels of copper and Cu/Zn and lower, but not significantly lower, concentration of plasma Zn compared to neurotypical controls. Zn levels increased significantly in autistic individuals with GI Disease and without GI disease after zinc therapy. Cu decreased significantly after zinc therapy in the GI disease group but not in the autistic group without GI disease. Autistic children significantly improved with respect to hyperactivity and stimming after zinc therapy in autistic children with GI disease. Autistic children without GI disease did not improve in hyperactivity or stimming after the same therapy.

Conclusions: These results suggest an association between zinc and copper plasma levels and autistic children, and that zinc therapy may be most effective at lowering copper levels in autistic children with GI disease.

110.013 13 Metabolic Imbalance Associated with DNA Hypomethylation and Oxidative DNA/Protein Damage In Children with Autism. S. J. James*[1], S. Melnyk[1], G. J. Fuchs[2], M. Lopez[1], S. Kahler[2], J. Fussell[1], L. Seidel[1], O. Pavliv[1] and B. J. Bellando[1], (1)*University of Arkansas for Medical Sciences*, (2)*Arkansas Children's Hospital*

Background: Oxidative stress and abnormal DNA methylation have been implicated in the pathophysiology of autism. The metabolic pathology of autism is relatively unexplored although metabolic imbalance is implicated in the pathogenesis of multiple other neurobehavioral disorders. An abnormal accumulation or deficit of specific metabolites in a defined pathway can provide clues into relevant candidate genes and/or environmental exposures. In addition, the identification of precursor-product metabolite imbalance can inform targeted intervention strategies to restore metabolic balance and potentially improve symptoms of autism. We have investigated metabolic pathways essential for cellular methylation and antioxidant capacity and the functional impact of metabolic imbalance on genome-wide DNA hypomethylation and protein/DNA oxidative damage in children with autism. These metabolic pathways regulate the distribution of precursors for DNA synthesis (proliferation), DNA methylation (epigenetic regulation of gene expression) and glutathione synthesis (redox/antioxidant defense capacity). Previously, we reported that the metabolic profile of many children with autism is consistent with reduced methylation capacity and a more oxidized microenvironment.

Objectives: To determine whether methylation and antioxidant metabolic profile differs between case children, unaffected siblings, and age-matched control children and to determine whether the metabolic imbalance is accompanied by DNA hypomethylation and protein/DNA oxidative damage.

Methods: Subjects included 162 children, ages 3-10, who were participants in the autism IMAGE study (Integrated Metabolic And Genomic Endeavor) at Arkansas Children's Hospital Research Institute. The IMAGE cohort is comprised of 162 children including of 68 case children, 54 age-matched controls and 40 unaffected siblings. Children with autistic disorder were diagnosed using DSM-IV (299.0), ADOS and/or CARS >30. Fasting plasma samples were analyzed for folate-dependent transmethylation and transsulfuration metabolites and 3-nitrotyrosine (oxidized protein derivative) using HPLC with electrochemical detection. Genome-wide DNA methylation (as %5-methylcytosine) and the oxidized DNA adduct 8-oxo-deoxyguanine were quantified with Dionex HPLC-UV system coupled to an electrospray ionization (ESI) tandem mass spectrometer.

Results: In a pair-wise comparison, the overall metabolic profile of the unaffected siblings differed significantly from their autistic siblings but was not different from unrelated control children. In addition, we report new evidence of genome-wide DNA hypomethylation (epigenetic dysregulation) and oxidative protein/DNA damage in children with autism that was not present in their paired siblings or in unaffected control children.

Conclusions: These data indicate that the deficit in antioxidant and methylation capacity is autism-specific and is associated with DNA hypomethylation (epigenetic dysregulation) and oxidative damage. Further, these results suggest a plausible mechanism by which environmental stressors might modulate the genetic predisposition to autism.

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110.014 14 Proteome Analysis of Lymphoblastoid Cell Lines of Patients with Autism Spectrum Disorder Carrying a Mutation In the Ribosomal Protein Gene RPL10.

S. M. Klauck*[1], A. Chiocchetti[1], D. Haslinger[2], J. Kellermann[3], E. Duketis[4], S. Wiemann[1], F. Poustka[4], F. Lottspeich[3] and L. Breitenbach-Koller[2], (1)*German Cancer Research Center (DKFZ)*, (2)*Paris-Lodron University*, (3)*Max Planck Institute for Biochemistry*, (4)*Goethe-University*

Background: Autism spectrum disorder (ASD) has a strong genetic background with a higher frequency of affected males suggesting involvement of X-linked genes. The complex genetic architecture points towards the contribution of rare genomic variants distributed over the complete genome targeting genes in pathways for synaptic signaling, cell adhesion, secretion or scaffolding. These are crucial processes in the establishment of synaptic plasticity (SP).

Objectives: We previously identified two rare missense mutations, L206M and H213Q, in the ribosomal protein L10 (*RPL10*) gene on Xq28 in three independent families. Functional analyses in yeast showed that both mutant alleles alter translation, a modulating mechanism of SP. Gene expression studies of *RPL10* itself in lymphoblastoid cell lines (LCL) of male patients harboring the H213Q mutation showed no significant difference at the transcriptional level. Therefore, we aim to analyze the impact of RPL10 mutations on differential translation applying 2D gel/mass spectrometry (MS) methods using these mutant LCLs.

Methods: Protein extracts of two biological replicates for DIGE were prepared from LCLs established from the two male index patients of each family, their heterozygous carrier mothers, an unaffected brother and a heterozygous carrier sister, respectively, and a male and female control. Each of the samples was stained with Cy3 and compared versus the Cy5 stained internal control, which was an isogenic mixture of each of the samples. Data acquisition was performed on the Typhoon Scanner System and data were subsequently analyzed using DeCyder Software. Data were normalized against the internal standard and relative volumes of spots were calculated using normalized intensity values. Three different types of statistical analyses (two-tailed t-tests) were performed: patients versus mothers, patients versus non-patients and mutant allele carriers versus wild-type allele carriers.

Results: Following data analysis ten significantly up- or down-regulated spots in the samples of the mutation carriers were selected and picked from a preparative, Coomassie-stained 2D-PAGE. Proteins were digested with trypsin and analyzed by MALDI-MS. Interestingly three of the ten spots could be identified as posttranslational modifications of a single protein. This down-regulated protein is a central regulator in gluconeogenesis. One other up-regulated protein was identified as a peroxisomal member of the lipid metabolism. Validation via RT-PCR and Western Blot is in progress.

Conclusions: There is evidence from the literature that RPL10 is not only involved in the translation processes as a component of the large ribosomal subunit, but also in the establishment of the cytoskeleton, mRNA turnover and ageing. We will use information of differential protein expression caused by these autism specific RPL10 mutations to search for

underlying pathways specifically relevant for synaptogenesis in neuronal development and therefore causative for the autism phenotype.

110.015 15 High Serum Level of Homocysteine Is Associated with Increased Risk of Autism In Oman. A. Ali*, M. I. Waly, Y. Y. Al-Farsi and M. M. Al-Sharbati, *Sultan Qaboos University*

Background: High level of homocysteine (HCY) is an indicator of impairment of folate-dependent methionine cycle, and is associated with oxidative stress, a condition under which the cellular antioxidants capacity is not counterbalancing the oxidative damage induced by various insults including, free radicals and environmental toxins. Studies suggest that oxidative stress can cause neuronal cell death and is involved in the pathogenesis of autism. No data is available on the HCY levels for the normal and autistic children in Oman.

Objectives: To compare the homocysteine levels as a biomarker of autism in normal and autistic Omani children

Materials and Methods: This case control study evaluated eighty Omani children, 40 diagnosed autistic children (3-5 years of age) and 40 their age and gender matched controls. Fasting serum HCY levels were measured using an enzyme immunoassay (EIA) technique.

Results: The results indicated that the mean serum HCY levels were significantly higher in autistic children (20.1 ± 3.3 µmol/L) as compared to controls (9.64 ± 2.1 µmol/L) as well as to the normal reference values (5-15 µmol/L) .

Conclusions: Our study suggests that high fasting serum level of HCY might be used as a biomarker for an early diagnosis and management of autism.

110.016 16 Elevated Leptin and Reduced Adiponectin Levels In Omani Autistic Children. M. E. Mohamed-Musthafa*[1], G. J. Guillemin[2], M. I. Waly[3], A. Ali[3], Y. Y. Al-Farsi[3], M. M. Al-Sharbati[3], N. Braidy[2] and M. Al-Shafaee[3], (1)*Sultan Qaboos University, Oman*, (2)*UNSW*, (3)*Sultan Qaboos University*

Background: Autism is a severe neurodevelpomental disorder with onset prior to 3 years of age and several factors have been implicated in the etiology of autism, including genetic, environmental, autoimmune and inflammatory factors. Studies suggest that abnormal levels of leptin have been implicated in autism and other neuropsychiatric disorders. And also adipokines, such as adiponectin, may play a role in the pathophysiology of autism. No such biochemical data is available for normal and autistic children in Sultanate of Oman

Objectives: This study was aimed to compare the circulatory levels of leptin and adiponectin in normal and Omani autistic children.

Methods: The blood/plasma samples were collected from SQU hospital, Oman from autistic and control children. THe study was approved by SQU ethical committee. Quantitation leptin and adiponectin were done by using the kits from R & D systems, USA

Results: Reduced adiponectin and elevated leptin were found in Omani autistic children as compared with controls.

Conclusions: This is the first study in Omani autistic children about leptin and adiponectin. The outcome of this study may give a lead to develop novel biomarkers for early detection of autism. Also this study will give the relationship between adiponectin / leptin and the pathophysiology of autism.

110.017 17 Dietray Antioxidants Vitamins Status In Omani Autistic Children. M. I. Waly*, M. M. Al-Sharbati, Y. Alfarsi and A. Ali, *Sultan Qaboos University*

Background:

It has been proposed that oxidative stress is involved in the pathogenesis of autism. Many studies have indicated that adequate dietary supply of α-tocopherol, β-carotene and vitamin C scavenge free radicals and counterbalance oxidative stress.

Objectives:

This study was aimed to examine the dietary antioxidants status in Omani Autistic Children.

Methods:

A case-control study approach was applied for this study. Blood samples were collected for all study participants (25 Omani autistic children and 25 matched Omani controls for age and gender) and plasma was separated for measuring α-tocopherol and β-carotene using a reverse-phase high-performance liquid chromatography (HPLC) method. Plasma vitamin C level was quantified by a fluorometric method.

Results:

Dietary record was used for nutrient intake analysis and there was no significant difference in the nutrients concerned in this study among autistic children and their matched healthy controls (P>0.05). The plasma levels of α-tocopherol, β-

carotene and vitamin C in autistic children were similar to those of healthy normal controls (*P*>0.05).

Conclusions:

Our results indicate that the studied Omani autistic children had sufficient α-tocopherol, β-carotene and vitamin C. Further antioxidants biomarkers are required for evaluating oxidation status for autistic patients.

110.018 18 A Functional Variant of the MET Gene Results In Increased Inflammation and An Association with the Presence of Maternal Anti-Fetal Brain Antibodies. L. S. Heuer*[1], P. Duncanson[1], R. Boyce[1], P. Ashwood[2], D. B. Campbell[3] and J. Van de Water[1], (1)*University of California, Davis*, (2)*University of California, Davis, MIND Institute*, (3)*University of Southern California*

Background: Autism Spectrum Disorder (ASD) is a highly heritable disorder. However, few causative mechanisms have been described for these genetic perturbations. Recently, genetic variants in the *MET* gene were associated with ASD risk in nine independent samples. A functional polymorphism in the *MET* promoter ('C' allele of rs1858830) disrupts gene transcription and results in a ~2 fold decrease in the expression of the gene product, the MET receptor tyrosine kinase. MET signaling is involved in a number of physiological processes that are relevant to autism risk including the formation and maturation of neural circuitry, and negative regulation of the immune response. An independent line of research revealed that a subset of mothers of children with autism exhibit an inappropriate immune response in the form of antibodies directed against fetal brain proteins with specific bands, at 37 kDa/73 kDa and 39 kDa/73 kDa. We hypothesized that mothers with the *MET* 'C' allele may have an increased incidence of fetal-brain antibodies as a result of altered immune system regulation.

Objectives: To examine the functional consequences of *MET* rs1858830 genotype on immune function, and the association of the *MET* 'C' allele with the presence of maternal antibodies directed against fetal brain proteins.

Methods: Genotypes at the *MET* rs1858830 locus were determined by direct re-sequencing. Peripheral blood immune cells were isolated from patients, treated with exogenous HGF (*MET* receptor ligand), and then challenged with LPS (a strong inducer of inflammation). Inflammatory cytokines in resulting cell supernatants were analyzed by multiplex analysis, and the presence of the MET receptor protein was determined by ELISA. In addition, plasma from all mothers was analyzed by western blot for the presence of antibodies directed against specific fetal brain antigens. The presence of specific antibody reactivity patterns was then analyzed with respect to *MET* rs1858830 genotype.

Results: Mothers carrying the *MET* 'C' allele showed a significant decrease in the expression of the MET receptor protein in peripheral blood immune cells following activation. Further, the *MET* 'C' allele was associated with a significant increase in the level of the pro-inflammatory cytokine IL-12p40 and a decrease in the level of the anti-inflammatory cytokine IL-10 following LPS challenge. Finally, the *MET* 'C' allele was significantly associated with the presence of antibodies directed against fetal brain proteins at 37, 39, and 73 kDa.

Conclusions: These results suggest a potential mechanism for the ontogeny of antibodies directed against fetal brain in mothers of children with autism. Herein we describe a reduction in the amount of the regulatory MET receptor on immune cells in mothers carrying the *MET* 'C' allele. As a consequence these mothers exhibited a more pro-inflammatory phenotype when challenged with LPS indicating the potential for a defect in immune regulation in these mothers. Further, the association between the *MET* 'C' allele in mothers and the presence of potentially pathogenic anti-fetal brain antibodies suggests that the presence of the *MET* 'C' allele confers susceptibility towards the loss of self-tolerance through immune dysregulation.

110.019 19 Glutathione Redox Imbalance and Increased DNA Oxidation In Specific Brain Regions In Autism. A. Chauhan*[1], T. Audhya[2] and V. Chauhan[1], (1)*NYS Institute for Basic Research in Developmental Disabilities*, (2)*New York University School of Medicine and Vitamin Diagnostic Laboratory*

Background: Accumulating evidence suggests that oxidative stress may provide a link between susceptibility genes and pre- and post-natal environmental stressors in the pathophysiology of autism. Brain tissue is highly heterogeneous with different functions localized in specific areas, and it is highly vulnerable to oxidative stress due to its limited antioxidant capacity and higher energy requirement. DNA is a major target for free radical-induced damage, and oxidative DNA damage refers to the functional or structural alterations of DNA resulting from the insults of free radicals, i.e. reactive oxygen species (ROS). Hydroxyl radical is a potent inducer of DNA damage, and 8-hydroxy-2'-deoxyguanosine (8-OH-dG) is formed during oxidative DNA damage through the oxidation of guanosine bases in DNA. Glutathione (GSH) is the most important

endogenous antioxidant in human tissues, which neutralizes ROS, and participates in detoxification and elimination of environmental toxins. Glutathione in its reduced state (GSH) and oxidised disulfide form (GSSG) are the primary determinants of redox status in all human cells. A decrease in GSH-to-GSSG redox ratio is a marker of oxidative stress.

Objectives: To compare DNA oxidation and glutathione redox status in postmortem brain samples from the cerebellum and frontal, temporal, parietal and occipital cortex from autistic subjects and age-matched normal subjects.

Methods: Frozen human brain tissues (cerebellum, frontal cerebral cortex, temporal cortex, parietal cortex and occipital cortex) of autistic and age-matched control subjects were obtained from the NICHD Brain and Tissue Bank for Developmental Disorders at the University of Maryland. DNA oxidation was assessed by quantitation of 8-OH-dG. The glutathione redox status was determined by measuring the levels of GSH and GSSG.

Results: DNA oxidation was significantly increased by two-fold in frontal cortex, temporal cortex, and cerebellum in individuals with autism as compared with control subjects. On the other hand, its levels in parietal and occipital cortex were similar between autism and control groups. The levels of reduced glutathione GSH were significantly reduced and the levels of oxidized glutathione GSSG were significantly increased in the cerebellum and temporal cortex in autism group compared with control group. On the other hand, similar levels of GSH and GSSG were observed in frontal, parietal and occipital cortices between autism and control groups. The ratio of GSH/GSSG, an indicator of redox status was also significantly reduced in the cerebellum and temporal cortex in autism compared with control subjects, but it was similar in other brain regions.

Conclusions: A decrease in reduced glutathione (GSH), an increase in its oxidized form (GSSG) and a decrease in redox ratio of GSH/GSSG in cerebellum and temporal cortex in autism subjects, but not in other brain regions suggest brain region-specific glutathione redox imbalance in autism. Increase in DNA oxidation in frontal cortex, temporal cortex and cerebellum in autism but not in parietal and occipital cortex further confirms that oxidative stress differentially affects selective brain regions in autism. These results indicate increased oxidative damage coupled with reduced antioxidant status in the brain of individuals with autism.

110.020 20 Reduced Glutathione-Mediated Antioxidant Capacity and Elevated Reactive Oxygen Species In Peripheral Immune Cells From Children with Autism. S. Rose*, S. Melnyk, T. A. Trusty, O. Pavliv, L. Seidel and S. J. James, *University of Arkansas for Medical Sciences*

Background: Oxidative stress has been implicated in the pathophysiology of autism as well as numerous other neurobehavioral disorders. Oxidative stress occurs when intracellular antioxidant defense mechanisms fail to counteract the generation of reactive oxygen species (ROS) leading to macromolecular damage and dysfunction. More subtle perturbations in redox status can affect signaling mechanisms that control and regulate vital cellular processes. Previously we reported an increase in oxidative stress and reduced glutathione-mediated antioxidant capacity in plasma of children with autism compared to unaffected control children. In lymphoblastoid cells derived from individuals with autism, we observed increased ROS production and more oxidized cytosolic and mitochondrial redox status compared to control cell lines. Taken together, these findings suggest that primary immune cells from children with autism may also be more oxidized than cells from unaffected control children.

Objectives: To determine whether intracellular glutathione-mediated antioxidant capacity in resting and activated peripheral blood mononuclear cells (PBMC) differs between children with autism and age-matched control children and whether decreased antioxidant capacity is accompanied by elevated ROS production in primary monocytes and lymphocytes.

Methods: Subjects included 80 children, ages 3-10, who were participants in the autism IMAGE study (Integrated Metabolic And Genomic Endeavor) at Arkansas Children's Hospital Research Institute. The IMAGE cohort consisted of 40 children with autism, 16 unaffected siblings and 24 unaffected control children. Children with autistic disorder were diagnosed using DSM-IV (299.0), ADOS and/or CARS >30. PBMC were isolated from whole blood using standard density gradient centrifugation. PBMC were left untreated or were stimulated for 4 hr with 0.1 µg/mL LPS or 10 ng/mL phorbol 12-myristate 13-acetate (PMA) and 1 µg/mL ionomycin. Monocytes and $CD4^+$ T-cells were then isolated from the stimulated cells using magnetic bead based technology. Glutathione (GSH) was measured using HPLC elution and electrochemical detection. ROS production was determined by flow cytometric measures of median fluorescence intensity of cells pre-loaded with DCFDA, a membrane permeable probe that fluoresces when oxidized by intracellular free radicals.

Results: Resting PBMC from children with autism exhibited a significantly higher concentration of oxidized glutathione

(GSSG) compared to age-matched control children. Similarly, resting PBMC and activated monocytes isolated from children with autism exhibited significantly higher percent oxidized glutathione equivalents as well as a significant decrease in the intracellular redox ratio (GSH/GSSG) compared to age-matched control children. Activated $CD4^+$ T-cells isolated from children with autism exhibited a significant decrease in intracellular GSH and GSH/GSSG redox ratio as well as an increase in oxidized glutathione equivalents. Consistent with reduced antioxidant capacity, resting lymphocytes from children with autism produced significantly more intracellular ROS compared to lymphocytes from control children.

Conclusions: Preliminary data indicate that primary immune cells from children with autism have a more oxidized intracellular microenvironment and a decrease in glutathione-mediated antioxidant capacity compared to age-matched unaffected control children.

110.021 21 Cyfip1, a Protein Involved In 15q Duplication Region, Regulated Neuron Morphological Changes Through the Translational Cascade. A. Oguro-Ando*[1], C. Rosensweig[1], D. Werling[1], J. Bomar[1], Y. Nishimura[2], B. S. Abrahams[3], E. Herman[1], H. Dong[1] and D. H. Geschwind[4], (1)*The University of California, Los Angeles*, (2)*Mie University*, (3)*Albert Einstein College of Medicine*, (4)*University of California, Los Angeles*

Background:

Growing evidence suggests that Cytoplasmic FMR1 interacting protein 1 (CYFIP1), a little-studied molecule that maps to 15q11, may play an important role in autism spectrum disorders (ASDs). Change in dosage of CYFIP1 also appears to increase risk for schizophrenia, and is observed in one of the major gene causes of autism, (dup)15q11-13 syndrome. We have used microarrays to identify genes in monogenic forms of autism, contrasting genome-wide transcript levels from 15q, Fragile X, and typically developing individuals. These analyses indicated that CYFIP1 is up-regulated in both patient groups. Furthermore, small copy number variants (CNVs) encompassing CYFIP1 are present in ASD cases, but their pathogenicity remains unclear.

Objectives:

To ascertain how increased dosage at CYFIP may modulate brain development, we have generated models of Cyfip1 over-expression in vivo and in vitro. The approach permits empirical evaluation of how variation at CYFIP1 in particular may act to modulate risk and presentation in patients with duplications at 15q11.2 who have classic autism. We have begun to perform a morphological characterization of neurons models, dendritic arborization and morphology, and identify pathways that are altered by Cyfip1 expression changes.

Methods:

We generated a panel of BAC transgenic mice in which copy number at CYFIP1 is elevated similar to patients (CYFIPbac). We established Cyfip1 over-expression and knockdown in mouse neural progenitor cells. We also performed Golgi staining of cortical neurons in adult mice for morphological analysis and reconstructed dendritic arbors by manual tracing (NeuroMath software).

Results:

The majority of pyramidal neurons in Layer V of CYFIP1bac mice showed shorter neurite length and larger cell soma, in addition to severe abnormalities of their dendritic spines. These results confirmed our original in vitro data that identified stunted dendritic arborizations.

Conclusions:

The severity of the dendritic abnormalities suggests that they may be primary and cell automonous through the translational cascade, but further investigation is necessary. Eventually, we combined these pathological analyses with functional characterization. The key role of CYFIP1 in directly modulating activity dependent protein translation, which has also been suggested as an important convergent pathway in ASD, further emphasizes its potential central role in mediating at least some forms of ASD.

110.022 22 The Role of Cytoplasmic FMRP Interacting Protein 1 In Translational Regulation In the Synapse. O. B. Gunal*, N. Uppal, T. Anderson, T. Sakurai and J. D. Buxbaum, *Mount Sinai School of Medicine*

Background: Copy number variation at the 15q11.2 region, which includes the gene that codes for CYFIP1 (cytoplasmic FMR1 interacting protein 1), has been implicated in neuropsychiatric phenotypes. We investigated the function of Cyfip1 in synaptic physiology and behavior, using mice with a disruption of the Cyfip1 gene. We demonstrated that metabotropic glutamate receptor (mGluR)-dependent long-term depression (LTD) in the CA1 region of the hippocampus was enhanced in the heterozygous mice and was independent of protein synthesis.

Objectives: In the current study we further dissected the synaptic pathways of LTD in Cyfip1-deficient mice.

Methods: We applied a combination of biochemical, immunohistochemical and electrophysiological techniques in mouse tissue, principally focusing on hippocampal area CA1.

Results: mGluR1/5 activation recruits both the mammalian target of rapamycin (mTOR) signaling pathway and the ERK pathway. We showed that in wildtype mice mGluR-LTD was sensitive to rapamycin, a selective inhibitor of mTOR, but *Cyfip1* heterozygous mice showed enhanced mGluR-LTD that could not be blocked by rapamycin. During activation, mTOR phosphorylates 4E-BP, a critical step in translation control. We investigated this by examining the localization of increased 4E-BP phoshorylation using immunohistochemistry. In slices from *Cyfip1* heterozygous mice, 4E-BP phosphorylation was not detectably altered by DHPG stimulation. Our results are consistent with what has recently been described for *Fmr1* knockout mice. We are currently examining MEK inhibitors to determine whether enhanced LTD can be reversed by inhibiting ERK signaling. We are also directly measuring protein synthesis in these studies.

Conclusions: Our results support a shared mechanism between Fragile X syndrome and loss of a functional copy of *CYFIP1*. Enhanced LTD observed in either case is insensitive to either protein synthesis inhibitors or rapamycin, suggesting that the ERK pathway, which is also activated by mGluR1/5, might be involved. We hypothesize that loss of a functional copy of *Cyfip1* leads to an intermediate phenotype that increases risk and/or severity of psychiatric disorders.

110.023 23 Maternal Exposure to Thimerosal, An Organomercury, Affects Early Serotonergic Development In the Fetal Rat Brain. M. Ida-Eto*[1], A. Oyabu[1], T. Ohkawara[1], Y. Tashiro[1], N. Narita[2] and M. Narita[1], (1)*Mie University*, (2)*Bunkyo University*

Background: Thimerosal is an organomercury preservative added to many child vaccines. Developmental toxicity of thimerosal including autism has received considerable attention, but has not been concluded yet. Previously, we reported “autism model rats” induced by thalidomide or valproic acid (VPA) based on human thalidomide embryopathy (Pediatr Res 58:232,2002; Int J Dev Neruosci 23:287,2005; Neurosci Res 66:2,2010), hypothesizing that exposure to thalidomide or VPA on rat E9 is critical to cause autistic phenotype to rats by perturbing early serotonergic development. However, whether maternal thimerosal exposure induces developmental disorders has not been proved yet.

Objectives: Along these lines, we tested whether fetal E9 administration of thimerosal affects early development of serotonergic system.

Methods: Thimerosal (1 mgHg/kg in saline) was administrated by intramuscular injection into *glutei maximi* to E9 pregnant rats (day of insemination = E1), and then E15 fetus were dissected out. Embryonic brains were cut along the dorsal midline and mounted flatly (whole mount preparation), and were fixed with 4% paraformaldehyde. Development of serotonergic neurons was examined immunohistochemically using serotonin antibody.

Results: Dramatic increase of serotonin neurons of the lateral part of caudal cluster was observed in thimerosal group (n=7) compared to control (n=9) by 190% (Student’s *t*-test, $p<0.01$). Basic structure of raphe groups between thimerosal and control was not generally affected.

Conclusions: These results suggest that exposure to thimerosal at E9 affects early serotonergic development.

110.024 24 Neuroanatomical Abnormalities In the Mecp2(308) Mouse Model of Rett Syndrome. J. Ellegood*, J. P. Lerch and R. M. Henkelman, *The Hospital for Sick Children*

Background: Rett Syndrome (RTT) is an X-linked disorder located under the Autism Spectrum of Disorders (ASD). RTT is caused by mutations in the Mecp2 gene. A commonly used mouse model of RTT involves a truncation of the Mecp2 gene at codon 308. The behavioural phenotype of the $Mecp2^{308}$ mouse includes abnormalities in social interaction and home-cage behaviours (Moretti et al. 2005), as well as learning and memory impairments (Moretti et al. 2006). Recently, anatomical phenotyping in the fixed mouse brain using MRI has been shown in a number of mutants to be useful in determining specific volumetric changes, which has helped to localize and aid further research in these mutants (Nieman et al. 2006).

Objectives: The purpose of this study was to examine the volume changes in the $Mecp2^{308}$ RTT mouse model with high resolution MRI.

Methods: Fifty-one C57/B6 fixed mouse brains were examined, 17 wild-type and 34 knockdown $Mecp2^{308}$ mice. Of the $Mecp2^{308}$ mice, 12 were heterozygous females, 12 were homozygous females, and 10 were hemizygous males.

MRI Acquisition - A multi-channel 7.0 Tesla MRI scanner (Varian Inc., Palo Alto, CA) with a 6-cm inner bore diameter insert gradient set (max gradient strength 100 G/cm) was used

to acquire anatomical images of brains within skulls. A T2-weighted, 3-D fast spin-echo sequence was used, with a TR of 325 ms, and TEs of 10 ms per echo for 6 echos, four averages, field-of-view of 14 × 14 × 25 mm^3 and matrix size = 432 × 432 × 780 giving an image with 0.032 mm isotropic voxels. Total imaging time was ~11 h.

Data Analysis – We use image registration to align a previously developed neuroanatomical atlas (Dorr et al. 2008) defining 62 separate brain regions towards each scan. Volumes of individual structures for each mouse were calculated in mm^3. Group differences in volume were calculated using linear models; multiple comparisons were controlled using the false discovery rate (FDR).

Results: Of the 62 different regions assessed 26 were found to be significantly different ($q<0.01$, q is defined as the FDR corrected version of the p-value) when comparing the $Mecp2^{308}$ with the wild type. Notable regions of decrease in the brain were the parieto-temporal lobe (4%, $q<0.01$), the corpus callosum (5%, $q<0.001$), the internal capsule (6%, $q<0.001$), the striatum (5%, $q<0.01$), and the thalamus (7%, $q<0.001$). Notable regions of increase were the cerebellar cortex (5%, $q<0.01$), the inferior of the cerebellar peduncle (5%, $q<0.01$), the cuneate nucleus (20%, $q=0.001$), and the third and fourth ventricles (7 and 15%, $q<0.01$ and $q<0.001$, respectively).

Conclusions: This study reports volumetric changes in different regions in the brain of the $Mecp2^{308}$ mouse. Regions such as the partieo-temporal lobe, striatum, thalamus, corpus callosum, and cerebellum are all affected in human Rett syndrome and significant differences were found in each of these regions in the $Mecp2^{308}$ mouse as well. Along with the behavioural characteristics shown in previous studies of the $Mecp2^{308}$ mouse, this model seems to be an accurate behavioural and neuroanatomical model of human Rett syndrome.

110.025 25 The Effects of Neuropeptide Secretin In Early Postnatal Brain Development. I. Nishijima*[1] and P. Jukkola[2], (1)*Tohoku University Graduate School of Medicine* , (2)*The Ohio State University*

Background: Secretin (Sct) is a peptide hormone that belongs to the secretin/VIP/glucagon peptide family. Secretin was originally isolated in the gastrointestinal system, but it has been found to also function as a neuropeptide in the brain. The receptor for secretin (Sctr) is a member of a G-protein coupled receptor family. Several clinical trials on secretin administration report neurobehavioral improvement in autism and schizophrenia, although the results of these trials remain mostly controversial. To identify the function of secretin in neuronal and behavioral development, we generated Sct and Sctr deficient mice. Sct and Sctr deficient mice are overtly normal and fertile, however, they show autism-related abnormal neuronal and behavioral phenotypes.

Objectives: In this study, we focused to analyze the role of secretin inearly postnatal brain development.

Methods: Since massive neurogenesis occurs during the early postnatal period, we analyzed hippocampal neurogenesis in mutant pups at postnatal day 21. In addition, we analyzed sensitivity to alcohol toxicity during early postnatal development in mutant mice.

Results: Interestingly, expression of Sct and Sctr during the early postnatal stages is much higher and more widespread compared to the mature adult brain. Specifically, we observed strong expression in the dentate gyrus of hippocampus and cerebellum during early postnatal stages. We observed impaired survival of neural progenitor cells in Sct and Sctr mutant hippocampus. In Sct and Sctr deficient mice, the number of BrdU-labeled new neurons was significantly decreased and apoptosis of neural progenitor cells was dramatically increased. These data suggest that secretin promotes the survival of neural progenitor cells.

Furthermore, our studies on Sctr deficient mice demonstrated increased sensitivity to alcohol toxicity during the first week of life. Alcohol exposure during brain development induces neuronal cell death in the brain. We identified significant ethanol-induced apoptosis in the external granular layer of the secretin receptor-deficient cerebellum after ethanol treatment. During the early postnatal period, there is a proliferation of granular cell progenitors that reside in the external granular layer. The results suggest that secretin signaling plays a neuroprotective role of neural progenitor cells against the neurotoxicity.

Conclusions: In summary, we hypothesize that the secretin receptor signaling pathway is required for survival of neural progenitors/immature neurons as well as protection against neurotoxicity that subsequently affects neuropsychological functions throughout the life of the animal. Knowing the mechanism of neuropeptide during postnatal develoment could lead to better understanding of autism.

110.026 26 A DARTEL Based Analysis of Post-Natal Brain Response to Prenatal Maternal Inflammation In Early or Late Pregnancy In the Mouse. G. M. McAlonan*[1], Q. Li[2], E. X. Wu[2] and C. Cheung[3], (1)*State Key Laboratory*

for Brain and Cognitive Sciences, (2)*University of Hong Kong*, (3)*The University of Hong Kong*

Background: Exposure to maternal inflammation during prenatal life is thought to increase the incidence of neurodevelopmental disorders such as autism and schizophrenia. However, direct evidence for a causal link in man is difficult to establish, making animal models a useful tool. In a well documented approach to this issue, offspring of pregnant mice exposed to the viral analogue PolyIC have been reported to have brain and behavioural phenotypes relevant to autism. However, the whole-brain extent of changes across grey and white matter tissue compartments has yet to be explored in detail. In addition, the evidence to date indicates the impact of early and late pregnancy exposure may be distinct, suggesting that the final phenotype depends upon particular windows of vulnerability in fetal life.

Objectives: To directly test the effect of early or late prenatal inflammation on post-natal brain morphometry in the mouse model using advanced automated MRI methodology.

Methods: The viral analogue PolyIC (5mg/5ml/kg) or saline (control) was administered to pregnant C57/B6 mice via tail vein in early (gestation day 9) or late gestation (day 17) and 12 week old adult offspring scanned *in-vivo* in a 7 T small animal scanner (maximum gradient 360 mT/m; 70/16 PharmaScan, Bruker Biospoin GmbH, Germany) with 23mm quadrature RF coil. Axial images were acquired in under 1 hour/mouse [T_2–weighted: Effective TE = 38.71ms, TR = 4614.566ms, No of Average = 6, Rare Factor =8, Acquisition Matrix = 256 × 256, FOV = 25 × 25mm, Slice thickness = 0.25mm, Scan Time = 11m4s]. The protocol was approved by the Committee on Use of Live Animals for Teaching and Research, University of Hong Kong. Final numbers available for analysis were: controls n=8, PolyI:C n=14 (PolyI:C, GD9 n=8, GD17 n=6). Voxel-wise group differences in volumes across whole brain were analysed using a diffeomorphic framework for registering images, DARTEL with reference to a conventional mouse brain template. Statistical analysis in SPM 2 software used “Single-subject: conditions & covariates” to compare tissue volume between different groups with results thresholded at p<.001, cluster extent 30 voxels.

Results: Early prenatal exposure to PolyIC lowered volumes in hippocampus, subiculum and striatum brain regions compared to saline exposed controls and increased volumes in mid-brain and lateral ventricles. Mice exposed later had more extensive volume differences in cerebellum with lower volumes in hippocampus regions and lateral ventricles and greater volumes around the amygdala and mid-brain.

Conclusions: The timing of prenatal insult determines the post-natal brain phenotype. Broadly speaking, ventriculomegaly and lower limbic-striatal volume in the early exposed mice appears to echo more closely similar anatomical features in schizophrenia, whereas, cerebellar dysmorphology and smaller lateral ventricles in late exposed mice, have have more relevance to autism. Thus the time of prenatal brain developmental perturbation may contribute to the phenotypic spectrum observed across related disorders of neurodevelopment.

110.027 27 Functional Analysis of SHANK3 In Zebrafish. G. Cai*[1], Y. Kajiwara[1], K. Tsang[2], K. C. Sadler[1] and J. D. Buxbaum[1], (1)*Mount Sinai School of Medicine*, (2)*Chinese University of Hong Kong*

Background: Mutations in SHANK3 can lead to autism spectrum disorders. Functionally analysis of SHANK3 has been restricted to cultured cells and to mouse models. We are developing *in vivo* systems for detailed, rapid functional analyses of autism gene, including SHANK3. Zebrafish, which represent a long-standing model for embryology and development, has attractive aspects as a model system for neurodevelopmental disorders. Its external, transparent embryonic development, high fecundity, and rapid life cycle make it organism particularly well-suited to the molecular genetic analysis of vertebrate neurodevelopment and facilitate studying gene function *in vivo*.

Objectives: To make use of the zebrafish as a model system to examine functional aspects of SHANK3 and to understand the pathological mechanisms underlying SHANK3 deficiency syndromes.

Methods: Gene knockdown was achieved by microinjection splice-blocking morpholinos into 1-2 cell stage zebrafish embryos. Early embryo development defects were scored and escape responses assessed. Changes in neurogenesis were examined using early neurogenesis markers including neurogenin1 transgenic fish (NGN1:EGFP) and anti-acetylated tubulin antibody.

Results: Double knockdown models of zebrafish Shank3 genes (3a and 3b) were generated. By using RT-PCR and sequencing, we validated the loss of native mRNA and the existence of aberrantly spliced mRNA products with premature stop site in the gene knockdown morphants. Morphological defects and delayed escape responses were observed in the Shank3 morphants. We are now introducing alternate human SHANK3 isoforms in rescue experiments as a means of understanding the function of SHANK3 isoforms.

Conclusions: SHANK3 plays important roles in early neurogenesis. Changes in neuronal function were observed in Shank3 morphants as assessed by escape responses. Zebrafish represent a useful model system to functionally assess autism genes.

110.028 28 Transgenic Expression of Mammalian Neuroligin Rescues the Oxidative Stress Phenotype of C. Elegans Neuroligin-Deficient Mutants. J. B. Rand*[1], G. P. Mullen[2], E. A. Mathews[2], J. W. Hunter[2] and J. M. Heatherly[1], (1)*University of Oklahoma Health Science Center*, (2)*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 was 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.

Objectives: To extend our previous data on the properties and function of *C. elegans* neuroligin, and determine the extent to which transgenic expression of mammalian neuroligin could "rescue" the mutant phenotypes associated with a *C. elegans* neuroligin knockout mutant.

Methods: We obtained cDNAs for human neuroligin-4 (hNLGN4) and rat neuroligin-1 (rNLGN1) from Thomas Südhof (Stanford). Using standard methods, we replaced the mammalian signal sequences and 3'-UTRs with their nematode counterparts, and expressed the modified cDNAs as stable transgenes (driven by the *C. elegans nlg-1* promoter) in *nlg-1* mutants. We then compared the behaviors and toxin sensitivity of animals expressing the mammalian transgenes to wild-type animals, *nlg-1* null mutants, and *nlg-1* mutants expressing a nematode neuroligin transgene.

Results: (1) In the presence of a temperature gradient, wild-type *C. elegans* will accumulate at the temperature at which they were grown, but *nlg-1* mutants are insensitive or indifferent to temperature, and distribute uniformly across the gradient. However, transgenic expression of hNLGN4, rNLGN1, or *C. elegans* NLG-1 restores the wild-type behavior. (2) Wild-type *C. elegans* are strongly repelled by dilute *n*-octanol, but *nlg-1* mutants are indifferent to the compound. However, *nlg-1* mutants expressing hNLGN4, rNLGN1, or *C. elegans* NLG-1 transgenes are strongly repelled by dilute *n*-octanol. (3) Wild-type animals and *nlg-1* mutants are comparably attracted to diacetyl and repelled by cupric acetate. However, when presented with these two compounds simultaneously (*i.e.*, with a cupric acetate barrier between the animals and the attractant), *nlg-1* mutants are far more likely than wild-type animals to cross the barrier. We found that transgenic expression of hNLGN4, rNLGN1, or *C. elegans* NLG-1 restored the behavior to wild-type values. (4) *nlg-1* mutants are hypersensitive to paraquat toxicity, but transgenic expression of either hNLGN4 or *C. elegans* NLG-1 restored normal paraquat sensitivity.

Conclusions: The nematode and mammalian neuroligins appear to be functionally equivalent (including the ability to prevent or counteract oxidative stress). This raises the possibility that neuroligin may play a role in the prevention of oxidative stress in mammals.

110.029 29 Contagious Yawning In Chimpanzees as a Measure of Empathy: Potential Implications for Autism Research. M. W. Campbell* and F. de Waal, *Emory University*

Background: Contagious yawning is hypothetically linked to empathy. Yawns are thought to be contagious for the same reason that smiles, frowns, and other facial expressions, like fear, are contagious. However, contagion of smiles, frowns, etc. can involve micro-expressions, which are too subtle to observe without technological assistance. The advantage of yawns is that they are fixed-action patterns which, once begun, go to completion. Since there are no 'micro-yawns', yawns are readily observable to the naked eye. The theoretical connection between contagious yawning and empathy has received empirical support in the form of positive correlations with performance on theory-of-mind tasks, self-face recognition (both important for complex forms of empathy), and social closeness. Importantly, negative correlations have been found with autism and schizotypy, two conditions associated with atypical empathy functioning. Chimpanzees (along with the bonobo) are humans' closest living relatives. They share many aspects of complex human social behavior, including some

forms of empathy, and therefore make for a suitable model for studying typical social development.

Objectives: 1) Confirm whether chimpanzees (*Pan troglodytes*) show contagious yawning, 2) test whether 3D computer animations can stimulate contagious yawning in chimpanzees, and 3) test whether contagious yawning is susceptible to ingroup-outgroup bias in chimpanzees, as predicted if empathy is the underlying mechanism.

Methods: In two separate studies, 23 chimpanzees from two different groups watched videos of yawn or control stimuli. The first set of stimuli comprised computer-animated chimpanzees programmed to yawn or make other expressions, as controls. The second stimulus set comprised actual video of chimpanzees yawning or at rest (control) from the two groups. Sessions were videotaped and coded for the number of yawns and amount of attention paid to the stimuli by each subject.

Results: Chimpanzees yawned significantly more when watching yawn animations than control animations, and when watching familiar individuals yawn than controls. Video of unfamiliar individuals did not produce a significant difference between yawn and control conditions. Critically, the chimpanzees yawned more when watching familiar individuals yawn than unfamiliar individuals yawn. There were no correlations between the rate of attention and yawning for any stimulus set.

Conclusions: We confirmed that chimpanzees show yawn contagion through the robust response to two separate stimuli. The yawn contagion in response to the 3D animations suggests that animations can be used to stimulate a natural, involuntary response, and that the chimpanzees identified with the animations on some level. The measurable ingroup-outgroup bias provides further support for the hypothesis that empathy is the mechanism underlying contagious yawning. Contagious yawning is a low-cost, easy-to-implement test of involuntary behavioral/affective contagion that may be useful to autism research. Potential uses include assessments of the efficacy of interventions, exploring whether interventions enhance involuntary affective processes, and as a comparative measure for some nonhuman models.

110.030 30 BTBR Mice Exhibit Deficits In Probabilistic Reversal Learning. M. E. Ragozzino*, D. Amodeo, J. Jones and J. A. Sweeney, *University of Illinois at Chicago*

Background: The BTBR T+ tf/J (BTBR) mouse exhibits repetitive motor behaviors and restricted interests similar to that observed in autism spectrum disorder (ASD). Less clear is whether the BTBR mouse displays cognitive flexibility deficits also observed in ASD.

Objectives: The present experiment investigated whether BTBR mice compared to C57BL/6J mice exhibit impairments in acquisition and/or reversal learning of a spatial discrimination using a completely accurate feedback procedure vs. a probabilistic learning procedure. In addition, both mouse strains were tested on different measures of motor stereotypy.

Methods:

In Experiment 1, BTBR mice and C57BL6J mice were tested on acquisition and reversal learning of a two-choice spatial discrimination using 100% accurate feedback. In Experiment2, the two mouse strains were tested on acquisition and reversal learning of a spatial discrimination using a 80/20 probabilistic learning procedure. In Experiment 2, mice were also tested for repetitive grooming and marble burying, as well as spontaneous alternation as a measure of short-term memory. 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. Testing occurred across two consecutive days. The learning criterion for the acquisition and reversal learning phase were each 6 consecutive trials. In Experiment 1, 100% accurate feedback was provided. In Experiment 2, the "correct" choice was reinforced on 80% of trials and the "incorrect" choice was reinforced on 20% of trials. To measure grooming mice were placed in a clear acrylic chamber for 10 min and the duration of grooming was measured. In the marble burying test, mice were placed in a plastic chamber with wood chip bedding and the presence of 20 marbles for 30 min undisturbed; buried marbles were recorded. In the spontaneous alternation test, mice explored a three- arm maze undisturbed for 20 min, while entry patterns were recorded.

Results: BTBR and C57BL6J mice performed comparably on acquisition and reversal learning of a spatial discrimination with 100% accurate feedback. BTBR mice performed similarly as C57BL6J mice on spatial acquisition, but were impaired in spatial reversal learning using a probabilistic learning procedure. The deficit was a result from a significant increase in regressive errors in which BTBR mice were impaired in maintaining the new choice pattern after being initially selected. As previously observed, BTBR mice spent significantly more time grooming and buried significantly more marbles compared to C57BL6J mice. In contrast, BTBR and C57BL6J mice exhibited similar spontaneous alternation

scores. not differ in the trials needed to reach criterion during place acquisition. Instead, analyses indicate that BTBR mice required significantly more trials to inhibit responding for the previously "correct" arm and switching to a new choice pattern.

Conclusions: The present findings indicate that BTBR mice not only exhibited increased repetitive motor behaviors, but also exhibit cognitive flexibility deficits as measured by probabilistic reversal learning. Thus, BTBR mice can serve as a useful model to study the mechanisms and potential treatments for cognitive flexibility deficits in ASD.

110.031 31 Abnormal Social Interaction In Gabrb3 shRNA Transgenic Mice. L. Herzing*, A. Czaplicki, K. Masterson and W. Dietz, *Northwestern University Feinberg School of Medicine*

Background: Multiple lines of evidence support a link between GABRB3, a $GABA_A$ receptor subunit, and autism spectrum disorders. This association is likely a consequence of alterations in gene dosage or expression of gene variants, as total or conditional loss of Gabrb3 results in post-natal lethality in mouse, with the few survivors exhibiting severe seizures and behavioral disorders. Little is known regarding whether GABRB3 variation contributes to specific autism-related phenotypes, although the general association with autism is enhanced in populations with elevated perseveration. In mouse, haploinsufficiency results in variable gene expression and only mild phenotypes that are gender, age and deletion parent-of-origin dependent.

Objectives: To characterize ASD-related behaviors in *Gabrb3* shRNA transgenic animals.

Methods: *Gabrb3* shRNA transgenic animals were generated on a C57Bl/6 background. Behavioral phenotypes in male and female young adult transgenic and littermate control animals were assessed using standard protocols, including activity and anxiety (open field), exploratory (place preference & T maze), socialization (interest, preference & memory: odor, tethered & free interactions), aggression (tube test), and learning and perseveration (radial/T maze). shRNA and mRNA expression levels were quantified using a custom TaqMan small RNA assay (Applied Biosciences) or SYBR-Green qRT-PCR, respectively.

Results: *Gabrb3* shRNA transgenic animals demonstrate abnormal social interactions that appear specific to live, 'free-range' animal encounters. Both females and males show an apparent increase in social interest, exhibiting high levels of interaction and minimal acclimatization to repeated exposures to a stranger mouse, and limited relative enhanced interaction time with a novel mouse. This is unlikely to be a pure social memory defect, as *Gabrb3* shRNA animals show normal acclimatization and response to novelty using soiled bedding rather than live stranger animals, albeit conversely with a somewhat decreased total interaction time as compared with wildtype littermates. Furthermore, for male *Gabrb3* shRNA animals, live encounters often result in aggression, yet no enhanced aggression or passivity is detected using the tube test. Nor do these persistent social interactions reflect a generalized increase in perseveration, as both genders show normal reversal learning in the T maze. Female *Gabrb3* shRNA transgenic animals, however, show enhanced learning acquisition in the T maze, which is currently under further investigation.

Conclusions: shRNA-mediated *Gabrb3* variation in mouse leads to gender specific phenotypes including abnormal, persistent social interactions reminiscent of the 'active but odd' categorization in autism spectrum patients. The association of specific traits or phenotypes with altered Gabrb3 expression will facilitate the identification of patient populations in which targeted therapies for this pathway will be most effective.

110.032 32 Gene Deletion of Pituitary Adenylate Cyclase-Activating Polypeptide (PACAP) Reduces Anxiety and Produces Deficits In Social Discrimination In Mice. M. C. Valdez*,

Background:

PACAP and its receptors are required for vasopressin (VP)-mediated osmoregulation (Gillard et al, 2007). PACAP has also been implicated in autonomic dysregulation and well as altered anxiety behavior to stress (Hashimoto et al. 2001). Autism spectrum disorders (ASD) are characterized by impaired social interactions, sensory deficits as well as dysregulated neuroendocrine function, and altered anxiety. However, whether PACAP is critical for behaviors relevant to ASD is unclear.

Objectives:

The aim of our study is to determine if PACAP gene deletion has aberrant affects on both neuroendocrine function and behaviors relevant to ASD, namely anxiety and social recognition. Using a PACAP gene knockout (KO) model we tested the hypothesis that PACAP gene deletion is critical for anxiety and social behavior. We also measured somatodendritic vasopressin responses in acutely dissected punches taken from the supraoptic nucleus of the same PACAP knockout (KO). Comparisons were made with age-matched wildtype (WT) mice.

Methods:

In the present study, PACAP KO mice subjected to 2g% NaCl drinking for 7 d did not show the stimulated VP release evident in wildtype (WT) mice (48.5+4.6 vs. 230.9+52.1% of WT normosmotic, p=0.03, n=11). These data indicate reduced osmotic regulation associated with the lack of PACAP. Central VP release from supraoptic neuroendocrine cells has also been implicated in neuromodulation of distant circuits associated with stress, learning and affiliative behaviors (Landgraf, 2005). Interference with VP or PACAP signaling can alter anxiety-related behavior (Landgraf et al. 1995; Hashimoto et al, 2001). Using an elevated plus maze we observed an increased open arm time for PACAP KO vs WT: 81.4+14.3 vs. 47.5+10.9 sec, respectively ($p<0.07$, n=16) while time spent in closed arm was similar, indicating reduced anxiety as a result of PACAP gene deletion.

Results: Next, we subjected PACAP KO mice to an olfactory-driven social discrimination task which used gonadally intact females presented within corrals inside clean test cages (MacBeth et al, 2009). Compared to WT mice, PACAP KO male mice were unable to discriminate a novel from a familiar female since time spent investigating novel or familiar females was not different: 47.3+2.9 and 45.9+5.7 sec, respectively (p=0.83, n= 8). Total investigation time in all trials remained constant. Olfactory testing using non-social stimuli indicated no deficits between PACAP KO and WT in distinguishing olfactory-based preference to stimuli.

Conclusions:

Recently, we have shown that PACAP-deficient mice show aberrant VP and nitric oxide (NO) release from magnocellular neuroendocrine cells (MNCs) in supraoptic tissue punches challenged with acute hyperosmolarity (Shahidizadeh et al, 2009). In this study we show that PACAP deficiency leads to more dramatic suppression of osmotic-activated vasopressin responses. Further, we show that PACAP gene deletion is associated with impairments in social discrimination behavior and anxiety responses. Our findings suggest that PACAP-operated circuits are critical for anxiogenic and social discriminative behaviors and that PACAP deficiency may be associated with and autistic-like phenotype. Supported by MARC (M.V.), UCLeads (C.B.) and Department of Education funds (A.K., R.N.).

110.033 33 Measuring Social Motivation In Mice Using Novel Operant Conditioning Paradigms. L. A. Martin*, B. Berk, Z. Maupin and L. Lane, *Azusa Pacific University*

Background: Much advancement has been made in the understanding and treatment of human disease through studies on animal models. For human disorders involving abnormal social behavior such as autism, research on mouse models will benefit from the development of novel assays of complex social behavior including social motivation.

Objectives: The goal of this research is to develop and validate new tasks of social motivation and social escape for mouse models of autism. The proposed tasks involve the use of original operant conditioning paradigms programmed through a computer system that will allow a test mouse to control access to another mouse within an operant box. The access to the stimulus mouse will serve as a social reward for mice with prosocial tendencies but may serve as an aversive stimulus for mice with nonsocial tendencies.

Methods: Initial research has been carried out through two experiments comparing individually-housed versus group-housed C57BL/6J mice, a prosocial inbred mouse strain. In the first experiment, each test mouse was trained to press a lever to seek a social reward in the form of access to an unfamiliar stimulus mouse. The social reward was set on a progressive ratio schedule with a step size of three. The number of lever presses achieved in the final trial of a testing session (breakpoint) was used as an index of social motivation. For the second experiment, motivation for a food reward was compared to a social reward. The mice were conditioned to associate one lever consistently with a food reward and another consistently with the same social reward described in the previous experiment. After this conditioning period, a series of 1 hr testing sessions assessed reward preference by allowing test mice to freely choose between the rewards by pressing the associated lever.

Results: In experiment 1, all mice demonstrated social motivation as determined by an increase in the number of lever presses when a stimulus mouse was present. In addition, group-housed mice consistently demonstrated higher breakpoints than individually-housed mice. In experiment 2, all mice showed a preference for the food reward over the social reward as demonstrated by a higher number of food lever presses than social lever presses across testing sessions. While performance was similar during the first half of the testing sessions, individually-housed mice demonstrated a heightened food to social reward ratio over group-housed mice in the latter half of the testing sessions.

Conclusions: The results suggest that these operant conditioning paradigms may be valuable tools to assess social

motivation in various mouse strains including models of autism. The validation of these paradigms is ongoing through the testing of additional group-housed and individually-housed mice, as well as mouse strains that have previously demonstrated social deficits. Preliminary data suggests that individually-housing mice long-term may decrease social motivation perhaps due to their lack of social experience. Future experiments will test mice lacking social motivation in an operant paradigm in which they can choose to escape a forced social interaction.

Epidemiology Program

110 Epidemiology: Biological and Social Risk Factors

110.121 34 Paternal and Maternal Age Are Jointly Related to Autism Spectrum Disorders In Jamaican Children. M. H. Rahbar*[1], M. Samms-Vaughan[2], K. A. Loveland[3], E. Boerwinkle[4], J. Bressler[5], D. A. Pearson[6], S. Pellington[5], C. Beecher[5], M. L. Grove[5], M. Ardjomand-Hessabi[5] and K. Bloom[5], (1)*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*, (5), (6)*University of Texas Medical School at Houston*

Background: Autism Spectrum Disorders (ASDs) are complex lifelong neurodevelopmental and behavioral disorders manifesting in infancy or early childhood, characterized by impairments in social interaction and communication, and by repetitive, stereotyped behavior. ASD has become a serious public health concern with a major familial and societal economic impact. The etiology of autism is not fully understood but there is consensus among scientists that genetic factors and gene-environment interaction play a role in autism. Several studies have reported advancing parental age as a risk factor for adverse behavioral outcome during early childhood, particularly autism, yet the results remain inconsistent and the potential contribution of delayed childbearing to the increased incidence of autism has not been fully investigated. Epidemiologic data in developing countries, where the environment may be very different from that of developed countries, will broaden our understanding of the etiology of ASDs.

Objectives: This study's primary objectives were to investigate whether environmental exposures to mercury, lead, arsenic and cadmium play a role in autism. Additionally, we investigated other potential risk factors for autism, including maternal and paternal age.

Methods: In collaboration with the University of West Indies (UWI) in Kingston, Jamaica, we are conducting an age- and sex-matched case-control study of 150 pairs of children. We are administering the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R) to children in the UWI's Jamaica Autism Database who have previously been identified as being at risk for ASD using the Childhood Autism Rating Scale (CARS). For each case, an age- and sex-matched control is identified using the Social Communication Questionnaire (SCQ) to rule out symptoms of ASD. We also administer a pre-tested questionnaire to assess demographic and socioeconomic information, parental history, and potential exposure to heavy metals through food or occupation of parents. At the end of the interview, we collect 5 mls of whole blood, 2 mls of saliva, and hair samples to be analyzed in the US. Conditional logistic regression and multivariate analysis are used for identifying risk factors for ASD.

Results: As of October 2010 we have enrolled 69 matched pairs. Demographic results show a study sample of 87% male with a mean age (months) of 66.41 (cases) and 67.24 (controls). About 97% of the participants are Black (African origin). Mean weight and head circumference of cases are significantly higher than those of controls ($p<0.05$). At birth of the index child, the mean paternal age (Mean=34.9 years, SD=8.2) and maternal age (Mean=29.4, SD=6.5) for the case population are significantly higher than that for parents of controls ($p<0.05$). A comparison of the joint distribution of age of the parents between the 69 matched pairs using multivariate analysis reveals a significant association between parental (paternal, maternal) age and ASD ($p<0.05$).

Conclusions: Although we have not yet reached our target sample size, we have gained significant insight in conducting epidemiological research on autism in other cultures. Our interim analysis of the 69 matched pairs strongly supports the joint effect (contribution) of the maternal and paternal age on ASD in offspring.

110.122 35 Use of Fertility Therapies In Association with Autism Spectrum Disorders In Children of the Nurses' Health Study II. K. Lyall*[1], S. L. Santangelo[2] and A. Ascherio[1], (1)*Harvard School of Public Health*, (2)*Department of Psychiatry, Harvard Medical School*

Background: Despite great interest in the long-term effects of fertility therapies, little is known about the relationship of various fertility treatments in association with autism and related conditions.

Objectives: To determine the association between maternal use of fertility therapies, including ovulation-inducing drugs and assisted reproductive therapy, as well as other types of therapies, and risk of having a child with an autism spectrum disorder (ASD), and to further examine these associations by advanced maternal age and diagnostic subgroup.

Methods: This was a nested case-control study among participants in the Nurses' Health Study II, a cohort over 116,000 women aged 25-42 at baseline who have provided information on reproductive, health, and lifestyle factors through mailed biennial questionnaires since 1989. In 2005, participants were asked whether they ever had a child diagnosed with ASD. The diagnoses were confirmed by mailing a supplementary questionnaire and by conducting the Autism Diagnostic Interview-Revised in a subgroup. Controls were randomly selected by frequency matching to case children's year of birth. Conditional logistic regression, stratified by child's year of birth, was used to assess the relation between reported fertility therapy and ASD.

Results: Nine percent of the 495 cases and 7% of 2,512 controls indicated use of fertility therapy for the index pregnancy; overall, use of different types of therapies was similar between the two groups. No significant associations were seen in the primary analysis. In the subgroup of women with maternal age > 35 years (n=1,010, including 162 cases), use of OID was associated with an increased ASD risk, but this association did not reach conventional significance after adjusting for potential confounders (OR 1.81, 95% 0.95-3.47). Results were similar by diagnostic subgroup, except that within the advanced maternal age group, OID and AI were significantly associated with mild ASD but not autism.

Conclusions: In this large cohort of nurses, fertility therapies, including ART, do not appear to increase risk of having a child with an autism spectrum disorder. However, the associations observed with ovulation inducing drug use and artificial insemination warrant further investigation, particularly within the subgroup of older mothers, for whom these exposures are more common.

110.123 36 Are Children Born After Assisted Reproductive Technology at Increased Risk of Developing An Autism Spectrum Disorder?. L. Hewitson* and M. Glausser, *Thoughtful House Center for Children*

Background: In the United States, assisted reproductive technology (ART) accounts for an estimated 1% of total births. In the last decade, a number of reports have suggested an increased risk of an autism spectrum disorder (ASD) in children conceived by ART.

Objectives: To determine the rate of infertility and ART in parents of children with an ASD in a clinical practice.

Methods: All new consultations for ASD (n=1117) from 2008-2010 for children ages 2-21 were reviewed and the rates of infertility, the use/type of assisted reproduction, and parental age were recorded.

Results:

A total of 159 (13.1%) parents of children with an ASD had experienced infertility, with 122 (10.0%) requiring some form of ART to conceive. This represents an 8-fold increase over the expected 1.2%. Interestingly, 21 (13.2%) parents reported prior infertility (i.e. required ART to conceive previous children) but their child in the ASD sample was conceived naturally.

Within the ART sample, 57 (46.7%) underwent ovarian stimulation alone; 51 (41.8%) underwent in vitro fertilization or intracytoplasmic sperm injection; and 14 (11.5%) underwent intrauterine insemination. In addition, 5 (4.1%) mothers reported endometriosis; 4 (3.3%) Polycystic Ovarian Syndrome; and 2 (1.6) Antiphospholipid Antibody Syndrome.

There were more multiple births within the ART sample: 31 (25.4%) sets of twins and 10 (8.2%) sets of triplets compared with the ASD sample as a whole: 76 (6.5%) sets of twins and 10 (0.8%) sets of triplets (Chi-square = 179.59, $p<0.001$).

The ratio of males to females in the ART sample was 6.18:1 compared with 4.74:1 in the total ASD sample. There was not a significant association between ART and Sex (Chi-square = 1.15, $p = 0.28$).

Parental age at conception was statistically higher for both mothers (33.6 versus 30.9 yrs) and fathers (35.5 versus 33.9 yrs) of ART/ASD children versus non-ART/ASD children, respectively (♀: t = 5.74, $p < 0.001$; ♂: t = 3.90, $p < 0.001$).

Conclusions: While the rates of infertility in this clinical sample were not higher than what is expected in the general population, there was a significant association between ART and ASD, with an 8-fold increase of ART compared to the general population. This finding confirms a previous report by Filipek et al (2008). As expected multiple births were highly associated with ART procedures; and both maternal and paternal age was higher in the ART sample. As the use of ART increases worldwide, it is important to consider the possible

risks involved, as well as the unknown potential long-term consequences for the offspring. For example, it is possible that ART procedures, including ovarian stimulation and the manipulation of gametes and preimplantation embryos, may be associated with unanticipated epigenetic changes. Large prospective studies are needed to better understand the risks associated with autism and ART.

110.124 37 Maternal Residential Proximity to Toxic Release Inventory Sites In Children with ASD and Other Developmental Disabilities. J. P. Zimmerman*[1], A. Bakian[1], R. Larson[1], R. Satterfield[2] and W. M. McMahon[1], (1)*University of Utah*, (2)*Utah Department of Health*

Background: Researchers have hypothesized that hazardous air pollutant exposures during critical periods of prenatal neurodevelopment could alter normal development.

Objectives: The objective of this study was to explore the hypothesis that a higher proportion of children with ASD and other developmental disabilities had maternal birth addresses within ¼ mile, ½ mile, and 1 mile buffer zones of Toxic Release Inventory (TRI) sites than expected.

Methods: Children born in 1994 (n= 23,609) with ASD (n=99), speech language impairment (SLI, n=838), and/or attention deficit hyperactivity disorder (ADHD, n=47) were identified by the Utah Registry of Autism and Developmental Disabilities. Maternal residential addresses obtained from birth records were geocoded for cases and controls. Environmental air pollutant data specific to TRI sites were obtained by year, chemical type, and annual poundage of emission. The proportion of cases and controls occurring within buffer zones were compared. Observed and expected values (O|E), odds ratios and 95% confidence intervals (OR 95% C.I.) and *P* values were calculated.

Results: Higher than expected proportions of children from the birth cohort with ASD and other developmental disabilities were identified in the one mile buffer zones surrounding some TRI sites by chemical type and annual poundage of emission.

Conclusions: Halogenated chemicals emerged as candidates that warrant further investigation for a possible role in the etiology of ASD and other developmental disabilities. The role of potential confounding variables in this preliminary study needs further exploration.

110.125 38 SSRI Use During Pregnancy and Risk of ASD or Developmental Delay In Children. R. A. Harrington*[1], L. C. Lee[1], C. K. Walker[2], R. L. Hansen[2], S. Ozonoff[2] and I. Hertz-Picciotto[3], (1)*Johns Hopkins Bloomberg School of Public Health*, (2)*University of California at Davis*, (3)*University of California Davis*

Background: Evidence indicates that serotonin is altered in children with an autism spectrum disorder (ASD); however, little is known about the developmental effect of prenatal exposure to medications that act on a child's serotonin system in utero.

Objectives: To provide preliminary data about the developmental effects of prenatal maternal use of selective serotonin reuptake inhibitors (SSRIs), a class of antidepressants. Both overall use and timing of use by trimester were assessed.

Methods: From the Childhood Autism Risks from Genetics and the Environment (CHARGE) study, a large population-based case-control study, we examined mother-child pairs for which self-reported maternal medication history was available (total sample) and a subset consisting of mothers who reported experiencing a mental health disorder at any time prior to their child's birth (mental health subset). The total sample comprised 479 children with ASD, 152 with developmental delay (DD), and 358 with typical development (TD). The mental health subset had 104 with ASD, 33 with DD, and 60 with TD. Children with ASD had an ADI-R and ADOS confirmed diagnosis; Vineland and Mullen scores were used to classify children as DD or TD. Exposure was defined as mothers who reported taking an SSRI at any time between conception and birth. Bivariate logistic regression was used to examine the association between prenatal SSRI exposure and developmental outcomes in children.

Results:

1. In the total sample, SSRIs were used during pregnancy by 29 mothers (6.1%) in the ASD group, 9 (5.9%) in the DD group, and 12 (3.4%) in the TD group. In the subset, SSRI use occurred in 27 mothers (26.0%) in the ASD group, 9 (27.3%) in the DD group, and 11 (18.3%) in the TD group.

2. ASD versus TD: Overall, the crude odds ratio (OR) for SSRI exposure was 1.86 (95% confidence interval (CI): 0.93-3.69). The trimester specific OR's were 1.45 (95% CI: 0.69-3.04), 1.73 (95% CI: 0.71-4.26) and 2.30 (95% CI: 0.97-5.46) for the 1st, 2nd, and 3rd, respectively.

3. DD versus TD: Overall, the crude OR for SSRI exposure was 1.81 (95% CI: 0.75-4.40). The crude

ORs for SSRI exposure were 0.85 (95% CI: 0.27-2.72), 2.42 (95% CI: 0.83-7.02), and 3.18 (95% CI: 1.16-8.71) for the 1st, 2nd, and 3rd trimesters respectively.

4. The trends were similar but attenuated for the mental health subset.

Conclusions: SSRI exposure was similar in the ASD and DD groups, and was lowest in the TD group. Compared to the TD group, the odds of SSRI exposure became increasingly greater from the first to third trimester for both the ASD and DD groups, although the number of mother-child pairs in some subgroups was small. Odds of exposure did not significantly differ between the ASD and DD groups at any time point. Results were similar among mothers who experienced a mental health disorder prior to their child's birth. The crude analysis indicates that timing of prenatal exposure to SSRIs is important to consider when investigating their affect on development. Results adjusting for potential confounders will be discussed.

110.126 39 Effects of Prenatal Stress, Prenatal Diet, and Maternal Genotype on Ultrasonic Vocalizations In Mice. K. L. Jones*, M. J. Will, C. Giesing, P. M. Hecht, C. L. Parker and D. Q. Beversdorf, *University of Missouri*

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 these effects. Therefore, it would be important to determine how prenatal stress, genetic susceptibility to stress, and dietary omega-6 and omega-3 PUFAs interact to affect offspring behavior including communication.

Objectives: In our study, we wished to examine the interaction between the effects of prenatal diet, prenatal stress, and maternal genotype on communicative behavior in newborn offspring in mice.

Methods: Pregnant C57BL/6J and 5-HTT +/- dams were placed into a chronic variable stress group or a control group. Mice placed in the chronic variable stress group were given one stressor per day beginning on gestational day 6 until the birth of the offspring. Additionally, they received one of four diets beginning 2 weeks before breeding and lasting until offspring were weaned: AIN-93G (control), AIN-93G with added safflower oil (high omega-6 PUFA diet), AIN-93G with added flaxseed oil (added omega-3 PUFAs), and AIN-93G with added pure DHA (pure DHA added omega-3 PUFAs). We subsequently recorded the ultrasonic vocalizations (USVs) of the offspring on postnatal day 8 as a measure of social communication.

Results: Our results support our previous findings, in that we observed decreased frequencies and amount of calls of prenatally stressed 5-HTT +/- offspring. Additionally, we observed effects from the omega-6 diet on the USVs in the offspring, as was observed previously with social behavior. Finally, addition of omega-3 interacted with these effects.

Conclusions: This study provides evidence for the roles 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.

110.127 40 Neonatal Morbidity and Risk of Autism Spectrum Disorder (ASD). P. N. Banerjee*[1], E. Jokiranta[2], A. Partanen[2], K. M. Lampi[2], I. W. McKeague[3], A. Sourander[2] and A. S. Brown[4], (1)*Columbia University*, (2)*University of Turku*, (3), (4)*NYSPI*

Background: While there is substantial evidence for a genetic influence upon the risk of Autism Spectrum Disorder (ASD), including infants diagnosed with Childhood Autism, Pervasive Developmental Disorder (PDD),PDD Not Otherwise Specified (NOS), and Asperger's Syndrome, recent research also demonstrates the association between perinatal and prenatal factors and ASD. It has been suggested that those infants most impacted by adverse prenatal and perinatal events exhibit neonatal morbidity. Thus, the aim of this study is to investigate the hypothesis that neonatal disorders mediate the association between perinatal and prenatal factors and ASD.

Objectives: The primary objective of this study is to systematically examine the relation between each neonatal disorder (as specified in the International Classification of Diseases (ICD)-10), and risk of ASD, as well as each ASD subtype, after accounting for factors strongly associated with prenatal and perinatal adversity, such as low birth weight, and other environmental or demographic characteristics previously shown in some studies to be related to ASD (e.g. maternal age, socioeconomic status).

Methods: A nested case-control study design was utilized. All ASD cases born in 1990-2005 were identified from the Finnish Hospital Discharge Register (FHDR). Information concerning controls (1:4), as well as data on neonatal morbidity, was obtained from the Finnish Medical Birth Registry (FMBR). Neonatal disorders: 1. Birth Trauma, (ICD-10, P10-P15); 2. Respiratory and Cardiovascular Disorder of the Newborn, (ICD-10,P20-P29); 3. Newborn Infection (ICD-10,P36-P39); 4. Hemorrhagic and Haematological disorders of the newborn, (ICD-10, P50-P61); 5. Transitory Disorders of Carbohydrate Metabolism Specific to Newborn (ICD-10, P70-P74); 6. Conditions Involving the Integument and Temperature Regulation of the Newborn, (ICD-10, P80-P83); and **7**. Other Neonatal Conditions (ICD-10, P90-P96), were analyzed as grouped/categorized in the ICD-10. Covariate data was collected from the FMBR. Data were analyzed using conditional logistic regression, and associations between neonatal conditions and ASD were estimated using odds ratios (ORs) with 95% confidence intervals (CIs).

Results: Odds ratios from unadjusted univariate analyses revealed newborns diagnosed with "Respiratory and Cardiovascular Disorders" (ICD-10, P20-29) were more likely to be diagnosed with Childhood Autism [OR=1.6 (95% CI: 1.04-2.49)], (p=.03) and PDD [OR=2.3 (1.65-3.21)], (p<.001). "Newborn Infection" (ICD-10, P36-P39) and "Haemorrhagic and Haematological Disorders" (ICD-10, P50-P61), were more likely to be diagnosed with PDD/PDD NOS [OR=1.6 (95% CI:1.02-2.51)], (p=.04), and [OR= 1.6 (95% CI: 1.1-2.4)], (p=.01), respectively. Further exploration of the Haemorrhagic and Haematological Disorders category revealed that neonatal jaundice (ICD-10, P58) was associated with PDD/PDD NOS [OR=1.95, 95% CI: 1.26-3.02], (p=.00) . Additionally, "Transitory Disorders of Carbohydrate Metabolism Specific to Newborns" was associated with ASD (p=.05), [OR=1.4, 95% CI: 1.00-2.01], and PDD/PDD NOS, [OR=2.06, (95% CI: 1.25-3.42)], (p=.00). "Birth Trauma", and "Conditions Involving the Integument and Temperature Regulation of the Newborn", (ICD-10, P80-P83), were unrelated to diagnosis of ASD, (p=.95) and (p=.86), respectively.

Conclusions: It is necessary to further explore each of the neonatal disorders that are included in each of these broad ICD-10 categories of neonatal morbidity, and their relation to ASD. Further understanding of the role of neonatal disorders in the development of ASD may inform treatment and prevention of the disorder.

110.128 41 A Preliminary Investigation of Prematurity Status and Clinical Presentation In Children with Autism Spectrum Disorders. K. B. Hornbeak*[1], R. A. Libove[1], J. M. Phillips[2], A. A. Penn[1], K. J. Parker[1] and A. Y. Hardan[1], (1)*Stanford University School of Medicine*, (2)*Stanford University School of Medicine/Lucile Packard Children's Hospital*

Background: Autism spectrum disorders (ASD) are highly sexually dimorphic conditions affecting males with greater frequency than females. Recent reports suggest that ex-preterm children are at an increased risk for developing ASD. Children with ASD born at term versus those born prematurely may have differences in clinical phenotype that could potentially be distinguished on the basis of clinical and/or cognitive features and/or proxy markers. ASD in ex-preterm children may be a manifestation of wide cognitive deficits and comparing these children to those with ASD born at term might help in the identification of a subgroup with specific developmental patterns and prognosis. Therefore, we hypothesize phenotype dimorphism in the clinical presentation of ASD symptoms in children born at term compared to those born preterm.

Objectives: Our objectives are three fold: 1) to determine if ASD children born at term versus those born preterm can be distinguished on the basis of clinical features; 2) to evaluate differences in ASD phenotype in children born at term and preterm using proxy markers for in utero androgen exposure; 3) to examine any head circumference differences as related to prematurity status.

Methods: Children with ASD born at term (≥37 months) and born preterm (≤36 months) between the ages of 3 and 12 years were included in this study. ASD diagnosis was based on Autism Diagnostic Interview Revised (ADI-R), Autism Diagnostic Observations Schedule (ADOS), and expert clinical opinion. Measures included the Stanford Binet, 5th Edition, the Vineland Adaptive Behavior Scales, 2nd Edition, and the Affect Recognition and Theory of Mind subscales of the NEPSY-II. Parent report measures included the Social Responsiveness Scale (SRS), the Repetitive Behavior Scale Revised (RBS-R), and the Sensory Profile Questionnaire (SPQ). Furthermore, a toy preference task used to determine gender specific toy preference and ratio measurements of the 2nd to 4th digits were both used as proxy measures of exposure to in utero androgens.

Results: To date, data from 27 ASD subjects born at term and 13 ASD subjects born preterm have been collected. There were no significant differences between the two groups on the SRS,

RBS-R, or SPQ. In addition, no differences between the two groups were found on 2nd to 4th digit ratio or head circumference measurements.

Conclusions: Findings from this preliminary investigation show no behavioral or proxy marker differences between children with ASD born preterm when compared to children born with ASD at term. These observations suggest that children with ASD born preterm and at term appear to be phenotypically similar based on the measures assessed. However, our sample size is small and additional data are required to assess if group differences are evident in a larger sample size.

110.129 42 Cesarean Birth and Autism Spectrum Disorder. C. K. Walker*, P. Krakiowiak, A. S. Baker, R. L. Hansen, S. Ozonoff and I. Hertz-Picciotto, *UC Davis*

Background: Some studies have suggested a higher risk for autism spectrum disorder (ASD) after cesarean birth. Such an association could stem from physical consequences of the operation itself or from the indications which led to the decision to perform the cesarean delivery.

Objectives: We hypothesize that children with autism spectrum disorder are more likely to have been the product of aberrant labor courses that result in non-elective cesarean delivery.

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 the course of labor and delivery were available for the mothers of 477 children with a diagnosis of autism spectrum disorder (ASD) and 272 population-based frequency-matched controls. 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 medical conditions of pregnancy as well as the labor and delivery process were abstracted in a systematic fashion. We performed the Autism Diagnostic Interview–Revised and the Autism Diagnostic Observation Schedule on study cases to confirm the diagnosis of autism. Logistic regression was used to examine the relationships between delivery mode and autism status. Because the risk of intraamniotic infection (IAI), use of antimicrobials, and cesarean rates and indications vary according to gestational age, we generated a Cox proportional hazards regression model with time-dependent covariates as a mechanism to evaluate the combined effects of IAI risk and antimicrobial use on mode of delivery.

Results: After adjustment for preeclampsia and / or diabetes and IAI risk, non-elective cesarean delivery following labor and / or ruptured membranes was more common among mothers whose children developed ASD compared with those who delivered vaginally (OR 1.71, 95% CI 1.04, 2.81). There was no association between elective cesarean delivery and ASD. A Cox proportional regression analysis examining the effect of IAI risk and antimicrobial use on the outcome of non-elective cesarean delivery and controlling for labor duration identified that women with both IAI risk and antimicrobial usage were twice as likely to have had a non-elective cesarean delivery compared to women who did not have IAI risk and did not take antimicrobials (OR 2.14, 95% CI 1.12, 4.07).

Conclusions: Our analysis suggests that it is not birth by cesarean itself that is associated with ASD. Rather, it appears that factors associated with difficult labor courses, including prolonged labor and membrane rupture, as well as occult and overt infection within the amniotic cavity may drive the relationship between non-elective cesarean delivery and ASD.

110.130 43 Birth Weight Characteristics and Risk of Autism In Finland. K. M. Lampi*[1], A. Partanen[1], P. N. Banerjee[2], A. S. Brown[3] and A. Sourander[1], (1)*University of Turku*, (2)*Columbia University*, (3)*NYSPI*

Background: Several studies have explored associations between birth weight characteristics and autism spectrum disorders (ASD). However, findings from recent population-based studies have remained inconsistent. For example, associations between low birth weight, abnormal gestational age, being small for gestational age (SGA) and autism has been reported in some studies, whereas others have found no associations between these neonatal risk factors and ASD. The increased risk of ASD related to birth weight characteristics has been suggested to be mediated by prenatal or neonatal complications and genetic predisposition.

Objectives: To compare birth weight, gestational age and weight for gestational age (WGA) with the outcome of childhood autism in the Finnish population 1987 - 2007.

Methods: A nested case-control study. Cases were identified from the Finnish Hospital Discharge Register (FHDR) and controls (1:4) were defined from the Finnish Medical Birth Register (FMBR). Data on birth weight and gestational age was obtained from the FMBR. Birth weight categories were: ≤ 1500, 1501 to 2500, 2501 to 4000, 4001 to 4500 and ≥ 4501 g. Gestational age was categorized into four categories: ≤ 31, 32 to 37, 38 to 41 and ≥ 42 weeks. WGA was estimated according to Finnish birth weight standards and it was categorized into three groups: small for gestational age (SGA, < -2 SD), appropriate for gestational age (AGA, -2 SD - + 2 SD)

and large for gestational age (LGA, > +2 SD). Sociodemographic confounders (maternal age and maternal socioeconomic status, SES) and potential markers for genetic susceptibility (parental psychiatric history) were included in adjusted analyses.

Results: A total of 1132 cases and 4538 controls were identified from the FHDR. In unadjusted analyses, all three neonatal factors were associated with the outcome of childhood autism (very low birth weight, <1500g: OR 1.89; CI 1.1, 3.4; p=.034, very short gestational age, <31 weeks: OR 2.13; CI 1.1, 4.1; p=.025 and being SGA: OR 1.68; CI 1.2, 2.5; p=.008). However, none of the associations remained statistically significant in adjusted analyses, although SGA status approached significance (OR 1.52; CI 0.98, 2.4; p=.062).

Conclusions: We found no evidence that low birth weight, abnormal gestational age or SGA/LGA would increase the risk of childhood autism. No independent effects were found for birth weight characteristics after adjusting for maternal sociodemographic factors (age and SES) and for both maternal and paternal psychiatric history, which represented markers for genetic susceptibility. It has been suggested that obstetric and neonatal factors may play a role in autism etiology especially among those with low genetic susceptibility, but have a lesser role in individuals with genetic predisposition. We believe that our sample is representative of the severe end of the autism spectrum and other diagnostic/milder subtypes of ASD need to be studied in the future.

110.131 44 Effect of Suboptimal Breastfeeding on Occurrence of Autism: A Case Control Study. Y. Alfarsi*, M. M. Al-Sharbati, M. I. Waly, O. A. Al-Farsi, M. Al-Shafaee and M. M. Al-Khaduri, *Sultan Qaboos University*

Background:

Several studies have shown that breastfeeding has a protective effect on the risk of autism spectrum disorder and is associated with improved cognitive development later in childhood and adolescence.

Objectives:

To evaluate the association between suboptimal breastfeeding practices and autism spectrum disorders.

Methods:

A case-control study was conducted among 102 ASD cases and 102 controls.

Results:

Adjusted odds ratios (OR) from logistic regression models, ASD was found to be associated with late initiation of breastfeeding (OR = 1.48; 95% CI 1.01, 3.1), non-intake of colostrum (OR = 1.7; 95% CI 1.03, 4.3), prelacteal feeding, and bottle feeding. The risk of ASD was found to decrease in a dose-response fashion over increasing periods of exclusive breastfeeding (trend p value = 0.04) and continued breastfeeding (trend p value = 0.001).

Conclusions:

This study indicates that increased autism spectrum disorder risk is generally associated with suboptimal breastfeeding practices.

110.132 45 A Preliminary Examination of Maternal Depression In Mothers of Infants at Risk for ASD. F. Martinez-Pedraza*[1], T. W. Soto[1], M. Maye[2] and A. S. Carter[3], (1)*University of Massachusetts, Boston*, (2)*University of Massachusetts - Boston*, (3)*University of Massachusetts Boston*

Background: Mothers of children with autism spectrum disorders (ASD) tend to show higher levels of depression compared to mothers of typically developing children (Montes & Halterman, 2007). However, little attention has been given to the study of depressive symptoms in mothers of infant siblings of children with ASD. Given that maternal depression is associated with negative maternal outcomes and child outcomes (Cummings & Davies, 1994), including language, cognitive, and social deficits (Brennan et al., 2000), this may be an important covariate to consider when exploring the influences on sibling and mother outcomes. The first step in examining this question is to explore if there are differences in depressive symptoms between mothers of infants at risk for ASD versus mothers of low-risk siblings.

Objectives: 1) To compare the levels of depressive symptoms among mothers of infants at risk and mothers of low-risk infants over time; 2) To examine group differences in the amount of mothers meeting clinically significant criteria for depressive symptoms within each group at each time.

Methods: As part of a longitudinal study of infant siblings of children with ASD, mothers of infants at risk for ASD (n = 59) and mothers of low-risk infants (n = 32) completed the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) at three different times (infants 12 months, 18 months, and 24 months of age).

Results: A mixed ANOVA was conducted to assess group (n_{ASD} = 19, $n_{control}$ = 18) and time (12 months, 18 months, and 24 months of age) differences in levels of maternal depression. Results indicate a significant main effect of group, F (1, 35) = 5.476, p =.025, partial eta^2 = .135, but not of time, F (2, 70) = .727, p = .487, partial eta^2 = .02. There was no interaction effect of time and group, F (2, 70) = .423, p = .657, partial eta^2 = .012. To further examine the clinical significance of these findings, a chi-square test was used to evaluate whether there are more mothers with clinically elevated depressive symptoms among the siblings at risk versus siblings not at risk groups (n_{ASD}=59; $n_{Control}$=32). These results indicate there is no significant relationship between maternal depression at 12 months and group (x^2_1 = 3.67, p = .055, phi = .201), nor at 18 months (x^2_1 = 2.375, p = .123, phi = .196), but there is a significant relationship at 24 months (x^2_1 = 5.021, p = .025, phi = .342). This indicates that mothers of infant siblings at risk for ASD endorse symptoms of depression significantly more than the control group.

Conclusions: Results suggest that mothers of infants at risk for ASD are more depressed than mothers of low-risk infant siblings, and this difference became clinically significant as the infants aged. Although the sample size for these analyses is small, the moderate effect sizes indicate that maternal depression may be an important covariate to consider in further studies investigating the well-being of infants at risk for ASD and their mothers.

110.133 46 Selected Vitamin D Metabolic Gene Variants and Risk for Autism Spectrum Disorders In the CHARGE Study. R. J. Schmidt*[1], R. L. Hansen[2], J. Hartiala[3], H. Allayee[3], L. C. Schmidt[4], F. Tassone[4] and I. Hertz-Picciotto[1], (1)*University of California Davis*, (2)*University of California, Davis, MIND Institute*, (3)*University of Southern California Keck School of Medicine*, (4)*University of California Davis School of Medicine*

Background:

Causes of autism are unknown, though genetic contributions are well-accepted. Sufficient levels of vitamin D are essential for proper neurodevelopment, cognitive and behavioral function, and suppression of autoimmune and inflammatory responses. Associations between autism and gene variants in the vitamin D pathway have not been reported.

Objectives:

To examine associations between autism and common, functional polymorphisms involved in vitamin D uptake and metabolism in maternal, paternal, and child blood samples.

Methods:

Northern California families were enrolled from 2003-2009 in the population-based case-control CHARGE (Childhood Autism Risks from Genetics and the Environment) Study. Children aged 24-60 months were evaluated and confirmed to have autism spectrum disorder (ASD, n=474), or typical development (TD, n=281) at the University of California, Davis M.I.N.D. Institute using standardized clinical assessments, including: the Autism Diagnostic Observation Schedule, Autism Diagnostic Interview–Revised, Mullen Scales of Early Learning, Vineland Adaptive Behavior Scales, and the Social Communication Questionnaire. Adjusted odds ratios (OR) were estimated for associations between autism and maternal, paternal, and child *TaqI*, *BsmI*, *FokI*, *Cdx2*, variants in the vitamin D receptor (*VDR*) gene, and *CYP27B1* rs4646536, *VBP* rs4588, and *CYP2R1* rs10741657 genotypes.

Results:

DNA samples were provided and genotyped for 384 (81%) families of children with ASD and 234 (83%) families of TD children. Paternal homozygous variant genotypes for the *TaqI* and *BsmI* polymorphisms on the *VDR* gene, and *CYP27B1* rs4646536 were associated with significantly increased risk for ASD when compared to the combination of homozygous wild type and heterozygous genotypes (OR=6.3, 95% confidence interval [CI]: 1.9-20.7; OR=4.7, 95% CI: 1.6-13.4; and OR=2.2, 95% CI: 1.0-4.9, respectively). Results were similar when the case group was limited to children meeting criteria for autism (n=264). There was no confounding by race, or other demographic variables. Only *VBP* rs4588 showed evidence for vulnerability to population structure bias.

Conclusions:

This study provides preliminary evidence that paternal vitamin D metabolism might play a role in the etiology of ASD, but there were limitations due to the sample size.

110.134 47 Yield of Routine Fragile-x Screen In Children with Autism, Is It Cost Effective?. S. M. Al Salehi*, *King Fahd Medical City*

Background:

As the prevalence of autism increases world wide, approach of professional communities to deal with it is not the same, especially the medical part where resources are not the same and it would be critical to allocate them efficiently. When it comes to investigations physicians vary on the tests and procedure the do. In this paper we will present our data of

fragile-x testing as routine study for children with autism, and discuss the findings as compare to the international literature.

Objectives:

This article aims find out if routine fragile–x screen is cost effective as services test for all children diagnosed with autism? And to see what of kind of autistic children most likely to have a positive fragile x screen?

Methods:

We reviewed medical records for all children diagnosed with autism through King Fahd Medical City, Children Hospital autism clinical program between 2008-2010 where referred children are assessed by multidisciplinary team(developmental behavioral pediatrician, PhD clinical psychologist, speech pathologist and social worker), all children had detailed clinical assessment using DSMIV criteria plus, CARS, IQ, chromosomal karyo-typing and hearing assessment, most of them had fragile-x screen. With simple analysis we look for how may came positive for fragile-x screen and what is their phenotype.

Results:

266 children where diagnosed with autism, 194 had fragile x screen (available results of tests till Dec,2010) 4 had positive fragile-x testing (2%), 100% of those with positive fragile-x test had clinical features of fragile-x syndrome.

Conclusions:

In the absence of clinical features of fragile-x syndrome doing routine fragile-x screen is not cost effective for clinical service, this may not be applicable for research programs.

110.135 48 Medical Problems Co-Occur with Autism Spectrum Disorders and Affect the Clinical Presentation. D. A. Zachor*[1] and E. Ben Itzchak[2], (1)*Tel Aviv University / Assaf Harofeh Medical Center*, (2)*Ariel University Center/ Assaf Harofeh Medical Center*

Background:

Medical conditions, including, sleep, eating and gastrointestinal (GI) problems and the presence of minor neurological dysfunction (MND), have been reported in autism spectrum disorders (ASD). Few studies have investigated the relationship between these medical problems and clinical manifestations in ASD.

Objectives:

1. To describe the frequencies of sleep, eating and GI problems and MND in a large cohort with ASD; 2. To examine the relationship between these medical conditions and autism severity and adaptive functioning

Methods:

Of 637 participants evaluated in a tertiary autism center, 529 were diagnosed with ASD and 108 received other diagnoses (developmental delay, specific language impairment, ADHD, and more). Medical histories were obtained from parents and a comprehensive neurological examination was performed by a pediatric neurologist. Evaluations of autism severity were based on the Autism Diagnosis Observation Schedule (ADOS) and the new ADOS severity scale. Adaptive skills were assessed using the Vineland Adaptive Behavior Scales. Non-parametric tests were used for nominal variables and MANCOVAs controlling for age were used for scale variables (adaptive skills, autism severity).

Results:

Sleep problems were not significantly different in the ASD cohort (N=185; 38.3%) in comparison to the non-ASD group (38.8%). In the ASD cohort, the group without sleep problems had better adaptive functioning than the group with sleep problems. Differences were noted in three adaptive domains: communication ($p<.01$), daily living ($p<.05$) and socialization ($p<.05$). Autism severity scores did not differ in these groups. Eating problems were significantly more common in the ASD cohort (N=191; 38.7%) than in the non-ASD group (28%), $\chi^2(3)=43.4$, $p<001$. Eating problems in the ASD cohort included minor food selectivity (N=112; 22.7%), major food selectivity (N= 69; 14%) and motor related eating problems (N=10; 2%). The group with no or minor eating problems had better adaptive functioning only in the daily living skills domain than the group with major eating problems ($p<.05$). Autism severity scores were not different in these groups. GI problems were documented in 16.7% of the ASD cohort and in 23.8% of the non-ASD group with no significant difference between the groups. Adaptive functioning and autism severity scores were not different in these groups. Having MND was very common in the ASD cohort (N= 274; 57%), but not significantly different than the rate in the non-ASD group (47%). The most common MND in the ASD cohort were: hyperlaxity of joints (34.8%), abnormal deep tendon reflexes (30.3%), hypotonia (27.9%),

cerebellar dysfunction (17.2%) and hypertonia (2.3%). Comparison of adaptive skills functioning revealed that the group with intact examination had better motor skills (85.9±13.5) than the group with MND (80.0±16.9) [$F(1,343)=11.5$, $p<.001$, $\mu^2=.032$]. Autism severity scores were not different in these groups.

Conclusions:

Eating, GI and sleep problems and minor neurological dysfunction co-occur frequently in ASD and in other developmental disabilities. However, only food selectivity problems are more common in ASD. These medical problems affect adaptive functioning but not autism severity. Assessment and treatment of these medical problems in ASD is of great importance.

110.136 49 ASD Co-Occurring Conditions and Change of ASD Diagnosis. H. Close*, L. C. Lee and C. N. Kaufmann, *Johns Hopkins Bloomberg School of Public Health*

Background: Researchers have recently begun to understand the importance of co-occurring developmental and psychiatric conditions in the context of proper diagnosis and treatment of autism spectrum disorders (ASDs). Previous studies have shown high rates of co-occurring developmental and psychiatric disorders in children with an ASD, while stability of ASD diagnosis seems to vary (75 – 95%). The need for a better understanding of the extent to which ASD co-occurring conditions are associated with ASD diagnosis and diagnostic change is warranted.

Objectives: This study aims to investigate associations between common co-occurring conditions in ASDs and ASD diagnosis change across three developmental stages: young children (ages 3 – 5), children (ages 6 – 11) and adolescents (ages 12 – 17).

Methods: The US 2007 National Survey of Children's Health dataset was obtained. Two study groups across three developmental stages were defined based on parent-reported data: 1) reported current ASD diagnosis (n=154 for ages 3-5; n=373 for ages 6-11; n=386 for ages 12-17), and 2) past but no current ASD diagnosis (n=53 for ages 3-5; n=189 for ages 6-11; n=211 for ages 12-17). Co-occurring conditions of interest included ADHD, learning disability, developmental delay, speech problems, hearing problems, anxiety, depression, behavioral or conduct problems, and seizures or epilepsy. Multinomial logit models were carried out to examine the association between co-occurring conditions and a current or past ASD diagnosis. Odds ratios were computed by taking the odds of each co-occurring condition for the current ASD group and comparing against the odds of the condition for the past ASD group. Confounding variables adjusted in multivariate regression models included race, ethnicity, maternal education, and individualized education plan.

Results: Results from multivariate analysis indicated that co-occurring conditions distinguishing the two study groups are: 1) current moderate/severe learning disability (Adjusted Odds Ratio [AOR]=11.07, 95% Confidence Interval [95%CI]: 2.48-49.49), current moderate/severe developmental delay (AOR=9.20, 95%CI: 1.90-44.42), and past anxiety (AOR=13.46, 95%CI: 1.08-167.20) in ages 3-5; 2) past speech problem (AOR=3.85, 95%CI: 1.09-13.67), current moderate/severe anxiety (AOR=3.51, 95%CI: 1.28-9.65), and past hearing problem (AOR=0.23, 95%CI: 0.06-0.83) in ages 6-12; and 3) current moderate/severe speech problem (AOR=3.91; 95%CI: 1.56-9.75), current mild seizure/epilepsy (AOR=10.48; 95%CI:2.25-48.87), and past hearing problem (AOR=0.11; 95%CI: 0.01-0.93) in ages 13-17. Due to small numbers (n<5) of some co-occurring conditions in the past age 3-5 ASD group, results of this age group need to be interpreted with caution.

Conclusions: This analysis showed that children with current ASD diagnosis are significantly more likely to have speech problems in the past and current moderate/severe anxiety, but less likely to have hearing problems, as compared to same age children with past ASD diagnosis. On the other hand, adolescents with current ASD diagnosis have more current, moderate/severe speech problems and current, mild seizures but fewer past hearing problems. Some co-occurring conditions are associated with the change of ASD diagnosis in children and adolescents with an ASD diagnosis. Effort is needed to clarify whether the change of ASD diagnosis (persistent vs. "grew out" of the diagnosis) is due to etiologic differences or diagnostic determination.

110.137 50 Evidence Indicating That Desulfovibrio Species May Play An Important Role In Autism, Pilot Study. S. Finegold*[1], J. A. Green[2], S. Dowd[3], D. Granpeesheh[4], J. Tong[5] and P. H. Summanen[5], (1), (2)*The Evergreen Center*, (3)*MBRI*, (4)*Center for Autism and Related Disorders*, (5)*VAMC WLA*

Background: In 2007, the incidence of autism in the US was 1%. We previously documented significant differences in bacterial phyla in feces of autistic children and controls.

Objectives: To study the incidence of *Desulfovibrio* in stools of children with regressive autism.

Methods: Blinded stool specimens from children with autism, healthy sibling controls, and non-sibling controls were studied by anaerobic culture and real-time PCR. *Desulfovibrio* was identified by 16S rRNA sequencing. *Desulfovibrio* was tested for antimicrobial susceptibility using the CSLI procedure.

Results: There was overall agreement between culture and real-time PCR results (p value = 0.005). Autistic subjects had statistically significantly higher percent of stools positive for *Desulfovibrio* by culture or real-time PCR compared to control subjects (p value=0.003). Comparison of autism severity with percent positive for *Desulfovibrio* by culture or real-time PCR showed a dose response (p value = 0.03). Using culture or real-time PCR showed a sensitivity of 47%, specificity of 90%, and unweighted accuracy of 68%. The *Desulfovibrio* strains were β-lactamase-positive and resistant to various antimicrobials, such as trimethoprim/sulfamethoxazole.

Conclusions: Our results indicate that *Desulfovibrio* may account for the pathophysiology of autism and its resistance to antimicrobials may precipitate autism in predisposed children. If these studies are confirmed and extended by a treatment trial that correlate elimination of *Desulfovibrio* with clinical and physiologic improvement, they could lead to 1) reliable classification of autism, 2) a diagnostic test for regressive autism (real-time PCR gives accurate, quantitative results in 2-3 hours), 3) antimicrobial therapy, 4) treatment with preformed antibodies against the organism, 5) tailored probiotics /prebiotics for therapy and prophylaxis, 6) prevention with an oral vaccine, 7) clues to diets that might limit colonization with *Desulfovibrio* and 8) epidemiologic information that could explain the rapid increase in autism and the presence of multiple cases in families and confirm the important role of certain antimicrobial agents in causation of autism.

110.138 51 Autism In An American Indian and Alaska Native Sample: The Contribution of Demographic Characteristics, Levels of Acculturation, and Cultural Values and Beliefs on Service Utilization. J. Wendt*[1] and A. J. Lincoln[2], (1), (2)*Alliant International University;Center for Autism Research, Evaluation and Service*

Background: Autism prevalence rates are assumed to be unbiased across ethnicity. However, the prevalence of identified cases of autism within the American Indian and Alaska Native population in California is much less than that observed for other ethnicities and lower than the expected rate. American Indians / Alaska Natives (AI/ANs) with autism are virtually absent from scientific literature yet the AI/AN literature regarding general healthcare supported that AI/ANs may experience barriers that result in less frequent reporting to or accessing services from a state agency for autism.

Objectives: The objective of this study was to examine the contributions of cultural characteristics of the AI/AN population with respect to the utilization of state-funded services for autism spectrum disorder. More specifically, this study compared the AI/AN population to the Hispanic population; an ethnic population most similar in cultural characteristics yet with a much higher identified prevalence rate of autism.

Methods: This study collected data from the AI/AN population, diagnosed with autism and registered with the California Department of Developmental Services (DDS). The data was examined in comparison to a control group of similar cultural characteristics (Hispanics) yet with a much higher rate of autism reported to DDS. Data was collected from DDS records and survey information from the identified populations.

Results: Participants were 37 people with Autism Disorder, recruited from the registry of the California Department of Developmental Services and identified as consumers of services coordinated by the California Regional Center System: American Indian and Alaska Native (n=18) and Hispanic (n=19). All participants were age 3 years or older, with a diagnosis of Autism. Aside from the difference in reported rates of autism, the study found no differences in cultural characteristics between AI/ANs and Hispanics but rather similarities: the number of services received for autism, the age of autism diagnosis, the geographic distance traveled to access services and beliefs regarding the cause and treatment for autism.

Conclusions: It was found that AI/AN and Hispanic groups reported similar cultural characteristics in regards to autism as supported by the literature. Although similar characteristics were found, there remains a discrepancy regarding the prevalence rate of autism found within the two groups. This study was a first attempt to look at possible reasons why AI/AN population may be under-identified with autism and future research is needed in order to answer this question.

110.139 52 The Relationship of US Autistic Disorder Changepoints to Proposed Environmental and Sociologic Causes. M. LaMadrid*, C. Brown and T. A. Deisher, *Sound Choice Pharmaceutical Institute*

Background: Recently, the EPA (Environmental Protection Agency) published a study that analyzed time trends in the cumulative incidence of autistic disorder (AD) in the US, Denmark, and worldwide. A birthyear changepoint around 1988 was identified. It has been argued that the epidemic rise

in autism over the past 3 decades is partly due to a combination of sociologic factors – changes in diagnostic rules, improved detection and availability of special education resources. Without debating whether these proposed sociologic and environmental factors have increased, this study has calculated changepoints for these factors in order to determine their relevance to autistic disorder.

Objectives: To compare the relationship between changepoints in autistic disorder (AD) rates and changepoints in proposed sociological and environmental causes of autism.

Methods: US and California AD prevalence or cumulative incidence were collected from previously published articles. Sociologic data were objectively represented as follows: improved detection was represented by the number of professionals who can diagnose autism, the number of Pubmed publications on autism, and the number of autism-related messages in Yahoo groups; the numbers were normalized to appropriate background counts. Dissemination of DSM revisions was represented by printing dates for each version. The availability of special education resources was represented by the amount of federal funding per year. The usage history of a proposed environmental cause, thimerosal in vaccines, was reviewed. When enough data were available, changepoints are defined to be the year when a slope change occurs; piecewise linear regression fits (2 lines or 3 lines) were used to calculate these changepoints. Otherwise, changepoints were predicted based on the birthyears first potentially impacted by a specific DSM or vaccine event.

Results: Additional birthyear changepoints were identified from AD data: 1980.9 [95%CI: 1978.6- 1983.1], 1988.4 [95%CI: 1987.8-1989.0] and 1995.6 [95%CI: 1994.6-1996.6], confirming and expanding the EPA work for US data. AD birthyear changepoints significantly precede the changepoints calculated for indicators of increased social awareness of AD (1997-1999). Only the 1988 changepoint can be associated with a thimerosal vaccine event, however, low compliance may lessen the importance of that association.

Conclusions: This study confirms the 1988 changepoint detected by EPA and adds 1981 and 1996 as additional changepoints. AD birthyear changepoints, particularly 1981 and 1996, cannot be explained by predicted birthyear changepoints based on altered thimerosal content in vaccines nor on revised editions of the DSM.

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110 Epidemiology : Prevalence, Trajectories, Interventions

110.092 71 Age, Period, and Cohort Effects In the Incidence of Autism In California From 1994 to 2005. K. M. Keyes* and P. S. Bearman, *Columbia University*

Background: The prevalence of autism in the U.S. has dramatically increased over the last 10 years. Decomposition of autism incidence rates into age, period, and cohort effects provide a nuanced analysis of underlying classes of factors that may be etiologically linked to time trends.

Objectives: We estimate an age-period-cohort effect model for autism incidence and additionally examine variation in effects by autism severity.

Methods: Data were drawn from California birth records; autism diagnoses were ascertained via records from the California DDS Client Development and Evaluation Report. Generalized estimating equations were used to model age, period, and cohort effects in a repeated measures dataset that included person-years for each child from age two through age 12.

Results: Compared to those born in 1992, each successively younger cohort has significantly higher odds of an autism diagnosis than the previous cohort, controlling for age and period effects. The cohort effect observed in these data was primarily limited to high functioning children with autism; trends by cohort are less evident among low functioning children with autism. Age is strongly related to autism diagnosis, with those aged 3 at 37 times the odds of autism compared to those aged 2 (95% C.I. 31.7-43.9). We also document a significant effect of period; regardless of age and birth cohort, those observed in 1995 have 3.75 times the odds of an autism diagnosis compared to those observed in 1994 (95% C.I. 2.4-5.9).

Conclusions: Autism incidence in California exhibits a robust and linear positive cohort effect that is primarily confined to high functioning autism cases. This finding supports the hypothesis that a proportion of the autism trend is due to diagnostic drift as the signs and symptoms of autism spectrum disorders become more well-known. Period effects in these data possibly reflect changing diagnostic systems, and contribute to observed increases in autism incidence.

110.093 72 Diagnosis Stories: Narrative Approaches to Understanding African American Mothers' Experiences of Their Children's ASD. M. C. Lawlor* and O. Solomon, *University of Southern California*

Background:

Research on the impact of a child's developmental disability on the family has focused primarily on parental functioning and psychological well-being relative to the kind of the disability (e.g.,autism vs. Down syndrome), its severity, and perceived parental burden and stress (Abbeduto et al., 2004; Dumas et al., 1991; Koegel et al., 1992). Parents of children with ASD report significantly more stress than parents of typically developing children and parents of children with other disabilities (Kasari & Sigman, 1997). While the group design of these studies provides important information about commonalities of parental experience, there is a need for a nuanced, socio-culturally situated understanding of family members' experiences (Lawlor & Mattingly, 2009) of raising a child with ASD. This study addresses a paucity of research on African American families' experience of ASD in the context of everyday life, especially in light of health and service disparities related to ASD diagnosis and services (Lord & Bishop, 2010; Mandell et all., 2002, 2007, 2009; Shattuck & Grosse, 2007).

Objectives:

1) To provide a socio-culturally situated account of African American mothers' experience of ASD diagnosis to complement studies on parental stress and well-being: 2) To examine how African American mothers narrate their experiences of interacting with professionals in the course of their children's diagnostic evaluations; and 3) To analytically capture diversity in the family life and experience of ASD while identifying themes and issues that hold across families.

Methods:

Diagnosis narratives were selected from video and audio interviews with 24 mothers collected for: 1) the longitudinal urban ethnographic study 'Boundary Crossings: Resituating Cultural Competence' that examines family life among 30 African American families and their children with chronic illnesses and conditions, of which a sub-sample had a diagnosis of ASD, and 2) the urban ethnographic study "Autism in Urban Context: Linking Heterogeneity with Health and Service Disparities" that examines health and service disparities in ASD diagnoses among 20 African American families. Narratives were analyzed along three dimensions: 1) chronologically, beginning with first concerns and ending with the child's diagnosis of ASD; 2) epistemically, following the mothers' understanding about their child's condition and their engagement with educational and clinical institutions; and 3) thematically, identifying developing and recurrent themes within and across a mother's narratives, and across narratives of different mothers.

Results:

Preliminary findings suggest that 1) chronologically, mothers narrate the experiences based upon a timeline of remembered noticings and the dates of clinical evaluations that led to an ASD diagnosis; 2) epistemically, the mothers evinced understanding of their child's particular kind of ASD; and 3) thematically, sources and nature of evidence, clinicians' and mothers' partnering up, and views of the child's abilities relevant to the future were present across the data.

Conclusions:

African American mothers 'diagnosis stories' provide a lens on their experience of how, when and by whom a child's atypical development was noticed, interpreted and identified. These stories offer a valuable perspective on the barriers to and opportunities for African American children receiving timely and accurate diagnosis and appropriate services.

110.094 73 Extending Social Competence Intervention (SCI) for Adolescents with HFA/AS into Schools. K. V. O'Connor*, S. McGhee, S. Leinert, M. Herzog and J. P. Stichter, *University of Missouri*

Background:

Despite frequent reports of academic success, individuals with high functioning autism or Asperger's Syndrome (HFA/AS) often manifest deficits in social abilities. These deficits can lead to daily difficulties and negative long-term outcomes. The SCI research team originally developed a social competence curriculum to target these abilities for youth with ASD in an after-school program. Initial findings (Stichter et al., 2010) have been promising for the efficacy of the after-school Social Competence Intervention (SCI-A) program for addressing these impairments in adolescents (11-14 yrs of age) with HFA/AS. Despite positive outcomes, the direct applicability of the after-school program for delivery in typical education setting remained unknown. Thus, the current study modified the existing SCI curriculum into a cost-effective intervention model that addresses a subset of social skill deficits for these students that can be administered and sustained in educational settings. This project is a three-year development grant funded by Institute of Education Sciences.

Objectives:

To determine the feasibility and sustainability of the Social Competence Intervention within the school setting (SCI-S). The pilot study is designed to impact social competence performance for a specific subtype of adolescents with social

deficits, a FS IQ 70+, and access to general education settings. This study was also conducted to monitor and adjust the development and implementation of the program in the school setting for maximum program benefit for schools and students.

Methods:

The SCI-S program has completed year two of a three-year initiative to build capacity in the schools. Throughout program implementation the curriculum moves from being led by research staff to being led independently by school staff. This program employs measures to both evaluate the translation of the clinic-based program into an educational setting (e.g., fidelity) as well as to determine student outcomes. Standardized assessments were administered pre- and post-intervention to evaluate programmatic effectiveness and the impact of the intervention curriculum on: Social Behavior, Theory of Mind, Executive Function and Emotion Recognition. The curriculum involves a semester long course consisting of five units, six lessons per unit in a small group format.

Results:

Initial results of Year 1 of SCI-S (N=12) indicate improvements in direct measures of Emotional Recognition (p<.05) and Executive Function (p<.05) as well as improvement on standardized parental and teacher reports of social behavior (p<.05) and executive functioning (p<.05). Year 1 demonstrated overall fidelity of implementation of content and process as 90.3%. Results of Year 2 (N= 12) will also be reported for both intervention outcomes as well as fidelity of implementation.

Conclusions:

Results indicate promise for successful translation the after school program into a school setting with positive results for participants. Year 1 results provide support that the program can be implemented with fidelity n the school setting while also evidencing gains that were relatively consistent with previous clinic based results. Results indicate promise for enhanced response to treatment in the area of designing interventions that target subtypes of individuals with social deficits.

110.095 74 The Disappearing Seasonality of Autism Conceptions In California. S. Mazumdar*, *Columbia University*

Background: Autism prevalence has increased dramatically motivating research for causative agents.Numerous studies have attempted to explore seasonality of autism births. However, the seasonality of autism conceptions are of greater scientific interest. Our study addresses this gap in research, in addition of making significant methodological contributions.

Objectives: To assess if the conceptions of children with autism cluster temporally and whether such temporal clustering of autism conceptions is robust over time.

Methods: We searched for excess risk of autism conceptions from 1992 to 2000 using case and control data from California, adaptive temporal windows and a one-dimensional scan statistic. We test for confounding by known risk factors in the cluster period using logistic regressions.

Results: There is a consistent but decreasing seasonal pattern in the risk of autism conceptions in November for the first half of the study period. Temporal clustering of autism conceptions is not compositional with respect to known risk factors for autism such as socio-economic status.

Conclusions: There is some evidence of seasonality in the risk of autism conceptions. The pattern of decreasing and disappearing risk suggests a possible change in the nature of the cases that comprise the autism caseload in California.

110.096 75 The Role of Parental Expectations In Predicting Post-High School Outcomes for Youth with ASD. J. L. Taylor*[1] and P. Shattuck[2], (1)*Vanderbilt Kennedy Center*, (2)*Washington University*

Background: There is considerable variability in post-high school outcomes of young adults with ASD. Underemployment is common, and many young adults continuing living with their parents or in supported settings after leaving high school. Research examining predictors of independence among adults with ASD has focused on characteristics of the adult that are difficult to change, such as early language or IQ. The present study focused on one malleable factor that is related to adult outcomes in typically developing individuals: parental expectations.

Objectives: This study had two objectives: 1) to describe parents' expectations for the post-high school educational, occupational, and residential outcomes of their son or daughter with ASD; and 2) to determine the correspondence between parental expectations and outcomes.

Methods: This study used data from waves 1 and 4 of the National Longitudinal Transition Study 2 (NLTS2), a nationally representative, 10-year longitudinal survey of adolescents in special education. Participants for this study included 390 parents whose son or daughter had received a diagnosis of

ASD through the school system and had exited high school by wave 4.

Parental expectations were assessed at wave 1, while youth were still in high school, with the following questions: "How likely do you think it is that (youth) will:" 1.) "graduate from a 4-year college;" 2.) "eventually will get a paid job;" 3.) "eventually live away from home on (his/her) own without supervision." The son or daughter's educational activities, current living arrangement, and work status were measured at wave 4. Severity of impairment (conversational ability, social communication, mental skills) was statistically controlled in all analyses.

Results: One-quarter (27%) of parents expected that their son or daughter would graduate from a 4-year college, 88% expected that their son or daughter would work for pay, and one-half expected that he or she would live outside the home without supports. Family income was not independently related to parents' expectations that their son or daughter would attain a 4-year degree or live outside of the home without supports. Families with higher incomes were more likely to expect that their son or daughter would work for pay, B=.08, p<.01. Only 39% of youth whose parents said they "definitely would" graduate from a 4-year college were currently enrolled or had graduated; 45% of youth whose parents said the "definitely would" live away from home independently were currently doing so. After controlling for income and severity, parental expectations were marginally related to whether the son or daughter was living independently or enrolled in/graduated from a 4-year university, OR=2.09 and 2.70, respectively, ps>.10. Parental expectations did, however, predict the likelihood that youth would be working for pay, OR=6.05, p<.01.

Conclusions: For many parents of youth with ASD, expectations for their son or daughter's post-high school living arrangements and education may not be realized. Expectations for paid employment, however, may increase the likelihood of post-high school employment.

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110.097 76 The Prevalence of Autism Spectrum Disorder In An Israeli Population. M. Davidovitch* and B. Hemo, *Maccabi Healthcare Services*

Background:

There is a dramatic rise in the prevalence of autism spectrum disorder (ASD) being reported around the world, and these figures are steadily increasing. In the United States alone, the Center for Disease Control (CDC) reported an overall average prevalence of 9.0 per 1,000 individuals (0.90%) in 2006. However, to-date, data on incidence and prevalence of ASD in Israeli populations has been limited.

Objectives:

To calculate the prevalence and incidence of ASD in an Israeli population.

Methods:

Data on ASD was available from the database of Israel's second-largest of four healthcare organizations, Maccabi Healthcare Services, which provides services to 1.8 million people (approximately 25% of the population). A case of ASD was defined as any child in the target age group with at least one physician-recorded diagnosis. ASD criteria included those diagnosed with autism disorder, PDD-NOS, and Asperger's syndrome. Autism prevalence was calculated as the total number of children under twelve years of age who had ever received an autism diagnosis, divided by total membership in that group. Data on prevalence was available for the 2009 calendar year. Autism incidence was calculated as the total number of new cases in children under twelve years of age divided by the total membership in that group. Data on incidence was available for the 2002-2009 calendar years.

Results:

In the 2009 calendar year, the prevalence of ASD for children under twelve years of age was 4.5 out of 1,000 (0.45%). Out of this figure, 83% were males. Since we found that most children (84%) were diagnosed with ASD through the age of six, we divided the resulting incidence figures into two groups: children up to the age of the six, and children between the ages of six and twelve. For children up to the age of six, there was a slight increase in incidence between 2002 (0.34 for 1,000 individuals) and 2003 (0.41), but a dramatic increase between the year 2003 and 2004, when the figure jumped to 1.09 diagnoses per 1,000 individuals. Thereafter, the incidence remained mostly steady with slight increases each year, peaking in 2009 at an incidence of 1.20. For children between the ages of six and twelve, there was a marked increase in incidence between 2002 (0.18 per 1,000) and 2003 (0.46). Thereafter, between the years of 2004-2009, the incidence fluctuated in the range of 0.40 and 0.60 per 1,000 individuals with no clear observable trend.

Conclusions:

The incidence of ASD in Israel is on the rise, mirroring the larger global trend of a rise in cases of ASD. However, the prevalence of ASD in Israel (0.45%) remains significantly lower than in the United States (0.90%). Since there is extensive screening for ASD in Israel, as well as widespread awareness and services, it is unlikely that this discrepancy is due to differences in these factors. It is possible that there is a stricter interpretation of the ASD diagnosis in Israel, although differing genetic and environmental influences cannot be ruled out.

110.098 77 Prevalence of Autism Spectrum Disorders In Hispanic and Non-Hispanic White Children. A. Pedersen y Arbona*[1], S. Pettygrove[1] and C. M. Cunniff[2], (1)*University of Arizona*, (2)*University of Arizona College of Medicine*

Background: Although the number of individuals diagnosed with autism spectrum disorders (ASD) has risen substantially over the last decade or more, most prevalence estimates indicate that ASD is being diagnosed less commonly in Hispanic individuals, compared to the non-Hispanic White population.

Objectives: The purpose of this report is to analyze differences in ASD prevalence between Hispanic and non-Hispanic White 8-year-old children in the Arizona Developmental Disabilities Surveillance Program (ADDSP), and to explore how prevalence has changed over time in these ethnic groups.

Methods: The ADDSP is a population-based surveillance system for ASD in Maricopa County, Arizona. The ADDSP has been conducted as part of the Autism and Developmental Disabilities Monitoring Network (ADDM), funded by the Centers for Disease Control and Prevention at multiple sites across the United States. The ADDM surveillance system ascertained ASD among 8 year-old children in years 2000, 2002, 2004, and 2006. Data are obtained via systematic review of clinical and educational records, which are evaluated by trained clinician reviewers to determine whether children meet ADDM criteria for ASD.

Results: In all study years, both non-Hispanic White ($p < .005$) and Hispanic ($p < .05$) samples included significantly more males than females who met ASD case definition. Across all study years, significantly more Hispanic children carried a Special Education Exceptionality of Intellectual Disability when compared to non-Hispanic White children ($p < .05$). In each study year, ASD prevalence in non-Hispanic White children was significantly higher than Hispanic children ($p < .005$). Estimation of regression lines representing change in prevalence over time showed that the prevalence of ASD significantly increased over time for Hispanic males, for whom prevalence increased from 3.4 per 1000 children in 2000 to 11.4 in 2006 ($\beta = 2.94$, $p = .04$). Non-Hispanic White male prevalence showed a trend toward significant increase, from 13.6 per 1000 children in 2000 to 23.6 in 2006 ($\beta = 3.80$, $p = .08$). Similarly, Hispanic females showed a trend toward significant increase, from 2.0 per 1000 children in 2000 to 4.1 in 2006 ($\beta = 0.79$, $p = .06$). Non-Hispanic White female prevalence did not change significantly over time ($\beta = 0.74$, $p = .29$). Slopes of the regression lines were compared to determine if prevalence increased at different rates depending on ethnicity and gender. Boys experienced significantly faster increases in prevalence over time compared to girls ($p = .005$), but comparisons of slopes across ethnicity were not significant.

Conclusions: These results support recent reports of increasing prevalence of ASD in many regions of the United States. In keeping with findings of recent literature, results of the current study indicate that Hispanic children have lower ASD prevalence as compared to non-Hispanic Whites. Of particular importance is the markedly higher ASD prevalence for Hispanics in this sample compared to results of previous investigations. Building on existing ASD prevalence literature which has largely examined single point-in-time prevalence, results of the current study show that ASD prevalence in non-Hispanic White and Hispanic males is rising significantly faster than in females.

110.099 78 Completeness of Case Ascertainment for Surveillance of Autism Spectrum Disorders Using the Autism Developmental Disabilities Monitoring Network Methodology. J. S. Nicholas*, L. A. Carpenter, L. B. King, W. Jenner and J. Charles, *Medical University of South Carolina*

Background:

The Centers for Disease Control and Prevention's (CDC) Autism and Developmental Disabilities Monitoring (ADDM) Network is an active, population-based surveillance program monitoring the prevalence of developmental disabilities among 8-year old children through retrospective review of records from both school and non-school sources. Children are classified as having an Autism Spectrum Disorder (ASD) if behaviors documented in evaluation records by a community professional are consistent with the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision criteria for autistic disorder, PDD-NOS (including atypical autism), or Asperger disorder. Prior diagnosis is not required for case identification.

Objectives:

The objective of this study was to determine the completeness of case ascertainment for ASDs using the CDC's ADDM Network methodology.

Methods:

In the ADDM Network's first study year, the prevalence of ASDs among 8-year olds was calculated for children born in 1992 and living in the surveillance region in 2000. These children were 15-years old in 2007. To determine the completeness of case ascertainment for study year (SY) 2000, we applied the same ADDM Network methodology to 15-year olds living in a three-county sub-region of the surveillance region in 2007. For comparison, we re-calculated the SY2000 prevalence among 8-year olds for the same three-county sub-region. In addition to comparing prevalence between the two age groups, we further evaluated records for those children abstracted in both years for consistency in assigning case status.

Results:

The prevalence of ASDs among 8-year old children residing in the three-county sub-region in 2000 was 7.6, 95% CI 5.7-9.5. The prevalence of ASDs among 15-year old children residing in the same three-county sub-region in 2007 was 7.6, 95% CI 5.8-9.4.

A subgroup of 106 children was abstracted at both time points. Of these 106, 105 lived in the three-county sub-region during both surveillance years, 32 were identified as cases in both years and 55 were identified as non-cases in both years (82% concurrence). Of the 19 children whose case status differed at the two time points, 8 moved from non-case to case (7 with an associated increase in the number of available evaluations), and 11 moved from case to non-case (7 with an associated decrease in the number of available evaluations). There was no apparent pattern in the gains and losses of evaluations in terms of school versus non-school sources. The remaining 5 children (4.7%) were within 1 criteria of meeting case status at both time points and/or had case statuses that had been changed based on a clinical consensus review by study clinicians.

Conclusions:

ASD prevalence among children born in 1992 was virtually identical in 2000 and 2007 for the sub-region studied, suggesting a high level of completeness of case ascertainment using the CDC's ADDM Network case identification methodology.

110.100 79 Psychotherapeutic Medication Use In Children with Autism In the State of Kentucky. P. G. Williams*, C. Woods, M. Stevenson, D. Davis, P. Radmacher, K. Sikes and M. Smith, *University of Louisville*

Background: Autism prevalence has increased dramatically in recent years, as has use of psychotherapeutic drugs (PTD) to treat behavior problems associated with autism.

Objectives: To assess the prevalence of ASD among Kentucky Medicaid children and determine usage of PTD in this population.

Methods: Kentucky Medicaid claims data were reviewed to identify children with an ASD diagnosis (ICD-9 code 299.XX) in 3 different age groups from 2005 -2008 and to assess use of PTD in this population. PTD use is defined as at least 1 prescription per year.

Results: Both the prevalence of children diagnosed with ASD and the use of PTD increased among all age groups over the last 4 years with the highest increases noted in the last two years (Tables 1 and 2). In 2008, 1 in 250 children was diagnosed with ASD. PTD use accounted for 70% of medications prescribed for children with ASD and included atypical neuroleptics such as risperidone, aripiprazole, and quetiapine, as well as SSRI's, atomoxetine and lisdexamfetamine.

Conclusions: The increased prevalence of ASD among children receiving Kentucky Medicaid insurance parallels national trends and may be due to improvements in diagnosis and early identification across levels of the ASD spectrum. The overall prevalence of children diagnosed with ASD in this population is below national estimates of 1 in 100. However, PTD use is much higher than in prior reports, especially in children 1 to 5 years old. Increased medication use may be compensatory for perceived inadequacies of comprehensive educational and behavioral services for these children. More data are needed to determine the safety and efficacy of PTD usage, alone and in combination with other therapies, in children with ASD.

Table 1: Prevalence of ASD Diagnoses in the Kentucky Medicaid Population

(per 1,000 children)

	Age Group (years)		
Year	1-5	6-12	13-18

2005	1.2	4.4	2.3	
2006	1.2	4.8	2.3	
2007	1.5	6.4	3.1	
2008	1.6	7.9	3.7	

Table 2: Prevalence (%) of PTD Use in Children with Autism

	Age Group		
Year	1-5	6-12	13-18
2005	73	88	91
2006	67	87	89
2007	78	90	94
2008	79	92	95

110.101 80 Change Over Time of the Reported Educational Disability of Children with An Autism Spectrum Disorder. W. Jenner*, J. S. Nicholas, L. A. Carpenter, J. Charles and L. B. King, *Medical University of South Carolina*

Background:

All children with disabilities are guaranteed the right to a Free and Appropriate Public Education. Many children with disabilities require special education services. In order to access special education services, children must be classified by the public school district with an Educational Disability (e.g. Autism, Visual Impairment, Learning Disability).Educational disability assignment can affect the types services that are provided to an individual child.

Objectives:

Given the increase in awareness campaigns about ASD, the objective of this study was to determine if there has been a change over time (from 2000-2008) in the classified educational disability for children who have an Autism Spectrum Disorder as determined by the South Carolina ADDM program.

Methods:

South Carolina is part of the Centers for Disease Control and Prevention's (CDC) Autism and Developmental Disabilities Monitoring (ADDM) Network. ADDM is an active, population based surveillance program which identifies children who meet DSM-IV criteria for an ASD through retrospective chart review. This study used SC-ADDM data to compare the stated educational disability for 8-year-old children with ASD born in 1992 to 8-year-old children with ASD born in 2000. Only children who had a stated educational disability in their records and eligible for special education were included in this analysis; children who were in regular education, receiving services under Section 504, and children not attending public schools were not included**.**

Results:

In 2000 only 28 % of all 8 year old children found by the ADDM methodology to meet the criteria for ASD (36/130) were identified in their records by the educational disability of Autism. The remaining 94 children with ASD were identified in nine other categories including Intellectual Disability (32%), Emotional Disorder (8%), Learning Disorder (14%), Speech and Language Disorder (12%), Orthopedic Impairment (1%), Hearing Impairment (1%), Vision Impairment (1%), Cross-Categorical (2%), Other Health Impaired (3%).

Eight years later, in 2008, 51% of all 8 year old children meeting the criteria for ASD (103/203 children) were identified in their records by the educational disability of Autism. In turn all other educational disabilities decreased, with the exception of other health impaired. The remaining 100 children were identified in only 5 other categories including Intellectual Disability (15%), Emotional Disorder (1%), Learning Disorder (5%), Speech and Language Disorder (10%), Other Health Impaired (15%).

Conclusions:

The number of children identified by the ADDM methodology as having an ASD and also classified with an Educational Disability as Autism increased significantly over the 8 year study period. This study supports the inference that there is better awareness of the characteristics of autism spectrum disorders among community professionals who serve this

population and that more children with an ASD are receiving autism specific services.

110.102 81 Parent-Reported Prevalence of Autism Spectrum Disorders in US-Born Children: An Assessment of Changes within Birth Cohorts from the 2003 to the 2007 National Survey of Children's Health. L. A. Schieve*[1], C. E. Rice[1], M. Yeargin-Allsop[1], C. A. Boyle[1], M. D. Kogan[2], C. Drews-Botsch[3] and O. Devine[1], (1)*National Center on Birth Defects and Developmental Disabilities*, (2)*Maternal and Child Health Bureau*, (3)*Rollins School of Public Health, Emory University*

Background: The reported prevalence of autism spectrum disorder (ASD) from the 2007 National Survey of Children's Health (NSCH) (11.0/1000 children) was twice the prevalence of autism from the 2003 NSCH (5.5/1000). Similar trends were observed in a separate US population-based ASD surveillance system. Three general explanations for the observed increases should be considered: survey measurement changes between time points (internal measurement effects); changes in ASD awareness, screening, access to diagnostic services, diagnostic criteria, and special education placements that led to increased identification of children with ASDs (external population identification effects); and changes in ASD genetic susceptibility among persons having children within a population and/or non-genetic risk factors (etiologic genetic or environmental effects). Because the NSCH covers a wide age range, prevalence estimates from 2003 and 2007 can be compared within subgroups based on either child's age or birth year. Comparison of population prevalence within birth cohorts is particularly informative as it holds genetic and non-genetic prenatal and early postnatal etiologic exposures constant and thus allows for assessment of measurement and identification impacts.

Objectives: From the two independent NSCH samples, we examined ASD prevalence in children who were US-born between 1990-2000. We assessed prevalence differences across surveys both by child age at survey and within one-year birth cohorts.

Methods: In the 2003 NSCH, prevalent cases were based on parental report of an "autism" diagnosis sometime during the child's life. In the 2007 NSCH, question verbiage was revised and expanded. Thus, prevalence was defined two ways: parental report of an "ASD" during the child's life and parental report of ASD currently. Estimates were weighted to be nationally representative of US-born children in various years.

Results:
In 2003, children aged 7-8 years had the highest "autism" estimates (10/1,000 children). Much lower estimates were observed for children aged 3-6 years (prevalence range 3-5/1000) and 11-13 years (prevalence range 4-6/1000). In 2007, children aged 5-13 years all had notably higher age-specific prevalence estimates of both "ever ASD" (prevalence range 18-29/1000) and "current ASD" (range 12-17/1000) than the "ever autism" estimates for children of comparable ages in 2003.

For children in each of the 1997-2000 birth cohorts (which includes children ages 3-6 years in 2003), relative differences between 2003 and 2007 estimates were 300%- 600% when comparison was based on the 2007 "ever ASD" definition and 200%- 400% when based on the 2007 "current ASD" definition. For children in the 1990-1996 birth cohorts (which includes children ages 7-13 years in 2003), the relative differences between 2003 and 2007 estimates were lower but still >100% for 5 of 6 cohorts when comparison was based on the 2007 "ever ASD" definition and >80% for 3 cohorts when based on the 2007 "current ASD" definition. ($p<0.10$ for all of these differences and $p<0.05$ for most)

Conclusions: Prevalence differences within birth cohorts are likely partially attributable to survey question changes. However, the magnitude of most differences suggests that continuing identification of children with ASDs between surveys was sizable, even among the oldest children, 7 years or older in 2003.

110.103 82 Autism and Other Developmental Disabilities In Uganda: Household Screening and Pediatric Assessment. A. Kakooza*[1], J. Grether[2], E. Trevathan[3], R. L. Hansen[4], L. A. Croen[5], K. Ssebeyla[6], K. S. Smith[2], S. Kiguli[7] and C. Karamagi[7], (1)*Makerere University, School of Medicine*, (2)*Sequoia Foundation*, (3)*St. Louis University*, (4)*University of California Davis*, (5)*Kaiser Permanente Division of Research*, (6)*Tumaini Child Health Project*, (7)*Makerere College of Health Sciences*

Background: Autism and other developmental disabilities present a substantial challenge in low-resource settings. Limited available data indicate that prevalence may be considerably higher in developing countries than in industrialized settings. The lack of local prevalence data greatly hampers efforts to advocate and plan for effective services to identify children at risk and provide interventions. Obtaining data on autism spectrum disorders (ASD) is especially challenging, due to numerous factors including lack of trained practitioners and prevailing cultural beliefs and

practices that impact identification and diagnosis of affected children. Furthermore, it is uncertain whether clinical presentation is similar across diverse cultural settings. We have been conducting a screening and assessment program for ASD and other developmental disabilities among children 2-9 years of age in the sub-Saharan country of Uganda in rural and urban communities. Results from door-to-door screening and follow-up pediatric assessments will be presented.

Objectives:

To describe data collection design, procedures, and tools, including screening questions for ASD used in this project.
To present data on number and characteristics of children screened for 7 developmental disabilities (ASD, hearing, vision, cerebral palsy, epilepsy, speech, mental retardation).
To compare the results of the screening to specialty referrals made by the project Medical Officers who conducted general pediatric exams for children who screened positive and a sample of those who screened negative.
To discuss obstacles and barriers that we encountered during field data collection.

Methods: For door-to-door screening of children 2-9 years of age, we adapted and expanded the Ten Question screener, previously validated for use in low-resource settings. In particular, we added questions designed to screen for ASD that were developed through collaboration among Ugandan and American clinicians and piloted among parents in Uganda. Following screening, a general pediatric assessment was conducted by project Medical Officers for children who screened positive and a sample of children who screened negative to assess the sensitivity and specificity of the screening tool relative to exam findings. Specialty medical examinations are now underway for children who met project criteria for one or more developmental disabilities based on referrals from the Medical Officer Exams. When specialty exams are completed, these specialty diagnoses will also be compared to initial screening results.

Results: In the rural communities, 561 children aged 2-9 years from 284 households were screened and 354 of these children underwent the Medical Officer Exam. In the urban communities, 568 children from 405 households were screened and 356 of these children underwent the Medical Officer Exam. Among the examined children, preliminary tallies indicate that 23 children were identified as needing a specialty referral for ASD. The presentation will include detailed description of the responses to the expanded TQ screener and compare the screening responses to the clinical data obtained in the Medical Officer Exam.

Conclusions: The results of this study will provide important information on how the expanded TQ can be used to screen for ASD and other neuro-developmental disorders in a resource-poor African country.

110.104 83 Epidemiology, Diagnosis, Aetiology and Knowledge about Autism Spectrum Disorders (ASD) In Africa: Perspectives From Literatures Cited In Pubmed Over the Last Decade (2000 - 2009). M. O. Bakare*[1] and K. Munir[2], (1)*Federal Neuro-Psychiatric Hospital, Upper Chime, New Haven, Enugu, Enugu State, Nigeria*, (2)*Developmental Medicine Center, Boston Children's Hospital, 300 Longwood Avenue, Boston, MA 02115, USA*

Background:

The universal occurrence of ASD was queried about twenty-six years ago. It was thought to occur only in western industrialized countries with high technological development. Over the last decade, knowledge about ASD and its prevalence had been documented to be on the rise in different regions of the world with most literatures coming from the western world but the present situation in Africa on aspects of ASD remained unclear.

Objectives:

To assess perspectives of literatures cited in pubmed over the last decade on aspects of epidemiology, diagnosis, aetiology and knowledge about ASD among Africans.

Methods:

Key words like autism, diagnosis, aetiology, knowledge and Africa were variously combined in doing a pubmed search of literatures published over the last decade about ASD among Africans.

Results:

No study addressed specifically epidemiology of ASD in Africa. One of the two studies that were relevant addressed epidemiology of ASD in Arab countries, though included two Northern African countries. Higher proportion of non-verbal cases of ASD compared to verbal cases was documented in literature coming from Africa. Associated co-morbid disorders included intellectual disability, epilepsy and oculo-cutaneous albinism. Aetiological factors postulated were post-encephalitic infection, genetic and auto-immune factors, vitamin D

aetiological hypothesis among others. Knowledge about ASD in Africa was noted to be low.

Conclusions:

There is need for epidemiological studies in Africa to define the magnitude of the problem of ASD and characteristics of children affected by ASD in this region. This would help in planning and might be helpful in answering the bothering question of aetiology of ASD. More policy making attention need to be directed at issues of childhood developmental disorders in Africa.

110.105 84 Differences In Autism Spectrum Disorder Assessment and Intervention In Rural, Urban, and Suburban Areas. M. Wojnaroski*[1], T. A. Perez[1], K. C. Guest[1] and S. E. O'Kelley[2], (1)*University of Alabama at Birmingham*, (2)*UAB Civitan-Sparks Clinics*

Background: Increasing evidence indicates the need for early identification of children with autism spectrum disorders (ASD), as early intervention leads to better outcomes. However, although ASDs can be reliably diagnosed by age two (Lord et al., 2006), the median age of diagnosis in America ranges from 41 to 60 months (CDC, 2009). Factors responsible for delay of diagnosis include living in an urban or rural area, fewer physicians nearby, higher IQ, and being female (Mandell et al., 2010; Shattuck et al., 2009).

Research indicates that family location is an important predictor of age of diagnosis (Mandell et al., 2010). There is a significant lag between parents' first mention of developmental concerns and when they receive an evaluation, which may differ by geographic location. However, more specific factors that contribute to differences in timely assessment and intervention based on geographic location are not known. Research indicates the need for a best practice autism specific evaluation that includes a structured observation (ADOS) and interview (ADI-R; Ozonoff et al., 2005). However, several children are diagnosed without a best practice evaluation. Previous studies examining age of diagnosis have not distinguished between evaluation procedures, despite the call for best practice evaluations. In addition, intervention services received may also differ by geographic location.

Objectives: This study will explore the nature of ASD diagnosis and intervention among children living in urban, suburban, and rural communities in Alabama with a sample of children referred for a best practice autism specific evaluation. Specifically, differences in age of first parental concern, time from first concern to completion of a best practice evaluation, age of diagnosis, number of previous evaluations, previous diagnoses received from other professionals, and previous intervention services will be compared between rural, suburban, and urban areas.

Methods: Children were evaluated with the ADI-R, ADOS, and a clinical interview. Final diagnoses were determined by members of the interdisciplinary team based on available data and clinical impressions. Children who received a diagnosis of an ASD were included in the current study. Children's home location was classified according to US Census guidelines (2002).

Results: Diagnostic evaluations have been completed with 59 children (mean age = 61 months). Results indicated a significant trend between the child's geographic location and age of diagnosis. Children who lived in an urban area (1000 people/ sq. mile) were diagnosed with an ASD at an average age of 59 months, children who lived in a suburban area (500 people/sq. mile) were diagnosed at age 52 months, and children who lived in a rural area were diagnosed at age 68 months. Additional analyses examining differences in ASD assessment and intervention will also be completed.

Conclusions: We anticipate completion of 100 additional autism specific evaluations. Based on the observed trend, we expect significant results with additional participants. Continued exploration of these factors has important implications for clinical practice and policy decisions. Specifically, this knowledge can lead to targeted interventions and improved screening methods to increase the number of children who receive a best practice evaluation as early as possible.

110.106 85 Characteristics of Ethnically and Socioeconomically Diverse Underserved Families of Young Children with Autism. E. Vanderbilt-Adriance*[1], R. Oti[1], A. Bohlander[1], Y. Nelson[1] and F. Orlich[2], (1)*Seattle Children's Hospital and Research Institute*, (2)*University of Washington/Seattle Children's Hospital*

Background: Despite the importance of early intervention (EI) for children with autism spectrum disorders (ASD), many receive far below the recommended number of EI hours (Lord & Bishop, 2010). In addition, the majority of studies with children with autism have primarily included children from White middle-class backgrounds, despite similar prevalence rates of ASD across ethnically and economically diverse populations (Fombonne, 2005). Several studies have shown cultural, economic, and ethnic disparities in service provision, parental decisions about treatment, and the perceived negative impact of having a child with ASD (see Bishop et al., 2007).

However, there remains a dearth of information about the characteristics of underserved families from diverse backgrounds, which is necessary to better understand their needs and effectively target intervention.

Objectives: This project aims to increase our understanding of the characteristics and concerns of diverse underserved families of young children with ASD, with the goal of informing interventions that address this population's unique needs. Specifically, we explored family demographics (e.g., income, ethnicity, parental education, government assistance), EI (e.g., presence, weekly number of hours), parenting hassles, and family resources.

Methods: Data for this study are currently being collected from parents of approximately 30 young children with ASD who are being recruited as part of an on-going multi-site project focusing on parent-mediated intervention for 2-5 year old children with ASD. In order to be eligible for the study, families had to be receiving less than 15 hours of EI. Questionnaire data includes information on demographics, parenting hassles (Crnic & Greenberg, 1990), and family resources (Leet & Dunst, 1987).

Results: Preliminary analyses from the initial 21 families indicate an ethnically and socioeconomically diverse sample (71% ethnic minority; 57% on government assistance; median per capita income = $10,400; median parental education = some college). Higher income per capita, but not ethnicity, was associated with lower frequency (r = -.54, p < .05) and intensity of hassles (r = -.49, p < .05) and higher overall family resources (r = .46, p < .05). Forty percent of parents reported a "high" level of daily parenting hassles, with "managing children in public" and "children not listening" as the most highly rated. Most families reported having adequate basic necessities such as food, housing, and clothing, but reported a lack of social/leisure time and instrumental and emotional support. Although all target children were receiving EI, the weekly number of hours was far below recommendations (Median = 3 hours, range 1-6 hours).

Conclusions: In summary, underserved families span a range of socioeconomic statuses, indicating the need for continued emphasis and provision of EI for all families. Although most families reported adequate daily necessities (e.g., housing, food), there is a need for interventions aimed at decreasing daily parenting hassles, increasing instrumental and emotional support, and helping families create time for social and leisure activities, particularly lower-income families. Future research should continue to examine characteristics of underserved families, particularly across geographic and regional areas in order to more fully understand and meet the needs of these families.

110.107 86 The Spatial Structure of Autism Spectrum Disorders In Utah. A. V. Bakian*, J. P. Zimmerman and W. M. McMahon, *University of Utah*

Background: The existence of environmental risk factors for Autism Spectrum Disorders (ASDs) has been a controversial topic. One step toward possible discovery is a spatial analysis. A non-random distribution of Autism Spectrum Disorders (ASDs) in Utah could reflect an underlying spatial structure in either the risk factors associated with ASD or in the services providing ASD education, awareness, and treatment. Spatial analysis of ASD patterns may lead to improvements in the development of hypotheses concerning ASD etiology or in the planning of ASD services.

Objectives: The objective of this study was to determine the presence, location and size of ASD clusters in a population of 8 year old children residing in a three county surveillance region in Utah. In addition, we investigated if the presence, location and size of ASD clusters change after controlling for confounding sociodemographic risk factors associated with ASD.

Methods: ASD (n = 132) was identified in children born in 1994 and residing in a three county surveillance region at age 8 by the Utah Registry of Autism and Developmental Disabilities using the methods developed by the Metropolitan Atlanta Developmental Disabilities Surveillance program. Control population (n = 21,935) included children from the 1994 birth cohort born in the three county surveillance region lacking a developmental disability. Maternal residential birth addresses of cases and controls were geocoded as latitude and longitude point locations. Clusters were detected using the scan statistic assuming a Bernoulli model as implemented by SaTScan software (Kulldorf 1997). Following the initial analysis, clusters were adjusted for sociodemographic factors including mother's age at birth and mother's race.

Results: One primary cluster was identified in the three county surveillance region. The primary cluster included 87 ASD cases, and the relative risk of ASD inside the primary cluster was 2.17. The secondary cluster contained 3 ASD cases and its relative risk was 15.07. The size of the primary cluster was reduced and the relative risk (RR = 35) increased considerably after adjusting for confounding sociodemographic factors. Controlling for confounding factors produced multiple

secondary clusters that were not present before adjusting for covariates.

Conclusions: ASD clusters exist in the 1994 Utah dataset and controlling for sociodemographic risk factors altered the size and shape of ASD clusters. The persistence of these clusters across multiple surveillance years will test for further support that these clusters are real. Further investigation with statistical models may elucidate potential risk or sampling factors responsible for ASD clusters.

110.108 87 Phenotypic Heterogeneity of Autism Spectrum Disorders and Its Association with Early Identification In a US Population-Based Study. M. J. Maenner*[1], C. M. Cunniff[2], E. Giarelli[3], L. C. Lee[4], J. S. Nicholas[5], C. E. Rice[6], L. A. Schieve[6], M. S. Wingate[7] and M. S. Durkin[1], (1)*University of Wisconsin-Madison*, (2)*University of Arizona College of Medicine*, (3)*University of Pennsylvania*, (4)*Johns Hopkins Bloomberg School of Public Health*, (5)*Medical University of South Carolina*, (6)*National Center on Birth Defects and Developmental Disabilities*, (7)*University of Alabama at Birmingham*

Background: Public health campaigns promote early detection and diagnosis of autism spectrum disorders (ASD), often by raising awareness of certain behavioral 'signs' that may be indicative of ASD. Several population-based studies examined autism prevalence and correlates of receiving a diagnosis, but did not consider differences in the presentation of core behavioral features. Other studies suggested that the phenotypic or behavioral presentation of ASD may differ by sex, race, socioeconomic status, and co-occurring intellectual disability.

Objectives: To describe the frequency of behavioral impairments among children meeting surveillance criteria for ASD in a population-based US study and to determine whether the behavioral impairments of children meeting surveillance criteria for ASD differ depending on whether they have been previously identified as having ASD, after adjusting for race, gender and other factors.

Methods: The Autism and Developmental Disabilities Monitoring (ADDM) Network performed population-based ASD surveillance of 8-year-olds in areas of 11 US states in 2006, using documented information in medical and/or educational records. Case ascertainment was performed by expert clinician reviewers and based on DSM-IV-TR criteria for autism. Of primary interest are 12 impairments (in domains of social interaction, communication, and repetitive/restricted behaviors and interests) which comprise the DSM-IV-TR diagnostic criteria for Autism and ASD. Children classified as ASD cases by ADDM were not all previously identified as having an ASD. Of the 2,757 children that met the ADDM case definition, 75.4% had previously received a clinical diagnosis and/or a special education classification of autism/ASD. Logistic regression was used to determine whether the probability of previous identification was associated with specific impairments, and random forests were used as a confirmatory analysis to evaluate the potential for complex interactions.

Results: Among 2,757 children meeting ADDM criteria for ASD, the frequency of impairments corresponding to the 12 diagnostic criteria ranged widely from 49.1% (DSM-1c – joint attention) to 90.4% (DSM-1d – emotional reciprocity). 351 (12.7%) of the children were described as having all 12 impairments. Among the 2,136 children meeting ADDM criteria for Autistic Disorder, inflexible routines or rituals (DSM-3b, OR=3.1 (95%CI: 2.2-4.3)), emotional reciprocity (DSM-1d, OR= 2.8 (95%CI: 1.7-4.5)), nonverbal communication (DSM-1a, OR=2.7 (95%CI: 1.9-3.8)), and stereotyped motor behaviors (DSM-3c, OR=2.1, (95%CI: 1.6-2.7)), were most strongly associated with previous ASD identification in the adjusted regression model. Gender, race, and intellectual disability were not significantly associated with the likelihood of previous identification in the adjusted model. The random forest analysis produced similar findings, and ranked repetitive motor behaviors (DSM-3c) and inflexible routines or rituals (DSM-3b) as the most "important" predictors of previous ASD identification.

Conclusions: Findings from this study have implications for efforts to improve early identification of ASD, suggesting that impairments related to social interaction, repetitive behaviors and restricted interests appear more likely to trigger a diagnosis or special education classification of ASD than impairments related to verbal communication. Consideration of possible combinations of impairments that meet diagnostic criteria for ASD and the relative frequency of each combination in the population provides insight into disparities in the prevalence and identification of ASD.

110.109 88 Developmental Regression In Children with Autism Spectrum Disorders. L. A. Carpenter*, C. A. Cheely, J. S. Nicholas, J. Charles, W. Jenner and L. B. King, *Medical University of South Carolina*

Background: Recent studies have found that as many as 50% or more of children with Autism Spectrum Disorders (ASD) have a history of regression in development, most commonly in language, social skills, or both. Prevalence of regression

depends on the sample studied and the definition used (Wiggins et al., 2009).

Objectives: This study describes developmental regression in a sample of children with ASD identified through the South Carolina Autism and Developmental Disabilities Monitoring program (SC-ADDM), which is part of the larger Centers for Disease Control and Prevention's (CDC) ASD monitoring program. Specifically, we examine (1) prevalence; (2) timing; (3) skills affected; (4) characteristics of affected children; and (5) subsequent developmental outcome.

Methods: Children with ASD born in 1992, 1994, 1996, and 1998 were identified via the SC-ADDM network methodology during study years 2000, 2002, 2004, and 2006. Records of those children who had been identified through SC-ADDM as having a history of regression were requested, and details regarding regression were re-coded to better characterize the age at which the child lost skills, the type of skills lost, and the child's developmental status prior to the regression. For this study, regression is defined as a loss (not simply a plateau in skill acquisition) of previously acquired skills in any domain not due to a clearly identified precipitating event such as physical or psychological trauma.

Results: Results indicated that 20.7% of children with ASD in this sample had documentation of developmental regression in their records (126/609). The mean age of regression was 22.8 months (SD ± 14), with a range of 6 – 84 months. Regression was most commonly reported in the domain of language/communication skills, followed by social skills. Regression in motor and adaptive skills was rarely reported. Significant differences were noted for intellectual disability status (X^2 = 15.8, P<0.0001), community diagnosis (X^2=35.6, p<0.0001), and educational placement at age 8 (X^2=45.1, p<0.0001). Gender and race were not associated with presence/absence of regression.

Conclusions: Regression was documented in one out of five children with ASD in this sample. Children who evidenced developmental regression were more likely to meet criteria for an intellectual disability. They were more likely to have an educational classification of Autism, and were more likely to have a community ASD diagnosis than children with ASD without a history of regression. No increased risk appeared to be associated with the child's gender or race. These results may suggest that a history of regression may lead educators and clinicians to consider an ASD diagnosis. This is one of the larger samples of children with ASD in which developmental regression has been studied.

110.110 89 Prevalence of Regression within AUTISM Spectrum Disorders: A Quantitative Synthesis.

B. Barger*[1], J. Campbell[2] and J. Donald[1], (1)*The University of Georgia*, (2)*University of Georgia*

Background: Developmental regression occurs in a sizable minority of individuals with autism spectrum disorders (ASD); however, a wide range of prevalence rates of regression is reported in the literature with a range of 12 – 50%. The literature also varies regarding types of regression reported, with language and/or social regression commonly reported and other regression types (e.g., motor, cognitive) reported less often. Authors have hypothesized that variation in the reported prevalence rates of regression depend in part on sample characteristics, such as sample size, with higher prevalence rates reported for smaller samples. Authors have also hypothesized that reports from clinic based samples yield higher rates of developmental regression when compared to population based samples.

Objectives: Organize the literature according to common reported types of regression and provide an aggregated estimate of regression for individuals with ASD. Examine the relationship between sample size, sample type (i.e., clinical or population-based) and prevalence rates. Provide an aggregated estimate of mean age of regression reported in the published literature.

Methods: Data from 61 published studies representing 14,647 participants were coded for four regression types: language, social, language/social, and mixed. Language regression was coded if the study operationally defined regression solely as language loss. Social regression was coded if the study operationally defined regression solely in terms of social behavior, such as social smiling. Language/social was coded if regression was operationally defined as a combination of both language and social loss. Mixed regression was coded if regression was defined by (a) language and/or social regression and another type of regression, such as motor and cognitive loss, or (b) was not operationally defined in the study. Prevalence rates of regression and age of onset of regression were coded and unweighted averages for prevalence and age of onset calculated. The relationship between sample size and prevalence rates was evaluated via correlation; differences in prevalence rates between clinic and population samples were evaluated via *t* test.

Results: Inter-rater agreement for coding decisions was excellent (κ = 1.0 for clinic/population coding; κ = .90 for regression type). Mean prevalence rates were: (a) mixed regression, 30.27% (*SD* = 13.3; *Mdn* = 25.9%); (b) language

regression, 23.38% (*SD* = 10.38; *Mdn* = 26%); (c) social regression, 14.15% (*SD* = 7.2%; *Mdn* = 15%); and (d) language/social regression, 29.40% (*SD* = 10.95; *Mdn* = 32.7%). Sample size and prevalence rates were significantly related for mixed regression (*r[51]* = 0.25, *p*<.000), language regression (*r[25]* = -0.30, *p*<.05), and social regression (*r[3]* = 0.93, *p*<.000), but not language/social regression (*r[1]* = 0.120, *p*=0.067). Clinical samples yielded higher rates of mixed (*d* = 1.21) and language (*d* = 2.14) regression when compared to population studies.

Conclusions: Prevalence rates for mixed regression and combined language/social regression converge on estimates of between 29-30% of individuals with ASD. Reported rates of language regression or social regression in isolation yield lower prevalence rates. Sample type impacted reported rates of regression, with clinical samples yielding higher rates of regression.

110.111 90 The Relation of Language Disorder and Developmental Delay to Timing of ASD Diagnosis. H. Patel*[1], J. Shenouda[2], P. Khandge[2], S. Mahabir[2], R. Baltus[1], N. Scotto-Rosato[3], S. Howell[3] and W. Zahorodny[4], (1), (2)*UMDNJ*, (3)*NJ State Health Department*, (4)*New Jersey Medical School*

Background: The prevalence rate of ASD has increased over the past decade causes of which are unknown. Studies show that timely identification of ASD leads to earlier intervention and better prognosis. Analysis of children diagnosed with Developmental Delay (DD) and Language Disorder (LD) may help indicate early ASD signs, thus provide early intervention services.

Objectives: This study investigated the number, proportion and distribution of ASD children with and without diagnosed Language Disorder (LD) and Developmental Delay (DD) as they relate to the average age of ASD diagnosis.

Methods: Data were collected as part of the New Jersey Autism Study (NJAS), an ASD surveillance investigation carried out in a four county New Jersey region. Using an active case-finding method, ASD surveillance data were developed for children who were born in 1998 and resided in the surveillance region in 2006. NJAS data were based on review, analysis and independent ASD case-determination derived from information contained in health and education records. Demographic information and case-specific data, including the pattern of diagnosis were analyzed services. The socioeconomic status (SES) of children with ASD was represented by the District Factor Group (DFG) ranking, a community-level index. Statistical analysis was performed using T tests.

Results: In a population of over 30,000 8-year old children, 533 were identified as having ASD. 366 ASD children (67%) had an ASD diagnosis in their records. 97 ASD children (18.2%) had a history of both LD and DD, and an ASD diagnosis (Group A), while 121 ASD children (22.7%) had an ASD diagnosis and neither LD and DD in their history (Group B). However, there was a significant difference in the age of ASD diagnosis between Groups A and B ($T = 4.32$, $p < 0.0001$). The average age of ASD diagnosis in Group A was 47 months, while the average age of ASD diagnosis in Group B was 59.6 months.

Conclusions: The study findings show that ASD children with a history of Language Disorder and Developmental Delay are diagnosed with ASD almost a year earlier; hence, they are likely to receive intervention earlier than ASD children without previously diagnosed LD and DD. The findings emphasize the fact that language impairment and developmental delay are key elements of ASD and suggest that more meticulous and sensitive ASD identification methods should be employed to identify children with ASD at an earlier age.

110.112 91 The Prevalence of Youth with Autism Spectrum Disorders In the Juvenile Justice System. C. A. Cheely*[1], L. B. King[1], E. J. Letourneau[2], J. S. Nicholas[1], J. Charles[1], W. Jenner[1] and L. A. Carpenter[1], (1)*Medical University of South Carolina*, (2)*Family Services Research Center Medical University of South Carolina*

Background:

Past national surveys have estimated the prevalence of youth with disabilities in the state juvenile justice systems at approximately 33% (Quinn et al, 2005); however little research has specifically examined the frequency at which youth with autism spectrum disorders (ASD) are in contact with law enforcement systems. One study specifically examining pervasive developmental disorders in a forensic setting found a rate of 15% (Siponmaa et al, 2001), however this retrospective study focused primarily on violent offenders who had been referred for psychiatric evaluation as part of their court sentencing. There is a need for prospective research on ASDs in forensic populations using up-to-date diagnostic methods and control groups.

Objectives:

(1) Using records linkage with the Department of Juvenile Justice (DJJ), we will determine the rate of contact with DJJ by adolescents meeting criteria for ASDs from the South Carolina

Autism and Developmental Disabilities Monitoring Program (SC-ADDM). (2) We will compare the types of offenses these adolescents are charged with to the overall SC-ADDM sample (*n*=609) and a randomly selected comparison group (*n*=99) of youth matched on age, sex, race, and county. (3) We will compare the outcomes of these charges to determine if prosecution rates vary based on the presence of an ASD.

Methods:

Data for the present study came from SC-ADDM, which is one of fourteen sites collaborating with the CDC to conduct ASD surveillance in the United States. For each of the study years, all 8-year-old children with an ASD in the study area (the Coastal and Pee Dee regions of SC) were identified through screening and records abstraction at multiple educational and clinical sites. The de-identified data were linked with Department of Juvenile Justice data through the South Carolina Office of Research and Statistics.

Results:

Of the youth identified in study years 2000, 2002, 2004, and 2006 (youth currently 12-18 years of age), thirty-one (5%) were charged with a total of 96 offenses (range 1-14). Compared to the overall SC-ADDM sample, charged youth with ASD were significantly less likely to have comorbid intellectual disability ($\chi 2$ (1) = 10.35, $p < 0.05$). When compared to the randomly selected control group, youth with ASD were significantly more likely to be charged for offenses that occurred at school ($\chi 2$ (1) = 32.51, $p < 0.05$). Youth with ASD were also less likely to be prosecuted for offenses than the comparison group ($\chi 2$ (1) = 13.47, $p < 0.05$).

Conclusions:

No epidemiological studies have examined rates of contact between individuals with ASD and Juvenile Justice; thus this study is the first to examine the frequency, charges, and outcomes in youth with ASD. These results suggest that not only are individuals with ASD represented with relative frequency in the juvenile justice system, but that they may be charged and prosecuted differently than the overall DJJ population. Furthermore, as these data reflect only those adolescents who were ultimately charged for their offenses, it is likely that actual rates of contact with the legal system may be much higher in this population.

110.113 92 Autism and Delinquent Behaviour. A. van der Reijken*[1] and I. A. van Berckelaer-Onnes[2], (1)*Centrum Autisme Leiden*, (2)*Leiden University*

Background:

Over the last 20 years an increasing number of papers have been published about autism in relation to delinquent behaviour. Several of these concern case histories, others concern incidence searches. The question arises whether people with autism are prone to delinquent behaviour.

Objectives:

The main questions in our research are:

1 What kind of delinquent behaviour is shown by people with autism?

2 Do specific autistic traits increase the risk of delinquent behaviour?

Methods:

N=44 study. All the cases were referred to one of the authors, who acted as an expert witness in the relevant court cases. Afterwards the cases were analysed in different respects, such as demographic data, type of delinquent behaviour, age at the time of diagnosis, co-morbid disorders, intelligence, concomitant circumstances, earlier behaviour and clinical assessment. The data found were compared with data from all suspects seen by expert witnesses in their court cases from 2004-2006 and data from ASD suspects during that same period (data collected by Blansjaar e.a., 2008)

Results:

Most of de subjects were high-functioning. Only three of them lived in sheltered quarters. Eleven of them were still going to school or college, fifteen had their own income by work. Although 35 of them were at one time taken into mental health care, only 19 were diagnosed with ASD. The others were classified differently, mainly ODD or personality disorders. 36 had shown problematic behaviour preceding the delinquent behaviour.

In contradiction to what is written in literature, arson is hardly more often committed by people with ASD than by others suspects. Six cases were suspected of stalking.

Conclusions:

Violence-related: suspects with ASD do not use more violence than other suspects, neither in adolescence nor in adulthood. The violence used is relatively less serious: more threats and slightly violent behaviour; fewer life attempts.

Sex-related: between 2004 and 2006 the occurrence of sexual offences in de ASD group is more frequent than in the total group. In our research group the percentage of sexual offences is even higher. This might be a result of a relatively new crime such as “cybersex” and increased police vigilance concerning child pornography downloading, which is a crime in The Netherlands. Shortly before the crime is committed certain problems often occur, especially obsessions, loneliness and idleness.

110.114 93 Prescription Drug Utilization and Associated Costs Among Children with Case-Defined Autism Spectrum Disorders. S. L. Logan*, J. S. Nicholas, L. B. King, L. A. Carpenter and J. Charles, *Medical University of South Carolina*

Background: Evidence suggests that children with autism spectrum disorders (ASD) have high rates of prescription drug utilization, particularly psychotropic medications used alone or in combination. Children with ASD have substantially higher costs of care than children without ASD; a large portion of excess costs could be due to prescription drugs. However, medication utilization studies in this population have been limited by parent recall, volunteer participation, or claims-based analysis to identify patients with recorded ASD diagnoses.

Objectives: The aims of this study were (1) to describe prescription drug use, and (2) to examine costs associated with prescription drug use among children with ASD.

Methods: Children were identified through the population-based South Carolina Autism and Developmental Disabilities Monitoring Network (SCADDM). All children with case-defined ASD from the two most recent surveillance years (2006 and 2007) and who were Medicaid-eligible during the surveillance year plus one year prior were included; at age 7 or 8 years for those identified in the Coastal and Pee Dee regions of the state in 2006, and age 14 or 15 years for those identified in a demographically similar sub-region in 2007. All confidentiality procedures were followed and appropriate regulatory approvals were granted. Data linkages were made using unique identifiers common to both datasets; PHI was removed following this linkage, resulting in a completely de-identified database that contained a two-year history of prescription drug utilization and associated costs. Categorical and continuous variable differences were assessed using chi-square or t tests respectively.

Results:

Of the 263 children with case-defined ASD and Medicaid information, 56% (n=147) had at least one prescription of any type filled, 40% (n=105) used psychotropic medication, and 20% (n=52) used multiple psychotropic classes during the study period. The most common combinations were attention deficit hyperactivity disorder (ADHD) medications plus an antihypertensive, antidepressant, or antipsychotic; and antidepressants plus an antipsychotic. Older children (15/16 years) were more often prescribed multiple psychotropic classes (31% versus 16%, p<.01), had a higher mean number of psychotropic prescription claims (16.3 versus 5.9, p=.02), and 2.4 times higher prescription drug costs over the study period ($2999 versus $1260, p=.05) when compared to younger children (7/8 years). Overall, children with any psychotropic medication had significantly higher mean prescription drug costs than children without psychotropic medication ($3632 versus $420, p<.0001).

Conclusions:

The current study was able to provide a more complete and precise estimate of medication use among children with ASD by combining population-based data and Medicaid. These results confirm that psychotropic medication use alone or in combination among those with ASD is common, costly, and may increase with age.

110.115 94 Quality of Life Among Families of School-Age Children with An Autism Spectrum Disorder In the United States. R. V. Whitney*[1], L. Kalb[1], B. H. Freedman[1] and L. C. Lee[2], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins Bloomberg School of Public Health*

Background: Family quality of life (FQoL) has emerged as a distinct conceptual framework, separate from individual or Health-Related Quality of Life. FQoL reflects the manner with which families tend to their basic daily needs and enjoy life together as they engage in activities that are important to them (Park et al., 2003). The FQoL model has been operationalized through 5 subscales including parenting, family interaction, disability-related support, material wellbeing, and emotional wellbeing (Hoffman et al., 2006). This holistic approach elucidates the overall family experience by capturing the internal attributes of family life and the influence of the environment on family wellbeing. Futher, FQoL guides the pursuit of more effective ways to support family wellness. To date, only one small study has examined FQoL in families with a child with ASD (*n*=18) (Brown, et.al.,2006). While this study demonstrated lower FQoL in this population, compared to families of a child with Down’s Syndrome, further research with a larger, less biased sample is required to validate or repudiate this finding.

Objectives: To a) examine the impact of raising a child with ASD on FQoL and b) observe the modifying effect of family structure on FQoL

Methods: Data used for this study were from the 2007 National Survey for Child Health (NSCH) (Blumberg et al., 2009). Analysis was restricted to school-age children ages 6-17 years (N= 64,076). Using the FQoL Survey (Hoffman et al., 2006) as a guide for item selection, an index was created using 29 items from the NSCH, which encompassed 5 subscale scores that were summed to create a total FQoL score. Linear regression models with survey commands and weights were carried out to examine the effect of raising a child with ASD (*n* = 759) on FQoL compared to children with ADHD (*n* = 5,039) and the unaffected population. Confounding variables, adjusted in multivariate regression models, included a variety of child, parent, and geographic factors. Beta Coefficients from the linear model were used to calculate effect sizes using Cohen's *d*. Subscale and total scores were stratified to examine the effect of family-structure on FQoL.

Results: Overall, the multivariate analyses indicated raising a child with ASD has a large, negative effect or strain on FQoL when compared to unaffected controls of two parent families and other family types, respectively (*d* = -1.24, -.94). There was a similar negative, albeit moderate, effect for raising a child with ADHD (*d* = -.61, -.57) (all p < .01).

Conclusions: Nationally representative data used in this study highlights the impact of raising a child with a neurodevelopmental disorder on FQoL. More specifically, family mental and physical health, caregiver burden, and disability support were implicated as the areas of greatest need in families with a child with ASD, whereas caregiver burden and family mental and physical health are implicated in families with a child with ADHD. Results substantiate and underscore the urgent need to develop interventions and policies that address multiple areas of family support extending beyond child-specific treatment.

110.116 95 Caring for An Autistic Child: Quality of Life of Caregivers In the State of Qatar.

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Background: Autism spectrum disorder (ASD) affects children at around the age of 3 years old and last throughout the person's lifetime. Children with autism poses clear psychological burden on their parents and caregivers; factor such as functional independence, severe maladaptive behaviours and severity of autism were strongly linked to maternal caregiving burden and adverse quality of life (QOL). In addition, physical health issues which are recently becoming more recognized and the extra hours spent looking after such children can also contribute to parental burden. To our knowledge, no previous research assessed QoL of parents/caregivers of autistic children in Qatar or the Gulf region. There is undoubtedly need to investigate how caring for a child with ASD affects the lives of the parents/caregivers and to develop comprehensive health care strategies that not only target the patient, but also cares for and supports those who are in direct daily contact with their child(ren).

Objectives: Our study aimed at quantifying the health-related QoL of caregivers of children with ASD in Qatar.

Methods: Caregivers of an autistic child between the age of 3 to17 years old were recruited from the two main developmental pediatric rehabilitation clinics in the country. The control group was represented by caregivers of a non-autistic child and who were visiting a family clinic for routine medical check-up. Data collected from both groups included demographic information of caregivers and children and QoL information. The Arabic version of the Short Form-36 (SF-36) was used to assess QoL.

Results: Most of the quality of life domains of caregivers of autistic children reflected poorer health compared to caregivers of healthy children, albeit the differences were not reaching statistical significance in most of the domains compared. However, caregivers of autistic children rated their health as poor and likely to get worse (p=0.003). The four domains that contribute the most to the Mental Component Summary (MCS) were consistently poor, and female caregivers had poorer mental health than males in this cohort of participants (p<0.05). These results suggest that caring for an autistic child does impact on the psychosocial aspect of the caregiver's or parent's life.

Conclusions: This study provided evidence for the impact of caring for an autistic child on the life of the caregiver and the findings should help health policy-makers provide more focused supports to the children with ASD and their families. However, the lack of statistically significant differences between the QOL domains of the control group and the caregiver of autistic children's group in most of the QOL domains measured could be due to the use of a generic, rather than a condition-specific, QOL instrument. Further work should focus on

developing and validating an instrument specific for measuring QOL of caregivers and parents of children with ASD.

110.117 96 Examining Parent Readiness for Diagnosis and Social Support In a Community-Based Screening Sample. M. E. Villalobos*[1] and J. S. Miller[2], (1)*Yale Child Study Center*, (2)*Children's Hospital of Philadelphia*

Background: Community-based screening studies for autism provide a unique context for studying issues related to early identification. As the push for universal screening and earlier diagnosis of autism increases, many challenges arise that the field has yet to address, which may impact a child's ability to actually enroll in early intervention following a positive screen. Some of these factors include parent readiness for screening and social support.

Objectives: The present study aimed to utilize a community-based sample as a way to examine issues related to population based autism screening. Specifically, we examined the parent process by examining how these families rated the screening process at each step, their reaction to the feedback provided at the in-person screening and their readiness for diagnosis. We also assessed social support and how it impacted the screening process.

Methods: We followed 24 toddlers brought in through a screening study conducted in a pediatric practice (Miller et al. under review) through their 4th birthday. These children were part of a cohort of children originally screened within their 2nd year life using the MCHAT and CSBS-ITC and subsequently brought back for a formal diagnostic evaluation during their 3rd year of life. During the follow-up evaluation, parent reactions to the screening process were evaluated based on final diagnostic category [Autism (N=6), PDDNOS (N=6), Language Delay (N=12)] using a parent interview developed by the authors. Social support, including spousal, extended family and community was also examined using rating scales and the Parenting Stress Index. Demographic and risk variables were also examined.

Results: We found that overall parents looked back on the screening process positively and did not consider it an undue burden (2/24 rated *some difficultly*). Only 50% (3/6) of the PDDNOS group demonstrated parent or provider concerns at the initial evaluation compared to 83% (5/6) of the Autism group. Parents of children with more signs of autism were more likely to have moved into action and sought out early intervention. In addition, those parents who reported higher levels of social support overall were more likely to enroll their children in early intervention. Also, we found that only 9 of the 24 families reported some understanding of autism before screening. No difference in parenting stress scores between groups was observed ($p > .05$).

Conclusions: The present study provides an important step in understanding the screening process for families of children at-risk for autism. As we begin to identify children earlier through screening, we must be better prepared to address the needs of a wider variety of families. Many of our families reported a positive experience, but expressed varying levels of social support and readiness for diagnosis. It will be important to further examine how families move through the diagnostic process in community samples so that we help families ensure children are receiving appropriate intervention.

110.118 97 Determinants of Survey Completion In Online Autism Research. P. A. Law* and L. Kalb, *Kennedy Krieger Institute*

Background: As familiarity and use of the internet increase, health researchers have found the online environment to be a viable mechanism for data collection. Online research is attractive because of its superior inclusiveness and low cost compared to center-based research. As with any mode of research, however, internet-mediated research (IMR) has its own particular issues with regards to bias and non-response. Non-response must be systematically addressed since the sample becomes more biased (and less generalizable) as non-response rate increases. In order to best utilize IMR for ASD research, patterns of non-response need to be understood and overcome.

Objectives: To examine the child, family, geographic, and survey-related factors associated with non-response in the largest autism IMR platform.

Methods: Data for this study were collected from parents of children aged 2 to 17 years (M = 9.04 years) with an autism spectrum disorder (ASD) who were engaged in a U.S-based online research initiative: the Interactive Autism Network (IAN). Parent (age, education, # of total children, # of affected children, family structure, and rurality) and child (diagnosis, age, gender, and race) factors were attained through questionnaires filled out upon IAN registration. Survey-related factors, including form type, and time since registration in IAN, were captured for two surveys, one focused on access to care and one exploring child vaccination history. Logistic regression models were used to estimate the association between non-response to survey and other factors.

Results: A total of 21,535 survey instances were examined, of which 4,963 or 23% were completed by the parent. In the final multivariate model, increasing child age, greater number of affected children, and increasing duration since registration with IAN were risk factors for non-response (all p<.001). Higher parental education, two-parent household, Caucasian race, and rurality were protective (all p<.01). In addition, parents were more likely to respond to surveys focusing on their affected child rather than unaffected siblings (p=.001).

Conclusions: To our knowledge, this is the first study to examine predictors of online survey non-response in autism research. Compared to previous IMR studies, the response rate in IAN was higher which may be due to the multifaceted nature of IAN. In contrast to typical one-time online surveys, IAN is an active environment that engages parents not only through surveys and additional research opportunities, but through its IAN Community e-newsletter, discussion forums, and research reports. In regards to predictors of survey non-response, data from this study demonstrates both family and survey-related variables play an important role. Since all subjects were already a part of the IAN research project, the differential response rates reflects issues surrounding retention rather than recruitment. Researchers should look towards developing tailored strategies that promote representative research through active enrollment and continued engagement of subjects in online autism research.

110.119 98 Parental Beliefs about the Etiology of Autism In a Population-Based Study. L. W. Wang*[1], V. A. Chaidez[2], E. Fernandez y Garcia[3], P. Krakowiak[2], I. Hertz-Picciotto[2] and R. L. Hansen[1], (1)*University of California, Davis, MIND Institute*, (2)*University of California, Davis*, (3)*University of California, Davis, School of Medicine*

Background: Many health care practitioners are unaware of what parents of children with autistic spectrum disorders may believe is the etiology of autism despite the strong influence of health beliefs on health behavior. Even less is known about how causal beliefs about autism may or may not differ between ethnic groups.

Objectives: The two aims of this study were to: 1) explore parental beliefs about the etiology of autism among families with at least one child with an autism spectrum disorder and 2) examine the relationship between race/ethnicity and causal beliefs of autism.

Methods: 400 families with a child 2-5 years of age with a confirmed diagnosis of autism or ASD were identified from an ongoing population-based case-control Childhood Autism Risks from Genetics and the Environment (CHARGE) study. A telephone-administered Environmental Exposure Questionnaire (EEQ) is completed with the mother or primary caregiver that includes an open-ended question, “What do you think causes autism?” Multiple causes could be given. Etiological categories were arrived at based on previous literature and themes from parent responses. Parent responses were independently coded by a pediatrician and a post-doctoral fellow. All discrepancies in coding were discussed and resolved. Associations between ethnicity and causal beliefs using Pearson's chi-square tests for association or Fisher's exact test were used to assess possible associations. The three ethnic groups with adequate sample sizes for analyses were White (W) (n=198), Hispanic (H) (n=118), and Asian (A) (n=18).

Results: After excluding 13 subjects due to missing data or duplicate sibling answers, our analysis sample included 387 parent responses. Ethnic comparisons were made on 334 responses after excluding multiracial individuals (n=43) and African-Americans (n=10). The two most common causes of autism cited among all parents was an environmental cause (51%) and/or a genetic cause (51%). Vaccines (22%) were the third most commonly believed etiological factor, followed by 20% of parents who did not know or have a guess as to what may cause autism. There were no ethnic differences in beliefs related to genetic (W 54%, H 39%, A 44%; p=0.15), environmental (W 50%, H 48%, A 44%; p=0.88), vaccines (W 23%, H 18%, A 17%; p=0.54), maternal and prenatal causes, (W 4.0%, H 7.6%, A 5.6%; p=0.30) or any other etiological categories. The least cited cause for autism was parenting (n=1).

Conclusions: In all three race/ethnic groups examined, the broad groups of 'environmental' and 'genetic' each were believed to cause autism by a slight majority of parents. Vaccines are commonly cited as a cause by parents in all ethnic groups despite a clear lack of scientific evidence demonstrating a relationship between autism and either the measles, mumps, rubella (MMR) vaccine, or thimerosal-containing vaccines. Early theories that parenting styles were a cause were not supported by this study population. Understanding parental beliefs about autism cause has important clinical implications for providing culturally-sensitive patient-centered care through parent education and informed discussions about treatment choices that would best serve their child and family.

110.120 99 Brazilian Scientific Production about Autism Spectrum Disorders. C. de Paula*[1] and M. C. Teixeira[2], (1)*Mackenzie Presbyterian University*, (2)

Background : In the last decades there was a substantial investment in research focused on the Autism Spectrum Disorder (ASD) and these data have contributed to the knowledge of the disorder, to raise awareness and to develop public policy. However, the vast majority of population-based data on ASD were obtained in developed countries. This limited knowledge of the reality of autism in developing nations is a further challenge that must be faced by stakeholders, including health, education, and other government officials.

Objectives: The objectives of this review were: a) to identify all ASD-themed articles, master's theses, and doctoral dissertations authored by Brazilian researchers between 2002 and 2009; b) to classify articles and thesis/dissertation abstracts into a broad category scheme according to research subject; c) to find out the impact factors of the journals in which these articles were published, and the bibliographic databases in which these journals were indexed; and d) to compile data on the institutional affiliation of the lead authors of articles, theses, and dissertations.

Methods: The bibliographic search was conducted in the following scientific databases: PUBMED, SciELO, LILACS and portal CAPES (Brazilian thesis database), including several key words, such as autism and pervasive developmental disorders. Journals indexed by more than one database were ranked in order of quality criteria (hence, PubMed first, followed by SciELO, then LILACS). Articles were also classified by impact factor of the journal in which they were published, as reported in the 2008 *Journal Citation Report* (JCR). Dissertation and thesis abstracts were obtained from the CAPES website (http://www.capes.gov.br/ avaliacao/cadastro-de-discentes/teses-e-dissertacoes), which does not list any quality criteria.

Results: A total of 93 papers were identified mainly produced by authors from the Southeast Brazil and from public universities. All articles and theses and dissertations were classified into one of the following seven research categories: (a) i**ntervention studies (most frequent), (b) Communication patterns and family relations, (c) Neurobiological and genetic bases of ASD and comorbidities in the autism spectrum, (d) Phenotype and endophenotype studies, (e) Psychometric properties of ASD assessment instruments, (f) Diagnostic criteria for ASD and (g) Epidemiological studies (less frequent).**

Approximately one third of papers were published in journals with some level of impact factor that varied between 0.441 and 3.211; most of them were based on small samples sizes. There were identified 140 dissertations/theses; 82.1% were master thesis. The major research topic was related to intervention programs addressing ASD.

Conclusions: This review shows that Brazilian researchers are interested in the ASD theme, however, a big piece of this scientific production is concentrated in dissertation/master thesis and the minority of papers was published in journals with high impact factor. The results of this systematic review suggest the need for studies with larger sample sizes which would produce better impact and visibility in the Brazilian scientific production in the field of the ASD.

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110.140 53 Validitating ASD Instruments for Use In Screening and Prevalence Studies. F. Scott*[1], T. S. Brugha[2], J. Bankart[2] and J. Smith[2], (1)*Autism Research Centre*, (2)*University of Leicester*

Background: There are no tested methods for conducting studies of the epidemiology of Autism Spectrum Disorders (ASD) in adult general population samples. The Autism Diagnostic Observation Schedule (ADOS) is widely seen as the best standardised observational instrument for autism diagnosis, but it has never been tested with an adult general population sample.

Objectives: To assessed the validity and reliability of the ADOS module 4, designed for use with verbally fluent adolescents and adults, in an adult general population sample

Methods: A random probability sample of adults aged 16 or over was interviewed throughout England in a multi-phase general population survey. A 20 item screening questionnaire - the Autism-spectrum Quotient (AQ-20) was completed by 7,353 adults in phase one. A random subset of respondents with a greater probability of scoring higher on the AQ-20 completed second and third phase data collections including face to face ADOS module 4 assessments (n=618); the probability of selection

increased with AQ-20 score. First and second phase data and qualitative clinical information were presented as vignettes to six experienced clinicians working in pairs to make consensus clinical judgements about autism spectrum presentation. The probability of respondents having an ASD was compared across the three phases of data collection.

Results: There was moderate agreement between clinical vignettes raters and ADOS findings, and a range of diagnostic

cut points were identified: ADOS Total Score 7+ (non specific ASD) to 13+ (autism) with greatest agreement at 10+ (AUC = 0.82). Modelling of the presence of ASD using 57 DISCO (diagnostic interview for social and communication disorders) assessments suggested an ADOS autism threshold in the range of 10 to 13 with highest AUC at ADOS 10+-+/11+ (AUC=0.92-0.93). ADOS cases could not be reliably predicted using AQ-20 screening data only.

Conclusions: Findings indicate that it is possible to use the ADOS as a valid instrument in epidemiological research in general population adults. Clinically recommended ADOS module 4 algorithm thresholds for ASD classification are comparable with existing ADOS validity data on children, with this community study indicating threshold scores of 7+ for broader spectrum and 10+ for definite cases. Further work on adult population screening methods is recommended

110.141 54 A Preliminary Analysis of the Ages and Stages Questionnaire (ASQ) Compared to the Modified Checklist for Autism In Toddlers – Revised (M-CHAT-R). S. Hardy*, K. Knoch, J. Green, M. Barton, T. Dumont-Mathieu and D. A. Fein, *University of Connecticut*

Background: The American Academy of Pediatrics recommends that children have autism-specific screening in addition to general developmental screening at the ages of 18- and 24-months. However, empirical data are lacking to determine whether general developmental screening for all children, followed by autism-specific screening for only the positive cases, can detect ASDs.

Objectives: To investigate the concordance between general and autism-specific screening in children with a suspected developmental delay or autism spectrum disorder at 18- and 24-months of age.

Methods: 580 children were screened with the M-CHAT-R as well as the ASQ at 18- or 24-months of age. Of those, 32 children failed the M-CHAT-R; 21 failed the M-CHAT-R initially, but passed the M-CHAT-R follow-up interview (Group 1), while another 11 failed the M-CHAT-R and the M-CHAT-R follow-up interview (Group 2), indicating that these children have autism-specific concerns confirmed on parent interview. The ASQ total scores in each domain: *Communication, Gross Motor, Fine Motor, Problem Solving*, and *Personal-Social* were assessed for developmental concerns and compared between groups.

Results: Independent samples t-tests revealed significant differences between Group 1 and Group 2 on the *Communication*, *Fine Motor*, and *Personal-Social* domains of the ASQ, but not on Gross Motor and Problem Solving. Within Group 2, 46% of children (n=5) had clinically significant scores on the two domains of the ASQ that would suggest a possible Autism Spectrum Disorder (i.e., *Communication and Personal-Social domains)*. Within Group 2 there were clinically significant concerns for 82% (n=9) of children on the *Communication* domain, and 55% (n=6) on *Personal-Social;* 91% of the group (n=10) had concerns on at least one of these domains. In Group 1, only 4.8% of children (n=1) had clinically significant concerns on both the *Communication and Personal-Social* ASQ domains. In Group 1, 19% of children (n=4) had clinically significant concerns on the *Communication* domain, and 24% of children (n=5) had concerns on the *Personal-Social* domain; 38% (n=8) had concerns on at least one of these domains.

Conclusions: Preliminary analyses suggest that the ASQ can identify most children who have autism risk. Further data analysis will analyze how many children with Personal-Social and Communication concerns on the ASQ do not screen positive for possible autism, as well as analyze discriminating items. The application of the current results is limited based on the small sample size, but overall the data suggest that a general developmental screener may serve as an efficient first stage screener for autism. However, further autism-specific screening would be necessary to specify concerns and decrease false positive referrals for comprehensive autism evaluations.

110.142 55 "True Misses" : The Characteristics of Missed Screening Cases. C. Chlebowski*[1], L. E. Herlihy[1], D. L. Robins[2], M. Barton[3] and D. A. Fein[3], (1)*University of Connecticut* , (2)*Georgia State University*, (3)*University of Connecticut*

Background:

The American Academy of Pediatrics recommends autism specific screening at 18 and 24 months of age. Several ASD screening tools have been developed, though few have been evaluated longitudinally to ascertain a more accurate estimate of sensitivity and specificity. Studying potential "missed" cases provides an opportunity to obtain a more accurate understanding of both the sensitivity of the screener as well as the characteristics of children who are missed by the instrument.

Objectives:

This study provides preliminary data from a 2-year follow-up screening with the Modified Checklist for Autism in Toddlers

(M-CHAT). The focus of the follow up is to assess the characteristics of potential "missed" screening cases, or children who screen negative on the ASD screening instrument but are later found to have an ASD diagnosis.

Methods:

Participants were drawn from a sample of children who passed the M-CHAT when screened between 16 and 30 months of age. Approximately 2 years later children were rescreened; the M-CHAT was mailed to families with a stamped envelope to return the form to the study. Rescreeners were sent back for 2996 children. A portion of the children rescreened with the M-CHAT were also screened with the Social Communication Questionnaire (SCQ) (n=1407) which was added to the study later.

Results:

At follow-up, 42 of the 2996 children were identified as "potential misses" and seen for diagnostic evaluation. 28 children were identified based on screening results (screening positive on the M-CHAT or SCQ), 11 children had a caregiver report that he/she received an ASD evaluation referral or diagnosis since their initial screening, and 3 were flagged by a healthcare provider. Fifteen children were diagnosed with ASD and classified as "true misses."

The majority (92.3%) of the true misses were male. The average age at initial screening was 22.8 months (SD=5.96); there was no difference in regards to whether the initial screening occurred at 18 or 24 months of age (46.2% were screened at 18-months and 53.8% were screened at 24-months). The mean M-CHAT score of the true misses at initial screening was 1.58 failed items of a possible 23 (SD=1.084); the mean M-CHAT score at follow up was significantly higher at 5.33 (SD=4.271) ($t=-3.174$, $p<.01$).

The average age at follow up evaluation was 52.2 months (SD=6.29). All true misses received ASD diagnoses at follow up: 10 with Autistic Disorder, 3 with PDD-NOS, and 2 with Asperger's Disorder.

Conclusions:

This study was designed to present preliminary data on a sample of missed screening cases. The results suggest that missed cases are largely identified by follow-up screening. The missed cases in this sample were more likely to be male and presented with significantly higher (more impaired) scores on the screening instrument at follow-up. This could be because there was regression after the initial screening, in which skills initially reported were lost, or because parents reported more accurately at age 4 than at age 2.

110.143 56 False Positives to the M-CHAT In An Italian Population. E. Salomone*[1], P. F. M. Molina[1], A. Narzisi[2] and F. Muratori[2], (1)*University of Turin*, (2)*University of Pisa - Stella Maris Scientific Institute*

Background:

Early screening at a general population level lowers the age of first diagnosis for autism, but caution must be taken related to possible over referrals and unneeded worries for the families due to the false positives rate. Nonetheless, research has shown that the majority of false positives do not show fully typical development. Little is known though about specific developmental course that may differentiate these subjects prior to screening. A deeper understanding of conditions at birth and younger ages associated to requiring a second level of screening to exclude autism is also needed to improve the psychometric properties of screening tools. This is especially important for Italy where currently no data is available from screening programs.

Objectives:

The objective of this investigation was to study the first systematic screening program in Italy by means of the FYI and the M-CHAT, currently translated and culturally adapted. The specific purpose of this study was to compare features of false positives and negatives to the M-CHAT with respect to conditions at birth (order of birth, weight at birth) and social-communication level at 12 and 18 months in an Italian population.

Methods:

The study was conducted in Tuscany, Italy on a preliminary ongoing sample of 165 subjects during the pediatric surveillance visits. During the 12th month visit the FYI and a 'response to name' task were administered; the M-CHAT was administered during the 18th month visit. Subjects failing the M-CHAT were given a follow-up phone call to receive the M-CHAT Follow-Up Interview and the Socialization and Communication Scales of the Vineland Scales II. Study associations were completed through using multiple logistic regression.

Results:

Toddlers with low weight at birth were significantly more likely to be false positive (OR= 1.52; CI 97%: 1.13 -2.04) while

firstborns were found less likely to be false positive (OR= 0.34; IC 97%: 0.26-0.44). Higher scores on the Social Affective Engagement and the Repetitive Behavior Scales of the FYI were also associated with an increased risk of being false positive (OR = 1.36; CI 97%: 1.31-1.41 and OR = 1.14; CI 97%: 1.12-1.16 respectively). Moreover, the chance of passing the M-CHAT only at the Follow-Up level was more than three fold for subjects failing a "response to name" task at 12 months (OR = 4.95; CI 97%: 3.70-6.61). Comparison analysis of the false positives Vineland scores with population norms showed no differences with typical development for the majority of the subjects.

Conclusions:

The current study suggests possible different developmental pathways for those subjects requiring a second level screening with the M-CHAT to exclude risk for autism. The significant associations of conditions of vulnerability at birth and developmental atipicalities at 12 months in presence of typical communication and socialization competence at 18 months is suggestive that false positives to the M-CHAT represent variations of typical development in this Italian sample. Further research is needed to study early features of false positives to implement multiple level screening processes in Italy and define a culturally sensitive screening protocol for the Italian context.

110.144 57 M-CHAT & STAT: The Effectiveness of Multi-Level Screening for ASD. 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 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 effectiveness of the STAT with children younger than 24 months of age.

Methods: Parents in the metro-Atlanta area completed the M-CHAT at their child's well-baby visits (n=10,440); 830 screened positive and 118 continued to screen positive on the FUI. A subsample of 54 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: Thirty-four cases screened positive on the STAT and 25/34 received an ASD diagnosis, yielding a PPV of .74 for this multilevel screening method, compared to previously published data on the M-CHAT/FUI, whose PPV ranged from .57 to .65 (Kleinman et al., 2008; Robins, 2008). Five of the 20 children who screened negative on the STAT had ASD, reducing the sensitivity of the multilevel method compared to M-CHAT/FUI alone.

ROC analysis for the subsample of children who completed a STAT before 24 months and also received a diagnostic evaluation (n=46) yielded an area under the curve (AUC) of .79. An optimal STAT cutoff score for this age group was 2.00: sensitivity=.88 and specificity=.55. Psychometric properties of the STAT for children ≥ 24 months was also high (AUC=.88), and the recommended cutoff of 2.00 was supported: sensitivity=.91 and specificity=.54.

Reanalysis of the data for two-level screening using a STAT cutoff of 2.00 for all children resulted in 40/54 screen positive STATs. Of these 40 cases, 27 received an ASD diagnosis, yielding a PPV of .68, similar to published data on the effectiveness of the M-CHAT alone for screening.

Conclusions: The lack of differential cutoffs by age in the current study compared to the Stone et al.'s (2008) study may be due to the qualitative differences in the sample (siblings of children with ASD vs. at-risk children from general population). However, the higher PPV for two-level screening when using age-based STAT cutoffs (2.00 vs. 2.75) is promising, although it reduces sensitivity. Efforts must continue to reduce the false positive rate without significantly increasing the number of missed cases. For example, approaches to identify children who urgently need an evaluation and autism-specific early intervention may be combined with approaches to reduce the false positive rate for children whose scores are not as high. Empirical studies are needed to inform policy decisions on the early detection of ASD to shorten the delay in receiving appropriate treatment.

110.145 58 Predictive Value of Red Flags for Communication at 6 and at 12 Months for M-CHAT Results at 18 Months In Children with Autism Spectrum Disorders. R. Maxim, MD*[1], E. Judd[2], L. Eversmeyer[2], D. Swann[2], P. Deutsch[2], C. Guild[1], N. Tamirisa[2], M. W. Baig[2], S. Stewart[1], A. Nay[1], T. Maxim[2], H. Klein[2] and E. S. Armbrecht[1], (1)*Saint Louis University*, (2)*SSM Cardinal Glennon Children's Hospital*

Background: Early identification of autism spectrum disorders (ASD) is associated with improved outcomes. Few studies have examined the predictive utility of an autism screening tool at 6 and 12 months, especially in community-based populations.

Objectives: To assess the ability of Red Flags for Communication (RFC), a new autism screening tool administered at 6 and 12 months, to predict M-CHAT results (i.e., pass or fail) at 18 months.

Methods: Educators from 26 Parents as Teachers Programs, a community-based, in-home parent support service sponsored by public school districts, screened more than 3,000 children ages 5 to 27 months for indicators of autism and other developmental delays. These children were assessed every 6 months using the Ireton Child Development Chart (ICDC); RFC was used for children ages 6 and 12 months; M-CHAT was used for children ages 18 and 24 months. Using our database of screening tool responses, we determined patterns of passing and failing 3 consecutive observations using RFC and M-CHAT to estimate the association between RFC results (at 6 and 12 months) and M-CHAT at 18 months. We employed the Fisher exact test to assess statistically significant differences in passing or failing M-CHAT between two groups: (1) consecutive passing RFC at 6 and 12 months vs. (2) consecutive failing RFC at 6 and 12. With the same statistical method, we also examined the association between RFC results at 6 months alone and M-CHAT results.

Results: Of the 260 subjects with complete screening data at 6, 12 and 18 months, 8 (or 3.1%) failed RFC at 6 and 12 months. Three of these consecutive RFC failing subjects (or 37.5%) also failed M-CHAT (at 18 months). Two of the three subjects with this screening result pattern were diagnosed with autism; the diagnosis of the other one is unknown (i.e., loss to follow-up). By comparison, 3 of 252 subjects or (1.2%) with consecutive RFC passing also failed M-CHAT ($p = 0.0004$). There were 324 subjects with complete screening data at 6 and 18 months. Among these subjects, 3 of 13 (or 23.1%) who failed RFC (at 6 months) also failed M-CHAT; while 5 of 311 (or 1.6%) who passed RFC (at 6 months) failed M-CHAT ($p = 0.0025$).

Conclusions: A child who fails the RFC at 6 months has a 14.1 times higher risk than a community-based population to fail the M-CHAT at 18 months. The risk for failing the MCHAT at 18 months further increases if the child fails consecutive RFC at both 6 and 12 months. By contrast, children who passed the RFC at 6 and 12 months had a high probability (96.7%) of passing the M-CHAT at 18 months. Use of the RFC screening tool at 6 months of age may improve the early identification of autism spectrum disorders in children.

110.146 59 Using the M-CHAT Best 7 Score In Screening for Autism Spectrum Disorders In Young Children Referred for Developmental Assessment. S. E. O'Kelley*[1], K. C. Guest[2], M. K. McCalla[2], M. Wojnaroski[2], K. J. Bailey[3], E. M. Griffith[4] and F. J. Biasini[2], (1)*UAB Civitan-Sparks Clinics*, (2)*University of Alabama at Birmingham*, (3)*Glenwood Autism and Behavioral Health Center, Inc.*, (4)*University of Colorado at Denver*

Background: The M-CHAT was developed for use in primary care settings to identify toddlers at risk for ASD and has undergone several revisions to administration and scoring procedures (e.g., the use of a follow-up interview) to increase clinical utility as well as sensitivity and specificity as a screening tool. However, the additional time required by the follow-up interview is potentially limiting for everyday practitioners. Dr. Diana Robins (IMFAR 2010) presented promising data regarding the use of a "Best 7" approach for scoring the M-CHAT in a primary care sample to reduce the need for a follow-up interview. The current study evaluates this refined approach in a sample of high-risk children who are referred for evaluation due to known or suspected developmental delays.

Objectives: To evaluate the Best 7 scoring and identification approach for the M-CHAT in young children in a tertiary care clinic setting among children at risk for ASD or DD.

Methods: As part of the intake process for children under the age of 4 years, caregivers completed the M-CHAT in addition to a general intake form requesting information about development. Based on referral question and intake materials, including scores on the M-CHAT, children received either ASD-specific or more general developmental evaluations. Rule out or diagnosis of an ASD utilized ADI-R/ADOS and final diagnostic conclusions were determined by members of the interdisciplinary team.

Results: Diagnostic evaluations are complete for 95 children whose caregivers completed the M-CHAT at intake (mean age = 33 months). Among the children with confirmed ASD, 86% were accurately identified by the original M-CHAT scoring procedure, while 67% were identified with the Best 7 approach. Specifically, the Best 7 approach did not identify 10 children with ASD who were identified by the original approach. Among the children whose ASD evaluations resulted in a non-spectrum diagnosis, 31% were accurately classified as not being at risk

for ASD using the standard M-CHAT scoring; however, 78% were accurately classified using the Best 7 approach. That is, within the non-spectrum group, 27 more children were accurately classified as not needing an ASD evaluation using the Best 7 approach versus the original approach. Positive predictive values (PPV) were 43% for the original approach and 61% for the Best 7 approach. Evaluations are in progress or will be scheduled for at least 50 more children.

Conclusions: Preliminary data suggest that the Best 7 approach may be a useful tool in a high-risk population for identifying which children are in need of ASD-specific evaluation versus evaluation for other developmental delays and disorders. Given the high demand for specialized ASD evaluation and the limited number of skilled clinicians who can provide these services, identification of an efficient yet effective screening tool could improve appropriate use of these specialized evaluation appointments, which also has potential to reduce waiting time for young children in strong need of ASD diagnosis and intervention. Further analyses utilizing a larger sample will also explore whether a different cutoff for the Best 7 score can increase sensitivity for identifying ASD in young children.

110.147 60 Screening for Autism Spectrum Disorder at 18 Vs. 30 Months In Extremely Preterm Infants. B. E. Stephens*[1], V. E. Watson[2], R. Tucker[2], S. J. Sheinkopf[1] and B. R. Vohr[1], (1)*The Warren Alpert Medical School of Brown University*, (2)*Women and Infants Hospital*

Background: The AAP recommends screening for autism spectrum disorder (ASD) in all infants at 18-24 months. But accuracy of early screening in extremely preterm infants is unknown. High rates of positive screen for ASD in extremely preterm infants at 18 months are reported but the rate of ASD diagnosis is unknown. Screening at 30 months may result in fewer false positives than at 18 months.

Objectives: To determine the rate of positive screen for ASD at 18 and 30 months in extremely preterm infants using three ASD screens (one validated in high risk children and two that involve direct observation of the infant); to determine the relationship of positive ASD screen to cognitive and language delay.

Methods: All infants born <28 weeks gestational age at Women and Infants Hospital and seen for 18 and/or 30 months follow-up from 5/01/08-10/30/10 were screened using the Pervasive Developmental Disorders Screening Test, 2nd edition, Stage 2 (PDDST) and 2 items from the Autism Diagnostic Observation Schedule, response to name (RN) and response to joint attention (RJA). Association between number of positive screens and cognitive or language composite score <70 on the Bayley Scales of Infant Development, 3rd edition) were determined. Diagnostic assessment was performed on infants with at least one positive screen at 30 months.

Results: At 18 months 28/152 (18%) had one or more positive screen. At 30 months 12/116 (10%) had one or more positive screen. Positive screen at 18 or 30 months was associated with cognitive and language delay. There was little overlap between the screens at either time point (Table 1). All infants who failed all 3 screens at 30 months were later diagnosed with ASD.

Conclusions: The lower rate of screen positive for ASD at 30 months than 18 months in extremely preterm infants suggests that many positive 18 month screens may be false positives, possibly due to high rates of language and cognitive impairment in these infants. Diagnostic confirmation is needed to determine true rate of ASD and accuracy of early ASD screening in extremely preterm infants. However, these results indicate that later screening and/or multiple screening data points improve screening accuracy.

Table 1: Screen overlap

	18 months (n=152)	30 months (n=116)
Failed one screen	10 (7%)	4 (3%)
PDDST	3 (2%)	1 (1%)
RN	5 (3%)	0
RJA		
Failed two screens	0	1 (1%)
PDDST and RN	0	1 (1%)
PDDST and RJA	5 (3%)	1 (1%)
RN and RJA		
Failed all three screens	5 (3%)	4 (3%)

110.148 61 Validation of a Questionnaire Based Checklist Identifying 3 Year Olds with Delayed Language In a Prospective Birth Cohort. S. Schjolberg*[1], M. Bresnahan[2], A. S. Oyen[1], M. Hornig[2], H. Aase[1], N. Gunnes[1], N. Stenberg[3], P. Surén[1], P. Eadie[4], K. K. Lie[1],

C. Roth[5], E. H. Alsaker Roti[1], T. Reichborn-Kjennerud[1], E. Susser[2], P. Magnus[1], W. I. Lipkin[2] and C. Stoltenberg[1], (1)*Norwegian Institute of Public Health*, (2)*Columbia University*, (3)*National Health Institute, Norway*, (4)*University of Melbourne*, (5)*Norwegian Insitute of Public Health*

Background: Language delay is an early developmental marker for a subgroup of children with autism spectrum disorders (ASD). Assessment tools that address language delay in questionnaire based epidemiological studies may enable early identification of children with milder forms of ASD and provide insights into the trajectories of language development in ASD and other neurodevelopmental disorders. The Norwegian Mother and Child Study (MoBa) is a pregnancy cohort comprising more than 100,000 participating children. It includes questionnaires throughout pregnancy and when the child attains the ages of 6, 18 and 36 months and 5, 7 and 8 years that focus on child health and development as well as on mothers' and fathers' health and well-being. The quality of epidemiological studies based on questionnaires depends on the validity of the selected instrument. Ideally, an instrument should be validated both in each study population and in other populations.

Objectives: To validate child language measures included in the 36-month maternal questionnaire in MoBa, we used clinical data collected in a nested case-cohort study of ASD, the Autism Birth Cohort study (ABC). Children were selected for clinical assessment at approximately three years of age

Methods: Subjects: The validation sample consisted of 444 children aged 36 to 42 months (286 boys, 158 girls; 198 controls, 246 cases). Measures: Language complexity [LC] (Dale and Bishop, 2003) and Expressive and Receptive language competence (Ages and Stages Questionnaire [ASQ-C], Bricker & Squires, 1999) was rated by mothers on the 36-month MoBa questionnaire. Instruments used at clinical assessment were: Child Development Inventory [CDI] (Ireton, 1992), an age-normed expressive language scale completed by both mothers and preschool teachers; Vineland Communication domain, a standardized interview conducted with mothers [VABS-C] (Sparrow et al 1984); a language subscale on the Stanford-Binet 5 Knowledge [KN] (Roid 2003) measuring the child's vocabulary.

Results: The correlation (Pearsons) between the two MoBa language measures LC and ASQ-C was 0.868** ($p<0.0001$). Low scores on LC (less than 3 word sentences) predicted low standard scores on VABS-C ($\beta= .818^{**}$;$p<0.0001$) as did low scores for ASQ-C ($\beta= .827^{**}$;$p<0.0001$). The children scored differently on VABS-C depending on parental rating on the LC-measure in the MoBa questionnaire. There were no overlapping confidence intervals. The relationship between the mothers' and teachers' scoring of expressive skills on the CDI showed high concordance ($\beta=0.881^{*}$;$p<0.001$). A Bland-Altman plot of this relationship showed that there were low levels of disagreement, with little change across the level of expressive language skills. Mean difference between mother and teacher ratings on CDI constituted only 3 months in language age, less than 0.5SD.

Conclusions: Overall consistency in maternal reporting of their children's language skills was high. MoBa questionnaire scores on language skills provide excellent measure of speech and language development.

110.149 62 Relationship Between Screening Measures and Symptom Severity In Young Children Evaluated for An Autism Spectrum Disorder. K. C. Guest*[1], S. E. O'Kelley[2], M. Wojnaroski[1], M. K. McCalla[1] 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 show tremendous promise for use in primary care settings to identify toddlers at risk for ASD, but these 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, it would be important to identify how the M-CHAT and CSBS-ITC screening measures compare to the results of gold standard assessment tools of the ADOS and the ADI-R.

Objectives: To evaluate the relation of two screening measures for identifying young children with possible ASD with the outcome of the ADOS and the ADI-R, including:

(1) do scores on screening measures correlate with ADOS symptom severity and ADI-R domain total scores?

(2) do screening results predict ASD classification using the ADOS and ADI-R?

(3) do ADOS severity scores differ among children identified as at risk on the screening measures versus low-risk children?

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 form requesting

information about development. Final diagnoses utilized ADI-R/ADOS and were concluded by members of the interdisciplinary team.

Results: 158 children have been screened using these procedures, with current diagnostic outcome available for a subset (n = 46), including final diagnosis of ASD or other developmental disabilities. M-CHAT total scores were positively correlated with ADOS severity scores ($r=.32$, $p<.05$) and with ADI-R domain scores ($r=.33$ to $.54$, $p<.05$), such that both screening and assessment measures showed elevated ASD symptoms. A similar trend was noted with the CSBS-ITC, where the presence of positive social/communication skills was negatively correlated with ADOS severity scores ($r=-.31$, $p<.05$) and with ADI-R domain scores ($r=-.59$ to $-.42$, $p<.01$). Among the children with an Autism Spectrum or Autism classification on the ADOS, 79% were detected with the M-CHAT and 91% were detected with the CSBS-ITC. Among the children with an Autism classification on the ADI-R, 94% were detected with the M-CHAT and 100% were detected with the CSBS-ITC. Children who failed the M-CHAT and CSBS-ITC screenings had a mean ADOS severity score of 5.8 (SD=2.74) and 5.9 (SD=2.6), respectively, compared to children who passed the M-CHAT and CSBS-ITC screenings with a mean ADOS severity score of 5.0 (SD=1.9) and 4.0 (SD=2.4), respectively. Evaluations will be completed on 50 additional children.

Conclusions: The current data suggests that there is a strong relation between brief, caregiver completed screening measures and more comprehensive observation and interview measures for young children with ASD and DD. Further, level of severity of ASD symptomatology does not seem to distort caregiver report of actual child behavior on screeners. Additional analyses with the complete sample will also address how screener and assessment outcomes relate to clinical diagnosis.

110.150 63 Early Identification of Autism: Development and Evaluation of An Online Training Program for Mothers and Child Care Providers. K. L. Thorsen* and W. A. Goldberg, *University of California, Irvine*

Background:

Although parents of children with autism report having concerns before formal diagnoses, mothers' utility as informants has been limited by varied levels of knowledge of autism and abilities to recognize subtle qualitative differences in atypical and typical behaviors. However, mothers typically spend the most time with their infants and see their behavior across multiple contexts. Likewise, paid providers of child care spend a large amount of time with infants, and are a valuable source of information regarding their behavior in non-maternal care settings. Therefore, mothers and child care providers are well-positioned to report on early signs of autism, but may need training to recognize subtle signs of autism in infancy to enhance the likelihood of early detection.

Objectives:

The primary objective is to develop and test a multimodal, online training program for parents and child care providers aimed at improving the early detection of autism. An experimental research design is used to determine if participants' *knowledge* of typical infant development and autism, as well as their ability to *recognize* the early signs of autism and typical abilities, can be improved.

Methods:

Sample. By the conclusion of data collection, 100 mothers and infants (mean age = 6 months, range = 5-8 months) and 50 child care providers who work with infants younger than 12 months will have participated in the study. Mothers include: 1) high-risk group: mothers with an older child with an ASD and an infant, and 2) low-risk group: mothers and infants with no family history of ASDs. Participants were recruited from child care facilities, autism fundraising events, and flyers in public locations where mothers tend to frequent.

Measures. The 45- minute, online training program was developed using information from academic sources, research findings, and assessments, as well as video of infants demonstrating typical and atypical behaviors, or "red flags" for autism. The program features text, videos, and activities to enhance *knowledge* of infant development and autism and *recognition* of typical and atypical behaviors. Mothers compare the behavior of their own infants to that of infants shown in the videos, and both mothers and child care providers are evaluate the behaviors of infants in the videos and indicate the extent of their concern about these behaviors.

Procedure. The effectiveness of the training program is tested with an experimental design. Mothers and child care providers are randomly assigned to A) the training program, or B) a control video about childproofing the home. Pre- and post-test questionnaires include measures of *knowledge* and *recognition* of infant development and autism.

Results:

At this time, data collection is in progress and results will be fully analyzed by the conference date. Trained parents and experienced child care providers are expected to demonstrate greater knowledge and accuracy regarding infant behaviors than untrained parents and less experienced care providers.

Conclusions:

This training is expected to be a cost-effective, valuable component in the screening of very early autism. Initiation of early intervention can help these infants with delayed development "catch up," or prevent children from falling behind.

110.151 64 Evaluating a Training Model for the Use of Enhanced Diagnostic Screening Measures within Community Pediatric Practice. E. H. Dohrmann*[1], Q. Humberd[2] and Z. Warren[1], (1)*Vanderbilt University*, (2)*Blanchfield Army Community Hospital*

Background: Early accurate diagnostic classification of young children with ASD is a critical public health issue. A growing body of research indicates that children who receive early ASD-specialized intervention services show significant gains in cognitive and adaptive functioning. While caregivers are able to report concerns to medical professionals by the age of 12 - 18 months and the diagnosis appears quite stable by 24 - 36 months, the average age of diagnosis is 4 years or older, representing a serious time lag. Since pediatricians and family physicians are often the first point of contact for families, they play an important role in early identification of ASD. The path from positive screening to appropriate diagnosis, however, is not well-established.

Objectives: In the current report we describe results from an ongoing training program in Tennessee designed to help pediatricians diagnose young children with ASD in community settings within a time-limited framework.

Methods: Six community health professionals (i.e., pediatricians, nurse practitioners) who had previously completed an office-based training program for introducing clinically-validated screening tools into primary care settings were invited to participate in the program. Phase 1 was a two-day evaluation workshop involving training on the STAT, MCHAT, and diagnostic interviewing. Phase 2 included evaluation practice and feedback, and Phase 3 involved independent evaluations and referrals of these cases to the university-based clinic for a separate evaluation.

Results: 13 cases were referred to the university-based clinic from this training. For the referred cases there was 84.6 % (11/13) agreement as to whether a child met criteria for an ASD diagnosis. Within the group flagged for ASD, there was 62.5 % (5/8) agreement on the specific ASD diagnosis made. For the two cases where there was disagreement on the presence of an ASD, the referral source was the same and there were no significant differences in calibrated severity, cognitive, or adaptive scores when compared to the cases in agreement.

Conclusions: The current results support previous findings from this program, namely that training in standardized ASD assessments can help community practitioners accurately identify children with ASD within their local practice settings. Continued expansion of the model will need to systematically assess trainee characteristics associated with accuracy of diagnosis. We are currently evaluating the model's impact on families and analyzing feedback from participating professionals, in part to determine whether definitive diagnosis or risk designation is the most appropriate goal. Findings from this program are promising given the large impact even a small number of community medical practitioners could have in providing timely diagnostic services across the state and country.

110.152 65 Aka (ASSESSMENT KIT FOR AUTISM): PRELIMINARY DEVELOPMENT of AN Indian SCREEN for Young Children. N. Singhal*, *Action For Autism*

Background: Culture specific, inexpensive screening instruments for autism spectrum disorders (ASD) are required to facilitate timely diagnosis, especially in South Asian countries such as India where awareness about ASD is still limited. Additionally, there is an increased need to create a workforce who can identify children at risk early and send them to specialists for detailed assessments.

Objectives: The objective was to complete the preliminary development of a new tool to screen for ASD. AKA is a tool designed for children aged 18 months and above to help differentiate those with ASD from those with severe behavioural disorders and those who are developing typically. It reflects the conceptualizations of autism as per the DSM-IV-TR criteria.

Methods: A review of existing screening tools and observational methods was conducted to develop an outline of potential components. Initial feedback was obtained after selected toys and components were provided to different potential users who were both experienced (at least five years of experience conducting functional and academic assessments of children with autism) and individuals training to become special educators with no prior background with autism. Expert review was also used to provide face validity.

Results: Based on the process above, development of an initial screening kit was developed with three components.

1 A **"quick scan"** of child behaviours, completed by asking parent or persons who spend most time with the child a set of five questions.

2 Suggested **activities** for the professional to conduct that will provide more information on the child's behaviours.

3 Suggested **questions** for people who spend the most time with the child to get information about usual patterns of behaviour and activity, since all the relevant information may not be evident in one sitting with the child.

The intention of AKA is that it can be completed by teachers, special educators, community-based rehabilitation professionals and caregivers in a variety of settings including child guidance clinics, schools, day-care centres and homes.

AKA was designed with an assortment of items that would be of interest to young children irrespective of their gender, educational, cultural and socio-economic background. Objects included are culturally familiar, child–friendly, easily available, and inexpensive and require no complicated manipulations for either the child or the administrator. A unique aspect of AKA is the inclusion of a companion resource to provide the administrator with an overview on ASD; suggestions on creative activities and questions for an interview; and key behaviours to observe and enquire about to capture the qualitative development in a child.

Conclusions: Validation of the AKA has not yet occurred. If validated, the AKA can be a useful tool for screening autism in low resource countries because of the instrument's flexibility and unique elements that demystify ASD and make it practical and reachable to various professionals in the field.

110.153 66 Early Identification of Autism Spectrum Disorders In Brazilian Day Care Centers. C. de Paula*[1], L. C. Zaqueu[1] and M. C. Teixeira[2], (1)*Mackenzie Presbyterian University*, (2)

Background: A recent systematic review of the Brazilian scientific literature on Autism Spectrum Disorders (ASD) demonstrated a significant increase in the Brazilian autism scientific production in the last two years. However, it also showed that most of these publications are not focused on matters that contribute significantly to improving public health and that studies related to early identification are extremelly rare in this country.

Objectives: this research aimed at (1) identifying delays in the cognitive/motor development and early signs of ASD in children enrolled in public daycare centers in Southeast Brazil; (2) establishing associations between developmental delays / early signs of ASD and demographic / personal features; (3) identifying gaps in Joint Attention and verifying its eventual association with higher risk of ASD.

Methods: Cross-sectional study including 92 children aged 16-to-24 months enrolled in five day care centers in a town from Southeast Brazil (Barueri, São Paulo State). This sample represented the universe of all children at day care units in the South of Barueri. Instruments: Pictorial Infant Communication Scales (PICS), Modified Checklist for Autism in Toddlers (M-CHAT), and Development Screening Test-II - DENVER II. Data were first managed in descriptive analysis. Further bivariate analysis with application of Chi-square and Fisher's Exact tests as well as calculation of odds ratio was carried out.

Results: Prevalence of 28.3% for cognitive and/or motor development delay was observed. Developmental delays were more frequent in the area of language (54.48%), followed by personal-social (17.97%), fine motor adaptive (14.74%), and gross motor (12.81%) domains. Association between developmental delays / signs of ASD and demographic / personal data was statistically significant as to prematurity and lack of prenatal care. Five children (5.4%) were classified as probable cases positive for ASD according to M-CHAT. Bivariate analysis considering the results of both PICS and M-CHAT showed the following tested skills as more frequently associated with ASD: (1) to point to draw attention, (2) to point to indicate interest, (3) to share an event, (4) to deliver an object, (5) to ask for help, (6) to stare at an desired object.

Conclusions: Evidences of developmental delay and early signs of ASD in children attending daycare centers were here found out, and can be helpful for future actions in health and education politics in Barueri, SP, Brazil.

110.154 67 Rapid, Feasible Observational Paradigm for Confirmation of Autism Spectrum Disorders. A. Abbacchi*, Y. Zhang and J. N. Constantino, *Washington University School of Medicine*

Background: Traditional methods for the clinical confirmation of autism spectrum disorders (ASD), which have been increasingly adopted in the U.S. as *prerequisites* for both service eligibility and research participation, are expensive and difficult to acquire consistently in public health settings. They are predicated on categorical conceptualization of autistic

syndromes, and are unfeasible for repeated-measures approaches to measuring response to intervention.

Objectives: This study represents a critical step in a series of efforts to substantiate a quantitative measurement system feasible for use in public health settings. The question addressed by this report is whether traditional paradigms implemented to establish clinical confirmation—given a strong level of suspicion of ASD engendered by the results of brief questionnaires encompassing developmental history and current symptomatology—might be achieved using a similarly brief observational paradigm that could be employed in general clinical and educational settings by clinicians and educators who are not specifically trained in the administration and scoring of extensive diagnostic rating scales.

Methods: In a sample of 64 subjects with a diagnosis of an autism spectrum disorder, we tested the ability of clinicians (including a school psychologist and a post-doctoral clinical psychologist) to discriminate level of severity of autistic symptomatology using specific adaptations of the Childhood Autism Rating Scale-2 (CARS-2). Adaptations included 1) clinicians coded the CARS-2 based exclusively on a 15 minute videotaped observation (no other subject data was made available to the coders), in which an examiner a) attempted to engage the subject in conversation or in simple imitative play; b) engaged in sustained symbolic interactive play with the subject; and c) initiated a transition to a sensory activity; 2) autistic severity indices were generated exclusively by the first 8 items of the CARS-2 which cover social impairments and stereotypic behavior; 3) the remaining items were used as a screen for the presence of co-morbid or alternate conditions, but did not figure into the total severity score for autistic impairment.

Results: Clinician's quantitative severity ratings reliably captured levels of gradation in severity ascertained independently using the Autism Diagnostic Interview-Revised (ADI-R; correlation with ADI-r social impairment score, r=.60); and exhibited item-level *and* scale-level inter-rater reliability on the order of 0.85. CARS-2 scale scores extrapolated from the sub total for items 1-8 were well within the published range for autism spectrum conditions.

Conclusions: Standardized clinician ratings based on brief semi-structured observations of interpersonal behavior—*without* the need for extensive rater training—show tremendous promise for the diagnostic confirmation of ASD, especially when combined with rapidly-obtainable information on developmental history and current symptomatology in daily social contexts. Such observations could constitute a key component of a highly cost-effective strategy for diagnosis, and could facilitate the acquisition of repeated measures data, which is vital to the ascertainment of response-to-intervention in research, educational and public health settings.

110.155 68 Utility of the SCQ In Predicting Clinician Concerns for ASD In An Outpatient Sample. A. B. Ratto*[1], A. J. Freeman[2], J. Kogos Youngstrom[2], T. W. Frazier[3], R. Findling[4] and E. A. Youngstrom[5], (1)*University of North Carolina*, (2)*UNC-Chapel Hill*, (3)*Cleveland Clinic*, (4)*University Hospitals Case Medical Center*, (5)*University of North Carolina at Chapel Hill*

Background: The prevalence rate of autism spectrum disorders (ASD) and public awareness of these disorders have increased dramatically increased over the past decade (Rice, 2009). Consequently, clinicians without specialized training in ASD are increasingly involved in the screening and diagnosis of these disorders. Given their increased role in the process of ASD diagnosis, it is important to examine how clinicians without ASD expertise identify children at risk. The Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003) is one of the most widely use ASD screening tools. Despite its wide use, the SCQ has been understudied in samples without developmental referral concerns (Chandler et al., 2007).

Objectives: The goal of the present study was to evaluate the degree to which the Social Communication Questionnaire (SCQ, 2003) predicted concerns of trained clinicians for ASD in a large, mental health outpatient sample.

Methods: Participants were 620 children and adolescents, ranging from 4 to 18 years of age, recruited using a consecutive case series design from all intakes at a community mental health clinic. Caregiver and youth pairs participated in an extended assessment of common disorders using the Schedule for Affective Disorders and Schizophrenia for Children (KSADS), as part of a larger battery of instruments. Research assistants were primarily pre-doctoral interns trained to a symptom level Kappa>.85. Final diagnoses were based on the Longitudinal Expert Evaluation of All Available Data process with a licensed clinical psychologist (Spitzer, 1983), including intake information, developmental history, KSADS, and extensive review of records. Diagnoses were masked to the SCQ. Most youth presented with multiple diagnoses (Mean: 2.6) and most youth had at least one disruptive behavior disorder (67%). Clinicians were only concerned about 12 youth (2%) having ASD.

Results: The ability of the SCQ to predict clinician concerns for ASD was examined using receiver operating characteristic (ROC) analysis. An Area under the curve (AUROC) of .50 indicates chance performance. The total ASQ score did not significantly predict ASD, AUROC=.63, *p*=.13. Given the low AUROC for the SCQ total score, separate ROC analyses were run on each of the three factors: social deficits, communication deficits, and stereotyped behavior. Social deficits (AUROC=.40, *p*=.23) and communication deficits (AUROC=.59, *p*=.29) did not significantly predict clinician concern about ASD. Caregiver reporting of Stereotyped behaviors significantly predicted ASD clinician concern, (AUROC=.79, *p*<.001).

Conclusions: The SCQ total score served as a poor predictor of clinician concerns for ASD in community mental health; however, scores on the stereotyped behavior factor of the SCQ were strong predictors of clinician concerns. The results of this study indicate that stereotyped and repetitive behaviors are associated with clinical concern for ASD, whereas social and communication symptoms did not predict clinical concerns. These results also suggest that the SCQ might not function well outside of developmentally-focused clinical settings, perhaps due to differences in parental knowledge and symptom presentation, or to high rates of other clinical issues generating false positives on scales measuring social or communication deficits.

110.156 69 Short (10-item) Versions of the Autism Spectrum Quotient (AQ) as 'Red Flags' In Identifying Children, Adolescents, and Adults with Autism Spectrum Conditions. C. Allison*, B. Auyeung and S. Baron-Cohen, *Autism Research Centre, University of Cambridge*

Background: Diagnosis of autism spectrum conditions (ASC) is often delayed, especially when impairments are less severe. Concerns may be raised by parents at 18 months, yet some individuals reach adulthood before their difficulties are recognized as warranting a clinical diagnosis. Often, secondary psychiatric conditions such as anxiety and depression may have developed. According to the National Audit Office report in the UK (2009), 80% of primary care professionals (GPs) believed that they required additional guidance to identify individuals with suspected undiagnosed ASC. Our previous studies reported four parent- or self-report questionnaires aimed at quantifying autistic traits in toddlers, children, adolescents and adults. These are the Autism Spectrum Quotient (AQ), adult, adolescent and child versions (Baron-Cohen et al., 2001, Baron-Cohen et al., 2006, Auyeung et al., 2009), and the Quantitative Checklist for Autism in Toddlers (Q-CHAT, Allison et al., 2008). These questionnaires all show highly significant group differences in scores between individuals with a diagnosis of ASC and controls. They have been useful as phenotyping measures in research, but are too long (50 items) for quick use to identify 'red flags' in front line clinical or educational settings. Thus, there is a need to test if shorter (10 item) versions of these measures discriminate ASC from controls with high sensitivity, specificity, predictive validity, and reliability.

Objectives: To produce short versions of the child, adolescent, and adult AQ and the Q-CHAT to aid professionals in primary health care, social care, and education settings in their decision making about whether to make a referral for a specialist assessment for ASC.

Methods: Over 3000 control individuals (or their parents), and over 1000 cases (or their parents) completed one of the four questionnaires according to age. Self-report was accepted for individuals over 16 years old. Parent-report was required for those under age 16. Administration was via online or postal questionnaire. The proportion of participants who scored ASC positive on each item was compared on each questionnaire across cases and controls. The ten most discriminating items from each questionnaire were chosen. Receiver Operating Characteristic (ROC) curves were examined for the short versions.

Results: Adults, adolescents, and children with ASC scored significantly higher ($p < 0.001$) than controls on each version of the 10 item AQ (AQ-10). The area under the ROC curve on all versions of the AQ-10 was > 0.96, representing excellent sensitivity and specificity. In the control groups, males scored significantly higher than females. Cut-points for referral for a multi-disciplinary assessment for ASC will be suggested for each tool. Q-CHAT data analysis is ongoing.

Conclusions: This study demonstrates that short (10 item) versions of the AQ discriminate well between individuals with ASC and controls. Further, the 10-item versions of the AQ perform as well as the longer (50-item) versions. This study involved large samples and therefore results are likely to be robust. A limitation is that questionnaires were completed through online or postal testing. Evaluation of these 'red flag' guides will be conducted in primary care, social care and educational settings.

110.157 70 Identifying Autism Spectrum Disorders In Adults with Intellectual Disability: The Validity of the Social Communication Questionnaire. W. T. Brooks* and B. A. Benson,

Background: Identifying autism spectrum disorders in both children and adults who present with diverse symptoms is a crucial step in understanding the nature of these disorders and allocating resources to individuals who may need specific treatment and support for the associated challenges. Individuals with ASDs often require extensive life-long support, and continued assessment throughout the lifespan is essential for maintaining appropriate care and treatment.

Continued research on the validity of ASD screening measures is important in identifying individuals who may need further assessment for autism, especially in at-risk populations, such as individuals with intellectual disability. Many adults who have autism spectrum disorders were misidentified as having other disorders before the increased awareness of ASDs and the introduction of more sophisticated diagnostic tools. While the psychometric studies of the SCQ in children and adolescents provide evidence that the SCQ is a useful and valid screening measure, no independent studies on the validity of the SCQ among adults with ASDs were found.

Objectives: This project examined the validity of the Social Communication Questionnaire (SCQ) in a sample of 69 adults with a prior diagnosis of 1) intellectual disability (ID) and an autism spectrum disorder (ASD), 2) intellectual disability (ID) presenting with moderate-severe challenging behavior, or 3) intellectual disability (ID) presenting with mild-no challenging behavior.

Methods: Adults with intellectual disability (ID) and/or their guardians were recruited from agencies in Central Ohio and provided assent/consent to allow researchers to review agency records to determine prior diagnosis of autism spectrum disorders. Participants with ID nominated support staff to complete several measures to assess ASD symptoms (the SCQ and a DSM-IV Symptom Checklist), behavior problems (the Aberrant Behavior Checklist-Community), and adaptive functioning (Adaptive Behavior Assessment System – Second Edition) of participants with ID. The discriminative validity of the SCQ Current version was assessed by examining sensitivity and specificity. Receiving Operating Characteristic (ROC) analyses were conducted to identify optimal cut-off scores of the SCQ Current.

Results: The SCQ Current version, as rated by support staff, yielded a sensitivity of .76 and a specificity of .79 at the cutoff score of 15 proposed by the authors. However, the optimal cutoff score in this sample was 12, which yielded a sensitivity of .86 and specificity of .65. The ROC analysis of SCQ Current total scores in the total sample yielded an area under the ROC curve (AUC) of .72. Analyses were repeated in a subset of participants in the ID-only group with high and low levels of behavioral problems, and comparable sensitivity, specificity and AUC values were found.

Conclusions: Although the SCQ Current version was not specifically designed to screen for ASDs in adults, it may be a useful tool for screening individuals whose early developmental history is unavailable. A lower cutoff score than the authors originally proposed is recommended for use in adults, which is consistent with research indicating that autism symptoms improve with age. Behavior problems did not appear to affect the discriminative validity of the SCQ Current in this sample.

Genetics Program

110 Genetics and Genomics

110.034 100 Disentangling Genetic and Assortative Mating Effects on Autistic Traits: Findings From the First Extended Twin Family Study In Adults. R. A. Hoekstra*[1], A. A. Vinkhuyzen[2], H. H. Maes[3], S. van der Sluis[4] and D. Posthuma[4], (1)*Open University*, (2)*Queensland Institute of Medical Research*, (3)*Viginia Commonwealth University*, (4)*VU University*

Background:

Autism is known to be highly heritable. Twin studies in children and adolescents suggest that subclinical expression of traits related to autism also shows strong genetic influences. Some researchers (Baron-Cohen, 2006; Constantino & Todd, 2005) have proposed that individuals may actively or passively select their partner based on their autistic traits, a phenomenon referred to as assortative mating. Assortative mating induces higher similarity between siblings and - when not taken into account - may attenuate heritability estimates. Previous studies examining assortative mating have yielded conflicting results, with spousal correlations ranging from non-significant (r=.03 to.05; Pollman et al., 2010; Hoekstra et al., 2007) to moderate (r=.26 to .38; Constantino & Todd, 2005; Virkud et al., 2009; Schwichtenberg et al., 2010).

Objectives:

This paper reports on the first community-based extended twin family study in adults, aiming to i) investigate the heritability of autistic traits in adulthood while taking into account assortative mating, and ii) elucidate the mechanisms behind potential assortative mating.

Methods:

305 twin pairs (mean age 46.14 years) and their parents, spouses, siblings and children (total N=1094) were asked to fill out the short version of the Autism-spectrum Quotient (AQ-short; Hoekstra et al., 2010). The genetic and environmental effects on individual differences in AQ-short scores were examined using structural equation modelling. It was tested whether spousal resemblance on AQ-short scores was due to active partner selection based on observable autistic traits (phenotypic assortment) or to a shared social background between the spouses (social homogamy).

Results:

Identical twins resembled each other more strongly on the AQ-short than fraternal twins, non-twin siblings, parents and their offspring, and other relatives with less genetic similarity, suggesting that genetic influences play a role. AQ-short scores of spouses correlated only modestly (r=.13). The very small effects of assortative mating were explained by social homogamy rather than phenotypic assortment. Genetic influences explained 55% of the variance in autistic traits, most of the remainder of the variance was explained by environmental influences unique to each individual in the family.

Conclusions:

In line with previous findings from studies in children (Ronald et al., 2006) and adolescent twins (Constantino et al., 2003; Hoekstra et al., 2007), individual differences in autistic traits show substantial heritability in adulthood. The effect of assortative mating is very limited; suggesting that these mechanisms have little influence on the risk for autism, and induce negligible bias in heritability estimates when using classical twin studies. Since autistic traits show considerable variation in the general population, future genetic studies may be aided by measuring autistic traits on a continuous measure such as the AQ.

110.035 101 Mitochondrial DNA and Anti-mitochondrial Antibodies in Serum of Autistic Children. T. Theoharides*, *Tufts University*

Background: Autism spectrum disorders (ASD) are neurodevelopmental disorders characterized by difficulties in communication, cognitive and learning defects, as well as stereotypical behaviors. For the majority of cases, there are no reliable biomarkers or distinct pathogenesis. However, increasing evidence indicates ASD may be associated with immune dysregulation, and may have a neuroimmune component. We recently showed that the peptide neurotensin (NT) is increased in autistic children.

Objectives: To examine the hypothesis that mitochondrial DNA may be released extracellularly early in life and induce an "autoimmune" response that may contribute to the pathogenesis of autism.

Methods: We investigated a homogeneous group of young Caucasian children with the same endophenotype. Subjects were diagnosed with autistic disorder using the ADI-R and ADOS-G scales, which have been validated in the Greek population. Anti-mitochondrial antibody Type 2 (AMA-M2) was detected using a commercial EIA Kit. Total DNA was extracted from serum samples using Qiagen DNA Micro extraction kit. Mitochondrial specific DNA for Cytochrome B (mt-CytB) and 7S (mt-7S) was detected and quantified by Real time PCR using Taqman assay. GAPDH DNA was used to exclude any genomic "contamination." Total DNA was isolated from supernatant fluids of cultured LAD2 cells using the same method.

Results: NT induces release of extracellular mitochondrial DNA (mtDNA) that could act as

"autoimmune" triggers. We further show that serum from young autistic patients contains mtDNA (n=20; cytochrome B, p=0.0002 and 7S, p=0.006), and anti-mitochondrial antibody Type 2 (n=14; p=0.001) as compared to normally developing, unrelated controls (n=12). Extracellular blood mtDNA and other components may characterize an autistic endophenotype and may contribute to its pathogenesis by activating auto-immune responses.

Conclusions: These results suggest that serum mitochondrial components may induce autoimmune responses, as previously reported for TLR9 activation on human peripheral polymorphonuclear leukocytes, and may help with early diagnosis of at least a subgroup of autistic patients.

110.036 102 Mitochondrial Dysfunction in Autism Spectrum Disorders: A Systematic Review and Meta-Analysis. D. Rossignol*[1] and R. E. Frye[2], (1)*International Child Development Resource Center*, (2)*University of Texas Houston Health Science Center*

Background: Mitochondrial dysfunction has been implicated in several psychiatric and neurological disorders. Over the past decade, evidence has accumulated that some individuals with autism spectrum disorders (ASD) have concomitant mitochondrial dysfunction. Several review articles have been recently published concerning mitochondrial dysfunction in ASD. However, to date, neither a systematic comprehensive review nor a meta-analysis of this recently evolving literature has been published.

Objectives: In this presentation, we systematically review the evidence for mitochondrial dysfunction in ASD. First, features of mitochondrial dysfunction in the general population of children with ASD are identified. Second, characteristics of mitochondrial dysfunction in children with ASD and concomitant mitochondrial disease (MD) are compared to ASD children without MD, and non-ASD children with MD.

Methods: A comprehensive literature search of PUBMED, Google Scholar, CINAHL, EmBase, Scopus, and ERIC databases from inception through August 2010 was conducted to collate biochemical markers and other features that could indicate mitochondrial dysfunction in ASD. A meta-analysis was performed based on the information derived from these studies.

Results: The prevalence of MD in the general population of ASD was 5.0% (95% CI 3.2-6.9%), much higher than found in the general population (~0.01%). The prevalence of abnormal biomarker values of mitochondrial dysfunction was high in ASD, much higher than the prevalence of MD. Variances and mean values of many mitochondrial biomarkers (lactate, pyruvate, carnitine and ubiquinone) were significantly different between ASD and controls. Some markers correlated with ASD severity. Neuroimaging, *in vitro*, and post-mortem brain studies were consistent with an elevated prevalence of mitochondrial dysfunction in ASD. Taken together, these findings suggest children with ASD have a spectrum of mitochondrial dysfunction of differing severity. Eighteen publications representing a total of 112 children with ASD and MD (ASD/MD) were identified. The prevalence of developmental regression (52%), seizures (41%), motor delay (51%), gastrointestinal abnormalities (74%), female gender (39%), and elevated lactate (78%) and pyruvate (45%) was significantly higher in ASD/MD compared to the general ASD population. The prevalence of many of these abnormalities was similar to the general population of children with MD, suggesting that ASD/MD represents a distinct subgroup of children with MD. Most ASD/MD cases (79%) were not associated with genetic abnormalities, raising the possibility of secondary mitochondrial dysfunction. Treatment studies for ASD/MD were limited, although improvements were noted in some studies with carnitine, co-enzyme Q10, and B-vitamins. Many studies suffered from limitations, including small sample sizes, referral or publication biases, and variability in protocols for selecting children for MD workup, collecting mitochondrial biomarkers, and defining MD.

Conclusions: Overall, this evidence supports the hypothesis that mitochondrial dysfunction is associated with ASD. Additional studies are needed to further define the role of mitochondrial dysfunction in ASD.

110.037 103 SFARI Base: An Adaptable Informatics Infrastructure for the Simons Simplex Collection. S. B. Johnson*[1], L. Rozenblit[2] and D. Voccola[2], (1)*Columbia University*, (2)*Prometheus Research, LLC*

Background: The goals of the Simons Simplex Collection (SSC) are to acquire the largest sample to date of simplex families with idiopathic autism in a highly compressed time-frame, maintain the highest data quality standards and disseminate data and biospecimens to the research community efficiently. Long-term requirements include support for additional studies and integration with partner systems such as the National Database for Autism Research (NDAR) and the Interactive Autism Network (IAN). The Simons Foundation partnered with a software vendor (Prometheus Research, LLC) to develop a distributed, Web-based, information system called **SFARI Base**.

Objectives: The purpose of SFARI Base is to support management of scientific data and materials generated by studies advancing the Simons Foundation Autism Research Initiative (SFARI). The information system must (1) acquire data via large-scale, multi-site, multi-modal clinical studies, and integrate these with results from laboratory studies of biomaterials; (2) curate data via data quality processes, controlled compilation of data releases, and inventory control for biomaterials; and (3) disseminate study data and materials via data exploration and advanced querying. Additional goals include the ability to add new studies, types of data, and functions at diminishing marginal cost and adapt protocols for

ongoing studies at costs proportional to the amount of change. These requirements demand a flexible, extensible infrastructure.

Methods: SFARI Base employs a distributed architecture, in which clinical sites use software (**SFARI Outpost**) to locally manage studies, define protocols, screen families, enroll participants and enter data. SFARI Outpost de-identifies the data and transmits them to a central repository. Data-quality consultants at the University of Michigan use validation tools to review submitted families and help sites identify and repair problems. Researchers access curated data and biospecimens through a Web interface (base.sfari.org). The process involves assigning privileges for laboratory staff, identifying a set of families of interest, describing a research project, requesting data or specimens and providing institutional approvals. Additional functions enable investigators to (1) submit new data generated from analysis of the collection, establishing a growing pool of knowledge, (2) re-contact families to initiate new studies, and (3) integrate data on participants to other autism collections such as NDAR using global unique identifiers (GUID).

Results: By July 2011, the SSC will have accrued over 2,500 families. At present, more than 65 different research groups have made over 250 requests for SSC data or materials, and nearly 120,000 DNA samples have been shipped. Results from whole genome scans performed using both Illumina and Nimblegen chips are available for nearly 1,000 families, with results from additional families and analysis types expected in 2011.

Conclusions: The SSC imposed ambitious requirements of large volume, high quality and compressed timeframe, requiring the development of innovative technologies and procedures. SFARI made a substantial investment in infrastructure to deliver a system that was adaptable in the face of rapid change and established a governance structure to respond to evolving needs. SFARI Base provides support for new studies, new data types, and new functions at a relatively low cost and a rapid timeline.

110.038 104 IAN Genetics: An Automated Web-Based System for Rapid Phenotyping, Enrollment, and Genetic Sample Collection. A. R. Marvin*[1], H. Lee[2], J. Nestle[1], J. N. Constantino[3], C. Anderson[1], T. Zandi[1], E. Yahudah[1], S. S. Marvin[1], J. K. Law[1], P. A. Law[1] and S. F. Nelson[2], (1)*Kennedy Krieger Institute*, (2)*UCLA*, (3)*Washington University School of Medicine*

Background:

A sufficient supply of genetic samples does not exist for comprehensive identification of autism risk alleles. Lee et al. (2010) established accuracy via clinical confirmation of a web-based approach to rapid phenotyping of autism using parent report of community diagnosis and scores on the SCQ-Lifetime.

Objectives:

To create a web-based, automated mechanism for large-scale rapid phenotyping and biomaterials collection.

Methods:

- Eligibility: Aged 4-17 years; Simplex ASD (and one unaffected sibling, if any) or twin set with one or both siblings affected; Participation (or willingness to participate) in US autism registry/database (requiring professional diagnosis of ASD to join).

- A protocol was developed using LabCorp as the primary blood-draw collection, genomic purification and storage site.

- An online consent was integrated into the registry form/questionnaire set.

- Upon electronic consent, the system generates and emails the following materials to the consenting parent within 1 minute (a copy is also sent to the study's email so that it can be resent upon request):

  - Welcome Email;

  - Instruction sheet (PDF attachment) stamped with child's name, Research ID, and DOB; contains link to LabCorp site and a social story;

  - LabCorp Requisition (PDF attachment) stamped with child's Research ID, plus a second explanatory page for LabCorp staff. Does not contain PHI.

- Within one minute of receipt of weekly LabCorp report, the system generates emails containing Amazon gift codes. If a completed SCQ-Lifetime is not detected, the system generates an "SCQ reminder" email. Once the subject completes the SCQ-Lifetime, the system generates the "gift code" email.

- An email is generated and sent to the study email box when an unconsented child has "aged out" of the study. Currently, manual intervention is required to check whether siblings should be added or removed from the study, although a web-based tool helps staff add or remove subjects.

· A web-based tracking system indicates status, days-since-consent, distance from nearest LabCorp, email, etc. This is used in reporting and in follow-up communications with parents of children consented but for whom we have no record of the blood-draw being completed.

· A study was performed to determine barriers to completion of blood-draw among consented participants. As a result, the follow-up procedure includes forwarding of the original welcome email and attachments (which, in many cases, have been misplaced). We are also developing an alternative mechanism to enable participation for those unable to reach a LabCorp site.

· Currently, children are not automatically added to the study: a list of qualifying children is uploaded into the system, which then assigns the online consent into each child's form/questionnaire set.

Results:

· As of 12/10/2010, 433 children (affected=271, 63%) from 43 US states have been consented, with 121 (affected=72, 60%) reported as completing the blood-draw so far.

· The system has enough capacity to handle all requests without concern for oversaturation.

· Automation of the workflow has minimized staffing needs.

Conclusions:

Web-based automation of subject recruitment and coordination of sample collection has been shown to be successful and cost effective.

110.039 105 Genomics Tool Allowing Data Aggregation Across Projects and Repositories In Autism Spectrum Disorder Research. S. I. Novikova*[1], D. Hall[2], L. Tatarov[3], M. McAuliffe[4] and M. F. Huerta[1], (1)*National Institute of Mental Health*, (2)*National Institute of Mental Health (NIMH)*, (3)*NIH Centers for Information Technology*, (4)*NIH Center for Information Technology*

Background: The National Database for Autism Research (NDAR) was designed to help the autism spectrum disorder (ASD) research community to accelerate discoveries by facilitated scientific collaboration, communication and sharing of detailed research data. By combining datasets from multiple existing data resources, NDAR enables researchers to search and aggregate data from multiple projects across multiple data repositories. NDAR supports clinical, phenotypic, imaging and genomics data. The first model of genomics data acquisition was based on Minimal Information about a Microarray Experiment (MIAME) format. Using this format, the NDAR team piloted data submission of raw genomics data from several investigators in July 2010. The results of the pilot experiment showed that the received genomics data was inconsistently defined across projects and required too much time for investigators to annotate for submission to NDAR.

Objectives: Based on the experience receiving genomics data, coupled with the need to provide access to genomics data from multiple different repositories, the NDAR team implemented a predefined set of parameters that would guarantee the consistency of raw experimental data, while simplifying the data definition for submission and aggregation across federated repositories such as the Autism Genetics Research Exchange, the NIH database for genotypes and phenotypes (dbGaP), the NIMH Genetics Repository, and the Simons Foundation Research Initiative, among others.

Methods: After thorough analyses of functional genomics data acquisition and storage criteria, such as MIAME, MAGE, MINSEQE, etc., and review of the needs of the ASD research community, the NDAR team developed an interactive tool that defines the relationship between samples and data files clearly and as simply as possible.

Results: The NDAR Genomics Tool standardizes the naming of data processing and analysis protocols, requires entering sufficient details and enforces unambiguous interpretation of the entered information. Scheduled for launch in December of 2010, in time for the January NDAR submission cycle, the tool will be used by ASD investigators to define their genomics data allowing data aggregation through NDAR across projects and data repositories.

Conclusions: The NDAR team will present at the IMFAR 2011 conference the conclusions from utilizing the NDAR Genomics Tool for submission into NDAR. Furthermore, we will update IMFAR attendees on the progress of refining and utilizing this tool in the process of establishing data federation with the Autism Genetic Research Exchange and dbGaP.

110.040 106 Building a Modular Database for Autism Research. S. B. Basu*, A. Kumar and E. Larsen, *MindSpec Inc.*

Background: The rising prevalence of autism spectrum orders (ASD) has spurred research focus on this complex neuropsychiatric disorder, generating diverse types of molecular information related to its pathogenesis. In the post-genomic era, hundreds more genes/loci have been associated with ASD than previously anticipated, and the rapid emergence

of this data poses a major challenge for systematic analysis of its content.

Objectives: To facilitate visualization and analysis of this large amount of data, we have created the Autism Database (AutDB), a publicly available, curated, web-based, and searchable database for genes linked to ASD. AutDB utilizes a systems biology approach by building a modular framework to integrate diverse types of evidence related to ASD risk genes. Current modules include: 1) *Human Gene*, which annotates all known autism-linked genes according to their genetic variation (genetic association studies, rare single gene mutations, and genes linked to syndromic autism)and relevance to autism; 2) *Animal Model*, which catalogs behavioral, anatomical, and physiological data corresponding to ASD-linked genes; 3) *Protein-Protein Interaction*, which builds interactomes based on all known direct relationships for protein products of ASD-linked genes; and 4) *Copy Number Variant*, which describes features of all reported copy number variants associated with ASD.

Methods: AutDB modules are integrated to allow cross-modal navigation of varied evidence related to ASD-linked genes. All data originates entirely from published, peer-reviewed scientific literature. Our researchers systematically search, collect, extract, and update data within AutDB modules based on multi-level annotation models. Notably, for the *Animal Model* module, we have developed a new standardized vocabulary of phenotypic terms designed to reflect the widely ranging clinical manifestations of ASD. Data is visualized in multiple formats for each module, ranging from hierarchical tables to chromosome ideograms and protein networks. We have also developed a tool called Workspace, a simulated environment in which a reference gene set from AutDB can be used along with the user's data for analysis without requiring the user to upload information into the database.

Results: As of December 2010, data content with AutDB modules consists of the following: 1) *Human Gene*: 230 entries based upon 140 primary research articles, 2) *Animal Model*: 79 entries encompassing 202 mouse models, 3) *Protein-Protein Interaction*: 84 entries containing a total of 1119 direct protein interactions, and 4) *Copy Number Variant*: 201 entries annotated from 22 primary research articles. The *Human Gene* and *Animal Model* modules are currently available on the website (http://www.mindspec.org/autdb.html), and the newly developed *Protein-Protein Interaction* and *Copy Number Variant* will be released in early 2011.

Conclusions: AutDB provides a publicly available web portal for ongoing collection, manual annotation, and visualization of genes linked to ASD. Importantly, this modular ASD database provides a platform for bioinformatics analysis which can be used to develop predictive disease models for ASD. Such prioritization of molecular pathways may accelerate the field of ASD research and lead to targeted drug treatments for this disorder.

110.041 107 Developmental Trajectories of Autism Spectrum Features and Sensory Behaviors In Angelman Syndrome. S. U. Peters*[1] and R. Hundley[2], (1)*Vanderbilt University; Kennedy Center for Research on Human Development*, (2)*Vanderbilt. University*

Background: Angelman syndrome (AS) is a neurogenetic disorder that is characterized by severe intellectual disability, lack of speech, seizures, and a low threshold for laughter. Previous studies have indicated overlap of autism spectrum features (ASD) and AS, primarily in individuals who are deletion positive, and primarily in those with larger deletions. Previous studies, however, did not control for the effects of cognition in examining ASD features, and did not examine longitudinal trajectories of ASD features or sensory behaviors.

Objectives: To examine: 1) Trajectories of autism spectrum features, sensory-seeking behaviors, and sensory-aversions within the context of development over time in individuals with AS who are deletion positive; and 2) Any differences in ASD features, sensory behaviors, and trajectories across patients who have Class 1 vs. Class 2 deletions.

Methods: Forty-two deletion positive patients with AS were enrolled as part of a larger natural history study of AS, including 17 patients with a larger, Class 1 deletion (extending from BP1-BP3) and 25 patients with a smaller Class II deletion (from BP2-BP3). Patients were between the ages of 2-25. The Bayley Scales of Infant Development-III, Vineland Adaptive Behavior Scales-II, Autism Diagnostic Observation Schedule, and the Behavior and Sensory Interests Questionnaire were given at baseline and after 12 months.

Results: The results of repeated measures ANOVA's indicate, that after controlling for level of cognition and chronological age, patients with Class 1 deletions have higher levels of impairment in social affect ($F= 8.65$; $p=.006$), higher restricted/repetitive behaviors ($F=7.92$; $p=.008$), and higher sensory aversions ($F=6.013$; $p=.02$) as compared to patients with Class 2 deletions. Sensory-seeking behaviors increase over time in both groups ($F=4.52$; $p=.04$), while restricted-repetitive behaviors remain stable over time in both groups. After controlling for the effects of cognition and age, patients with Class 1 deletions show a trend toward greater impairment

in social affect over time, while patients with Class 2 deletions show a trend toward improvement in their social affect over time (F=1.50). There are also significant differences in trajectories of sensory aversions across deletion class groups (F=3.23; p<.05).

Conclusions: The results indicate that even after controlling for the effects of cognition, patients with Class 1 deletions have greater severity in ASD features and sensory behaviors that remain over time. Our results also suggest that there may be different trajectories of sensory aversions and social affect across deletion class groups, even after controlling for the effects of cognition. This suggests that ASD features in AS are not solely related to level of intellectual disability and that perhaps other genes in the deleted region contribute to ASD features and sensory behaviors. There are four genes (*NIPA 1*, *NIPA 2*, *CYFIP1*, & *GCP5*) missing in Class I and present in Class II deletions, one or more of which may have a role in the severity of social affect impairment, level of restricted/repetitive behaviors, and sensory aversions as well as the trajectories of these behaviors over time.

110.042 108 Genetic Abnormalities In People with Autism Spectrum Disorder Presenting to Clinical Services. D. M. Robertson*[1], E. Wilson[2], C. M. Murphy[3], M. J. Doyle[4], D. Spain[5], C. Ecker[6], E. Daly[7] and D. G. Murphy[6], (1)*South London and Maudsley NHS Trust*, (2)*King's College London*, (3)*King's College London, Institute of Psychiatry*, (4)*Institute of Psychiatry*, (5)*south london and maudsley nhs foundation trust*, (6)*Institute of Psychiatry, King's College London*, (7)*King's College London, Institute of Psychiatry,*

Background: To date, there have been relatively few studies of the association between genetic abnormalities and ASD symptoms in 'real life' clinical settings.

Objectives: To investigate behavioural symptom profiles and genetic abnormalities in adults with ASD presenting to a clinical diagnostic service.

Methods: We reviewed genetic investigations completed for patients diagnosed with ASD at the Behavioural Genetics Clinic, a specialist clinic providing assessment of autism spectrum disorder at the Maudsley Hospital, London. Diagnostic assessment includes a detailed neuropsychiatric assessment, Autism Diagnostic Interview-Revised (ADI-R) or Autism Diagnostic Observation Schedule (ADOS) pending consent to contact parents/parental availability, physical examination, and genetic investigation. Genetic investigation of blood samples includes a comparative genomic hybridization (CGH) analysis using oligonucleotide arrays with ~44,000 probes across the genome. In addition, a karyotpe analysis and a microarray analysis is conducted. (CGH), also referred to as chromosomal microarray analysis (CMA), and array CGH (aCGH), may identify small deletions and duplications of subtelomers, pericentromeric regions and other chromosome regions, that would not be detected by traditional chromosomal analysis. We reviewed results of diagnostic assessment and CGH genetic investigations completed for 70 participants with ASD that attended the clinic in a 3 month period.

Results: 14 (20%) of participants (11 male, 3 female) had chromosomal imbalances. Nine had a single chromosome deletion, and three a single duplication (two on chromosome 7). One participant had 2 deletions (chromosome 2), and one participant had both a deletion and a duplication. Of these patients, 8 met criteria for ASD on all three domains (diagnosed with 'autism' or Asperger syndrome), 3 met criteria for ASD on 2 domains (diagnosed with 'atypical autism'), and 3 met criteria for Pervasive Developmental Disorder – not otherwise specified (ICD 10). The three female participants also met criteria for ADHD (DSM-IV). 3 male participants also had co-morbid diagnoses (hyperkinetic disorder, depression, and generalised anxiety)

Conclusions: Preliminary results suggest that approximately 20% of individuals with ASD assessed at a specialist clinic also had an underlying chromosomal abnormality detected by CGH analysis. However, the genes affected varied widely. We plan to present data from a larger 12 month sample at the conference investigating whether particular genetic variations (and the genes they involve) are associated with particular behavioural features of ASD.

110.043 109 Genetic Analysis of Social Responsiveness and Head Circumference as Endophenotypes for Autism Spectrum Disorders. J. K. Lowe*[1], R. A. Mar-Heyming[1], S. J. Spence[2], R. M. Cantor[1] and D. H. Geschwind[1], (1)*University of California, Los Angeles*, (2)*National Institute of Mental Health*

Background: Extensive genetic heterogeneity in the autism spectrum disorders (ASD) has been challenging in linkage and association studies to date. Increased head circumference (HC) is a prominent physical feature in ASD patients, with estimates of macrocephaly ranging from 12-30%. The Social Responsiveness Scale (SRS) is a quantitative assessment of social ability, one of the three core deficits of ASD. We sought to reduce phenotypic heterogeneity in ASD by using HC and SRS as quantitative endophenotypes for genetic analyses.

Objectives: To identify genetic susceptibility loci for ASD using linkage and association approaches for the analysis of social responsiveness, and of ASD in patients and family members with above-average head circumference.

Methods: We examined head circumference (HC) in the Autism Genetics Research Exchange (AGRE) cohort and adjusted for age and gender according to standard growth charts. Nuclear families in which two or more offspring exhibited above-average HC were selected for linkage analysis.

Raw SRS scores for patients with autism and their unaffected siblings were obtained from the Autism Genetics Research Exchange (AGRE). We assessed correlation between SRS scores submitted by the subjects' teachers and those submitted by parents and elected to use scores primarily from teachers, supplementing with scores from parents when necessary. Age was not a significant covariate. Although gender was a significant covariate, we elected to use raw SRS, as gender differences in SRS are likely confounded by the male:female ratio in patients with autism.

Genome-wide SNP data for AGRE subjects were analyzed for linkage and association to ASD or to SRS as a quantitative trait. Following SNP quality control, a subset of independent markers was selected (pairwise $r^2 \leq 0.1$) for non-parametric linkage analyses in Merlin. Regions of interest were identified based on peak LOD scores, and additional SNPs in those regions were analyzed for association to ASD.

Results: We identified significant linkage for ASD on chromosome 8q21 (LOD 3.21; rs6994256) in families with above-average HC. The one-LOD interval surrounding the linkage peak spans ~6.7 Mb and includes 24 known genes. We identified additional markers under the linkage peak on chr8q21 and report results for tests for association in the presence of linkage.

Quantitative linkage analysis for SRS showed a suggestive peak on chromosome 4q13.1 (LOD=2.52; rs1124974). The one-LOD interval surrounding the linkage peak spans 11 Mb and 19 known genes, including *EPHA5*, which is thought to function in synaptic remodeling. Using additional markers in the linked region, we observe an excess of association signal in the linked region for ASD, but not SRS. We also note that Weiss *et al* (2009) reported suggestive association with ASD for SNPs near *EPHA5* ($p=8.5 \times 10^{-6}$; rs17088254). Because our cohort overlaps with that analyzed by Weiss *et al*, the correlation in association findings cannot be considered independent evidence. However, our linkage and association results are consistent in suggesting the existence of ASD susceptibility loci on chromosome 4q13.1.

Conclusions: Linkage and association studies of HC and SRS support the utility of quantitative traits related to ASD in improving our ability to identify genetic susceptibility loci.

110.044 110 Chromosomal Microarray Analysis In Patients with Confirmed Diagnosis of Autism Spectrum Disorder: Diagnostic Yield and Clinical Characteristics. S. G. McGrew*[1], B. R. Peters[2], J. A. Crittendon[1] and J. Veenstra-VanderWeele[3], (1)*Monroe Carell Children's Hospital at Vanderbilt*, (2)*Monroe Carell Childrens Hospital at Vanderbilt University*, (3)*Monroe Carell Children's Hospital at Vanderbilt University*

Background: Studies on Autism Spectrum Disorders (ASD) show a strong genetic predisposition, with multiple risk genes identified or postulated. Currently, G-banded karyotype and fragile X DNA testing are recommended for all patients with ASD. Guidelines for chromosomal microarray analysis (CMA) in the absence of dysmorphology and focal neurologic deficits have not been established; however recent reports suggest a high yield in ASD.

Objectives: We aimed to determine the yield of CMA, karyotype, and Fragile X testing in patients with a confirmed diagnosis of ASD and to determine whether any clinical characteristics separate patients with abnormal CMA.

Methods: Electronic Records from 2000 to 2010 from a single pediatrician autism specialty practice were reviewed. All patients in this practice were offered genetic testing including karyoptype, Fragile X and CMA. CMA was recommended in place of karyotype to all patients after 2007. Abnormal CMA results were subclassified as clinically significant based upon the lab interpretation and literature review.

Patients with a diagnosis of autism confirmed by one or more psychological tests (Autism Diagnostic Observation Scale, Child Autism Rating Scale, Gilliam Autism Rating Scale) and DSM-IV clinical criteria were selected and clinical, cognitive, behavioral and developmental information was collected. Cognitive results were stratified into above, average, borderline and intellectual disability. Contingency table analyses using Chi square tested for significance in the relationship between CMA result and cognitive level, dysmorphology, seizures or congenital malformations.

Domains from parental report scales, including the Parental Concerns Questionnaire (PCQ), Repetitive Behavior Scale (RBS), Child Behavior Checklist (CBCL), and psychologist

administered Vineland were used to assess specific behavioral and developmental symptoms. T-tests compared CMA results (independent variable) and Vineland subdomains (Communication, Daily Living Skills, Socialization, Motor Skills, and Adaptive Behavior Composite); CBCL subdomains; RBS subdomains (Ritualistic/Sameness, Stereotypic, Self-injurious behaviors, Compulsive behaviors, and Restricted Interests); and Parental Concerns Questionnaire items (language, compulsion, anxiety, aggression, sleep, hyperactivity, attention, mood, social, self stimulatory, self injury)

Results: 90 CMA, 117 Karyotype and 174 Fragile X results were identified. There were 19 (21%) abnormal CMA results with 7 (8%) classified as clinically significant. 3 (2.5%) of 119 karyotypes were reported as abnormal, (2 translocation carriers and 1 gain). 1(0.6%) Fragile X positive was identified. There was no relationship between CMA result and cognitive level, presence of seizure disorder, dysmorphology, or congenital malformations ($p>0.5$) and developmental/ behavioral categories of obsession, compulsion, aggression, self-injury, repetitive behaviors, attention, hyperactivity, sleep disorders, mood, social interactions, language. There were lower PCQ anxiety scores ($p=.03$) and less CBCL externalizing behavior ($F_{1,50}=6.02$, $p=.02$) in the group with clinically significant CMA as compared to the other two groups.

Conclusions: CMA has a superior diagnostic yield as compared to Fragile X and karyotype in unselected patients with ASD. No clinical, intellectual or developmental characteristics separate the groups of ASD patients with abnormal or clinically significant CMA results from the group with normal results. Behavioral symptoms are identical or improved in the clinically significant CMA group.

110.045 111 Genotype-Phenotype Associations In Response to the Intruder Paradigm for Humans. P. D. Chamberlain*[1], N. K. Jamison[1], K. Taylor[2], R. J. Robison[3], P. Wilson[3], T. Newton[1], S. van Tassell[1], O. Johnston[1], M. Christensen[1], J. D. Higley[1] and M. South[1], (1)*Brigham Young University*, (2)*Virginia Commonwealth University*, (3)*University of Utah School of Medicine*

Background:

Previous research correlating genotype and categorical diagnostic symptoms of autism spectrum disorders (ASD) have yielded largely inconclusive findings, in part due to variation of behaviors within the ASDs. Ecologically-valid dimensional behaviors may improve insight into underlying genetic and neuropathological processes, as opposed to mere categorical diagnostic designations. We adapted a paradigm used in studies with rhesus monkeys that use a human intruder to provoke anxiety (Kalin, 2003). This paradigm may provide a particularly useful translational model because of the similarity in related brain systems across species and because anxiety is a frequent debilitating symptom of those diagnosed with ASD.

Objectives:

Our goal was to explore the relationship between known anxiety-related genetic single nucleotide polymorphisms (SNPs) and psychophysiological responses during anxiety-provoking situations. Analysis of associations between allelic variations and such specific phenotypes provides better opportunity for understanding symptom heterogeneity found within ASD.

Methods:

We adapted the Human Intruder Paradigm from studies of emotion regulation in monkeys (Kalin, 2003). Participants were 38 children and adolescents diagnosed with an ASD (mean age = 13.3, mean Full Scale IQ = 108) and 36 typically developing controls (TYP group) matched for age and IQ. Each participant performed a simple computer task with a research assistant present while we measured their skin conductance response (SCR). During the first stage of the paradigm, the attending research assistant leaves the room for a short time, leaving the participant alone. After the RA returns, an imposing male confederate enters the room and begins arguing with the RA until she agrees to leave with him to resolve their differences. One minute later, the confederate intruder returns, this time without the RA.

We collected saliva samples for DNA extraction using Oragene kits. Genotyping was conducted using TaqManÒ, with ready SNP assays from Applied Biosystems for COMT, DAT1 (SLC6A3), 5-HT1B (HTR1B), HTR2A, SNAP25, BDNF, MAOA, and TPH2. T-test analyses included genotype status (± expected minor allele) as the independent variable and psychophysiological response amplitudes as dependent variables.

Results:

In the ASD but not the TYP group, SCR response during the Isolation phase was significantly affected by variation in the functional COMT Val158Met polymorphism (rs4680; Met tranformation = increased response), $t(36) = 3.86$, $p < .001$. Also in the ASD group but not the TYP group, the minor C allele of the HTR1B SNP also showed an increased response

during Isolation that was marginally significant ($p < .10$). In contrast, the TYP group but not the ASD group showed significant associations between MAOA status (major A allele has increased SCR activation) for the Intrusion and post-intruder Recovery phases. There were no significant associations between genotype variation and ASD symptoms scores measured by the ADOS.

Conclusions:

Our findings suggest that genotypes are more helpful in predicting specific behavioral variables, such as the response to a strange human intruder, than more general symptom categories. The development of relevant and rich behavioral measures of important dimensions such as anxiety can provide insight into the associations of genes, brain development, and behavior in autism.

110.046 112 Language and Neuropsychological Evaluations In Maternal Int Dup (15) Autism Cases. N. Urraca*[1], J. E. Cleary[2], V. Brewer[1], K. A. McVicar[3], E. Pivnick[1] and L. Reiter[4], (1)*UTHSC*, (2)*The University of Memphis*, (3)*University of Tennessee Health Sciences Center-Memphis*, (4)*University of Tennessee Health Science Center*

Background: It has been estimated that as many as ~3-5% of all autism cases may be the result of maternal duplications of the 15q11-q13 region. A key structural feature of chromosome 15 is the high number of low copy repeats (LCRs), which predispose to both deletion and duplication events mediated by non-allelic homologous recombination (NAHR). The 15q11-q13 region has a 2-Mb cluster domain of genes preferentially expressed from one parental allele referred to as the PWS/AS critical region. There are two main types of deletion/duplication: class I deletions/duplications with breakpoints at BP1 (proximal) to BP3 (distal) and class II deletions/duplications with breakpoints from BP2 (proximal) to BP3 (distal). There are 4 genes between BP1 and BP2

Objectives: The aim of the present study was to determine if individuals with maternal interstitial 15q duplications class I and II have phenotypic differences in language and neuropsychological evaluations.

Methods: ADOS/ADI-R were used for autism diagnosis. Peabody Picture vocabulary test four edition (PPVT-4) was done to evaluate receptive vocabulary. The neuropsychological tests done, were IQ and Vineland-II.

Results: Nine patients were recruited through the IDEAS parent support group (www.idic15.org): 4 class I and 3 class II were available for the analysis. All subjects scored as ASD upon ADOS/ADI-R analysis. In the neuropsychological evaluations 2/5 subjects had a low average IQ score, 3/5 were borderline. Most of the subjects had a low-moderate adaptive functioning score on the Vineland II evaluation with no differences among groups. All subjects performed below age corrected average for receptive vocabulary (PPVT-IV) but we found a significant difference (pval<0.03) between class I and class II subjects.

Conclusions: Language trends will require more subjects to be accurately described. Interestingly there are no major phenotypic differences in maternal deletion subjects (Angelman syndrome), except for the lack of verbal language in Class I patients, so it will be important to determine the roll in language of those four extra genes duplicated/deleted in Class I patients.

110.047 113 Identification of Molecular Pathways Associated with Autism by Genome Wide Expression Profiling of Lymphoblasts From Autism Patients. R. Luo*[1], I. Voineagu[2], R. A. Mar-Heyming[2], J. Ou[3] and D. H. Geschwind[2], (1)*University of California,Los Angeles*, (2)*University of California, Los Angeles*, (3)*UCLA*

Background: Autism is a disorder of neural development that is characterized by deficits in social interaction and communication and the presence of restricted and repetitive behavior. The etiology of autism is complex, with both genetic and environmental factors playing a role.

Objectives: Our aim is to investigate the contribution of common variants to altered gene expression in autism and to identify molecular pathway related to autism disorder.

Methods: We assayed the gene expression profile of lymphoblast cell lines (LCLs) from the Autism Genetic Resource Exchange (AGRE) by Illumina Human Ref8 version2 and the Simons Foundation Simplex Collection by Illumina Human Ref8 version3 by using two analyses: 1) standard differential expression (DE) analysis and 2) network analysis for analysis at the systems level.

Results: We compared gene expression level between 473 affected 274 unaffected siblings in AGRE and identified 1483 DE genes, some of which have been previously reported to be associated with autism. However, DE analysis failed to find consistent signal across AGRE and Simons. For the systems level analysis, we applied Weighted Gene Co-expression Network Analysis (WGCNA) to identify gene co-expression modules in cases and controls separately, in both AGRE and Simon's data sets. One module that was differential between cases and controls and that was observed in both cohorts was enriched in genes involved in protein folding and the

endoplasmic reticulum (ER) stress response. Analysis of genes showing the largest difference in network position between autism and controls (Differentially connectivity; DK) of genes in the ER module highlights CAMK1G and ARMET as two of the most different hub genes between autism and control. We observed CAMK1G differential expression in both lymphoblasts and brain (Voineagu I. et al, unpublished data), which suggests a possible important role in autism.

Conclusions: Gene expression profiling of lymphoblast cell lines from a large number of autism cases and unaffected siblings identified transcriptional differences associated with autism, but these were non-overlapping between AGRE and Simons cohorts. This is consistent with significant heterogeneity and overall low signal using standard analyses of differential expression. By applying WGCNA, we are able to identify and replicate consistent changes across the two large cohorts, AGRE and Simons. This highlights several differentially connected genes including ARMET and CAMK1G, which are both involved in endoplasmic reticulum response. ARMET is also known to selectively promote the survival of dopaminergic neurons of the ventral mid-brain and modulate GABAergic transmission to the dopaminergic neurons of the substantia nigra. CAMK1G is associated with cytoskeletal re-organization and learning and memory.

110.048 114 Characterization of Hotspot Motif Matches In Exons of Autism-Associated Genes In the X-Chromosome. N. Doan*[1], A. Ard[2], M. LaMadrid[3] and T. A. Deisher[3], (1)*Seattle University* , (2), (3)*Sound Choice Pharmaceutical Institute*

Background:

Autism is associated with chromosomal abnormalities such as microduplications, deletions and inversions. The gender bias of autistic disorder suggests an important role of the X-chromosome in the etiology of the disease. Homologous recombination (HR) initiated by double-strand breaks can repair and diversify mammalian genes. Non-allelic homologous recombination can lead to predispositions to disease, for example, by changing gene dosage by duplications or deletions. Regions on chromosomes with high frequency of recombination are called “recombination hotspots.” Recombination hotspots in the human genome have been mapped and a 13-mer motif is found to be present in more than 40% of the hotspots. Notably, some of these hotspots are found to be located close to known disease-causing nonallelic HR hot spots and common mitochondrial deletion hot spots. In this work, autism-associated genes in the X-chromosome are checked for hotspots and five out of fifteen genes (NLGN4X, NLGN3, AFF2, GRPR, and IL1RAPL1) are found to contain them. Moreover, it is shown that some exons of these genes unexpectedly contain perfect or near-perfect matches to the most common 13-mer hotspot motif. Possible effects of the presence of the 13-mer motif matches are predicted based on cell mechanisms and three-dimensional protein structures.

Objectives:

To predict the possible effects of the presence of the 13-mer hotspot motif in exons of autism-associated genes in the X-chromosome.

Methods:

Recombination hotspots in autism-associated genes were found by overlaying the locations of the hotspots with gene coordinates. The presence of the most common 13-mer motif was detected in exons by alignment of the motif with the individual exons. Protein structural modeling and SNP analyses were used to predict the possible effects of the hotspot motifs.

Results:

The alignments showed the presence of 12-mer matches in GRPR at exon2, NLGN4X at exons 2 and 3, NLGN3 at exons 2 and 8 and AFF2 at exons 11, 14, 17 and 21. There is a perfect 13-mer match for GRPR exon3 and AFF2 exon15. No matches were found in IL1RAPL1 exons. On GRPR exon3, the hotspot region is located in the cytoplasm at the C-terminus; and HR is predicted to cause interruption of multiple cellular signal transduction pathways. The 12-mer match on exon2 of GRPR affects the third extracellular domains that are essential for the GRP-ligand specificity. Both exons 2 and 8 of NLGN3 along with exon2 of NLGN4X are known to be involved in binding with Neurexin1. A SNP can convert the 12-mer match to a 13-mer match, and HR is predicted to interrupt the signal transport between NLGN4X/NLGN3 and Neurexin1. On AFF2, both 13-mer motifs on exon15 and 12-mer motifs on exons 17 and 21 can affect translation and transcription, and the ability to bind to guanine-quartets; while the 12-mer motif on exon11 is predicted to interrupt the nuclear localization signals for the FMR2 protein.

Conclusions:

Although most recombination hotspots are located far from coding regions of the genome, this study has shown perfect or near-perfect motif matches inside exons of genes associated with autism, with potential disease-causing effects.

110.049 115 ERP Error Related Negativity as a Specific Phenotype for Candidate Gene Associations In ASD. N. K. Jamison*[1], R. J. Robison[2], M. J. Larson[1], P. Wilson[2], O. Johnston[1] and M. South[1], (1)*Brigham Young University*, (2)*University of Utah School of Medicine*

Background: Although autism has been shown to be highly heritable, candidate gene approaches related to diagnostic symptoms of the autism spectrum have been inconclusive. De Guess (2010) suggests that EEG endophenotypes can help to make sense of candidate gene variants identified by large-scale association studies. We recently reported results from an EEG study showing that children diagnosed with an autism spectrum disorder (ASD) display a significantly smaller error-related negativity (ERN) pattern during the well-established Eriksen Flanker task (South et al, 2010). We hypothesized that this ERN task may provide a specific neurophysiological marker that relates to targeted gene variation in ASD.

Objectives: We investigated potential links between variations in several single nucleotide polymorphisms (SNP) and brain activity in response to the Flanker task. This kind of strategy maximizes the potential for smaller samples to highlight genotype-phenotype relationships that lead to better understanding of heterogeneity in symptom expression in ASD, and can result in improved, more individualized treatments for those with ASD and their families.

Methods: We collected behavioral and neuroimaging data from 33 children and adolescents diagnosed with ASD, ages 8-18; and 28 typically developing children (TDC), matched for age and IQ. The flanker task requires that the participant decide as quickly and accurately as possible whether the direction of a central arrow is the same as the direction of other arrows flanked on each side. Because the task moves quickly, many errors result. The ERN is a rapid negative deflection in the Event Related Potential that occurs within 100ms of making an erroneous response, such as on the Flanker task. It is associated with activity of the brain anterior cingulate cortex (ACC).

We collected saliva samples for DNA extraction using Oragene kits. Genotyping was conducted using TaqMan®, with ready SNP assays from Applied Biosystems, for SNPs in the following genes: COMT, DAT1 (SLC6A3), 5-HT1B (HTR1B), HTR2A, MAOA, , and TPH2. T-test analyses included genotype status (± expected minor allele) as the independent variable and ERP response amplitudes as dependent variables.

Results: Carriers of the minor C allele for the dopamine transporter DAT1 (rs40184) polymorphism showed significantly decreased activation associated with response to error trials but not to correct trials in the ASD group. In the TDC group, the C allele was associated with decreased activation on both error and correct trials. Those with the Val allele in the COMT Val158Met (rs4680) polymorphism exhibited a significant decrease with the difference score between error trials and correct trials in the ASD group. There were no significant associations for either group with any of the other genes assayed.

Conclusions: Because ERP responses reflect performance and error monitoring, these findings have strong implications for the neurological basis of decision-making difficulties in autism that may arise in part from impaired awareness of internal emotional states. Findings with the DAT1 and COMT polymorphisms suggest dissimilar mechanisms in ASD and TDC groups for monitoring performance that could help account for difficulties in decision-making and impaired emotional awareness in those with ASD.

110.050 116 Genome Scan of Serotonin Levels In Utah Families with Autism Spectrum Disorders. D. Bilder*[1], H. Coon[2], E. H. Cook[3], D. Cannon[2], M. Hobbs[1], D. Wilkins[4], R. J. Robison[5] and W. M. McMahon[1], (1)*University of Utah*, (2)*University of Utah* , (3)*University of Illinois at Chicago*, (4)*Center for Human Toxicology*, (5)*University of Utah School of Medicine*

Background: Autism Spectrum Disorders (ASDs) are highly heritable conditions. Elevated whole blood serotonin levels have long been associated with ASDs, with several candidate genes proposed to explain this relationship.

Objectives: The purpose of this study is (1) to perform a genome scan to determine chromosome locations with variants possibly explaining variation in blood serotonin levels among individuals with ASDs and their families, (2) to cross-reference suggestive and significant chromosomal locations from this scan with locations of known serotonin-related genes which may merit closer exploration, and (3) explore gender effects and associations with other phenotypes measured in these families.

Methods: Serotonin levels, platelet count, and DNA were available on a total of 432 individuals from 69 multiplex and extended Utah families. 119 of these subjects had ASDs, and 316 were unaffected family members. Serotonin was measured using a sensitive and specific liquid chromatography-tandem mass spectrometric method (LC-MS/MS). The precision and accuracy of the method were determined from replicate analyses of quality control (QC) samples fortified at

low and high QC concentrations. Individuals taking medications known to alter serotonin were excluded from the analysis. Serotonin levels were adjusted for the effects of age, sex, and platelet count. Genotypes from the 6k single nucleotide polymorphism (SNP) Illumina Linkage Panel 12 were provided by the Center for Inherited Disease Research (CIDR). SNPs were screened for errors, low informativeness (minor allele frequency < 0.10), and high linkage disequilibrium, leaving 4718 SNPs for analysis. Linkage analyses not assuming a genetic model (nonparametric) were performed using quantitative serotonin levels with the SOLAR analysis package.

Results: Individuals with ASD were significantly more likely than unaffected family members to have an adjusted serotonin level 1 standard deviation above the mean (p=0.004). Serotonin demonstrated significant heritability (h2=0.75) in these families. Using data from all subjects, the highest lod score was 2.56 on chromosome 8 at 115 centiMorgans. When analyses were restricted to males only, this result increased to a lod score of 3.04. Positive results with scores over 2 were also found for males only on chromosomes 2, 11, and 12. Females only showed positive results over 2 on chromosomes 2 and 9. Initial database searches have not indicated any apparent relationship between these regions and known serotonin-related genes.

Conclusions: Analyses indicate multiple chromosomal locations that may contain DNA variants influencing serotonin levels in families with ASDs. In addition, our results suggest possible gender-specific DNA variants. We are refining our analyses, and investigating possibilities that variants in these regions could be associated with genes involved in regulation and/or expression of serotonin.

110.051 117 Family-Based Association Analysis of Genes Involved In Synaptic Plasticity and Autism. R. Sasanfar*[1], R. Siburian[2], S. Haddad[2], M. Ghadami[3], A. Tolouei[4] and S. L. Santangelo[5], (1)*Department of Psychiatry, Harvard Medical School*, (2)*Psychiatric and Neurodevelopmental Genetic Unit, Center for Human Genetic Research, Massachusetts General Hospital*, (3)*Research Center, Ministry of Education*, (4)*Diagnosis and Prevention Center, Special Education Organization*, (5)*Department of Epidemiology, Harvard School of Public Health*

Background: A wide variety of evidence, using many different behavioral paradigms, indicates a broad role for the involvement of the extracellular signaling-regulated kinases (ERK) pathway in synaptic plasticity and consequently learning and memory. Disruption of neuronal protein synthesis through ERK pathway is the shared point of several essential pathways associated with autism including the mTOR pathway. Therefore, aberrant regulation of the ERK pathway is a potential cause for deficits associated with autism.

Objectives: The purpose of this study was to investigate the association of the six genes in the ERK pathway, including ERK2, MNK1, eIF4E1, 4EBP2, as well as the upstream regulators GRIN2A encoding NMDA receptor 2A and GRM1encoding mGluR1 with autism in an Iranian autism sample.

Methods: Family-based association analysis was performed using 700 individuals from 200 nuclear families from Iran with at least one autistic child. In total, 175 SNPs were genotyped for all six genes using Sequenom iPLEX. TDT analyses were performed with Plink software. TDT analyses were performed with Plink software. Quality control procedures applied to the data included rejection of any SNP markers with missingness greater than 0.15, MAF less than 0.01, HWE p-value less than $2.8*10^{-4}$, and Mendelian Error rate of greater than 0.1. Families with a Mendelian Error rate of greater than 0.05 were also removed. After QC, 150 SNPs and 672 individuals from 194 nuclear families were analyzed.

Results: We failed to identify a significant association with these six genes and ASD. The best result was a nominally significant association of two markers from GRM1 (rs9403771, p=.047, and rs2024589, p=.049) and one marker from GRIN2A (rs11645219, p=.046). Analysis is ongoing using Plink and FBAT to explore potential multimarker associations and gender effects.

Conclusions: Although the sample size for this investigation is small and slightly underpowered (For a significance level of 0.05, there is 78% power to detect a heterozygote GRR of 2.0 at D' = 0.8 for q = 0.1), our results do not support the involvement of these genes in conferring risk for ASD.

110.052 118 Deep Sequencing of MECP2 In Autistic Boys. A. H. Joyner*[1], V. Bansal[2], R. Tewhey[2], G. Oliveira[2], C. Ahrens-barbeau[3], S. Murray[2], E. Topol[2], K. Pierce[4], E. Courchesne[4] and N. Schork[5], (1), (2)*Scripps Genomic Medicine*, (3)*San Diego ACE*, (4)*University of California, San Diego*, (5)*Scripps Research Institute*

Background:

While the gene MECP2 has classically been linked to Rett Syndrome, primarily occurring in females, it is becoming increasingly clear that it plays a role in the etiology of autism

and closely related developmental learning disorders in boys. Past sequencing studies have failed to find exonic mutations in autistic boys. A more recent study has found novel 3'UTR variants that were not detected in controls. Regulation of MECP2 expression has been shown not only to occur in the promoter and 3'UTR, but in flanking enhancers and silencers. The potential exists that autism spectrum causing mutations exist in regulatory elements of MECP2.

Objectives:

This study attempted base-pair inclusive sequencing of the MECP2 gene to detect both common and novel variants that may be enriched in autistic males. Additionally, novel statistical methods were developed to pinpoint genetic regions that associate with clinical and brain-imaging phenotypes among individuals with autism spectrum disorder (ASD).

Methods:

Next-generation, paired-end sequencing using the Illumina GA2 was employed to thoroughly catalog variation at each base-pair in the entire 163 kb MECP2 region including exons, introns, promoter, 3'UTR and distal regulatory elements, in 73 ASD males compared to 70 (pooled) typically developing males. For comparison of common single nucleotide variants, our data was combined with the Autism Genetic Resource Exchange (AGRE) and HapMap sample. For comparison of common and rare indel events, data from the 1000 Genomes Project was used. Detailed phenotypic assessment on clinical and brain imaging data was obtained. Multivariate sequence-based distance matrix regression was used to detect within-case associations between combinations of MECP2 variants and phenotypes.

Results:

The frequency of common SNPs (rs6571303: p=.011) and a common MECP2 haplotype is significantly different in cases versus controls. Additionally, 6 novel 3'UTR variants (5 SNV, 1 indel), a previously discovered exonic synonomous variant, and many novel single nucleotide variants and indels were discovered in the intronic and intergenic regions that did not exist in multiple control datasets. A sliding-window, sequence-based association method was developed to examine potential consequences of combinations of variants on multiple clinical and brain-imaging phenotypes, with significant results consistent with the prior literature on MECP2. A specific 1kb segment in the upstream, promoter region of MECP2 consistently associated with scores on clinical (expressive language as assessed in the Mullen Scales of Early Learning) and brain imaging phenotypes (total brain and putamen volumes).

Conclusions: Both common and rare variants of MECP2 appear to play a role in the etiology of some autism cases, as previously thought. While it is unclear if these variants are causal and/or modifiers of ASD phenotypes, certain variants and haplotypes associate with specific ASD subphenotypes that share similarities with Rett Syndrome, where the cause is almost exclusively exonic mutations in MECP2, which are theorized to be intolerable in males. Consistent with this hypothesis, no deleterious exonic mutations were detected. Several variants in known regulatory elements including the promoter and 3'UTR were detected that were not found in controls, and these variants associate with clinical and imaging phenotypic measures.

110.053 119 Linkage and Association Studies Show Evidence of Neurexin and Neuroligin Involvement In Autism. O. J. Veatch*[1], N. Schnetz-Boutaud[1], B. M. Anderson[1], K. Brown-Gentry[1], H. H. Wright[2], R. K. Abramson[2], M. L. Cuccaro[3], J. R. Gilbert[3], M. A. Pericak-Vance[4] and J. L. Haines[1], (1)*Vanderbilt University*, (2)*University of South Carolina*, (3)*John P Hussman Institute for Human Genomics*, (4)*University of Miami*

Background: Autism is a complex neurodevelopmental disorder characterized by impaired social interaction, language/communication deficits and restricted, repetitive behavioral patterns. Previous studies established a strong influence of genomic variation in the etiology of autism and it is recognized as one of the most heritable complex neuropsychiatric disorders. A number of studies have linked members of the neurexin (NRXN) and neuroligin (NLGN) gene families to autism. Members of the NLGN family are proposed to act as splice site-specific ligands for beta-NRXNs. NLGN genes are located on the X chromosome and are involved in the formation and remodeling of central nervous system synapses.

Objectives: We sought to evaluate the involvement of *NRXN* and *NLGN* gene families in our autism dataset. Specifically, we were interested in determining if single base-pair variants located in these genes are over-represented in cases. Also, we are interested in assessing a potential sex-bias for this variation and the involvement of putative gene-gene interactions in the disease process.

Methods: We genotyped 26 SNPs located in *NLGN3*, *NLGN4*, and *NRXN1* in our dataset consisting of 403 Caucasian American families. The Pedigree Disequilibrium Test (PDT) and

the Family Based Association Test (FBAT) were used to test for association. Linkage analysis was conducted using two-point heterogeneity LOD scores (HLOD). Both recessive and dominant models with disease allele frequencies of 0.01 and 0.001, respectively, were analyzed. Taking into account the 4:1 ratio of males to females affected with autism, the HLOD, PDT, FBAT were also run in a subset of families containing only affected males. "Pseudo" controls were constructed, using the non-transmitted alleles of the parents, to confirm previously reported association results.

Results: FBAT identified significant associations in the entire dataset for two SNPs in *NLGN4*, rs5915658 (p=0.0006) and rs5915659 (p=0.005). This association remained significant after correcting for multiple comparisons (p=0.006 and p=0.05, respectively). Following FBAT in the male only subset, rs5915658 and rs5915659 remained significant (p=0.005 and p=0.03, respectively). FBAT in the entire dataset showed nominal significance (p=0.02) for rs7606758, in *NRXN1*. This association is also nominally significant in the male only subset (p=0.04). When evaluating the entire dataset, the highest HLOD score of 2.21 (recessive model) was observed for rs4971649 in *NRXN1* on chromosome 2p16.3. In the male only subset, the HLOD score (recessive model) calculated for this same SNP was 1.82. No linkage was detected for *NLGN3* and *NLGN4* at Xq13 and Xp22 respectively. The case/pseudo-control analysis performed for *NLGN3* and *NLGN4* confirmed previously reported association results and allelic and genotypic associations for rs5915658 and rs5915659 were both significant.

Conclusions: The most significantly associated SNP, rs5915658, is located in intron 1 of the *NLGN4* gene and is a good candidate for future functional studies. We are currently using logistic regression to evaluate the probability of epistasis, among *NRXN1, NLGN3* and *NLGN4*, contributing to autism.

110.054 120 The Expanding Role of the Methyl-CpG-Binding Domain Family In Autism Etiology. H. N. Cukier*[1], B. L. Butler[1], H. H. Wright[2], R. K. Abramson[2], J. L. Haines[3], M. L. Cuccaro[4], J. R. Gilbert[4] and M. A. Pericak-Vance[1], (1)*University of Miami*, (2)*University of South Carolina*, (3)*Vanderbilt University*, (4)*John P Hussman Institute for Human Genomics*

Background: The methyl-CpG-binding domain (MBD) family performs a strategic role in epigenetic regulation by encoding for proteins involved in histone methylation and chromatin remodeling. The MBD genes have been linked to autism for over a decade ever since Rett syndrome, which falls under the umbrella of autism spectrum disorders (ASDs), was revealed to be caused by mutations in the *MECP2* (*methyl-CpG binding protein 2*) gene. Since that time, a few classic autistic patients have been shown to carry alterations in *MECP2* as well. Recent reports also demonstrate that patients with deletions across the *MBD5* gene present clinically with intellectual difficulties, impaired speech, repetitive behaviors and seizures, all features found in ASD patients. Previous work in our laboratory investigating ASD patients identified variants in *MECP2*, *MBD1*, *MBD2*, *MBD3* and *MBD4* that altered amino acid sequence, were unique to autistic patients and concordant with disease in multiplex families.

Objectives: We now describe the first study evaluating ASD individuals in four of the remaining MBD family members, *MBD5*, *MBD6*, *SETDB1* (*SET domain, bifurcated 1*) and *SETDB2*, and expand our initial screening of patients in the *MECP2* gene.

Methods: All sixty-nine coding exons of these five MBD genes were Sanger sequenced in 576 samples (288 ASD individuals, 86 African American and 202 Caucasian, as well as 288 controls of matching ethnicity).

Results: We identified a total of 144 alterations, the vast majority of which were novel (108 variants, 75%). Thirty-four of these alterations appear to result in a change in amino acid sequence, including thirty-one missense variations, two nonsense mutations, and a frameshift predicted to result from a single base pair insertion. In relation to the relatively small coding sequence of *MECP2*, this gene appears to carry a disproportionately large number of nonsynonymous alterations (10 variants, 29%). Thirty-two of the alterations identified are specific to ASD patients and absent in controls. It also appears that many of the variants are specific to a particular ethnicity, with 34 variants identified only in African Americans and 55 variants solely identified in Caucasians. We are currently sequencing additional family members in order to distinguish whether the variants segregate with disease.

Conclusions: From our studies, we demonstrate that the MBD gene family may play a larger role in rare and private genetic causes of autism than was initially believed.

110.055 121 Loss of Heterozygosity Analysis In Saudi Patients with ASD. J. M. Shinwari*, M. Aldosari, A. Almuslamani, A. Adi, D. S. Khalil, N. Abu-Doheim, M. Nester, M. Ghannam, B. F. Meyer and N. Al Tassan, *King Faisal Specialist Hospital and Research Center*

Background:

ASD is a heterogeneous condition with various contributing factors both genetic and environmental. An apparently Mendelian recessive model of inheritance has been observed in some multiplex families particularly from the Middle East.

Molecular studies of ASD in different populations have provided strong evidence for genetic variability, where different genes and/or loci have been associated or linked to this disorder; therefore, characterizing ASD as one of the complex genetic disorders in which more than one gene may contribute to a broad-spectrum phenotype. Genome wide scans, linkage studies of multiplex families, cytogenetic studies and copy number variation [CNV] have yielded a number of associated and susceptible genes and high risk loci on several chromosomes these include; 1p, 2q32, 5q, 6q21, 7q22,11p12-p13,13q, 16p13, 17q,19p and Xq13-q21. The increased incidence of ASD in Saudi Arabia and the presence of multiplex families with a consanguineous background highlights the importance of and opportunity to determine the genetic basis of this disorder in these families.

Objectives:

Utilize whole genome scanning methods in highly inbred families with two or more affected members to search for shared Loss of Heterozygosity (LOH) regions.

Methods:

This is a report from an ongoing approved research project of studying multiplex ASD families in Saudi Arabia using 250K Affymetrix GeneChip® Human Mapping Arrays. We have so far recruited 12 families with at least 2 affect individuals. The diagnosis of ASD was established by two independent evaluations by experienced clinicians utilizing DSM-IV criteria. In addition, many individuals underwent evaluations using Autism Diagnostic Interview – Revised (ADIR-R).

Results:

Affected Sib-pair analysis from each family independently and combined analysis of affected individuals from multiple families revealed a number of shared LOH regions in these families. These regions may harbor candidate genes.

Conclusions:

The large number of homozygous regions in affected individuals identified fit the model for a complex genetic syndrome. LOH analysis revealed a number of shared candidate loci between at least 3 families on different chromosomes.

110.056 122 Sex Hormones In Autism: Androgens and Estrogens Differentially and Reciprocally Regulate RORA, a Novel Candidate Gene for Autism. T. Sarachana*, M. Xu, W. Ray-Chang and V. Hu, *The George Washington University Medical Center*

Background: Autism, a pervasive neurodevelopmental disorder manifested by deficits in social behavior and interpersonal communication, and by stereotyped, repetitive behaviors, is inexplicably biased towards males by a ratio of at least 4:1. Although there is some evidence linking the level of fetal testosterone to autistic symptomatology, there is still no clear mechanistic understanding of how the sex hormones may play a role in autism susceptibility. We have recently identified a novel autism candidate gene, retinoic acid-related (RAR) orphan receptor-alpha (RORA), which is a hormone-dependent transcription factor (Nguyen et al., 2009, FASEB J. 24:3036-51). Because of its importance in regulating a number of functions impacted by autism, such as Purkinje cell survival and differentiation as well as cerebellar development, we investigated the regulation of RORA by sex hormones.

Objectives: The main objectives of this study were: a) to determine whether male and female hormones regulate the expression of RORA in a neuronal cell line, SH-SY5Y; 2) to examine whether or not RORA transcriptionally regulates aromatase, an enzyme that converts testosterone to estrogen; and 3) to investigate the relationship between RORA and aromatase expression in the frontal cortex of autistic vs. sex- and age-matched nonautistic controls.

Methods: Neuroblastoma cells SH-SY5Y were cultured and treated with 17β-estradiol or dihydrotestosterone (DHT). Dose-response and time-course studies of the sex hormones were conducted using RT-qPCR analyses. Chromatin immunoprecipitation (ChIP)-PCR experiments were used to demonstrate that RORA is a transcriptional target of androgen receptor (AR) and estrogen receptor alpha (ERα), and also that aromatase is a transcriptional target of RORA. To further validate that RORA can modulate aromatase expression, the cells were transfected with a RORA expression plasmid, and aromatase expression was then determined by RT-qPCR analyses. Confocal immunofluoresecence analysis was conducted using a tissue array containing postmortem brain tissues (BA9 region) from autistic and sex- and age-matched control subjects to determine the expression and relationship of RORA and aromatase protein levels in the brain.

Results: Our findings reveal that male and female hormones differentially regulate the expression of RORA. In addition, we demonstrate that RORA transcriptionally regulates aromatase (CYP19A1), an enzyme that converts testosterone to estrogen. Finally, we show that aromatase protein is reduced and strongly correlated with the level of RORA protein in brain tissues from autistic and control subjects.

Conclusions: These results collectively indicate that RORA has the potential to be under both negative and positive feedback regulation by male and female hormones, respectively, through one of its target genes, aromatase. These findings not only offer a molecular explanation for the elevated testosterone levels found in some individuals with autism, but also suggest a mechanism for introducing sex bias in autism.

110.057 123 Association Study of Apoe Polymorphisms and Autism In Puerto Rican Children. J. Montalvo*[1], M. Echegaray[2], R. E. Oliveras-Rentas[3], L. Deliz-Bauza[4], S. F. Acevedo[5], M. S. Collazo[5], S. Carlo[3], L. Alvarado[6], V. Velazquez[6], X. Negroni[6], Y. Hernandez[6] and M. Vazquez-Correa[7], (1)*University of Puerto Rico Medical Sciences*, (2)*University of Puerto Rico-Cayey*, (3)*Ponce School of Medicine* , (4)*Clinical Psychology Program*, (5)*Ponce School of Medicine*, (6)*St. Luke's Memorial Hospital*, (7)*University of Puerto Rico Medical Sciences Campus*

Background: Autism is a neurodevelopmental disorder characterized by stereotypic and repetitive behaviors and interests, together with social and communicative deficiencies. Various genomic scans have identified the 19p13.2 and 19q13.4 loci as having possible linkage with autism spectrum disorder. Within this region is the apolipoprotein E (APOE) gene, which codes for a protein, whose different isoforms (E2, E3, E4) affect neuronal growth and development. Previous studies on the possible association between APOE gene variants and autism have produced contradictory results.

Objectives: To test the hypothesis of association between the APOE gene variants (E2, E3, E4) and autism disorder in a cohort of Puerto Rican children.

Methods: A case-control study was performed with 50 patients, aged 3-12 y.o, diagnosed with Autism and 55 unrelated age-matched control subjects. Genomic material was collected from buccal swabs. The amplification of the APOE gene was carried out by PCR and the polymorphic variants were identified by restriction fragment length polymorphism and agarose gel electrophoresis.

Results: We found no significant difference in allele frequency between autistic (4% E2, 91% E3, 5% E4) and control (4% E2, 85% E3, 11% E4) children ($X^2 = 3.69$, df =2, P = 0.15). However, we did find a significant difference for genotype frequency with autistic children (8% E2/E3, 86% E3/E3, 6% E3/E4) showing a lower frequency of the E3/E4 genotype than controls (7% E2/E3, 71% E3/E3, 22% E3/E4); ($X^2= 17.5$, df = 2, P = 0.0002).

Conclusions: The results of the present study support the hypothesis of association between genotype, based on the APOE variants, and autism in our cohort of Puerto Rican children. In particular, significant underrepresentation of the E3/E4 genotype was observed in group of autistic subjects, supporting the possible involvement of apolipoprotein in the development of autism.

110.058 124 Replication of the Association of a MET Variant with Autism In Chinese Han Samples. X. Zhou*[1], J. Wang[1], X. Liu[1], Q. Ayub[2], X. Wang[1], C. Tyler-Smith[2], L. Wu[1] and Y. Xue[2], (1)*Harbin Medical University*, (2)*The Wellcome Trust Sanger Institute*

Background:

Autism is a common, severe and highly heritable neurodevelopmental disorder in children, affecting up to 100 children per 10,000. The *MET* gene has been regarded as a promising candidate gene for this disorder because it is located within a replicated linkage interval, is involved in pathways affecting the development of the cerebral cortex and cerebellum relevant to autism patients, and has shown significant association signals in previous studies.

Objectives:

To replicate the association of MET variants (rs1858830 and rs38845) with Chinese Han population with autism.

Methods:

Case-control analysis is used for the association study by comparing allelic and genotypic distributions of individuals with ASD to a group of autism-free controls. Chi-square test and Relative Risk are used to estimate the association of SNPs and ASD. Family-based study was performed applying the transmission disequilibrium test (TDT) by comparing the transmitted allele and the non-transmitted allele from a heterozygous parent to the affected child. Haploview software version 4.2 was used in TDT analysis and Chi-square was used to estimate the association.

Results:

Here, we present new ASD patient and control samples from Heilongjiang, China and use them in a case-control and family-based replication study of two *MET* variants. One SNP, rs1858830, showed very little variation in China, but we successfully replicated the other, rs38845, in the case-control association (RR = 1.13, P = 0.019). We failed to replicate the association in a family-based study due to small sample size.

Conclusions:

This is the first attempt to replicate associations in Chinese autism samples, and our result provides evidence that *MET* variants may be relevant to autism susceptibility in the Chinese Han population.

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110.158 125 Parental Attitudes on the Transition to Adulthood in Adolescents with Autism Spectrum Disorders and Other Developmental Disabilities. A. W. Duncan*, *Cincinnati Children's Hospital Medical Center*

Background: The transition from high school to the adult world presents challenges for any adolescent, but adolescents with autism spectrum disorders (ASD) face increased difficulties. For example, only 15-25% of individuals with ASD achieve an adult outcome that includes employment, independent living, and a social network (Seltzer et al., 2004). There is little research on what factors during the transition to adulthood may facilitate an optimal outcome in adolescents with ASD. Parents of adolescents with ASD can provide a critical perspective on the transition to adulthood. Transition barriers reported in previous studies included long waiting lists for vocational supports and residential placements and struggling to replace the often-extensive supports provided during high school (Hanley-Maxwell et al., 1995). The current study seeks to further our understanding of the transition issues of adolescents with ASD by surveying parents of these adolescents as well as parents of adolescents with non-ASD developmental disorders.

Objectives: This study had 3 objectives: (1) to describe parent-reported transition-related concerns; (2) to determine what services or interventions are being utilized or are desired; and (3) to examine future goals and expectations that parents have for their adolescents.

Methods: Parents of adolescents with ASD and other developmental disabilities (e.g., ADHD, cerebral palsy, Down syndrome, and spina bifida) completed a questionnaire packet that included a newly developed parent questionnaire, the Adolescent Transition Survey (ATS). The ATS obtained information about transition areas including general concerns, education, vocation, residential placement, independent living, recreation, transportation, and social skills. Parents also completed a background history form and the Vineland Adaptive Behavior Scales-Caregiver rating scales.

Results: Data collection is ongoing and the sample is expected to exceed 100 participants by May, 2011. The current sample consists of 25 parents of adolescents with ASD and 18 parents of adolescents with other developmental disabilities. Adolescents were predominately male (74%) and ranged in age from 13 to 17 (mean age = 15.3 years). They represented a wide range of cognitive and adaptive functioning. Preliminary analyses indicated that the following transition issues were significant concerns of parents of adolescents with ASD: social skills and support (91%), academic skills needed for college or career training (74%), and money management skills (74%). Parents of adolescents with other developmental disabilities identified social skills and support (44%), communication skills (44%), and independent living skills (28%) as significant concerns. Additional analyses will be conducted to outline specific social-communication concerns, current utilization of supports, and expectations about educational, vocational, and independent living goals and supports. Analyses will also explore whether parent identified concerns and goals are related to characteristics of the adolescent (e.g., demographics, adaptive behavior scores).

Conclusions: A better understanding of the transition needs of adolescents with ASD is needed to improve outcomes in this population. This study will provide critical information about the concerns and barriers faced by parents of adolescents with ASD and further the development of more targeted and effective interventions.

Funding Sources: NIMH RC1 OD-09-003

110.159 126 Latino Families' Daily Experiences with Children with ASD. E. Blanche* and S. A. Cermak, *University of Southern California*

Background:

Families of children with autism spectrum disorders experience many disruptions of day-to-day life that are associated with lifestyle issues (Stein, Foran & Cermak, in Press.) A diverse body of research has shown that these parents display

increased levels of stress, depression, anxiety and physical health challenges (Abbeduto et al, 2004; Boyd, 2002, Eisenhower, Baker, & Blacher, 2005; Estes et al., 2009; Grey, 2003; Hastings, Kovshoff, Ward, et al., 2005; Herring et al., 2006; Ingersoll & Hambrick, 2010; Yamada et al, 2007). Latino families encounter unique additional challenges including a late diagnosis, fragmented services, and lack of information in their native language (Overton, Fielding & Garcia de Alba, 2007; Rodriguez, 2009; Williams, Atkins & Sole, 2009).

Objectives:

The experience of Latino families with children with ASD has seldom been described. The purpose of the study was to obtain detailed understandings of the daily experiences of families with a child with ASD, as well as their daily activities, routines, and coping strategies. This information will be used to develop an intervention approach that is sensitive to the unique needs of Latino families.

Methods:

Six Latino families of children with ASD were interviewed and audiotaped for analysis. Qualitative analysis was used to identify experiences unique to this population.

Results:

The results of the study suggest that Latino families of children with ASD encounter similar issues as Caucasian families in addition to unique issues such as the role of the father/husband in the family, challenges to family participation in assessment and intervention services, the role of extended family, and cultural factors that may contribute to diagnostic delay. Parents expressed a need for parent programs that would address the multiple challenges facing this population.

Conclusions:

There is a need to further explore the specific and unique needs of Latino families. The results of this study will be used to develop and test the feasibility of a comprehensive lifestyle redesign (LR) intervention intended to promote the health, well-being, and quality of life of individual Latino family members and the family system as a whole.

110.160 127 Observing social inclusion of children with ASD. S. Mahjouri*[1], J. J. Locke[1], E. Rotheram-Fuller[2] and C. Kasari[1], (1)*University of California, Los Angeles*, (2)*Temple University*

Background: Social isolation is one of the most enduring challenges facing children with autism spectrum disorders (ASD). Gathering information from multiple informants and including observations of children in natural settings provides a more complete picture of the social inclusion of individuals with ASD in schools. Most children with ASD are not isolated at school, but vary in their social connectedness to peers in their classrooms (Chamberlain, et al., 2007). However, observing children's interactions with their peers on the schoolyard yields more information about the nature of their social inclusion. The Playground Observation of Peer Engagement (POPE) has been utilized in several studies accounting for approximately 100 high functioning children with ASD, fully included in general education classrooms.

Objectives: The objective of this paper is to describe an observational measure for use on school playgrounds that measures children's social engagement with others and that can be collected live. For this presentation, the reliability and validity of the POPE will be discussed in relation to other measures collected on children's social relationships.

Methods: Using the POPE, children's peer interactions were observed during school (recess and lunch periods) for levels of engagement, initiations and responses, and affect. Observers watched children for forty seconds and coded for twenty seconds, for an average of fifteen-minutes per period. Social network, friendship self-report data, and teacher and parent report of social behavior were also examined in relation to playground engagement.

Results: The POPE has high inter-rater agreement, $\kappa > .80$, and has been successfully used in multi-site studies with suitable inter-rater agreement ($\kappa > .70$). Data from one study found children with ASD were engaged on the playground for an average of 38.6% of observed intervals (Kasari et al., in press). Even children with more friends and high social network scores were as unengaged as children with fewer friends and less social network centrality. Teacher and aide ratings of social behavior in the classroom were significantly related to observer-rated playground engagement ($r = .48$, $p < .05$), total playground initiations($r = .51$, $p < .05$), to peers and appropriate responses ($r = .60$, $p < .05$) (Locke, 2011). Parent ratings of play dates at home were also significantly associated with observations of playground engagement. Number of reciprocal friendships and social network status were non-significantly associated with playground engagement.

Conclusions: These data suggest that the POPE is a reliable measure of peer social engagement on the playground, and is

significantly associated with teacher and parent report of social behavior. Peer and self report of friendships are less associated with playground behavior, and taken together suggest that children who are nominated by peers as friends have great difficulty engaging with their friends on school playgrounds. By utilizing the POPE, it is possible to understand the level of engagement children with ASD have with their peers and their spontaneous social behaviors, which ultimately may inform intervention, monitor progress, and measure efficacy of social skills treatments.

110.161 128 A Virtual Reality Study of Complex Social-Attention In School-Aged Children with Autism. W. L. Jarrold*[1], M. V. Gwaltney[1], N. V. Hatt[1], B. E. Seymour[1], N. McIntyre[1], M. Solomon[2], S. Ozonoff[1] and P. C. Mundy[1], (1)*UC Davis*, (2)*Department of Psychiatry, MIND Institute, Imaging Research Center*

Background:

Social attention theory has contributed to clinical advances for preschool children with autism, but has had less impact on school-aged children. Social-attention paradigms with preschool children measure a child's capacity to coordinate attention with one social partner to an external object or event. In school-aged children, however, social-attention often involves coordinating attention with *multiple* social partners, regarding referents to internal thoughts and representations, as well as external objects/events.

Objectives:

To address this measurement challenge we have begun to use virtual reality applications to study social-attention in school-aged children with autism.

Methods:

Our first study examined social-attention in groups of younger 8- to 11-year-old and older 12-to 16-year-old children with higher functioning autism and matched controls (total N = 40). Participants wore a head-mounted virtual displays system and were presented with a 3D virtual classroom populated by 9 avatar "peers". They verbally respond to questions about themselves, while trying to looking at all the avatars. To see all of these, the participants needed to turn 80 degrees left and right from midline. They also needed to look behind the *front* avatars to fixate on the two avatars at the rear of the room. Social attention was defined as the total number of looks to the 9 avatar peers' head regions. In the No Cue Condition participants were instructed simply to look at, and talk to all the avatars. In a Cued Condition avatars faded if they did not receive attention, but became solid again if fixated.

Results:

Consistent with other recent research (e.g. O'Hearn et al. 2010) results revealed the later onset of a developmental disturbance in autism. There was evidence of a Diagnostic Group X Age Group interaction such that there was no difference between Younger HFA and Control groups on social attention defined as the total frequency of looks to social avatars (106.8 vs. 98.3 looks respectively), but there was a significant difference on social attention between the Older HFA and Control groups, $F(1,14) = 6.28$, $eta^2 = .31$ (105.4 vs. 144.5 looks respectively). The older controls also displayed reliably more looks to avatars than younger controls ($p < .025$), but this cross-sectional developmental effect was not evident in the autism sample. Fortunately, the social attention of all children was malleable, including those with autism, and improved with fade cues ($p < .009$ HFA, $p < .03$ Controls). Thus, cued practice with this task could help to offset adolescent delays in this type of social-attention ability in children with autism.

Conclusions:

Consistent with the hypothesized pivotal nature of social attention for learning (Mundy et al. 2009), poorer social-attention in was strongly associated with parent reports of learning problems in school in both groups ($r = -.64$ to $-.65$, $ps < .002$). Additional analyses indicated that variance in ADHD symptoms and IQ significantly moderated social attention in the HFA sample. The implications of these data for social attention theory, the developmental course of expression of autism, and the utility of virtual reality research paradigms will be discussed.

110.162 129 Are Autistic Traits Associated with Compromised Audiovisual Integration of Socially Relevant Information?. J. P. Thomas* and M. Shiffrar, *Rutgers University*

Background:

This study investigated the relationship between autistic traits and the perception of audiovisual displays of human motion. Previous research has demonstrated that, in typical observers, visual sensitivity to point-light walkers improves when paired with footstep sounds, but not when paired with meaningfully unrelated sounds. Superior temporal sulcus and premotor cortex are implicated in biological motion perception (Saygin, 2007) and audiovisual integration (Barraclough et al., 2005; Keysers et al., 2003). These regions appear to be compromised in individuals on the autism spectrum (Pelphrey

& Carter, 2008; Oberman et al., 2005). Thus, compromised audiovisual integration of human actions may be associated with autism. Impairments in the integration of such socially relevant information could lead to difficulties in social interaction. There is no consensus as to whether multisensory integration is compromised in individuals with Autism Spectrum Disorder (ASD). Some studies report intact audiovisual processing (Keane et al., 2010) while others report deficiencies (Smith & Bennetto, 2007). To address this inconsistency, multisensory integration was tested in typical individuals as a function of the magnitude of their autistic traits. Typically developed adults vary in the degree to which they possess autistic traits (Baron-Cohen et al., 2001). Here, we investigated the relationship between autistic traits, as measured by the Autism Quotient (AQ) and sensitivity to audiovisual displays of human movement.

Objectives:

The aim of this study was to determine whether autistic traits are associated with the integration of auditory and visual cues to human actions in typically developed adults.

Methods:

Eighty-three typical adults completed the AQ and an audiovisual biological motion detection task. Point-light displays of human walking motion (3000ms duration) were presented coherently (person present) or scrambled (no person), and hidden within a point-light mask. In a between-subjects design, participants heard either footsteps (meaningfully related) or frequency-scrambled footsteps (not meaningfully related) that were coincident with the footfalls of the point-light walker. On each trial, participants indicated whether or not a walker was present.

Results:

AQ scores ranged between 9 and 31 (mean 18.83). Separate correlational analyses were conducted for the coherent footstep and the scrambled footstep groups. Analyses revealed a significant negative correlation between task accuracy (% correct) and AQ score for the footstep group ($r = -.373$, $p = .021$) but not for the scrambled footstep group ($r = -.121$, $p = .430$). Thus, as autistic traits increase, sensitivity to meaningfully related audiovisual biological motion cues decreases, while sensitivity to meaningfully unrelated audiovisual biological motion cues does not.

Conclusions:

In the real world, social interactions include both visual and auditory cues. Social capabilities are constrained by one's ability to integrate cues that are meaningfully related and segregate cues that are meaningfully unrelated. We observed a negative correlation between autistic traits in typical observers and the ability to detect human motion in the presence of meaningfully related footstep sounds. This supports the hypothesis that the integration of meaningfully related auditory and visual biological motion cues is impaired increasingly with increases in the magnitude of autistic traits.

110.163 130 Attention to Social and Nonsocial Events In Children with Autism Spectrum Disorders: The Role of Stimulus Variability. B. M. Sorondo*, L. E. Bahrick and J. Vasquez, *Florida International University*

Background:

Autism spectrum disorders (ASDs) are characterized by impaired social-communicative functioning and decreased preferences for social events (Dawson et al., 1998, 2002). Because social events differ from nonsocial events along various dimensions, the basis for enhanced preferences for nonsocial over social events in ASD is unclear. For example, social events typically involve more stimulation, contingent feedback, and affective content, as well as greater complexity, variability, and unpredictability than nonsocial events.

Objectives:

The present study: 1) assessed preferences for social vs. nonsocial events, while partially controlling for complexity, unpredictability, and variability (hereafter referred to as "variability") across event type, and 2) examined whether the level of variability impacted visual preferences for children with ASDs and typical development (TD). We predicted that children with ASDs would prefer nonsocial over social events and events of lower variability than TD children.

Methods:

Participants included 12 children with ASDs and 12 TD children, all 1- to 4-year-old males, roughly matched on nonverbal mental age (NVMA; Mullen, 1995; ASD 3.15 years; TD: 3.44 years). Children viewed six films with synchronous soundtracks. The social events depicted a woman speaking and the nonsocial events depicted dynamic, multicolor, oscilloscopic images with music. The social and nonsocial events were designed to depict low, moderate, and high levels of variability and to be approximately matched for variability across event type. Variability levels were created by manipulating pattern length and number of repetitions of the

pattern within each 30 s video. Each video was played twice for a maximum of 30-s per trial or until the child looked away for at least 2-s. The dependent variables indexing interest were looking time to each video expressed in seconds (LT), looking time to each video expressed as a proportion of the child's looking time to all videos (PLT), and number of disengagements per minute from each video.

Results:

A 2 x 2 x 3 repeated measures ANOVA with diagnostic group (ASD vs.TD) as the between subjects factor and event type (social vs. nonsocial) and variability level (high, moderate, low) as repeated measures factors was conducted for each measure. Results indicated a main effect of event type for each measure (*p*s < .05) with greater interest in the nonsocial than the social events. Moreover, a diagnostic group by event type interaction was obtained for each measure (*p*s < .05), indicating that the preference for nonsocial events was carried by children with ASDs. They showed significantly greater interest in nonsocial than social events whereas TD children showed no preferences for one event type over another. Surprisingly, no main effects or interactions involving variability for any of the measures emerged for either diagnostic group (*p*s>.10).

Conclusions:

Regardless of the level of stimulus variability, children with ASDs preferred nonsocial to social events whereas TD children showed no preferences. These findings support previous research demonstrating social orienting deficits and enhanced preferences for nonsocial events in children with ASDs. They suggest that interest in nonsocial events may be robust despite manipulations of variability, complexity, and predictability.

110.164 131 Effects of Manipulating the Coordination of Gesture and Speech In Computer Animations of Storytelling. F. E. Pollick*[1], A. B. de Marchena[2], J. A. Gillard[1], A. M. Nardone[1] and I. M. Eigsti[2], (1)*University of Glasgow*, (2)*University of Connecticut*

Background: Gestures typically accompany speech and are known to help in the understanding of the meaning of speech. It is thought that speech and gesture are tightly coupled and that the precise coordination of gesture and speech is different between typically developed individuals and those on the autism spectrum (de Marchena & Eigsti, 2010). However, the perceptual factors that influence speech-gesture coordination are not well understood.

Objectives: We wished to explore the perceptual factors that lead to gesture not being perceived as coordinated with speech and the effects this has on understanding and appreciating someone gesturing while telling a story. To obtain precise control of the visual stimuli we used techniques of computer animation to capture the motion of storytellers and play back the story on a computer character.

Methods: The voice and body motion of 4 typically developed storytellers was captured using a audio recorder and a 12-camera Vicon motion capture system using a standard marker set. The stories told were taken from the cartoon task of Modules 3/4 of the ADOS. In this task participants see a series of cards representing a sequence of events and then are asked to tell the story. The motion capture data was used to drive the behaviour of a computer-generated mannequin using the program MotionBuilder. Motionbuilder allows editing the motion of the character and we created an animation without any manipulation and one in which the elbows were restricted from moving, resulting in straight stiff arms throughout the story. These two animations were combined either with the standard audio or audio misaligned temporally by 330 ms. This resulted in a total of 4 displays that were shown to 15 participants. Participants viewed and listened to the displays and made judgments about the quailty of the story and the storyteller. Each participant viewed each of the 4 conditions once given by a different individual.

Results: The different ratings about the perceived quality of the storyteller and story were combined to provide an average for each condition of each participant. An effect of order of presentation was obtained that complicated the interpretation. However, the unaltered original animation was rated significantly different from the animation with the asynchronous audio and the one with the locked elbow. Surprisingly, the combined asynchronous and elbow locked display was not rated different from original animation.

Conclusions: These results provide an important first step in establishing a rigorous procedure for analysing the perceptual factors which are key to perceiving coordinated gesture and speech.

110.165 132 Eye Gaze Patterns In Children with and without Autism During Social Exclusion. D. R. Sugrue*, D. Z. Bolling, A. C. Voos, E. S. MacDonnell, H. Seib and K. A. Pelphrey, *Yale University*

Background: Prior research has demonstrated that individuals with autism spectrum disorder (ASD) exhibit both impairments in social cognition and atypical eye gaze patterns to social stimuli. However, researchers have not examined the eye gaze patterns of children with an ASD while they are being socially

excluded. Cyberball is a virtual ball toss game that has been used to examine the effects of social exclusion on individuals with and without an ASD. No studies have evaluated gaze patterns in the dynamic social situation of Cyberball. Based on the reported atypical eye gaze behavior of individuals with ASD in social situations, it is hypothesized that these participants will reference the faces of the other players less frequently during exclusion than typically developing (TD) children.

Objectives: We are investigating eye gaze behavior of children with and without an ASD while playing Cyberball by examining the frequency with which both groups direct eye gaze to the faces of the other players, and whether the number of fixations is modulated by inclusion and exclusion. We are also examining individual differences in social responsiveness and autistic traits in relation to eye gaze behavior.

Methods: Participants play Cyberball, in which they are excluded and included in alternating blocks by two other virtual players whom they believe to be real opponents on the Internet. During inclusion the participant receives the ball on one third of the throws. During exclusion the participant does not receive the ball at all. The number of fixations directed toward the pictures of the other players during both inclusion and exclusion is recorded using a Tobii T60 XL eye-tracker. After the game, the participant is asked ten questions to assess her/his distress in response to the exclusion. In addition, a Social Responsiveness Scale (SRS) and Autistic Traits (AQ) measure on each participant is completed.

Results: Preliminary results from 6 children with ASD and 2 TD children suggest that on average, the number of fixations TD children make toward the faces of the other players is significantly increased during exclusion versus inclusion. This modulation of gaze patterns is less pronounced in children with ASD. Planned analyses will correlate this data with self-report measures, anticipating relationships between self-reported distress and number of fixations. Correlations between scores on the SRS and AQ in relation to frequency of fixations may also reveal significant relationships between gaze behavior and autistic traits.

Conclusions: We are examining eye gaze behavior of children with and without an ASD in a dynamic social situation where preliminary findings suggest that the frequency with which TD children reference faces of the other players is increased during periods of exclusion. This work has the potential to extend theories of disordered gaze patterns in the viewing of social stimuli in ASD to dynamic, interactive social situations.

110.166 133 Identifying Children with Characteristics of Asperger Syndrome In the Special Education Units In Schools In Malacca, Malaysia. K. Amat*, *University of Strahclyde*

Background: Asperger syndrome (AS) is one of the PDD's subtypes associated with normal intelligence and intact formal language skills (APA, 2000). In Malaysian schools, children with AS are not being fully recognised. Children with ASDs in Malaysian schools are generally identified as 'autistic' and are placed with other children with learning disabilities in the special education programme which is carried out in the normal primary and secondary schools. Children with Asperger syndrome should be identified so they could be given an appropriate and the same degree of diversification in terms of educational opportunities as other children (Peeters & Gillberg, 1999). It would be more important for children with AS and High functioning autism (HFA) to be identified because their higher IQ could lead them to have a better prognosis (Ben-Itzcak & Zachor, 2007) and they were also shown as very amenable to a variety of psychologically based interventions (Birkan, Mclannahan & Krantz, 2007).

Objectives: The aim of this study is to identify children with characteristics of AS within children diagnosed with autism in the special education units in schools in Malacca, Malaysia.

Methods: This study was undertaken using a standardised rating scale specifically formulated to identify individuals with AS (Asperger Syndrome Diagnostic Scale or ASDS) and assessment of the children's current language and IQ skills. These findings were compared to their language and cognitive developmental history, acquired from GADS parent interviews forms, to verify whether they fulfil the DSM-IV criterion for AS: 'no speech and cognitive delays'.

Results: It was found that 2 children were 'very likely' to have characteristics of AS as determined by the standardised rating scale. However, their full scales IQ (FSIQ) indicated by the WASI IQ test fell in the low average and borderline range. For current language skills, even though one of the children has outstanding language skills, particularly in listening, speaking and reading, to some extent his writing skills are still quite low. Meanwhile, the other child did not record a high score, especially in writing, reading and speaking skills. GADS parent interview also revealed that both children had not used single words by age two, or communicative phrases by age three and they also have delays in cognitive development.

Conclusions: Even though 2 children were perceived by their parents and teachers as 'very likely' to have characteristics of

AS, discrepancies in manifestation of their features make it impossible to absolutely verify that any child shows characteristics of AS. Furthermore, they do not meet the DSM-IV criteria for AS. Since their characteristics are hardly different from autism, they may then benefit from the wealth of knowledge available on how to support individuals with autism (Macintosh & Dissanayake, 2004). Therefore a dimensional rather than categorical approach would be more helpful in understanding the distinction amongst the PDD subtypes.

110.167 134 Inner Speech and Self Ordered Pointing Performance In Autism Spectrum Disorder. P. Tok* and J. Low, *Victoria University of Wellington*

Background:

Language has been implicated in a variety of controlling functions apart from merely acting as a conduit for transferring thoughts and ideas. A cognitive conception of language holds that language – inner speech in particular – can service executive functioning (Holland & Low, 2010). The engagement of implicit verbalization for problem solving is especially relevant to illuminating the nature of executive function deficits in children with autism spectrum disorder (referred to as ASD). Inner speech seems to be available to ASD for short-term maintenance and storage of verbal and phonological information, but there appears to be irregularities in its application (Whitehouse et al., 2006; Williams et al., 2008). Holland and Low posited that autistic weaknesses in inner speech use may be especially evident in terms of when and how sub-vocal rehearsal is recruited to support central executive control processes.

Objectives:

Uing a dual task paradigm, we tested whether articulatory suppression would have any disruptive effect on executive working memory in ASD.

Methods:

Participants with ASD and typically developing (TD) matched controls were administered verbal and nonverbal variants of Petrides and Milner's (1982) Self-ordered Pointing Test (SOPT). The SOPT is a non-spatial, self-monitoring test that requires generation of novel responses while monitoring actions already made and retained in working memory with choices yet to be made. The SOPT was administered using a 15" ELO Touch Screen Computer. Participants completed the verbal and non-verbal SOPT silently by themselves or concurrently with a secondary task that required the overt recitation of a familiar sequence (repeatedly saying the days of the week). The underlying logic was that if the secondary task (articulatory suppression) disrupts performance on the primary task relative to a silent output condition, subvocal speech used by the secondary task is inferred to be involved in performance on the primary task.

Results:

We found a robust effect whereby ASD, compared to the IQ and language matched TD group, performed poorer on the verbal but not on the nonverbal variant of the SOPT. Moreover, ASD did not appear to recruit inner speech to facilitate verbal SOPT performance: there was no detrimental effect of articulatory suppression on accuracy in the verbal SOPT variant for ASD compared to the control group.

Conclusions:

The results indicated that ASD do not appear to recruit internal verbal representations for assistance with the self-regulation and monitoring of a sequence of actions by the central executive. Consequently, given that inner speech partly contributes to supporting executive control over setting up, maintaining and operating task-specific programmes, and that ASD do not show any effect of articulatory suppression on executive working memory, the study of suppression effects in a dual-task paradigm may be especially sensitive to revealing potential limitations of the self-regulatory qualities provided by inner speech function in autism spectrum disorder.

110.168 135 Temperament and Peer Victimization as Predictors of Facial Emotion Recognition Among Adolescents with and without High-Functioning Autism. L. Sperle*[1], A. R. Neal[1] and T. Wells[2], (1)*University of Texas*, (2)*Brown University*

Background: According to the "modifier model" of autism, variability in social skills and behavior is the product of biological causes of autism and environmental modifiers like social relationships (Mundy et al., 2007). Temperament factors like high Negative Affectivity (NA) are associated with poorer social skills and social-emotional outcomes (Schwartz et al., 2009). Furthermore, abused children display an anger bias in facial emotion recognition tasks, suggesting that negative social relationships may contribute to biased emotion processing (Pollak et al., 2000).

Objectives: The purpose of the present study was to examine high-functioning autism (HFA), negative affectivity (NA) and peer victimization (PV) as predictors of emotion recognition, sensitivity and bias. It was predicted that adolescents with HFA would demonstrate poorer overall identification of and

sensitivity to emotional facial expressions. Furthermore, it was predicted that higher NA and PV would be associated with lower sensitivity and negative emotion bias in both groups.

Methods: Adolescents with (n=7; M_{age}=15.2Y) and without (n=17; M_{age}=15.1Y) HFA participated in three computerized facial emotion recognition tasks. Prototype emotion identification was tested with prototype happy, sad, and angry faces. Emotion sensitivity was tested via short movie-like clips of a neutral face progressing towards a happy, sad or angry expression. Emotion bias was tested using ambiguous morphed faces along happy-sad, happy-angry and sad-angry continua. Participants were also administered the Autism Diagnostic Observation Schedule, the Kaufman Brief Intelligence Test, the Early Adolescent or Adult Temperament Questionnaire, Social Experiences Questionnaire and Olweus Bully/Victim Questionnaire. Data collection is ongoing.

Results: Preliminary results show that adolescents with HFA were less accurate at identifying prototype emotions than controls (t (22)=2.73, p < .05), specifically happy (t (22)=2.50, p<.05) and sad (t (22)=2.07, p=.05) faces. However, they were not impaired (minimum accuracy ≥ 83%. With regard to temperament, high NA was associated with a bias to identify anger when presented with ambiguous happy-angry faces (r=.42, p=.05). Finally, while adolescents who had experienced overt PV did not show a significant emotion bias, they were observed to be less sensitive to subtle facial cues. They required a higher level of emotion strength to correctly identify the emotion of facial stimuli progressing from a neutral to an expressive face (r=.43, p=.04).

Conclusions: Adolescents with HFA were less accurate in prototype emotion identification than peers without HFA; however, they were not impaired. Sadness was the most challenging emotion for HFA to identify. NA was associated with a bias to identify anger given ambiguous emotion stimuli. This suggests that temperament may play a role in adolescents' assessment of emotional information and is consistent with Schwartz et al. (2009). Our research failed to find that children with high PV have a bias to overidentify negative emotion. We did find, however, that children who have experienced high PV show lower sensitivity to emotional cues. It may be that lower sensitivity to emotional information may make adolescents vulnerable to PV. This causal explanation requires further investigation. The interaction between HFA, NA, and PV will be explored as sample size and power increase in this ongoing study.

110.169 136 An Exploration of Using Children's Reasoning about Math to Identify Cognitive Profiles In Autism Spectrum Disorders. C. Piatt*, J. Volden and J. Bisanz, *University of Alberta*

Background: Research on autism spectrum disorders (ASD) has moved toward mapping the variability in ASD (Happé et al., 2006; Szatmari, 2003; Volkmar & Klin, 2005). The search for meaningful profiles within that variability extends across multiple levels including genes, clinical presentation, and cognition. Research into cognitive profiles in ASD has been limited to performance measures on standardized tests. Investigating how children with ASD think will further enrich our understanding of cognitive profiles in ASD (Asperger, 1944).

Mathematics is a useful domain for exploring how children with ASD think because a body of research investigating how typically developing children think about mathematical concepts is available (De Corte & Verschaffel, 2006). For example, four different cognitive profiles of strategy discovery and generalization were revealed in Luwel et al.'s study (2005) of typically developing children's discovery and use of strategies for subtraction. There are very few studies of mathematical thinking in children with ASD, but Jones et al. (2009) showed evidence for cognitive profiles marked by "peaks" and "dips" in reading and mathematical performance relative to full-scale IQ scores. Little work has been done, however, on *how* children with ASD learn about math or whether they show the same kinds of cognitive profiles as typically developing children. Cognitive profiles in ASD will provide rich descriptions that may complement the detailed investigations ongoing in areas such as genetics.

Objectives: The purpose of this study is to probe the reasoning of children with ASD on several math tasks, well-characterized in the literature from typical development, in order to explore math as a vehicle for establishing cognitive profiles in ASD.

Methods: Eight children (6-14 years) with clinical diagnoses of ASD participated. Each child completed a standardized measure of math achievement (Woodcock Johnson-III) and engaged in several tasks probing their mathematical reasoning, including number line estimation (Booth & Siegler, 2006), insightful subtraction (Luwel et al., 2005), and inversion (Bisanz et al., 2009).

Results: Children with ASD differed from each other in both math performance and how they think about math. Not only did some children with ASD show a "math peak" relative to an overall measure of cognitive ability, but some children also showed relative "peaks" and "dips" within math. Across math tasks, three potential cognitive profiles emerged. One profile is characterized by consistently using more rote, procedurally

based strategies across math tasks. A second profile is represented by consistently using more insightful, conceptually based strategies across math tasks, and a third profile is characterized by using both kinds of strategies across tasks .

Conclusions: Being able to map the cognitive terrain in ASD is important for understanding the variability observed in ASD. Previous studies of cognition in ASD have focused on outcome measures of thinking to the exclusion of information about the process of thinking. This study is the first to explore reasoning about math as a vehicle for examining profiles of cognition in ASD. Targeted studies of performance and reasoning on specific math tasks in children with ASD are planned.

110.170 137 Imitation of Maternal Social Communication From 6 to 18 Months In Infants at Risk for Autism. M. R. Thompson* and H. Tager-Flusberg, *Boston University*

Background: Impairments in language and social communication skills identified by 12 months of age in infants later diagnosed with autism include impairments in language, joint attention, imitation, and gesture production. These findings come primarily from two lines of research: one examining early development retrospectively, from family home movies, after a diagnosis of autism has already been made; the other from studies of high-risk infants (HRA) who are followed prospectively. Recent investigations have also identified language delays in HRA infants who do not go on to receive ASD diagnoses. Given the pervasiveness of these language difficulties within the entire group of HRA siblings, a more detailed understanding of the factors that contribute to early language ability in this group of infants will potentially impact treatment not only for the subset who are diagnosed with ASD, but for a significant portion of siblings whose diagnostic status may be less clear. The current study unites the benefits provided by standardized laboratory measures with the more naturalistic setting of the home, by collecting prospective videos of semistructured infant-caregiver interactions. In doing so, we are able to examine the development of early social communication within the daily, reciprocal exchanges that occur between infants and their caregivers.

Objectives: The goal of the present study is to examine the trajectory of infant imitation of social communicative behaviors from 6 to 18 months and their relation to language ability at 18 months of age in a sample of infants at risk for autism.

Methods: Data for this project was obtained from a larger ongoing longitudinal study of infants at high risk for autism (HRA) and low risk controls (LRC). Upon enrollment, parents were provided with a video camera and a brief set of instructions for filming semistructured social interactions with their infants at home, twice per month. Activities include an object exploration task, in which infants are provided with a series of toy and 'non-toy' objects to play with, a book reading task, and several more open-ended social games or interactions (e.g. peekaboo, singing 'itsy bitsy spider'). Videos were coded for infant imitation of maternal vocalization, gesture, and actions and further specified by the types of imitation within each of these categories (e.g. imitates point, imitates wave, imitates shaking rattle).

Results: Home video diaries have been collected from 104 families (59 HRA, 45 LRC). Of these, 88 infants have completed their 18-month laboratory visit, which includes administration of the Autism Diagnostic Observation Schedule (ADOS). Although final group status will be determined by scores at 36 months of age, 9 children have met diagnostic criteria at 18 months and are considered to have ASD for these analyses. Results of specific behavioral trajectories (rate of gesture imitation) will be discussed.

Conclusions: The current methodology allows for a more thorough understanding of the relationship between early social communicative skills, such as imitation of caregiver vocalizations, and later language abilities. These findings will have significant clinical implications by helping parents to 'make the most' of these early interactions.

110.171 138 Parsing Heterogeneity In Autism Spectrum Disorder Using Blink Inhibition as a Measure of Social Engagement. S. Shultz*[1], W. Jones[2] and A. Klin[2], (1)*Yale University*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Heterogeneity in autism spectrum disorder (ASD) is an obstacle to advancements in identifying and treating causes of the disorder. Measures capturing the core underlying features of ASD, such as reduced engagement with socially adaptive stimuli, may provide a means for parsing phenotypic heterogeneity in ASD. Our laboratory developed a novel approach for quantifying viewers' moment-by-moment engagement with dynamic stimuli by measuring patterns of blink inhibition during a natural viewing task. This method capitalizes on the fact that people spontaneously inhibit eye-blinks when processing salient visual stimuli to minimize the loss of visual information that occurs when blinking. Using this method, we demonstrated that children's visual engagement with dynamic stimuli led to predictable patterns of blink inhibition: typically-developing (TD) toddlers inhibited eye-blinks when viewing highly affective content and exhibited increased eye-blinking during portions of low affective content. In

contrast, the blink rate of toddlers with ASD did not vary with respect to social content. While these findings suggest reduced engagement with socially relevant stimuli in ASD, the clinical utility of these results for parsing heterogeneity in ASD and identifying homogeneous subgroups remains unknown.

Objectives: (1) To assess whether reduced social engagement, as measured by blink inhibition, correlates with social disability in ASD, and (2) to assess the utility of this measure for identifying homogeneous subgroups in ASD.

Methods: Eye-tracking data were collected from school-age children with ASD (n = 49) and matched typically-developing peers (n = 26) while watching movies of social interaction. Visual engagement in individuals with ASD was indexed by patterns of blink inhibition relative to salient movie events, defined as movie frames during which the TD group inhibited their blinks. Our dependent measures were (1) an individual's decrease in blink rate relative to salient events, and (2) the latency at which an individual decreased their blink rate following salient events.

Results: A subgroup of children with ASD (n = 15) exhibited relatively normative patterns of blink inhibition, as indexed by a significant decrease in blink rate following salient events. Within this subgroup, both percentage decrease in blink rate and latency of blink inhibition correlated strongly with social ability, measured by the ADOS (r's =.5-.8, *p*'s < .05). Greater decrease in blink rate and shorter latency of blink inhibition were associated with greater social ability. Preliminary analyses identified a second subgroup of children (n=7) with disrupted patterns of visual engagement, as indexed by a significant increase in blink rate following salient events. These children had significantly lower IQ and Vineland scores compared with the first subgroup. Ongoing analyses are aimed at further identifying and understanding altered patterns of visual engagement in subgroups of ASD.

Conclusions: Visual engagement with dynamic social stimuli, as indexed by patterns of blink inhibition, provides a promising measure for parsing heterogeneity in ASD and improving quantified phenotypic characterization of children. Future analyses, aimed at investigating the type of stimuli that engage subgroups of children with ASD will be an important step towards identifying alternate learning strategies and ways of experiencing the world in ASD.

110.172 139 The Truth, Nothing but the Truth: When Children with Autism Care Less about Reputation Than Honesty. C. Chevallier*, C. Molesworth and F. Happe, *Institute of Psychiatry, KCL*

Background: Human beings are endowed with a strong motivation to be included in social interactions. This natural social motivation encourages behaviours such as flattery or self-deprecation aimed to ease interaction and to enhance the reputation of the individual who produces it. Diminished social interest, as it is typically found in autism spectrum disorder (ASD), is therefore likely to affect reputation management.

Objectives: Our goal in this study was two-fold: i) to test whether children with an ASD are less prone to flattery than their typically-developing (TD) peers, ii) to test whether flattery correlates with self-reports of social enjoyment.

Methods: 36 male adolescents (18 with a high functioning ASD and 18 TD) took part in the study. The ASD and the control groups were matched on chronological age (M = 13;10) and IQ (M = 102). Flattery task: in this simple protocol inspired by social psychology, participants were asked to rate ten drawings. Two of these drawings were subsequently presented again by a new experimenter for a second rating. The experimenter claimed to have drawn one of the drawings (the other drawing worked as a control). The dependent variable was the difference between the first and the second rating. Social pleasure: to assess social pleasure, we used a validated self-report scale (Kazdin, 1989) measuring anhedonia in various situations, including interpersonal contexts. Predictions: We predicted that TD but not ASD children would inflate their second rating for the experimenter's drawing but not for the control drawing and that this index of flattery would correlate with self reports of social pleasure.

Results: Contrary to TD children, children with an ASD did not enhance their ratings in the presence of the drawer. There was no significant difference between their initial rating and their second rating, and the resulting difference score was similar to that obtained in the control condition (judging a picture in the artist's absence). The anhedonia scale further demonstrated that participants' flattery behaviour correlated with their self-report of enjoyment of social interactions: the higher the score in social anhedonia, the lower the score in flattery.

Conclusions: This study reveals that ASD participants do not display flattery behaviour and points to a diminished concern for reputation in the condition. This suggests that, in line with clinical observations, individuals on the spectrum may favour honesty over the concern for reputation. These findings are among the first to directly test reputation management in ASD and open new routes for investigation of social motivation in this condition.

110.173 140 Parenting Behavior Among Parents of Children with Autism Spectrum Disorder. G. Lambrechts*[1], K. Van Leeuwen[1], H. Boonen[1], B. Maes[1] and I. Noens[2], (1)*Parenting and Special Education Research Group, Katholieke Universiteit Leuven*, (2)*Katholieke Universiteit Leuven*

Background:

Contrary to the extensive amount of empirical findings about parental perceptions, parenting cognitions, and coping in families with a child with autism spectrum disorder (ASD), research about parenting itself is very scarce. However, parents of children with ASD face specific challenges in parenting and parenting behavior plays an important role in intervention.

Objectives:

A first goal of this study was to examine the factor structure and internal consistency of two scales to measure parenting behavior: the Parental Behavior Scale – short version (PBS, Van Leeuwen, 2002; Van Leeuwen & Vermulst, 2004; 2010) existing out of five subscales (Positive Parenting, Discipline, Harsh Punishment, Material Rewarding, and Rules) and a new scale to measure parenting behaviors more specifically relevant to children with ASD. A second goal was to compare general and more specific parenting behavior among parents of children with and without ASD.

Methods:

The experimental group was recruited through the Flemish Association for Autism and consisted of 305 parents of a child with ASD between 8 and 18 years old. The control group was recruited through five primary and four secondary schools and consisted of 325 parents of a typically developing child between 8 and 18 years old. Parents filled in both questionnaires.

Results:

Exploratory factor analysis of the new scale resulted in two factors: Stimulating the Development and Adapting the Environment. Multisample confirmatory factor analyses showed good fit indices for the noninvariant model of both the PBS and the new scale. Mean level analyses revealed significant main effects of group with higher mean scores for the control group in comparison with the experimental group for the subscale Harsh Punishment and the reversed effect for the subscale Stimulating the Development.

Conclusions:

The PBS-short version as well as the new scale showed a relatively stable five respectively two factor structure for the control group as well as for the experimental group. The two factors 'Stimulating the child's Development' and 'Adapting the child's Environment' were also convincing as regards content. They are related to the treatment goals of Rutter (1985) who made a distinction between goals aimed at adapting the environment and goals directed to the child, with fostering typical development as primary subordinate goal. A first indication was found that parents of children with ASD indeed use more specifically relevant parenting behaviors. It is self-evident that more research is needed to gain further insight in the nature of these behaviors.

110.174 141 Measuring Reciprocity In High Functioning Children and Adolescents with Autism Spectrum Disorders. T. Backer van Ommeren*, S. Begeer, A. M. Scheeren and H. M. Koot, *VU University*

Background:

A defining feature of autism is the absence of reciprocity. To date, few instruments have been developed that measure reciprocity directly.

Objectives:

In the current study we examined reciprocity during an unstructured and unfamiliar situation, by means of a new interactive testing procedure, the Interactive Drawing Test (IDT).

Methods:

53 children and adolescents with and without high functioning autism spectrum disorders (HFASD) were assessed with a new instrument targeting the quality of reciprocity: the interactive drawing test (IDT). Participants were invited to collaborate with an adult experimenter in making a joint drawing.

Results:

Compared to controls, HFASD participants showed less reciprocity in their collaboration with the experimenter. They were more inclined to work parallel with the experimenter, preferably based on their own initiative, and they were less tolerant of the experimenter's input compared to the controls. The performance on the IDT was strongly related to the severity of social impairment, but unrelated to cognitive functioning.

Conclusions:

The IDT is a promising instrument to differentiate between the reciprocal skills of children and adolescent with HFASD or typical development. Self-other orientation is a crucial component of reciprocal behaviour in HFASD.

110.175 142 Assessing Illness Communication and Behaviour In Youths with and without Autism Spectrum Disorders. K. Kalousek*, K. Strapps and S. A. Johnson, *Dalhousie University*

Background: To date, no research has investigated how children and adolescents with Autism Spectrum Disorders (ASD) communicate and cope when sick with physical illnesses. Given that people with ASD often communicate and cope with situations differently than typical individuals, youths with ASD may have different ways of expressing symptoms of illness and distinct coping strategies compared to typical youth. In addition, results from previous studies of pain in ASD (e.g., Tordjman et al., 2009) have suggested that youths with ASD express and communicate pain differently than those without the disorder.

Objectives: We are currently examining how youths (8 to 17 years of age) with ASD express and communicate symptoms of illness, as well as how they behave and cope when sick, compared to typically developing controls.

Methods: In order to assess youth's illness communication and behaviour, we developed a series of short vignettes that describe characters with a variety of medical conditions. The ailments in the vignettes consist of different illnesses (e.g., cold, kidney infection), symptoms of illness (e.g., rash, fever) as well as various injuries (e.g., scrape, concussion). The ailments are balanced in terms of severity and frequency, which were determined by physician consensus during measure development. Participants are presented with each vignette and asked to answer a number of closed- and open-ended questions to assess illness communication and behaviour for each ailment. A series of close-ended questions are also included to assess the likelihood that the youth would engage in a set of specific coping behaviours for illnesses, ranging in severity. Parents are also presented with the same vignettes and asked to report on their child's illness communication and behaviour.

Results: (anticipated, and progress to date) After the vignettes were created, pilot testing was completed with a number of typical youths and parents to ensure feasibility and address any limitations. The illness vignettes are part of a larger study investigating illness knowledge, communication, and behaviour in youths with ASD. Data collection is ongoing (N = 20 typically developing participants and N = 4 ASD participants; target sample size = 35 per group). We anticipate that youths with ASD, and their parents, will report fewer attempts to communicate the specific ailments to others, compared to typical controls and their parents. We also expect those with ASD, and their parents, to report less social forms of illness behaviour (e.g., seeking comfort) and more independent forms of coping (e.g., spending time alone) compared to the typically developing group. In addition, we expect that those with ASD, and their parents, will report more atypical forms of illness behaviour (e.g., getting angry, becoming frustrated) than those without ASD will report.

Conclusions: We anticipate that the findings of this research will demonstrate important differences in the way youths with ASD communicate and cope with illness. Results of this study will provide important information for parents and practitioners that may subsequently be used to help children with ASD develop strategies for communicating and coping with illness effectively.

110.176 143 Attentional Biases towards Nonsocial Objects Vary as a Function of An Observer's Autistic-Like Traits. C. Joseph* and M. Shiffrar, *Rutgers University*

Background: Current research conducted on visual attention in children with Autism Spectrum Disorder (ASD) has shown these children to exhibit selective attention to nonsocial stimuli in their environment (Sasson et al., 2010). The authors suggest this selective attention to nonsocial stimuli may have a negative impact on the development of social abilities, social impairments being highly indicative of ASD. In support of Sasson et al.'s conclusions, past research conducted by Klin et al. 2002 found autistic social impairments to correlate significantly with fixations on objects. Longer fixation times on objects were associated with greater social impairments in individuals diagnosed with ASD. The findings of these studies suggest further research is needed to investigate the relationship between selective attention to objects and social impairments as well as the disengagement from socially relevant stimuli such as human bodies. In the current study we utilized a dot-probe paradigm to examine whether attentional biases exist when typical observers viewed objects and human bodies. We examined the relationship of these biases to social abilities as measured by the Autism-Spectrum Quotient (AQ) (Baron- Cohen et al., 2001).

Objectives: To determine whether the magnitude of autistic traits is associated with attentional biases to objects and whether this bias, if it exists, is a function of engagement

towards nonsocial objects or a disengagement from human bodies.

Methods: Male and female observers (*n*=14, mean age 20.1), completed a modified dot-probe task to assess attentional biases across scenes containing human bodies and objects. After a fixation is presented, a body of the same gender as the observer was presented simultaneously with an object (coke bottle) one above the other (location counterbalanced). After 500ms, the body and object disappeared and an arrow appeared (arrow direction and location counterbalanced) in the previous location of one of the stimuli. Participants reported arrow direction with a key press. Reaction times in correct trials were analyzed to determine whether observers showed an attentional bias towards human bodies or coke bottles. Observers also completed a control baseline condition in which they observed two bodies or two bottles presented simultaneously. Attentional bias scores computed from these trials will determine whether observers are engaging or disengaging from the targeted stimulus. Autistic-like traits were measured using the AQ.

Results: All subjects scored below the level of classification for autistic traits (AQ>32) on the AQ (*M*=*19.9*, *SD*= 5.0). Correlations revealed a significant relationship between AQ scores and an attentional bias towards objects $r(12)=.495$, $p=.036$. Increased autistic traits in typical observers were associated with increased visual attentional biases towards coke bottles.

Conclusions: The strong relationship observed between autistic traits and selective attention to nonsocial objects support the hypothesis that a failure to attend to socially relevant stimuli may underlie social impairments related to autism. Future studies with observers with ASD are needed to further examine the extent of this relationship and its contribution to the ASD phenotype.

110.177 144 Face-Expression Expert System: a New Teaching Program Using Equivalent Relations for Children with Autism Spectrum Disorder. 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 program called Face-Expression Expert Program (FEEP), which is based on the framework of the equivalent relation among four types of stimuli. The program consisted of four classes ("facial expression," "emotion-word," "descriptive sentence," and "prosody of emotion") covering wider developmental age. In the current studies, we evaluated the effect of FEEP on the development of facial expression in individuals with autism.

Objectives: Study 1 examined the condition for establishing concept of facial expressions by sorting facially expressed pictures with younger individuals with autism. In Study 2, we assessed the emergence of equivalent relations among facial expression, emotion-word, sentence, and prosody.

Methods: In Study 1, young children with autism were given pictures of "happy" and "sad" facial expressions of two adult males and two females (stimulus set A and B), and illustrations (stimulus set C). As generalization stimuli, pictures of another adult female (stimulus set D) were used. Tasks were identical matching-to-sample and categorical matching-to-sample. In Study 2, we used four facial expressions; "happy," "sad," "surprised," and "angry." We examined the emergence of equivalent relations among three stimulus sets; facial expression, emotion-word, and descriptive sentence. We evaluated the following six relations; 1) Comprehension task: "word - selecting picture" (i.e., the child was required to select the corresponding picture of facial expression when the emotion-word was presented as sample stimulus), 2) Naming task: "picture - word naming," 3) Imitation task: "facial expression - imitating facial expressions," 4) Expression task: "word name - making facial expression," 5) Context Comprehension task: "descriptive sentence - selecting picture," and 6) Context Production task: "facial expression - describing with sentence."

Results: Study 1 showed the generalization to the stimulus set D, the equivalent relations, even though they were not trained. Study 2 showed that 1) the intervention of Comprehension task facilitated the correct naming in Naming task, 2) the intervention of Imitation task facilitated the correct facial expression in Expression task, and 3) both of the Context Comprehension and Production tasks showed high level of correct responding.

Conclusions: Results from Study 1 and 2 indicated that the *concept formation* and *equivalent relations* (symmetry and transitivity) of facial expression did emerge by newly developed teaching program, FEEP. Study 1 indicated that sorting task of facial expressions established the concept formation of facial expressions. Study 2 showed several equivalent relations: 1)

symmetrical relation emerged betweencomprehension and naming, 2) equivalent relation emerged among word naming, other's facial expressions, and self-facial expressions, and 3) symmetrical relation emerged between facial expressions and descriptive sentences. We will make FEEP as a computer-based teaching (CBT) program. It will enhance more comprehensive research, such as comparison study and intervention study on the same platform.

110.178 145 Do Children with High-Functioning Autism Spectrum Disorder Have More Difficulty Responding to Maternal Wh-Question Across Languages?. M. Oi*[1] and S. F. Huang[2], (1)*United Graduate School of Child Development, Osaka University, Kanazawa University, and Hamamatsu University School of Medicine*, (2)*Taitung University*

Background:

Japanese children with high-functioning autism spectrum disorder (HFASD) have relatively more difficulty responding to maternal Wh-questions (Wh-Qs) than yes/no questions (Y/N-Qs) when compared to typically developing (TD) children (Oi, 2010). A similar difficulty was found in non-echolalic English-speaking children with autism who are mildly retarded (Curicio & Paccia, 1987). Japanese Wh-Qs are different from English Wh-Qs in grammatical construction. Movement of Wh, inversion of verb-subject order, and use of substitutive or auxiliary verbs are not seen in Japanese. For Y/N-Qs, the pragmatics is different between the two languages (Tsuchihasi, 1983). Despite these differences, the relatively greater difficulty responding to Wh-Qs than Y/N-Qs can be hypothesized to be observed across languages.

Objectives:

We tested this hypothesis in Taiwanese children. Taiwanese is different from both Japanese and English in terms of having A-not-A questions (ANA-Qs). Taiwanese is also different from Japanese in terms of the pragmatics of Y/N-Qs (Chao, 1968). We asked whether these differences influenced the greater difficulty of response to Wh-Qs compared to Y/N-Qs.

Methods:

We compared the response to maternal questions in conversations collected under a semi-structured setting in 12 children (CA 7-15 years, mean 10.5, sd 2.76) with HFASD with 12 TD children matched by age, gender, IQ, and MLU. The response data were coded by type of maternal question, type of response, and meshing of question and response by adopting a slightly modified version of the coding schema devised by Bishop et al. (2000). Maternal questions consisted of Wh-Qs (mean+/-sd 38.9+/- 8.68 for TD, 42.8+/- 7.63 for HFASD), Y/N-Q (mean+/-sd 24.6+/- 7.89 for TD, 29.1+/- 4.01 for HFASD), Ch-Qs (mean+/-sd 25.5+/- 6.17 for TD, 24.5+/- 4.96 for HFASD) and ANA-Qs (mean+/- sd 25.9+/- 9.41 for TD, 26.6+/- 2.64 for HFASD). A graduate student who was unaware of the objectives coded the data. Inter-rater reliability was determined by using a second coder who was also a graduate student. The Kappa coefficients were .84 for type of question, .86 for type of response, and .89 for meshing.

Results:

Taiwanese children with HFASD produced significantly higher proportions of inadequate and pragmatically inappropriate responses, to Wh-Qs and Y/N-Qs than the TD children. HFASD children didn't show more relative difficulty with Wh-Qs than to Y/N-Qs when compared to TD children. No difference was seen for Ch-Qs and ANA-Qs between the two groups.

Conclusions:

Similar to the Japanese study, Taiwanese children with HFASD showed difficulty in responding to maternal Wh-Qs when compared to TD children. Y/N-Qs were, however, also difficult for them. In contrast, the HFASD children responded to Ch-Qs and ANA-Qs as adequately as TD children. Taiwanese Ch-Qs and ANA-Qs might have functioned like Y/N-Qs in Japanese and English; both types expect the listener to choose one of two answers. The relative difficulty responding to Taiwanese Y/N-Qs could be explained by the tendency for these questions to be asked when the probability of the listener's intention to do the actions was less than 50%. These results merit further investigation into why children with autism have difficulty responding to Wh-Qs across languages.

110.179 146 Parental Reports on Pain Reactivity and Pain Expression In Children with Autism Spectrum Disorder. E. G. Duerden*[1], P. A. McGrath[1], A. Oh[1], M. J. Taylor[2] and W. Roberts[3], (1)*The Hospital for Sick Children*, (2)*Hospital for Sick Children*, (3)*Holland Bloorview Kids Rehabilitation Hospital*

Background:

Clinical observations and anecdotal reports suggest that children with autism spectrum disorder (ASD) have abnormal behavioral responses to pain such as the absence of withdrawal reflexes or protecting a broken limb. Presently, few reports have systematically assessed pain reactivity and pain expression in children with ASD, and have reported discrepant results. Improved information concerning the extent of

children's pain reactivity levels and how they express their pain would aid in improving pain management in this population.

Objectives:

To objectively assess pain reactivity and expressiveness for children with ASD.

Methods:

A semi-structured interview was conducted with 47 parents (45 mothers, 2 fathers; age=44 ± 12 yrs) of 53 children with ASD (48 boys, 5 girls; mean age=10 ± 5 yrs; range=3-18 yrs). Parents were asked to describe their child's physical and emotional reaction to pain and whether their child had low, normal or high pain reactivity. Parents completed the Non-Communicating Child's Pain Checklist to rate how their children expressed pain (vocalization, socialization, facial expressions, changes in activities, physiological symptoms, and differences in eating and sleeping habits). In the instance where parents had multiple children with ASD, they rated pain reactivity and pain expression separately for each child.

Results:

Children differed in pain reactivity: 55% of the children had low pain reactivity, 19% had high pain reactivity and 23% were within the normal range. Pain reactivity of the children and adolescents did not vary by age ($F=0.92$; $p=0.6$) when assessing the data using a univariate general linear model. Additionally, no age differences were seen when removing the data from the girls from the analysis. Scores on the Non-Communicating Child's Pain Checklist indicated that parents assessed children's pain by evaluating behavioural cues, especially body movements (mean = 8.2; sd=3.7, $p<0.03$) and facial expressions (mean=6.8; sd=4.3; $p<0.03$) more so in comparison to the other five domains on the questionnaire, assessed using a one-way ANOVA. We subsequently assessed whether pain reactivity in the children would influence the means by which they express pain. Parents assessed pain comparatively across six of the seven domains of pain expression among the three pain reactivity groups. However, parents rated that they used vocalizations to identify pain in their children with high pain reactivity (mean 7.3; sd=2.5) significantly more so in comparison to children who were rated as having normal (mean=5.75, sd=2.9) or low pain reactivity (mean=4.4, sd=2.8; $F=4.09$; $p=0.02$).

Conclusions:

Pain reactivity in children and adolescents with ASD varies considerably from low to high levels, independent of children's age or sex. Although children with high pain reactivity tend to express pain more vocally in addition to expressing pain through their body movements and facial expressions, parents should assess both overt and subtle signs of distress when assessing pain in children with ASD. Future research will evaluate how pain reactivity and pain expression are related to pain processing in children with ASD.

110.180 147 Belief Attribution Despite Heavy Verbal Interference In Autism. B. Forgeot d'Arc*[1], C. Chevallier[2], J. Grèzes[3] and F. Ramus[4], (1)*APHP/CNRS*, (2), (3)*INSERM*, (4)*CNRS*

Background:

Theory of Mind deficit is one of the most influent theoretical explanations of autistic symptoms. Poor performances in false belief tasks (FBT) have been widely observed in subjects with autistic spectrum disorders (ASD), and are one essential argument for this account.

However, the paradox of high-functioning subjects with ASD passing FBT has led to a dual-processing explanation of belief representation including two hypotheses:

(1) An intuitive processing of beliefs in normal subjects and

(2) A deficit of this intuitive processing in autistics, with compensatory verbal reasoning in high-functioning subjects (Happé 1995).

In order to test (1), we designed the Belief Attribution Task (BAT), a completely nonverbal paradigm consisting of silent animated cartoons in five closely related conditions, systematically teasing apart different aspects of scene analysis and allowing the assessment of the attribution of beliefs, goals, and physical causation, respectively. We then used verbal shadowing as a dual task to inhibit inner speech and showed that typical adults remained able to attribute beliefs despite heavy concurrent demands on their verbal abilities, supporting hypothesis (1) (Forgeot d'Arc & Ramus, QJEP, in press).

Objectives:

In order to test hypothesis (2), we aimed to compare the effect of heavy verbal interference on the ability to attribute beliefs, goals and physical causation in adults with and without ASD.

Methods:

We used verbal shadowing to inhibit reasoning, during the BAT in high functioning adults with and without ASD.

Results:

In both groups, verbal interference decreases overall performance, but has no specific effect on belief Attribution. Participants with and without ASD remained able to attribute beliefs despite heavy concurrent demands on their verbal abilities.

Conclusions:

Contrary to (2), our results are most consistent with the hypothesis that belief attribution is independent from inner speech in high functioning adults with and without ASD.

110.181 148 Cognitive Skills Promoting Social Adaptation In Autism and Asperger. M. R. Marteleto*[1] and J. Perissinoto[2], (1), (2)*Universidade Federal de Sao Paulo*

Background: Cognitive skills involve answers to solve problems. These responses are expressed in daily life activities and influence the performance of adaptive skills necessary for the child to be socially included and have personal autonomy. Qualitative failures to adapt to social demands, over time, lead to diagnoses such as autism and Asperger. In these syndromes the disabilities global adaptive course with the communication and restricted interests and activities. The manifestations vary widely in the degree of severity and intellectual level of each child and affect the perform activities of daily living necessary for autonomy.

Objectives: The aim this study was to identify the cognitive abilities that promote a better child social insertion with Autism and Asperger in a 12 month period.

Methods: A total of 21 children between 3 and 12 years old, diagnosed as Autism and Asperger, were assessed and their mothers were interviewed. Children were included in regular schools or attending special Autistic schools. A period of 12 months after the first assessment, the same children took part in the second stage of this research. In individual interviews the mothers provided the data about adaptive abilities and behavior characteristics giving answers to the Vineland Adaptive Behavior Scales – VABS (Sparrow, Balla, Cichetti, 1984) and the Autism Behavior Checklist – ABC/ICA(Krug, Arick, Almond, 1993). Each child was individually assessed, by an experienced psychologist, trained in the Stanford-Binet Intelligence Scale 4th Edition (Thorndike, Hagen, Sattler, 1986).

Results: The two assessments demonstrated that specific cognitive abilities and specific adaptive domains presented high correlations. In the first assessment, the Stanford Binet areas and total were correlated with the Communication domains, Daily life abilities, Socialization and Total score of the Vineland Scale ($p < 0,05$). One year later, there was a correlation between the Stanford Binet areas and total and the Communication domains, Daily life abilities, Socialization, Motor abilities and total score of the Vineland Scale ($p < 0,05$).

Conclusions: In a year's time the logic mathematics and memory cognitive abilities promoted a better social insertion in children with Autism and Asperger. General cognitive ability promoted Communication domain.

110.182 149 Eye Movement In Reading for Students with Autism Spectrum Disorders. M. Omori* and J. Yamamoto, *Keio University*

Background: Students with autism spectrum disorders (ASD) are known to have reading difficulties (Nation, Clarke, Wright, & Williams, 2006). Akita and Hatano (2000) reported that there are five types of skills required for reading Japanese: phonetic awareness, phonics, vocabulary, reading comprehension, and reading fluency, as also required in English reading. Previous researches suggested that poor eye movement is one of the major causes of reading difficulties (Stein, 2003). Although many studies have focused on the eye movements toward social stimuli such as facial expression (Klin, Jones, Schultz, Volkmar, & Cohen, 2002), few studies were conducted on the eye movements during reading sentences.

Objectives: In the present study, we examined the eye movement patterns of students with ASD and typically developing students, during their reading and listening to the stories. We compared the patterns of them by quantitative analysis. We used an eye-tracker to measure the eye movements. We also evaluated the reading accuracy, fluency and reading comprehension to examine the correlation with eye movement.

Methods: *Participants*: Students with ASD and typically developing children (TDC) participated in the present study. *Apparatus*: A computer (Windows XP) was used to control and present the stimuli. We used an eye-tracker (Tobii, X120) to measure the numbers of gaze plots. This eye-tracker worked by reflecting invisible infrared light onto eyes, recording the reflection patterns. *Stimulus:* The stories consisted of about 70 Hiragana (Japanese Phonogram) letters and were made of 16 sentences. *Procedure:* In the reading test, participants were required to read stories presented on the computer. In the

listening test, they were required to follow the spoken sentences by the eye movements toward sentences. *Dependent measures:* In order to analyze the data quantitatively, the numbers of gaze plot in reading and listening tests were counted for the eye movement. In order to examine the correlation among eye movement, reading accuracy, reading time and reading comprehension were measured.

Results: Students with ASD showed lower reading accuracy, less reading fluency, and more eye movements than TDC in both reading and listening tests. In the reading test, students with ASD tended to focus on letters separately, whereas TDC focused on the each sentences. The numbers of the eye movements, gaze plots toward sentences in reading, were greater than those in listening in students with ASD. When they could not read accurately, their eye movement patterns were disturbed, and inaccurate reading led them difficult in fluent reading and reading comprehension.

Conclusions: The eye movement patterns in students with ASD were different from age-matched TDC in both reading and listening tests. In the present study, we found the patterns of the eye movements while students with ASD were reading stories. We also found that students with ASD could fluently synthesize the spoken sentence and eye movement toward sentences. This suggested that training with auditory and visual cues would be effective for establishing reading skills in the students with ASD.

110.183 150 Parenting-Related Stress and Psychological Distress In Mothers of Toddlers with ASD. E. M. Olson*[1], A. M. Estes[1], J. N. Greenson[1], J. Munson[1], J. Winter[1], S. E. Zebrowski[1] and G. Dawson[2], (1)*University of Washington*, (2)*Autism Speaks, UNC Chapel Hill*

Background:

Previous research indicates that stress is increased for parents of children with developmental disabilities, particularly autism spectrum disorders (ASDs). Parent stress research has mainly focused on families with older children and factors influencing stress in parents of young children are not yet well understood. However, recent advances in early diagnosis have resulted in younger children being diagnosed with ASDs. Therefore, studies of parents of younger children are needed. Studies of preschool-aged children have found problem behavior is associated with increased parent stress, but studies examining whether decreased daily living skills are associated with increased stress have yielded mixed results. Further research is needed to understand how child-related factors in toddlers with autism impact parent stress.

Objectives:

We aim to investigate the influence of child characteristics, including diagnosis, problem behavior, and adaptive functioning, on parenting-related stress and psychological distress in mothers of toddlers with autism in comparison to typically developing toddlers and toddlers with developmental delays.

Methods:

One hundred and twelve toddlers between 18 and 30 months of age and their parents participated in this study. Participants (Male=85; Female=27) were assigned to groups based upon the child's diagnostic status: Autism Spectrum Disorder (ASD; n=61), Developmentally Delayed (DD; n=25), and Typically Developing (TYP; n=26). The groups were well-matched on age (ASD= 23.5, DD=22.4, TYP= 22.8 months). Each child received a developmental evaluation. Non-verbal mental age was obtained using the Mullen (AUT=17.68, DD=18.24, and TYP=22.96 months). The average Adaptive Behavior Composite standard scores from the Vineland were: AUT=70.32, DD=77.21 and TYP=95.23. Mothers completed questionnaires assessing psychological distress (Brief Symptom Inventory) and parenting-related stress (Questionnaire on Resources and Stress), and children's problem behavior (Aberrrant Behavior Checklist) and daily living skills (Vineland).

Results:

We hypothesized that (1) parenting-related stress and psychological distress would be higher in mothers of toddlers with ASDs compared with mothers in the DD and TYP groups; (2) toddlers in the ASD group would have increased problem behavior and decreased daily living skills compared with the DD and TYP groups; and (3) child problem behaviors would be more strongly related to maternal parenting stress and psychological distress than child daily living skills. Preliminary analyses confirm that levels of stress differ significantly among groups, with mothers of toddlers with autism reporting significantly higher levels of stress (ASD>DD>TYP). Future analyses will focus on exploring the relationships among child characteristics and parent stress.

Conclusions:

This study is designed to shed light on maternal stress in families with toddlers with ASD in comparison to toddlers with DD or typical development. To date, there is little published research on stress in mothers of very young children with ASD.

These results may provide targets of intervention for toddlers that will likely reduce parent stress and psychological distress. Additionally, because previous research has elicited mixed results regarding the predictors of stress at different ages, these results may help clarify the course and impact of stressors across children's development. Consequently, more precise interventions may be developed resulting in improved outcomes for children and their families across their lifespans.

110.184 151 A Longitudinal ANALYSIS of Maternal Infant Directed Speech to Preverbal, at-RISK for ASD, Infants. J. Quigley*,

Background: Developments in language acquisition research are coalescing on earlier and earlier stages of infant development as the crucial times and the critical importance of speech addressed to infants during the preverbal period is well established. Mother's vocal/verbal input and imitation rates are predictive of later language development in both typically and atypically developing children (Meltzoff 2002; Masur & Olson 2008) yet comparatively little is known about the input received in this early pre-verbal stage before 12 months (Gros-Louis 2007). The acoustic and prosodic characteristics of maternal infant directed speech have been well documented but little systematic research has been carried out into the syntactical and grammatical aspects of that speech input.

Objectives: To compare maternal Infant Directed Speech characteristics in face-to-face interaction with infants at genetic risk of autism with maternal speech to typically developing low-risk controls.

Methods: This paper presents one set of findings from a longitudinal study of mother-infant interaction over the course of a nine month period. Nineteen mother-infant dyads participated, of whom nine infants, including twins, are at genetic risk for autism spectrum disorder. Using a prospective observational design, dyads were videorecorded in naturalistic face-to-face interaction every 4 weeks for a period of nine months when the infant was aged between 3 and 15 months. 142 five-minute samples of maternal speech and vocalisations were selected and transcribed and approximately 10,000 utterances were analysed on a range of measures of quantity, quality and complexity.

Results: Results indicate differences in the linguistic environments of the high-risk infants in interaction, in terms of quantity of speech input, lexical diversity and clausal complexity of linguistic input. Although there were few statistically significant differences for most characteristics, given the sample size, on many of the measures mothers of at-risk infants could be differentiated from mothers of TD infants. The mothers of at-risk infants are consistently making additional modifications to their speech when interacting with their infant.

Conclusions: Two conclusions are drawn. First, typical patterns of maternal input and response are disrupted by the high-risk status of the infants, evidenced, for example, by increased use of compensatory, attention-getting, vocal but non-meaningful, linguistic devices, zero clause utterances, and very frequent use of the infant's name. This is at the expense of more complex and diverse linguistic constructions. These attention getting-and-keeping devices may be a function of the mother's heightened awareness of the infant's risk status and her interaction with the older sibling with ASD. It has been suggested (Johnson 2010) that this persistence in relation to engaging the infant in interaction may serve to promote joint attention development and this will be analysed in relation to the infants' performance on the ESCS at 12 and 18 months. Second, a subset of the high-risk infants themselves can be identified as behaving differently in interaction and are providing fewer feedback opportunities for mother to create tailored linguistic environments over time.

110.185 152 Parsing Heterogeneity In Autism Spectrum Disorders: Visual Scanning of Dynamic Social Scenes In School-Age Children with Autism. G. Ramsay*, K. A. Rice, J. M. Moriuchi, W. Jones and A. Klin, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background:

Past studies of visual scanning of dynamic social scenes in adults with autism spectrum disorders (ASD) revealed distinct differences from typically-developing (TD) individuals matched on chronological age and cognitive functioning. Results showed that visual fixation strongly correlated with level of social disability in individuals with ASD. However, while adults provide information about endpoints of this lifelong disorder, school-age children may offer an opportunity to examine a range of developmental trajectories still in progress. Additionally, given the broad range of trajectories in ASD, a larger, more heterogeneous sampling allows for more detailed examination of the relationship between visual fixation patterns during viewing of naturalistic social scenes and social disability.

Objectives:

The current study measures visual fixation patterns of school-age children with ASD and investigates the relationship

between visual fixation and social disability as moderated by profiles of cognitive functioning.

Methods:

Eye-tracking data were collected while school-age children with ASD (n=109) and TD peers (n=26) viewed video scenes of children and adults engaged in social interaction within naturalistic visual settings. Across all scenes, percentage of visual fixation time on eyes, mouth, body, and object/background regions was calculated for each child. In a first set of analyses, a subset of children with ASD (n=49) was matched to TD peers (n=26) on chronological age, verbal, nonverbal, and full-scale IQ to compare the fixation patterns of the matched samples. In a second set of analyses, data from the entire sample of children with ASD (n=109) were analyzed to determine the relationship between scanning patterns and social disability in a heterogeneous sample. The sample represented a broad range of level of social disability (ADOS Calibrated Severity Score: mean=7.0(2.5), range=1 to 10) and cognitive functioning (FSIQ: mean=96.6(21.4), range=42 to 149).

Results:

Visual fixation patterns of the matched samples of school-age children with ASD and TD children are significantly different: children with ASD looked less at the more socially relevant face region and looked more at the body and object/background regions. Within the full ASD sample, the strength and direction of the relationships between visual fixation and social disability were significantly moderated both by full-scale IQ and by the discrepancy between verbal and non-verbal IQ.

Conclusions:

Visual fixation patterns observed in a broad, heterogeneous sample of school-age children with ASD indicate a range of atypical viewing patterns associated with ASD as well as a modifying role for cognitive profiles in the relationship between visual fixation and social disability.

110.186 153 Visual Processing of Social Information In Adults and Children. G. Serlin*[1], S. Menon[2], M. R. Swanson[3] and M. J. Siller[4], (1)*Hunter College at the City University of New York*, (2)*Hunter College, City University of New York*, (3)*The Graduate Center*, (4)*Hunter College of the City University of New York*

Background: Healthy infants and adults have consistently shown a preference for gazing at faces in their environment (Pelphrey et al., 2002; Hoehl et al., 2009). Many researchers theorize that this tendency signifies an innate predisposition for detection of socially relevant information. Current theory asserts that this is an advantageous mechanism that prioritizes processing of social versus non-social information. Conversely, individuals on the autism spectrum spend less time gazing at faces; a difference that has been shown across eye tracking investigations (Klin et al., 2002; Dalton et al., 2006; Wang et al., 2007.)

Objectives: The goals of this study were to test differences in attention to facial expressions while viewing ironic and sincere scenarios and to determine the nature of the relationship between attention to these facial expressions and performance on measures assessing an individual's presentation of traits associated with autism.

Methods: Using a Tobii T60 eye tracker, this study examined attention to faces by evaluating the visual processing of potentially ironic cartoon scenarios. Thirty-three neurotypical adults (18-30 years) and a pilot sample of 9 neurotypical children (3-7 years) viewed a random sequence of 20 vignettes that were equally likely to be ironic or sincere. Ironic scenarios featured a speaker delivering a remark in a sarcastic tone accompanied by a negative face (e.g., anger, disgust). Sincere scenarios portrayed a speaker delivering a remark in a genuine tone accompanied by a positive face (e.g., happiness). At the end of each vignette, participants were asked to determine if the speaker meant what they said. Time spent gazing upon the speaker's face was recorded. Twelve control scenarios that featured a speaker in a neutral situation delivering a neutral remark with either a happy (positive condition) or a sad (negative condition) face were also presented. This determined if there were differences between the salience of faces expressing opposite emotions. In all conditions, expressive faces remained on the screen until the participant gave their response concerning the speaker's intent. Additionally, adult participants received the Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2006) to detect autism traits by providing subscores for aloofness, rigidity and pragmatic language. Child participants received the Social Responsiveness Scales (SRS; Constantino, 2005) to reveal social deficits associated with autism.

Results: Paired samples t-tests and RM ANOVA both revealed that adults and children spent significantly more time gazing upon sarcastic versus sincere faces. This trend occurred during and after the sarcastic statement was delivered, but not during and after the participants were asked to determine the speaker's communicative intent. The relationship between

fixation times upon faces and BAPQ or SRS scores continues to be analyzed.

Conclusions: Thus far, these results suggest that typical adults and typically developing children are naturally attuned to expressive faces carrying social information and are efficient at processing them in order to understand someone's intended meaning (Wang et al., 2006; 2007).

110.187 154 Examining the Role of Empathy on Socialization and Communication Skills In Individuals Diagnosed with Autism Spectrum Disorders (ASD). M. Ivanisevic*, D. L. Robins and T. Z. King, *Georgia State University*

Background: Empathy includes affective and cognitive processes involved in understanding emotions and behaviors of others (Smith, 2008; Oberman & Ramachandran, 2007). Furthermore, empathy is shown to serve an important role in prosocial behavior, thus strengthening social interactions (Schrandt et al., 2009).

Objectives: In this study, we examine the role of empathy on social skills and communication skills in individuals diagnosed with autism spectrum disorders (ASD) in hopes of better understanding how individuals diagnosed with ASD perform in social environments. We hypothesized that empathy will be predictive of social skills and communication skills in individuals with ASD, but not for typically developing (TD) individuals.

Methods: Our sample consisted of 34 participants (17 ASD, 17 TD), 8-21 years old (27 male, 7 female). Participants were matched on age (ASD mean age = 12.00 years (*SD*= 2.76); TD mean age = 12.18 years (*SD*= 3.13)) and Full Scale IQ (ASD Mean = 109.18, SD =14.29; TD Mean=108.71, SD=23.05). Social and communication adaptive functioning was measured through parent report using the Vineland Adaptive Behavior Scales, Second Edition (VABS-II; Sparrow et al., 2005**)** and the Behavior Assessment System for Children, Second Edition (BASC-2; Kamphaus & Reynolds, 1998). Participants 16 years and older completed the self-report version of the Empathy Quotient (Baron-Cohen et al., 2004), and the parent-report version was used for participants 15 years and younger (Auyeung et al., 2009); z-scores were calculated for each using the appropriate norms. Range of scores obtained for all measures was adequate in each group.

Results: Linear regression indicated that empathy is predictive of socialization as measured by the VABS-II for the ASD group, accounting for 19% of the overall variance in socialization (β=.49, *p*=.047). This relationship was not significant for the TD group (β=.45, *p*=.069), although it showed a trend towards significance. Similarly, empathy is predictive of social skills as measured by the BASC for the ASD group, accounting for 27% of the overall variance in social skills (β=.60, *p*=.020). This relationship is not significant for the control group (β=.26, *p*=.32). Linear regressions indicated that empathy is not predictive of communication skills measured by VABS-II and BASC for the ASD group (β=.38, *p*=.138 and β=.22, *p*=.388, respectively) nor for the TD group (β=.27, *p*=.298 and β=.39, *p*=.184, respectively).

Conclusions: Consistent with our hypothesis, empathy was predictive of social skills and socialization in our ASD group, but not the control group. This suggests that the ability to understand the emotions and behaviors of others is a critical skill for successful social interaction, and individuals with ASD who have poorly developed empathy skills have greater difficulties in everyday social interactions. Contrary to our hypothesis, empathy was not predictive of functional communication. This may reflect the broad measure of communication skills, beyond pragmatic skills such as conversation abilities that may be selectively related to empathy.

110.188 155 Similar Behavior, Different Goal: Response to Naturalistic Joint Attention Cues Correlates with Cognitive Function In Typical Toddlers but with Maladaptive Behavior In ASD. K. A. Rice*, W. Jones and A. Klin, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background:

Research has repeatedly found altered gaze monitoring in individuals with autism spectrum disorders (ASD). Atypicalities include diminished sensitivity to mutual gaze and impaired response to directional gaze cues. Much of that research, however, has either relied on general observational measures or has used fine-grained experimental measures at the expense of naturalistic presentation. How that work translates into sustained natural interaction, where gaze cues change quickly and often co-occur with vocalizations and other environmental cues, is unclear. Additionally, a separate body of research has indicated that toddlers with ASD preferentially attend to physical, rather than social, environmental contingencies. Investigating how young children respond to naturalistic joint attention cues during dynamic social scenes, and how these responses relate to individual social and cognitive functioning, may help to illuminate how these skills develop in toddlers with and without ASD.

Objectives:

This study uses eye-tracking to measure the response of toddlers with ASD to naturalistic video scenes of dynamic joint attention cues, and investigates how these measures correlate with cognitive and social functioning in both ASD and typically-developing (TD) populations.

Methods:

TD two-year-olds and two-year-olds with ASD watched a three-minute video of an actress interacting with two puppets. Throughout the video, the actress spontaneously shifted her gaze between the viewer and the puppets. Each toddler's scanning patterns were examined within a fixed temporal window following each gaze shift to measure sensitivity and response to gaze changes. In a first set of analyses, a sample of boys with ASD was matched to TD peers on chronological age and verbal and nonverbal functioning. In a second set of analyses, data from larger, unmatched samples of ASD and TD toddlers, with both males and females, were analyzed to determine within-group correlations of visual scanning with measures of cognitive and social functioning.

Results:

Response to joint attention cues—shifting towards the face during mutual gaze or towards the puppet during directed gaze shifts—positively predicted language ability in the TD sample. We observed some similar, although reduced, behaviors in the ASD sample; however, rather than responding prototypically to joint attention cues (e.g., shifting towards the eyes), ASD toddlers shifted more widely to other parts of the face and head. These measures of response were uncorrelated with cognitive function in the ASD sample and instead predicted *more severe* restricted and repetitive behaviors. For the more impaired toddlers with ASD, this behavior appeared to be primarily driven by attention to the scene's physical contingencies (movement and sound).

Conclusions:

While toddlers with ASD differed significantly from their TD peers in measures of gaze responsivity and social monitoring, toddlers with ASD did at times shift their gaze between characters and did, although at reduced frequency, appear to respond to some joint attention cues. However, these superficial similarities in behavior actually masked a more important distinction: different underlying processes drove these behaviors within each group. This phenomenon underscores the importance of investigating the underlying processes that give rise to manifest behaviors in order to understand and predict developmental trajectories in autism.

110.189 156 Visual Attention and Cue Evaluation In a Modified Posner Paradigm: Relation to Social Skills and Symptom Severity. J. L. Bean*[1] and I. M. Eigsti[2], (1)*University of Connecitcut*, (2)*University of Connecticut*

Background: Research on visual attention in young children with autism spectrum disorders (ASD) suggests differences in visual orienting and disengagement (Landry & Bryson, 2004). Visual saccade tasks with adults with ASD suggest right-localized differences in saccadic responses, without generalized abnormalities (D'Cruz et al., 2009). The connection between visual attention and social skills is unclear.

Objectives: We investigated the interaction of low-level attentional abnormalities and higher-order social attention in younger individuals with ASD. Using a modified Posner paradigm, in which directional cues are presented to indicate subsequent targets, we controlled for (a) *cue validity*- cues which correctly/incorrectly direct attention toward the target, (b) *disengagement from competition*- cues remaining on screen during target presentation, (c) *salience*- manipulating the number of valid cues preceding invalid ones, and (d) *laterality*- right- versus left-sided targets.

Methods: Participants ages 7-17 with ASD (n = 17) and typical development (TD; n = 24) completed measures of visual attention and social cognition, including joint attention and theory of mind. Groups were diagnosed via ADOS and matched on age and FSIQ. Repeated-measure MANCOVAs examined group differences in reaction time (RT) as a function of experimental condition; bivariate correlations evaluated associations between RT and social cognition.

Results: Error analyses indicated *no* accuracy-speed tradeoff; RT was included as a covariate in all analyses. There were main effects of *validity*, p = .002, *competition*, p = .04, and *salience*, p < .001. Across groups, participants were faster with valid cues, with cues that disappeared before the target appeared, and with lower salience cues. There was a group by condition interaction for *competition*, p = .001, and a trend for a group by *validity* interaction, p = .09. Both interactions indicated greater cue cost in the TD group.

Laterality analyses indicated that both groups were slower for *competitive* cues to rightward targets. The cost associated with competitive cues (i.e., main effect) was not significant for leftward targets; however, the TD group demonstrated significantly greater cue cost for competitive cues bilaterally.

Similarly, both groups were slower to respond to *invalid* cues to both sides, whereas the TD group was significantly more slowed for rightward targets. Findings are consistent with previous research suggesting left lateralization of visual attention and cue evaluation.

Correlational analyses indicated that performance with *competitive* cues was correlated with behavioral measures of joint attention, $r = .38$, $p = .02$. For the ASD group, (a) *invalid* cue performance was correlated at the trend level with ASD symptomatology, $r = .44$, $p = .10$, and (b) RT to *rightward* targets was correlated with NEPSY Theory of Mind, $r = -.64$, $p = .01$, suggesting a left lateralized bias in both tasks

Conclusions: Participants with ASD did not exhibit "attentional stickiness" (Landry & Bryson, 2004). Rather, results suggested that greater attention to cue validity and more thorough evaluation of cue predictiveness were associated with better joint attention, theory of mind, and ASD symptomatology. The link between low-level attentional mechanisms and higher-order social cognition may lie in the intensity of cue evaluation.

110.190 157 A Longitudinal Look at Expressive and Receptive Language Development In Children and Adolescents with Autism. A. Cariello*[1], E. D. Bigler[2], N. Lange[3], A. L. Alexander[4], A. Froehlich[5], M. B. DuBray[5], J. R. Cooperrider[5] and J. E. Lainhart[5], (1)*Utah Autism Research Project*, (2)*Brigham Young University*, (3)*Harvard University*, (4)*University of Wisconsin*, (5)*University of Utah*

Background: Autism spectrum disorders are currently defined in terms of impairments in communication, social interaction and restricted/repetitive behaviors. The language impairment found in autism is not restricted to difficulty in acquiring spoken language and in pragmatic language but often includes expression and comprehension. Longitudinal investigation of the development of specific types of language in children and adolescents with autism is necessary to understand their specific developmental trajectories and targets for new interventions.

Objectives: Our goal was to understand longitudinal expressive and receptive language during late neurodevelopment in autism, asking two questions: 1) At each time point, does the autism group show different expressive, receptive and total language ability relative to controls? and 2) Is the developmental trajectory of expressive, receptive, and total language ability over time similar or different in the autism and groups?

Methods: Neuropsychological assessments were examined from two time points of testing acquired an average of 8.7 years apart, from 40 high-functioning children and adolescent males with autism (mean age Time 1 = 11.07 years, range = 6-17; mean age Time 2 = 19.95 years, range = 12 - 28) group-matched by age and handedness to 14 typically developing control male children and adolescents (mean age Time 1 = 10.47 years, range = 5-16; mean age Time 2 = 18.66 years, range = 14-26). A diagnosis of autism was obtained using the Autism Diagnostic Interview (ADI) and the Autism Diagnostic Observation Schedule (ADOS). Expressive language ability, receptive language ability and total language ability were measured by the Clinical Evaluation of Language Fundamentals version 3 (CELF- 3). Our comparison employed independent two-sample t-tests, and analysis of covariance.

Results: While controlling for both age and age x group interaction, as expected, language level in the autism group was lower than in controls at the first time point for expressive ($p = 0.047$) and total language ($p = 0.042$) abilities. Decreased receptive language ability was found in the autism group compared to the controls at the second time point ($p = 0.026$). Receptive, expressive and total language standard scores were stable across the age range studied in controls, but significantly improved with age in the autism group.

Conclusions: As expected, mean expressive, receptive and total language standard scores are decreased in high functioning individuals with autism compared to typical development at each time point. Importantly, age-related language ability appears to be increasing at a greater than expected rate in the autism group during late neurodevelopment. To our knowledge, this is one of the first longitudinal studies using the CELF in autism. Greater than expected improvement in the autism group over time suggests that late neurodevelopment, as well as early childhood, is an extremely important time for interventions that target language development in autism. Examination of patterns of individual trajectories of late language development in autism is in progress.

110.191 158 Building Bonds: An Examination of Emotional Closeness Between Mothers and Their Children with ASD. W. J. Hudenko*[1], L. Bradstreet[2], B. Bookman[3], D. Beck[4], K. Yoshida[5] and A. Mayer[1], (1)*Ithaca College*, (2)*Children's Hospital of Philadelphia*, (3)*SUNY Delhi*, (4)*La Trobe University*, (5)*New England Center for Children*

Background:

A number of studies suggest that families of children with Autism-Spectrum Disorders (ASD) have higher levels of stress, more depression and anxiety, and lower levels of marital satisfaction and family adaptability than families with Typically-Developing (TD) children. Given the impact of ASD on family systems, recent work has focused on revealing the family dynamics of this population. Unfortunately, however, little attention has been given to specific protective factors that may promote family resilience such as emotional closeness between children with ASD and their caregivers.

Objectives:

The purpose of this study was to identify factors that promote or inhibit emotional closeness between mothers and their children with ASD. In addition, we hoped to reveal factors that could increase closeness between mothers and their children with ASD.

Methods:

Participants consisted of 11 mothers of children with ASD (ages 4-8) in the Central New York area. Semi-structured interviews were conducted to identify factors that promote, inhibit, or may increase emotional closeness between mothers and their children. Interviews were audiotaped and transcribed verbatim. Five raters read the transcripts and were trained to code when mothers discussed activities that promoted, inhibited, or increased emotional closeness. Inter-rater reliability analysis revealed a mean intra-class correlation coefficient of .967 across coders. A grounded theory approach was utilized to extract and code relevant items from the transcripts, to group similar concepts, and to form hierarchical categories. From these categories, basic themes were developed to reflect the mothers' experiences of closeness with their children.

Results:

Results revealed that a wide variety of factors influence mothers' feelings of emotional closeness with their children. Despite a diverse set of responses, approximately 50% of the variance was accounted for by three themes: 1) Mothers most often cited a "special relationship" with their children as the biggest contributor to feelings of emotional closeness, followed by 2) accomplishments of their children and 3) physical contact. When questioned about increasing emotional closeness, over 50% of the variance was accounted for by 1) a desire for improved verbal skills, 2) an increase in social interaction, and 3) miscellaneous idiosyncratic responses that were specific to the parent-child relationship. Lastly, mothers most often cited noncompliance and feelings of parental helplessness as themes that were associated with feelings of distance from their children.

Conclusions:

Results from our study suggest that it may be possible to target individual factors that promote or inhibit emotional closeness, which may assist families of children with ASD that struggle to build positive relationships. In particular, targeting interactions that promote a "special bond" between mothers and their children and helping parents to manage noncompliance may be the most effective strategies to assist with the formation of strong parent-child relationships.

110.192 159 How Accurate Are Teachers at Estimating Cognitive Abilities of Children Who Are on the Autism Spectrum?. J. Hellriegel*[1], M. Murin[1], W. Mandy[2] and D. H. Skuse[3], (1)*Great Ormond Street Hospital for Children*, (2)*University College London*, (3)*Institute of Child Health*

Background: Clinical experience indicates that teachers often over- or under-estimate the intellectual abilities of children with Autism Spectrum Disorders (ASDs) who are in mainstream education. No previous study has explicitly measured objective IQ and compared this with teacher reports. Evaluating teachers' accuracy in estimating cognitive abilities in children with an ASD may provide useful information in planning school based interventions.

Objectives: We aimed to examine how accurate teachers are at estimating intelligence in a large heterogeneous sample of children with an ASD. We aimed to test the hypothesis that both cognitive and behavioral child characteristics, and attainments in reading, numeracy and oral expression, would influence their teacher's estimation of general intellectual ability.

Methods: Data from school reports and clinical assessments were analyzed for a sample of 106 children (mean age 10.0 years, mean full scale IQ 88) who met DSM-IV-TR criteria for either Asperger syndrome (n=52), autism (n=35), or PDD-NOS (n=19). Each participant attended a different mainstream school. Their teachers were asked to estimate IQ as being: i) above average (111+); ii) average (91-110); iii) low average (81-90); iv) well below average (<80). Results were compared to actual IQ scores, measured using the WISCV-IV. Behavioral difficulties, also rated by teachers, were measured using the Strengths and Difficulties Questionnaire, the Social Communication Disorders Checklist, and the Conners 3rd edition, as potential confounding variables.

Results: 30/106 teachers felt unable to estimate the child's intelligence, but this did not characterize any subgroup on the basis of their intellectual or behavioral characteristics. When teachers did offer an IQ estimate, there was a weak association between estimated and actual full-scale IQ with most children receiving an inaccurate IQ estimate (n=45/76, 59%). The great majority (n=39/45) of these inaccuracies involved overestimating the child's abilities with underestimations being unusual (n=6/45). Accuracy was highest for children with above average abilities (90%; n=9/10) and was lowest in children with below average abilities (average IQ=42%, n=11/26; low average=30%, n=4/13; well below average=25%, n=7/27). There was no correlation between estimates and the child's verbal-performance IQ discrepancy.

Overestimation of IQ was associated with a lack of conduct problems (p=.03), but not with prosocial behavior. Neither peer difficulties nor ADHD severity were related to the accuracy of IQ estimate. For children with abilities in the average range, overestimation was significantly associated with above average reading skills (p = .02). A similar trend was found in those with below-average intelligence (p=.06). Children whose IQ was underestimated tended to have a poor working memory (p = .07)

Conclusions: These findings indicate that the majority of teachers in mainstream education overestimate the cognitive abilities of children with an ASD. This discrepancy is explained in part by child attributes, such as a lack of problematic behavior at school and good reading attainments. Children with poor working memory skills may appear to be less able. Overestimation of abilities may lead to unrealistic expectations, and potentially to disappointment and frustration on the part of children and their parents.

110.193 160 Sensitivity to Social Touch In School-Age Children with Autism Spectrum Disorders. M. J. Ackerman*[1], W. Jones[2], A. Klin[2] and G. Ramsay[2], (1)*Yale University School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Atypical sensitivity to touch has been described frequently in children with autism spectrum disorders (ASD). Existing reports cover a wide array of behaviors, including under-sensitivity to pain, over-sensitivity to light touch, preference for deep pressure, and atypical reaction to social touch. Most of these reports have been either anecdotal or qualitative, however, and few studies exist with direct, quantitative measurements of sensitivity to social touch in individuals with ASD.

Objectives: The aim of the present study was to measure selective sensitivity and response to contingent social touch in school-age children with autism spectrum disorders in comparison with typically-developing peers matched on age and non-verbal IQ. Control conditions measured basic motor function during mechanical manipulation in absence of social touch.

Methods: We designed and built a novel device for measuring haptic interaction between two individuals. The device consisted of horizontal rollers, linked remotely, that could be turned by either of two participants using left and right hands independently. The rollers of each participant were coupled mechanically, so that if one participant moved a roller the other participant would feel that movement on his or her own roller. Participants performed twelve separate tasks. In baseline mechanical manipulation tasks, participants moved the rollers forwards and backwards at slow and fast rates. In social interaction tasks, participants moved the rollers in interaction with the experimenter. BEI optical encoders and a National Instruments data acquisition system with Labview software measured rotational movements of the rollers. Measures of amplitude, period, and duty cycle ratio served as dependent variables.

Results: We compared the behavior of 60 children with ASD and 20 age- and non-verbal IQ-matched, typically-developing controls during non-social, mechanical manipulation tasks and during haptic social interaction. The behavior of children with ASD was distinguished by stereotyped and repetitive movements and, in a subset of the children, by the favoring of select parts of the hand and forearm during task completion. These patterns were not observed in typically-developing children. In addition, children with ASD, in contrast to controls, showed little change in behavior between the haptic interaction condition and the non-social, mechanical manipulation condition.

Conclusions: These results quantify altered sensitivity and response to social touch in individuals with ASD, and serve as a platform for future studies of the development of haptic intersubjectivity: how typically-developing children, beginning in infancy, are highly sensitized to recognize certain kinds of touch as social, and to react and respond in kind. This will be an important part of understanding atypical behavioral and neural specialization in individuals with ASD.

110.194 161 Longitudinal Study of the Impact of Sensory-Motor Skills on Functional Independence and Adaptive Behaviors of Children with ASD. M. Couture*[1], E.

Fombonne[2] and E. Gisel[3], (1)*Laval University*, (2)*Montreal Children's Hospital*, (3)*McGill University*

Background: In recent years, the sensory-motor domain has gained increased attention among autism researchers. However, very few studies are addressing the impact of these skills on the autonomy or functional independence of children with autism spectrum disorders (ASD).

Objectives: 1) To describe the developmental trajectory of children with autism spectrum disorders at preschool-age over a period of 24 months regarding 3 developmental domains i) motor skills, ii) sensory processing skills, and iii) the functional independence in daily living skills. 2) To determine the contribution of sensory-motor skills on functional independence in daily living skills.

Methods: This is a clinical longitudinal study of 37 children diagnosed with autism spectrum disorders and aged 3 to 5 years 11 months at Time 1 and re-assessed 24 months later (Time 2). Children were tested with the Peabody Developmental Motor Scales-PDMS-2, the Sensory Profile, and the Vineland Adaptive Behavior Scales-VABS-2. 83% of the children from the sample were boys with an average IQ of 59, from Caucasian families (70%), speaking English (67%), and whose mother had university degrees (70%).

Results: Based on the sensory Profile results, sensory processing difficulties of children with ASD do not diminish over time since no significant differences were observed between scores at time 1 and time 2 ($p > .05$). Therefore, sensory processing difficulties are still apparent at school entry. All children learned new motor skills based on the increase of raw scores. Nevertheless, standard scores indicate that ASD children had stable gross motor skills development in comparison to norms but increased their performance in fine motor and total motor skills. However, when comparing results of only children under the age of 72 months at T2, ($n = 21$) for which norms are available, results were stable for gross motor and total motor scores, but a significant increase in standard score was still observed in fine motor skills. ASD children also did acquire new adaptive behaviors (increase in raw scores), however, standard scores remained stable and low for socialization and daily living skills (between 1 and 2 standard deviation below the norms). Only the communication skills did get significantly better over time ($t = 3.926$ $p = .0004$). Predictors of functional independence at T1 were sensory processing skills and fine motor skills (Couture, 2008). At T2, the only significant predictor was total motor quotient; language, cognition and sensory processing skills were not significant predictors.

Conclusions: Sensory-motor difficulties do not disappear by the end of the preschool period. At around the age of 6 years old, children with ASD still present important sensory processing and gross motor difficulties that are associated to their poor adaptive functioning. Specific interventions focusing on sensory-motor skills could potentially lead to better daily living skills and integration in daycare or school.

110.195 162 Temporal Coordination of Visual Scanning In School-Age Children with Autism Spectrum Disorders and Typically-Developing Peers. J. M. Moriuchi*, A. Klin and W. Jones, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Significant correlations between visual fixation and level of social disability have been found across eye-tracking studies of visual scanning of dynamic social scenes in children with autism spectrum disorders (ASD). However, parallel studies revealed that the amount of visual fixation on eyes and mouth regions in toddlers with ASD, not typically-developing (TD) peers, was positively predicted by the level of audiovisual synchrony in each region. While TD toddlers viewed the faces of others with sensitivity to underlying social cues, toddlers with ASD instead attended to faces based on their embedded physical contingencies. Children could be looking at the same region, but for very different reasons and perhaps at different times. The results stressed a need for more time-sensitive measures of visual scanning and raised the hypothesis that the temporal coordination of visual fixations of children with ASD relative to TD peers may be equally as or more predictive of functioning than the basic amount of visual fixations on socially relevant face regions.

Objectives: The aims of the current study are (1) to compare how the timing of visual scanning and the amount of visual fixation each relate to levels of social and cognitive disability and (2) to identify distinct visual scanning strategies associated with less social disability among children with ASD.

Methods: Eye-tracking data were collected while school-age children with ASD and TD peers watched video scenes of children and adults engaged in social interaction within naturalistic visual settings. Across all scenes, percentage of visual fixation time on eyes, mouth, body, and object/background regions was calculated for each child. In addition, novel computational methods were used to quantify the temporal and spatial coordination of each child's visual attention relative to both TD and ASD participants.

Results: Initial results show that degree of temporal coordination with the visual scanning pattern of TD children is

more strongly correlated with measures of both cognitive and social functioning than the overall amount of eyes or mouth fixation in children with ASD. Within the ASD group, preliminary analyses suggest that comparison of each child's degree of spatial and temporal synchrony in visual fixations relative to other participants with ASD allows the specification of subgroups with meaningful differences in level of social disability.

Conclusions: The timing rather than amount of visual fixations on socially relevant eyes and mouth regions was most predictive of levels of social disability and cognitive functioning in children with ASD during viewing of naturalistic social scenes. While the distinct visual fixation patterns of children with ASD illustrated different ways of learning about the world, the measures of temporal coordination of visual scanning provided a more sensitive assessment of predisposition to the same social cues as TD children.

110.196 163 Not Created Equal: Identifying Subtypes of Toddlers with Autism Based on Their Attentional Patterns. K. Chawarska*[1], D. Campbell[2], F. Shic[1], J. Chang[2] and S. Macari[1], (1)*Yale University School of Medicine*, (2)*Yale University*

Background:

Regulating attention to complex visual scenes and abstracting task-relevant information is essential for development of cognition. Compared to typical peers, toddlers with ASD experience attentional difficulties and atypical visual scanning patterns, yet their performance is highly heterogeneous. Identifying sources of such heterogeneity would advance our grasp of the underlying mechanisms and inform design of optimal intervention strategies.

Objectives:

As part of a study examining contextual factors on visual scanning strategies in ASD, we exposed a large group of toddlers with autism (83.3% male) (n=84, age=1.93 yrs, sd=0.61) to a 1-min video with an actress speaking to the camera simulating bid for dyadic attention. Four salient toys were placed in each corner of the screen. The purpose of this analysis was to identify consistent subtypes within the autism group based on their looking patterns.

Methods:

Gaze behavior was recorded with an eye tracker. Proportion of looking at specific regions of interest were examined using hierarchical clustering analysis using Ward's algorithm. Distances between pairs of observations were calculated using percentage values of overall time spent looking at the scene, the speaker, toys, and background. To examine cluster stability, a set of bootstrap samples was obtained from the data by resampling with replacement, and the same hierarchical clustering procedure was applied to each such sample.

Results:

Three clusters were identified; all between-cluster comparisons were significant at least at $p<.01$ level. Cluster#1: Toddlers who had difficulty attending to the scene in general, and when they did, spent less time looking at the speaker and more at toys; they had low verbal and nonverbal developmental quotient (DQ). Cluster #2: Toddlers who showed very good attention to the scene, but spent less time on the speaker and more on the toys; they had higher verbal and nonverbal DQ. Cluster#3: Toddlers showed distribution of attention similar to our typical toddler sample (data not reported here): very good attention to the scene in general and to the speaker in particular and limited attention to toys; this group was as high functioning as those in Cluster#2. There were no differences between clusters with regard to symptom severity score on the ADOS. Bootstrapping analysis revealed very high cluster stability. Preliminary analysis comparing performance of a subset of toddlers at 2 and 3 years suggests excellent stability of clusters over time.

Conclusions:

Performance of toddlers with autism differed with regard in their ability to regulate attention to the visual scene as well as their interest in the speaker and objects within the scene. There was considerable stability in cluster membership at 2 and from 2 to 3 years. Cluster membership could not be accounted for by differences in symptom severity and were only moderately associated with verbal and nonverbal functioning. Considering the importance of regulating attention in general, as well as selecting context-relevant aspects of a scene for learning and adaptive functioning, the properties of visual attention and scanning in the second year are likely to be highly consequential for future development of social and nonsocial cognition and predictive of outcome.

110.197 164 Semantic Representations In Asperger Syndrome and Nonverbal LD. M. Stothers* and J. Cardy,

Background: In 1995, Klin and colleagues described a convergence of features in individuals with Asperger Syndrome (AS), an Autism Spectrum Disorder, and Nonverbal Learning Disability (NLD), a learning disorder defined by deficits in visual-spatial organization. Only recently has research begun to systematically explore the nature of these similarities, and little

work has investigated language. Individuals with AS and NLD have well-documented pragmatic impairments. It is possible, however, that pragmatic impairments are due in part to underlying semantic difficulties, which appear as subtle in assessment situations but are more conspicuous socially.

Objectives: The purpose of the present study was to investigate whether individuals with AS and NLD have semantic representations that are a) less precise and b) less rich than semantic representations as expressed by peers without disabilities.

Methods: Participants were typical adults and those with a community diagnosis of AS or NLD who had successfully completed at least one course at a Canadian college or university. Conversational samples obtained during a semi-structured interview and individual's responses to test stimuli on the Vocabulary and Similarities subtests of the Wescheler Adult Intelligence Scale (WAIS) IV were coded for Mean Length of Utterance (MLU). Samples were also coded for MLU-Coherence, a measure of the number of utterances required to express single ideas that were relevant to the questions asked of the participants. MLU for irrelevant responses and their frequency were also compared by group.

Results: Participants with AS and NLD had more variable MLU scores than did their typical peers. For all participants with a diagnosis, MLU scores were highest for interview questions about strengths, weaknesses, and interests. These scores were longer for AS than NLD participants, but this trend did not absolutely distinguish the two clinical groups from each other. Both groups produced more words to express single ideas, whether or not they were in response to the questions or test stimuli presented. Finally, the clinical participants produced more irrelevant utterances in response to the Vocabulary subtest stimuli, although scaled scores on the test were not significantly different by group.

Conclusions: Results suggested that adults with AS and NLD may be distinguished from typical adults by subtle weaknesses in semantics. Longer, less precise utterances were produced by the adults with diagnoses in semi-structured interviews and on psychometric testing. Richness of semantic representations also appeared to be affected; responses for participants with AS and NLD had more instances of word repetitions than did controls. Differences between clinical groups were seen for a question about interests. Overall, findings implicated similarities over differences between adults with AS and NLD; however, they also suggested a potential source of difference to be researched further.

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110.059 165 Neural Correlates of Implicit Learning In Young Children with ASD. S. S. Jeste*, A. Norona, S. F. Freeman and T. Paparella, *UCLA Center for Autism Research and Treatment*

Background: Communication impairment is a core deficit in Autism Spectrum Disorders (ASD), yet language outcomes vary tremendously, with approximately 50% of children remaining non-verbal. Part of the difficulty in predicting language outcome lies in the limitation of standardized assessments to capture specific areas of strength and impairment and, importantly, to characterize neural mechanisms underlying behavior. One cognitive domain critical for language function is statistical (implicit) learning, or the extraction of patterns from probabilistic cues. This domain can be very difficult to characterize behaviorally in young children, but it can be investigated using event related potentials (ERPs), as has been done in several infant studies.

Objectives: (1) To characterize the neural correlates of implicit learning in young children with ASD enrolled in an intensive, standardized, 3-month intervention program and to then investigate the association between language function and implicit learning. (2) To characterize change in implicit learning after intensive intervention.

Methods: Children were recruited through the UCLA Early Childhood Partial Hospitalization Program (ECPHP). ECPHP ascribes to an informed, eclectic treatment approach consisting of both adult and child directed instructional techniques. Children receive 30 hours/week of intervention for approximately 12 weeks. Children entering ECPHP over the past 6 months were investigated with an ERP paradigm of implicit learning. In this modified oddball paradigm, children were first exposed to a continuous sequence of shapes organized into three pairs repeated 10 times each. In the test phase, children were exposed to learned pairs (80%) and unexpected pairs (20%). The principal dependant variable was the frontocentral P300, which occurs between 210-350 msec after stimulus onset. EEG recording was accomplished using a 128 Hydrocel Geodesic Sensor Net System (EGI Inc), using NetStation software. Data were amplified and filtered (0.3-30 hz), with a sampling rate of 250 hz, and digitized using a 12 bit National Instruments Board. ERP data were edited using NetStation 4.4.

Results: 15 children were investigated, with 13/15 providing adequate EEG data. Ages ranged from 3-5, with 1 female. 3/13 were nonverbal. As a group, children showed evidence of

statistical learning, as shown by differences in P300 amplitude between the expected and unexpected conditions. In preliminary analyses, the nonverbal group (n=3) showed less differentiation between the two conditions than the verbal group (n=10), suggesting an association between impairment in language and statistical learning. No hemispheric differences were seen. In the three children who were followed longitudinally, there was evidence of a larger P300 to the unexpected stimulus after intervention.

Conclusions: This is one of the only studies investigating neural correlates of implicit learning in young children with ASD. These preliminary findings not only demonstrate that implicit learning can be characterized with ERPs in this population, but they also suggest an association between implicit learning and language function. As we continue this study and increase our sample size, we will be able to create models that include both behavioral and electrophysiological measures to better understand pathways to language impairment in ASD, with the ultimate goal of defining predictors of language outcome in this population.

110.060 166 Transcranial Magnetic Stimulation Modulates P300 Indices of Selective Attention In Autism. J. M. Baruth*, E. M. Sokhadze, L. L. Sears and M. F. Casanova, *University of Louisville*

Background: Autism Spectrum Disorder (ASD) has been previously shown by our group to be associated with abnormalities in later-stage event-related potential (ERP) indices of selective attention. Specifically the attention-orienting frontal P3a and the sustained attention centro-parietal P3b have been found to be atypical in ASD during a visual oddball task; this may be related to reduced inhibitory tone of the dorsolateral prefrontal cortex (DLPFC) in ASD, as the DLPFC has been associated with selective attention and working memory.

Objectives: In this study we wanted to test the effects of bilateral low frequency repetitive transcranial magnetic stimulation (rTMS) applied to the dorsolateral prefrontal cortices on novelty processing in ASD. We hypothesized that rTMS would improve cortical inhibitory tone by selectively activating inhibitory GABAergic double bouquet interneurons, and this would improve task performance.

Methods: We recruited 25 participants with ASD and randomly formed a 15 subject active-TMS group and a 10 subject wait-list group. We assessed task performance before and after twelve sessions of bilateral low frequency rTMS in the active TMS group and before and after a six week waiting period in the waitlist group.

Results: Individuals with ASD showed significant improvement following treatment evidenced by improved P3b responses to targets and better stimulus discrimination. There was also a significant improvement in frontal reactivity to novelty as indicated by the P3a component. The wait-list group did not show any significant changes.

Conclusions: We propose that that low-frequency rTMS may have increased cortical inhibitory tone and subsequently improved performance in the novelty processing task. TMS has the potential to become an important therapeutic tool in ASD treatment with few, if any side effects.

110.061 167 Differences In Electrophysiological Indices of Cognitive Control In the Younger Siblings of Children with Autism. L. Mohapatra*[1], H. A. Henderson[2] and D. S. Messinger[2], (1)*University of Minnesota Medical Center*, (2)*University of Miami*

Background: Younger siblings of children with autism (Sibs-ASD) are at a heightened risk for the development of clinical and subclinical cognitive and social deficits characteristic of the Broader Autism Phenotype (BAP). In typically developing young children, the development of executive attention skills (e.g., cognitive control) are important for social development. An understanding of executive attention in Sibs-ASD may provide a foundation for further exploring the social variability observed among Sibs-ASD and the BAP.

Objectives: The aims of the current study were to identify behavioral and electrophysiological differences between Sibs-ASD and a sample of younger siblings of children without a diagnosis of an ASD (Sibs-COM) on a modified version of the Children's Attention Network Task (ANT). It was hypothesized that a) Sibs-ASD would display a greater number of errors and slower reaction time on incompatible trials of the Children's ANT and b) they would display atypical electrophysiological indices of executive attention (smaller N2 and larger P300).

Methods: Preliminary data was collected on 28 preschoolers: 14 Sibs-ASD (8 males) and 14 Sibs-COM (8males). Groups were matched on age, $t(26)=.06$,ns and verbal IQ, $t(26)= .96$, *ns*. Participants completed the Children's ANT while Electroencephalograph (EEG) was collected continuously using a 128-channel dense array system. The N2 and P300 were analyzed at midline scalp sites on correct compatible and incompatible trials. The N2 was analyzed as the mean

amplitude ±50 ms of the largest negative peak between 250 and 400 ms while the P300 was analyzed as the mean amplitude ±50 of the largest positive peak between 500-700 ms after stimulus onset.

Results: Behaviorally, there were no difference between groups on performance on the Children's ANT. Both groups made significantly fewer errors on compatible compared to incompatible trials $F(1,26)= 16.43$, $p<.01$, $\eta^2= .39$. Separate 2(Group: Sibs-ASD vs Sibs-COM) X 2 (Compatibility: Incompatible vs. Compatible) X 4(Scalp Site: Fz, FCz, Cz, and Pz) repeated measures ANOVAs were conducted for the mean amplictue N2 and P300. No significant group differences in N2 mean amplitude were observed; however, the P300 amplitude was predicted by the interaction of compatibility and diagnostic group, $F(1,23)=4.89$, $p<.05$, $\eta^2= .18$. Post hoc analyses revealed that for Sibs-ASD, the P300 amplitude was enhanced (more positive) on compatible compared to incompatible trials, $t(14)= -2.17$, $p<.05$. In contrast, this was not observed for Sibs-COM. Also, a marginal effect of diagnostic group on P300amplitude was observed for compatible trials such that Sibs-ASD demonstrated larger P300 mean amplitude compared to Sibs-COM, $t(23)=1.95$, $p=.06$.

Conclusions: Overall, Sibs-ASD and Sibs-COM were comparable on behavioral performance of the Children's ANT; however, compatibility of ERPs differentiated the two groups. Behaviorally, compatible trials were easier (faster response time and fewer errors) than incompatible trials for both Sibs-ASD and Sibs-COM; however, the enhanced amplitude P300 on compatible trials for the Sibs-ASD may reflect inefficient attention allocation or a compensatory strategy. Due to the importance of executive attention in social development, poorly developed executive attention may contribute to the social variability in Sibs-ASD and provide a model for exploring social deficits in ASD.

110.062 168 Frontal Asymmetry and Temperament In Young High Functioning Children with Autism Spectrum Disorders. K. M. Burner*, S. Faja, J. Tiwana and M. Murias, *University of Washington*

Background: Studies of temperament in autism spectrum disorders (ASD) strongly suggest deficits in effortful control, lower positive affect, and higher negative affect compared to typically developing children. Among typically developing children, frontal EEG asymmetry has been related to temperamental factors. For instance, individuals with relatively greater right frontal activity tend to be more withdrawn and express negative affect whereas individuals with relatively greater left frontal activity tend to be more approach oriented and express positive affect (Baving et al., 2002; Hane et al., 2008). Frontal asymmetry may also serve as a bio-behavioral marker of individual differences in social motivation and emotional development in ASD (Sutton, et al., 2005).

Objectives: To further examine temperament and its relation to frontal asymmetry in individuals with ASD.

Methods: Subjects were 14 6 and 7-year-olds with ASD with usable EEG data and 15 age and IQ-matched controls. Diagnosis was confirmed with the ADOS, ADI-R and DSM-IV-TR. All children in both groups had cognitive ability in the average to above average range. EEG was collected with a high-density (128 channel EGI) montage and referenced to the common average. Frontal asymmetry was calculated by taking the natural log of the mean alpha power for the 8-10 Hz frequency band and subtracting the value of left from right (F4 – F3). Temperament was assessed via parent report on the Children's Behavior Questionnaire.

Results: Children with ASD had lower CBQ scores for Attention Shifting ($t(26) = -3.6$, $p < .01$), Inhibitory control ($t(26) = -4.86$, $p < .001$), High Pleasure ($t(26) = -2.08$, $p < .05$), Smiling/Laughter ($t(26) = -2.19$, $p < .05$), and higher scores for Discomfort ($t(26) = 2.65$, $p < .05$), Fear ($t(26) = 2.24$, $p < .05$), Sadness ($t(26)=2.45$, $p < .05$), and Shyness ($t(26)=2.08$, $p < .05$). Groups differed in mean EEG alpha power in the right hemisphere ($t(27) = 2.11$, $p < .05$; ASD>TD), but not in the left hemisphere or in asymmetry scores. Within the ASD group, lower alpha power in the right hemisphere corresponded with increased scores on the High Pleasure scale ($r(13) = -.56$, $p < .05$). Greater left alpha power was related to increased Approach/Anticipation ($r(13) = .63$, $p < .05$) and increased Smiling/Laughter ($r(13) = .56$, $p < .05$).

Conclusions: Results support findings of temperamental differences in children with ASD including difficulties with attention shifting and inhibitory control as well as decreased expression of positive affect and higher rates of negative affect. Preliminary EEG results do not reveal differences in frontal asymmetry scores between groups, although the ASD group did have significantly greater right alpha power. Within the ASD group, alpha power in the right hemisphere was inversely related to pleasure while in the left hemisphere alpha power was positively related to approach and smiling.

110.063 169 Cortical Inhibition and GABAergic Function In Autism Spectrum Disorders. P. G. Enticott*[1], H. A. Kennedy[1], N. J. Rinehart[1], B. J. Tonge[1], J. L. Bradshaw[1] and P. B. Fitzgerald[2], (1)*Monash University*, (2)*The Alfred*

Background: There is mounting evidence for the role of γ-aminobutyric acid (GABA) in the neuropathophysiology of autism spectrum disorders (ASD). An *in vivo* measure of GABA involves the use of transcranial magnetic stimulation (TMS) to the primary motor cortex to index cortical inhibition (CI). A preliminary TMS study of ASD found evidence of reduced CI among those diagnosed with high-functioning autism (although this finding did not extend to those diagnosed with Asperger's disorder).

Objectives: To conduct a comprehensive assessment of CI in ASD through the application of TMS to the motor cortices.

Methods: Adolescents and young adults with ASD (n = 36) and matched controls (n = 34) were administered motor cortical TMS paradigms assessing several aspects of CI (thought to reflect activity at $GABA_A$ and $GABA_B$ receptors).

Results: There were no differences in CI when comparing ASD and control groups. When comparing ASD subtypes, however, specific CI impairments were found among those who had experienced early language delays.

Conclusions: These findings argue against a broad role for GABA in ASD, but indicate that disruption at $GABA_A$ and $GABA_B$ receptors may be involved in ASD where there is a delay in language acquisition. While clinical subtyping may be useful to better understanding the neurobiology of ASD, this research also has implications for the proposed use of GABA agonists in the treatment of ASD.

110.064 170 Atypical Maturation of Oculomotor and Manual Motor Response Inhibition In ASD. L. M. Schmitt*[1], M. W. Mosconi[2], M. E. Ragozzino[2], E. H. Cook[2] and J. A. Sweeney[2], (1)*University of Illinois at Chicago, Center for Cognitive Medicine*, (2)*University of Illinois at Chicago*

Background: Eye movement studies of individuals with ASD have demonstrated compromised abilities to voluntarily inhibit prepotent behavioral responses that may be related to repetitive behaviors. Yet, little is known about whether this deficit is specific to the oculomotor system, how it is expressed across development, and whether it is related to repetitive behaviors in ASD.

Objectives: To examine age-related changes in manual motor and oculomotor response inhibition deficits in individuals with ASD, and to identify whether these deficits underlie repetitive behavior subtypes.

Methods: Forty-one individuals with ASD and 36 healthy controls matched on age (range 6-38 years) and Performance IQ were administered manual motor and oculomotor stop-signal tasks (SST) and blocks of 100% go trials to determine mean RT in that context. During the SST, subjects were instructed to either press a button (manual version) or make a saccade (oculomotor version) when a peripheral target appeared ('go' trials), or inhibit these responses when a central stop signal appeared at varying times following the appearance of the peripheral cue ('stop' trials). Subjects' reaction times and rate of incorrect stop trials (i.e., pressing a button or looking towards the peripheral target) were examined. The Repetitive Behavior Scale-Revised (RBS-R) was used to assess repetitive behaviors.

Results: Subjects with ASD made more errors on stop trials than healthy controls on the manual motor and oculomotor tasks (p's$<.05$). Stop trial error rate was associated with the degree to which subjects slowed their reaction times from baseline trials to SST task go trials, such that increased slowing during the interspersed go and stop trial conditions was associated with fewer stop trial errors ($p<.01$). Subjects with ASD did not slow their reaction times as much as controls ($p<.05$). Increased age was associated with fewer stop trial errors and increased slowing of reaction times in healthy controls (p's$<.01$), but not in subjects with ASD. The increased stop trial error rates in ASD participants were related to increased rates of compulsive behaviors on the RBS-R ($r = -0.432$, $p<.05$).

Conclusions: Inhibiting learned or prepotent responses involves suppression of motor pathways via input from PFC and striatum. These frontostriatal systems show significant maturation into adulthood. Our findings suggest that this dysmaturation of frontostriatal brain systems may underlie some repetitive compulsive behaviors that are evident in many individuals with ASD. Treatments aimed at enhancing cognitive control and frontostriatal function may reduce these compulsive behaviors.

110.065 171 Functional Connectivity Abnormalities Between Primary Auditory Cortex and Broca's Area In Autistic Children: a High Density ERP Study of Phonemic Processing. K. M. Martien*[1], H. Bharadwaj[2] and M. R. Herbert[2], (1)*Massachusetts General Hospital-Harvard Medical School*, (2)*Massachusetts General Hospital*

Background: The autism spectrum disorders (ASD) are a heterogeneous group of neurodevelopmental disorders that share specific a behavioral phenotype classically described as impairment of social reciprocity and communication, accompanied by repetitive 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. Most of this investigative work has used fc/fMRI data in higher functioning individuals. EEG coherence measures electrocortical synchrony of oscillatory brain rhythms between neural networks, hypothesized as a mechanism for functional connectivity, and can be carried out in behaviorally-challenged young autistic children. Since communication deficits in autism are often associated with receptive and expressive language deficits which 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 show decreased functional connectivity between temporal and frontal language networks.

Objectives: To collect cortical auditory evoked potentials in response to phonemic stimuli in autistic and age-matched typical children and to measure phase coherence for both groups between regions activated by phonemes in primary auditory cortex (STG) and defined frontal language networks (Broca's area).

Methods: Auditory ERP 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 each groups: ASD and controls. The coherence spectrum between the activated auditory cortex (LSTG) and Brodmann's area 45 (Br45) was computed for each subject. Group differences were assessed using a t-test with a Bonferroni correction for multiple comparisons.

Results: Phase coherence between regions of activation in LSTG and Br45 was reduced in children with ASD in the theta band at 7 Hz (t-stat 3.9004, p=0.001 before and p=0.05 after bonferroni correction). There was a trend toward significance in the lower theta and delta bands and in the low beta band around 23 Hz which showed a strong trend, but did not withstand Bonferroni correction. Group comparisons showed a trend toward increased activation in LSTG and a decreased activation in the IFG operculum in the ASDs compared to typicals, though these, too, fell short of statistical significance. Additional data will be presented with correlations to autism severity, language level and IQ.

Conclusions: These results support the view that children with ASD have an impairment of functional connectivity between critical language networks involved in phonemic processing. Impaired phonemic processing across these language networks would be expected to contribute to impairment of receptive and expressive language development. Our ability to demonstrate this impairment using quantitative EEG underscores the value of this technology in behaviorally challenged young children with autism.

110.066 172 Auditory Processing In Young Children with and without Early Signs of Autism Utilizing Event Related Potentials. K. Harpster*, V. Sloutsky and A. E. Lane, *The Ohio State University*

Background:

The prevalence of sensory processing disorders in children with autism ranges from 69% to 95%. Sensory processing disorders manifest themselves as auditory under-responsiveness and restrictive and repetitive behaviors and are thought to contribute to the functional limitations experienced by children with autism. Behaviors related to sensory processing difficulties can be detected prior to diagnosis. Retrospective videotape analysis suggests that infants later diagnosed with autism exhibit auditory under- and over-responsiveness and delayed response to name more often than typically developing children or children with developmental delays. Several of these studies report that sensorimotor and social development features can be used to distinguish young children later diagnosed with autism from neurotypical and developmentally delayed children. Further, early identification and treatment of sensory processing deficits in young children with early signs of autism may promote more typical developmental patterns thereby reducing the severity of core autism symptoms. Currently, identification of auditory processing disorders in young children is reliant on imprecise proxy-report measures. There is limited neurophysiologic research available regarding auditory processing of young children with early signs of autism.

Objectives:

This paper will describe auditory processing function using Event Related Potentials while administering a novel phoneme discrimination task in young children with and without early signs of autism during the second year of life.

Methods:

A total of 50 children (12-24 months of age) were recruited to this study. Children were divided into two groups based on their

scores on the Autism Detection for Early Childhood (ADEC). Inclusion criteria: children between 12-24 months of age who passed their newborn hearing screening. Exclusion criteria: children with developmental disability other than autism. Auditory processing function was evaluated using an Event Related Potentials (ERP), mismatch negativity paradigm. MMN is a pre-attentive measure of sensory processing elicited by speech sounds.

Results:

Preliminary data analysis displays trends in participants with and without early signs of autism in their auditory processing. Scores on the ADEC indicate a significant difference ($p<0.001$) between the groups with and without early signs of autism. The group with no early signs of autism (n=21) scored (M=3.2, S.D. =1.3) compared to the early signs of autism group (n=19; M=8.6, S.D. =2.5). Additionally, visual inspection of ERP waveforms indicate a higher amplitude to deviant stimuli in the group with no early signs of autism as compared to the group with early signs of autism indicating attenuated responsiveness to speech sounds in young children with early signs of autism. Final analysis will be completed by March, 2010 and will include data from 50 participants.

Conclusions:

This study addresses a significant gap in scientific research specific to auditory processing in children with early signs of autism. As hypothesized, children with early signs of autism exhibited attenuated responsiveness to speech sounds as evidenced by lower amplitude to deviant stimuli as compared to children with no early signs of autism.

110.067 173 ERPs to Words In Toddlers with ASD Predict Behavioral Measures at 6 Years of Age. S. Coffey-Corina*[1], D. Padden[2], P. Kuhl[2] and A. M. Estes[3], (1)*UC Davis* , (2), (3)*University of Washington*

Background: Language/communication deficits and social impairment are key components of Autism Spectrum Disorder (ASD). Event related brain potentials (ERPs) have been shown to be a sensitive measure of differences in speech processing abilities of 3 year olds with typical development (TD) and ASD (Kuhl, et al., 2005). ERP measures of word processing have also been related to differences in language abilities in TD toddlers (Mills, et al., 1997).

Objectives: Our goals were to use ERP measures of word processing in a longitudinal study to (1) investigate differences in patterns of ERP response to words in TD children and children with ASD; and (2) study the relationship between ERP measures and later outcomes in children with ASD (cognitive, language and social domains).

Methods: Participants were children with ASD and age-matched TD controls. ERPs were collected at 18-30 months (T1) from all participants. Behavioral measures of cognitive, language, and social function were collected at 18-30 months (T1) and again at 6 years (T4) in the children diagnosed with ASD. ERPs were recorded using 22 channel electrocaps with standard 10/20 arrangement. Stimuli consisted of 3 word types: words known to the child, unknown words and backwards words (known words reversed). Parents of participants signed a University IRB approved consent form prior to study participation.

Results: Significant differences in patterns of ERP latency, amplitude and timing were observed at T1 between TD children and children with ASD. In general TD children show a more focused response to known and unknown words, with a differential left temporal response to known and unknown words. Children with ASD show a broadly distributed response across electrode sites for known and unknown words. High functioning children ASD (HF) exhibited a more localized response to words, similar to that of TD controls. Low functioning children with ASD (LF) had more diffuse patterns of response. In addition, T1 ERP measures from children with ASD were significantly correlated with measures of language and cognitive development collected four years later at T4: mean amplitudes (200-500 msc) at left parietal region for known words at 18- 30 months predicted scores on the Differential Abilities Scale, Peabody Picture Vocabulary Test and Vineland Adaptive Behaviors Scale taken 4 years later.

Conclusions: In general, HF children with ASD exhibited more localized ERP response, similar to TD controls. LF children with ASD had more diffuse patterns of response. Significant predictive correlations were obtained between ERPs to known words and various measures of language and cognition/adaptation obtained four years after ERP testing. Further research using brain measures of speech processing in children with ASD and TD controls is important to theory building and to understanding the nature of the relationship between the linguistic and social deficits which are characteristic of autism, and may have implications for diagnosis and treatment in children with developmental disabilities that involve language.

110.068 174 Visual Statistical Learning In Infants at Risk for ASD. A. Norona*[1], L. Hawkins[2], A. Law[3], T. Hutman[1], S. P. Johnson[3] and S. S. Jeste[1], (1)*UCLA Center for*

Autism Research and Treatment, (2)*UCSD* , (3)*University of California, Los Angeles*

Background: Language acquisition has been shown to involve the extraction of patterns from probabilistic cues in the auditory input. Accordingly, infants have been shown to readily learn statistically defined patterns in auditory as well as visual domains, which presumably facilitates language development. Infant siblings of children with autism spectrum disorders (ASD) are at increased risk for both ASD and language impairments. Do these high-risk infants exhibit impairment in statistical learning? No prior studies have investigated statistical learning in infants at risk for ASD.

Objectives: Here, we used an event-related potential (ERP) paradigm to examine cortical activity in infants at high-risk for developing ASD and low-risk, age matched controls as they participated in a visual statistical learning experiment adapted from the habituation paradigm described by Kirkham et al. (2002). The aim was to examine group differences in statistical learning.

Methods: Infants were exposed to a continuous sequence of colored visual shapes which were organized into 3 pairs repeated 10 times each in a random order during a training phase. A test phase consisted of a maximum of 200 randomly ordered frequently occurring pairs. 80% of the pairs were learned in the training and 20% were unexpected. EEG recording was accomplished using a 128 Hydrocel Geodesic Sensor Net System (EGI Inc.) using NetStation software. Data were amplified and filtered (0.3-30 hz), with a sampling rate of 250 hz, and digitized using a 12 bit National Instruments Board. ERP data were edited using NetStation 4.4. The principal dependent variable was the magnitude of the P300, an ERP component that reflects cognitive abilities such as attention and information processing. It is exhibited in response to unexpected stimuli. To examine the neural correlates of visual statistical learning, we examined the peak amplitude of this component when infants were presented with a specific shape. We compared P300 peak amplitudes of unexpected sequences, which were formed by the second shape of one learned pair and the first shape of another, among the high-risk and low-risk infants.

Results: Five high-risk infants and seven low-risk infants completed the training and a sequence of a minimum 20 pairs and a maximum of 140 pairs during the testing phase. The data show that both groups learned the shape pairs in the training phase, as all exhibited the P300 to the unexpected sequences. An interesting trend emerged showing that high-risk infants exhibit a larger P300 peak amplitude to the unexpected stimuli than do low-risk infants.

Conclusions: Our preliminary data suggest that high-risk infants and low-risk control infants may differ in neural markers of statistical learning. The underlying etiology of the larger neural response needs to be further explored as our sample size increases. In addition, data collected from these infants at later time points can provide more insight into the development of this cognitive process and its potential implications for ASD diagnosis and language acquisition.

110.069 175 Electrophysiological Indices of Conflict Monitoring In Autism Spectrum Disorders. A. Clawson*, P. E. Clayson, M. J. Larson, O. Johnston and M. South, *Brigham Young University*

Background: Children with autism spectrum disorders (ASD) often display deficits in cognitive control processes, potentially contributing to characteristic difficulties in monitoring and regulating behavior. Studies examining the neural mechanisms underlying performance-monitoring components of cognitive control show that children with ASD have decreased neural activation and impaired response monitoring relative to controls (Henderson et al, 2006; South et al., 2010). The N2, a stimulus-locked component of the event-related potential (ERP) putatively reflects conflict monitoring and the allocation of attention during conflict to increase behavioral control (Yeung & Cohen, 2006). Thus, the N2 provides a physiological indicator of conflict monitoring processes and has direct implications for appropriate behavioral adjustment during social-emotional processing. Examining such electrophysiological mechanisms in individuals with ASD may contribute to greater characterization across the spectrum and increase our understanding of the neural bases of behavioral abnormalities in ASD (Henderson et al, 2006).

Objectives: The purpose of this study was to examine conflict monitoring processes in children with ASD relative to typically developing (TD) controls. Specifically, we examined behavioral and electrophysiological correlates of the N2 during high-conflict and low-conflict trials. We hypothesized that children with ASD would display an attenuated N2 relative to controls, indicating deficits in conflict monitoring processes.

Methods: High-density ERPs and behavioral data (error rates, reaction times [RTs]) were acquired while 17 children with ASD and 18 healthy controls completed a modified Eriksen flanker task. Groups were well matched for age, education, and IQ. The ADOS-G (total social communication score >7) and and SCQ (total score >15) were used to characterize ASD

participants. Data were analyzed using a 2-Group (ASD, control) x 2-Congruency (congruent, incongruent) mixed model analysis of variance for ERP and behavioral data.

Results: Behaviorally, groups showed similar patterns of performance; both groups had longer RTs and higher error rates on high-conflict (incongruent) trials relative to low-conflict (congruent) trials. For N2 amplitude, the Group x Congruency interaction was significant. Controls demonstrated larger N2 amplitudes to high-conflict trials compared to low-conflict trials. Children with ASD showed no such differences between congruent and incongruent trials.

Conclusions: Results indicate disrupted neural reflections of conflict monitoring processes in children with ASD. Uniform N2 amplitudes in children with ASD for high-conflict and low-conflict trials potentially indicate decreased attention to conflicting information. Despite decreased N2 amplitudes relative to controls, behavioral data from children with ASD do not reflect greater conflict-based recruitment of cognitive control. This mismatch between behavior and neural activation may indicate that children with ASD are unable to recognize conflict or unable to allocate cognitive control mechanisms to adapt their behavior relative to the presence of conflict. Future research is necessary to accurately characterize and understand the behavioral implications of these deficits relative to diagnostic severity, anxiety, and personality.

110.070 176 Neural Mechanisms of Reward Processing In ASD. D. Perszyk*, M. J. Crowley, A. Naples, J. Wu, A. Y. Nguyen-Phuc, M. Victorinova, L. Mayes and J. McPartland, *Yale Child Study Center*

Background: Performance monitoring refers to on-going cognitive processes evaluating the success or failure of an individual's actions. It occurs during feedback appraisal and reward processing and entails error detection to optimize future behavior. The temporal resolution of event-related potential (ERP) research reveals distinct components of this process, presumed to originate from anterior cingulate cortex. The error-related negativity (ERN) occurs ~50-120 ms after an error commission and reflects *self-perceived* inconsistency between intended and actual outcomes. The feedback related negativity (FRN) occurs at ~250 ms in response to *external* feedback indicating an outcome worse than expected. Both the ERN and FRN have been applied to study reward processing in ASD. Most published work investigates the ERN, revealing a tendency toward attenuated intrinsic performance monitoring that correlates with degree of social impairment. A single study has investigated neural response to extrinsic feedback in ASD; Larson and colleagues (in press) compared FRN evoked by wins versus losses in a guessing game and found comparable FRN amplitudes among children with ASD and typically developing counterparts.

Objectives: The current study examined extrinsic feedback, indexed by the FRN, under conditions that more closely approximate the subtle feedback that characterizes social interactions (reward versus non-reward). Toward this end, children with ASD and typical counterparts completed a guessing game in which choices resulted in monetary gain or no reward. We predicted that in response to less concrete extrinsic feedback, children with ASD would display attenuated FRN.

Methods: ERPs were recorded from 15 high-functioning children with ASD and 15 age- and IQ-matched typically developing controls using a 128 electrode Geodesic Hydrocel Net. Participants performed a computerized feedback-reward task in which they selected one of four balloons. Outcomes were determined randomly and entailed monetary gain or no reward. FRN was extracted over frontocentral leads over a time window extending from 200 ms to 400 ms. Behavioral measures assessed social anxiety (SASC-R) and social personality traits (EPQ-Jr).

Results: Typically developing children showed an expected difference in FRN amplitude in response to feedback; neural responses of those with ASD did not discriminate between positive versus neutral outcome. Correlational analyses revealed relationships between FRN and social behavior in children with ASD.

Conclusions: Prior work demonstrates normative responses to extrinsic feedback regarding positive versus negative outcomes in children with ASD. Current findings show reduced sensitivity to more subtle feedback indicating positive versus neutral outcomes. We demonstrate, for the first time, that reward processing in ASD is contingent upon the nature of extrinsic feedback, offering insight into vulnerabilities in social learning in ASD. Experiential learning in social contexts may be negatively impacted in ASD by performance monitoring mechanisms reliant upon highly valenced outcomes rarely evident in social interactions. Results inform understanding of social learning processes in ASD and suggest potential utility of intervention strategies designed to tailor feedback on social performance to functional strengths in performance monitoring.

110.071 177 ERP Correlates of Episodic and Semantic Memory Judgements In ASD. E. Massand*[1] and D. M. Bowler[2], (1)*City University, London*, (2)*City University London*

Background:

Recognition memory in Autism Spectrum Disorder (ASD) tends to be undiminished, but is characterised by fewer episodic 'remember' judgements and more semantic 'know' judgements relative to typically developing (TD) individuals (Bowler et al., 2000a, b, 2007). In addition to this, semantic know old-new event related potentials (ERPs) thought to reflect cognitive strategies engaged during recognition, show altered topography in ASD (Massand and Bowler, in prep). However to date, these studies have exclusively used word stimuli and little is known about old-new effects for other types of stimuli in ASD.

Objectives:

This study investigated the nature of the previously reported differences in the semantic know old-new word repetition effect using nameable line drawings and the Inclusion/Exclusion paradigm.

Methods:

Fifteen ASD (mean age and FIQ; 38.9 years, 114) and 18 TD (37.2 years, 111) individuals took part in the study. Study stimuli were coloured nameable line drawings (Cycowicz et al., 2001) and were presented in either red or blue. At test studied stimuli and new stimuli were presented in black. Item memory (memory for the line drawing alone), and Source memory (Target/Other judgement; memory for the line drawing and its presentation colour) was tested. ERPs were recorded from 32 scalp sites and averaged according to (correctly) recognised, Items and Targets versus correctly rejected New stimuli.

Results:

The behavioural data revealed that Item recognition was better than Target recognition in both groups ($F(2,30)=39.47$, $p<.01$). The ASD group demonstrated marginally diminished recognition performance ($F(1,31)=3.64$, $p=.07$).

Early old-new effects associated with item recognition in the TD group were diminished in the ASD group.

ERPs for Target and Non-target recognition showed significantly enhanced late posterior negativity in the TD group, associated with episodic recollection of contextual information (Cycowicz et al., 2001). ASD individuals demonstrated late posterior negativity for Item, Target and Non-target recognition suggesting that this effect was not specific to Episodic recollection of contextual information.

TD individuals demonstrated an enhanced late anterior positivity associated with episodic recollection (Squire and Knowlton, 2000; Cycowicz et al., 2001; Wolk et al., 2009). ASD individuals demonstrated anterior positivity during recognition, however this ERP was not modulated by latency (was not enhanced in the later time window).

Conclusions:

Episodic memory, although quantitatively diminished in ASD is in large part qualitatively preserved. This suggests that the phenomenological experience of (residual) Remember judgements is preserved in ASD. These findings provide further evidence for differing functional neurophysiology underlying semantic memory judgements in ASD.

110.072 178 IQ Discrepancy Profiles and EEG Alpha Power In Autism Spectrum Disorders. B. Aaronson*, K. Sullivan, M. Murias and R. A. Bernier, *University of Washington*

Background: Previous reports of the cognitive profile of autism spectrum disorders (ASD), specifically a non-verbal and verbal IQ discrepancy, indicate significant variability in performance. Although one profile may not effectively represent ASD, profile analysis may aid in elucidating sub-types. EEG provides an avenue to explore cognitive profiles in ASD given the consistent, although complex, relationship identified between EEG and intelligence.

Objectives: To examine EEG alpha power in individuals with ASD and typical development, with and without the presence of a discrepancy between verbal and non-verbal intelligence, with the prospect of exploring the validity of split vs. no-split cognitive profile.

Methods: Spontaneous EEGs were collected during resting state condition from a sample of adults with an autism spectrum disorder (ASD, N=14) and typical development (TYP, N=11). Power was calculated in the alpha frequency band (8-12 Hz) across five regions of interest: frontal, central, parietal, temporal, and occipital. Cognitive ability was assessed using the Wechsler Adult Intelligence Scale-3rd Edition (WAIS-III). Participants in both diagnostic groups were separated into split and no-split profile groups based on a discrepancy between performance and verbal IQ greater than 15 points.

Results: Individuals with a cognitive split, regardless of diagnosis, showed decreased alpha power during rest ($p<.05$). A significant interaction between diagnosis and cognitive profile was found for electrodes over the parietal lobe ($p<.05$). While typical participants showed no differences in spectral power based on the presence of a cognitive split, ASD participants

with a cognitive split showed reduced spectral power in the alpha range compared to ASD participants without a cognitive split in the parietal region.

Conclusions: These findings expand upon previous work indicating a relationship between resting state alpha power and intelligence, as well as differential EEG activity in ASD. They suggest that cognitive profiles may help in identifying subtypes of ASD. Further, they suggest that cognitive profiles may play a role in observed differential electrophysiological activity. The use of cognitive profiles and electrophysiology may be useful in parsing out groups within the heterogeneous ASD population.

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110.073 179 EEG Photic Driving Interhemispheric Coherence Deficit In Childhood Autism. V. V. Lazarev*, A. Pontes and L. C. deAzevedo, *Oswaldo Cruz Foundation*

Background: In our previous research, it was shown that the EEG photic driving responses to the intermittent photic stimulation (IPS) reveal in autistic patients with relatively intact verbal functions and without severe or moderate mental retardation certain latent interhemispheric asymmetry not present in the spontaneous background EEG: 1) the right hemisphere driving “hyporeactivity”, detected by the reduced presence of driving spectral peaks in the different hemispheric regions and a reduced driving amplitude in the occipital area, predominantly at the fast alpha and beta IPS frequencies (Intern. J. Psychophysiol, 2009, 71: 177-183); and 2) the left hemisphere driving “hyperconnectivity” – augmented a number of high *intra*hemispheric coherent connections of likely compensatory nature (Clin. Neurophysiol., 2010, 121:145-152).

Objectives: Examination of the EEG photic driving *inter*hemispheric coherence during IPS in autistic patients with relatively intact verbal and intellectual functions in order to enhance the likely latent alterations in the *inter*hemispheric neural connectivity.

Methods: Fourteen autistic boys, aged 6–14 years, free of drug treatment, with I.Q. 91.4 ± 22.8, and 19 normally developing boys were subject to IPS of 11 fixed frequencies of 3–24 Hz. In each subject, the number of *inter*hemispheric coherent connections among the 20 highest coherent connections with maximum coefficients of coherence (CC) at the EEG frequencies corresponding to those of stimulation was evaluated. The CC values between homologous symmetrical EEG derivations of the two hemispheres were also estimated at the EEG frequencies of stimulation.

Results: Among the 20 highest coherent connections, the number of *inter*hemispheric ones in autistic patients proved to be significantly lower than in the control group. This difference was observed at the IPS frequencies of 4 and 12 Hz and at all the beta frequencies applied: 3.6±2.4 as against 6.4±1.7 connections for different frequencies. The CC values between various homologous derivations were also lower in the autistic patients. For example, for the IPS frequency of 21 Hz, this difference was significant in the parietal, central and posterior temporal areas where the CCs were 0.48±0.06 as against 0.62±0.08.

Conclusions: Coherence characteristics of the EEG photic driving reactions show latent potential deficit in the *inter*hemispheric functional connectivity at high EEG frequencies not detectable in the spontaneous EEG of the resting state.

110.074 180 Simultaneous Measurement of Pupillary Light Reflex and Heart Rate Variability In Children with Autism. C. L. Daluwatte*[1], T. T. Muzorewa[2], S. E. Christ[2], D. Q. Beversdorf[1], T. N. Takahashi[3], J. H. Miles[2] and G. Yao[2], (1)*University of Missouri, Columbia*, (2)*University of Missouri*, (3)*Thompson Center for Autism and Neurodevelopmental Disorders*

Background: Atypical pupillary light reflexes (PLR) were recently observed in children with Autism Spectrum Disorders (ASD). Studying simultaneous heart rate variability (HRV) would provide insights into associated non-specific impairments in the autonomic nervous system (ANS).

Objectives: To investigate the association between atypical PLR parameters and non-specific impairments in ANS by measurement of heart rate variability simultaneously with PLR in children with ASD.

Methods: PLR was measured using a two channel binocular apparatus, and HRV was measured using a remote heart rate device. PLR was induced by a 100ms green light pulse and measured in both light adapted (LA) and dark adapted (DA) conditions. Heart rate recording was started five minutes before the PLR test while keeping the participant in a sitting position and ended five minutes after the test. The tests were conducted in 71 children with ASD (age 11.3±3.0 years, 63 males and 8 females) and a typically developing control group of 50 children (age 10.8±2.4 years, 26 males and 24 females). To study medication effects, the ASD group was divided into a medication group (if the participants were taking antipsychotics, ADHD medications, antidepressants, etc.) and a non-medication group. Five basic PLR measurements including

resting pupil diameter, relative constriction, latency, constriction velocity and re-dilation velocity were calculated to quantify PLR. To analyze heart rate variability, Fourier transform was applied to calculate the high frequency (0.15 – 0.4 Hz, "HF") and low frequency (0.04-0.15Hz, "LF") components of the RR tachogram power spectrum.

Results: Similar to the previous findings, PLR latency was significantly longer in children with an ASD than children of typical development ($p < 0.0001$). The ASD group with medications had smaller PLR constriction than the typical controls and the non-medication ASD group ($p < 0.001$). The latency difference between the ASD group with and without medication was not significant. The average heart rate was significantly higher in children with an ASD ($p < 0.05$). Both the ASD and control groups showed smaller normalized HF power and higher LF/HF ratios during the PLR test than during the resting periods ($p < 0.05$). However such PLR test associated changes were significantly smaller in the ASD group than in the typically developing control group.

Conclusions: The atypical PLR profiles found in our preliminary study were confirmed in the larger ASD population tested in this study. The observed high average heart rate suggested an increased sympathetic tone in the ASD group. Our results also indicated that PLR testing itself induced less ANS modulation changes in the ASD group than in the typical controls.

110.075 181 High-FREQUENCY Oscillatory RESPONSE to Kanizsa Square IN Typically Developing BOYS and BOYS with AUTISM Spectrum Disorders. A. O. Prokofyev*[1], T. A. Stroganova[2], E. V. Orekhova[3], M. M. Tsetlin[1], V. V. Gratchev[4], A. A. Morozov[5] and Y. V. Obukhov[6], (1)*Moscow State University of Psychology and Education*, (2)*Psychological Institute of Russian Academy of Education*, (3)*Sahlgrenska University Hospital*, (4)*Mental Health Research Center of Russian Academy of Medical Sciences*, (5)*Institute of Radio-Engineering and Electronics*, (6)*Institute of Radio-Engineering and Electronics, Russian Academy of Sciences*

Background: Illusory contour (IC) perception, a fruitful model for studying the automatic contextual integration of local image features, can be used to investigate the putative impairment of such integration in children with autism spectrum disorders (ASD).

Objectives: To explore phase-locked gamma and beta responses to the Kanizsa square in TD children and to look for their possible abnormalities in ASD children.

Methods: We used illusory Kanizsa square and control non-illusory stimuli (experimental procedure described in Stroganova et al., 2007) to test how the phase-locked gamma and beta EEG responses of 23 typically developing (TD) children aged 3 to 7 years and those with ASD were modulated by the presence of IC in the image.

Results: The phase-locked beta and gamma activity strongly differentiated between IC and control figures in both groups of children (IC effect). However, the timing, topography, and direction of the IC effect differed in TD and ASD children. Between 40 and 120 ms after stimulus onset, both groups demonstrated lower power of gamma oscillations at occipital areas in response to IC than in response to the control figure. In TD children, this relative gamma suppression was followed by relatively higher parieto-occipital gamma and beta responses to IC within 120 to 270 ms after stimulus onset. This second stage of IC processing was absent in children with ASD. Instead, their response to IC was characterized by protracted (40-270 ms) relative reduction of gamma and beta oscillations at occipital areas.

Conclusions: These data suggest different modes of ICs processing in TD and ASD children. We hypothesize that children with ASD rely more heavily on lower-order processing in the primary visual areas and have atypical later stage related to higher-order processes of contour integration.

110.076 182 Low-Frequency Repetitive Transcranial Magnetic Stimulation (rTMS) Modulates Evoked-Gamma Frequency Oscillations In Autism Spectrum Disorder (ASD). M. F. Casanova*, J. M. Baruth, A. S. El-Baz, L. L. Sears and E. M. Sokhadze, *University of Louisville*

Background: It has been reported that individuals with Autism Spectrum Disorder (ASD) have both abnormal reactions to the sensory environment and visuo-perceptual abnormalities. Electrophysiological research has provided evidence that gamma band activity (30-80 Hz) is a physiological indicator of the co-activation of cortical cells engaged in processing visual stimuli and integrating different features of a stimulus. A number of studies have found augmented and indiscriminative gamma band power at early stages of visual processing in ASD; this may be related to decreased inhibitory processing and an increase in the ratio of cortical excitation to inhibition. Low frequency or 'slow' (≤1HZ) repetitive transcranial magnetic

stimulation (rTMS) has been shown to increase inhibition of stimulated cortex by the activation of inhibitory circuits.

Objectives: We wanted to test the hypothesis of gamma band abnormalities at early stages of visual processing in ASD by investigating relative evoked (i.e. ~ 100 ms) gamma power in individuals with ASD and controls. Additionally, we wanted to assess the effects of 12 sessions of bilateral 'slow' rTMS to the dorsolateral prefrontal cortex (DLPFC) on evoked gamma activity.

Methods: We recruited 25 subjects with ASD and 20 age-matched controls and assessed evoked gamma activity using Kanizsa illusory figures at baseline and after 12 sessions of bilateral 'slow' rTMS using a randomized controlled design.

Results: In individuals with ASD evoked gamma activity was not discriminative of stimulus type, whereas in controls early gamma power differences between target and non-target stimuli were highly significant. Following rTMS individuals with ASD showed significant improvement in discriminatory gamma activity between relevant and irrelevant visual stimuli. We also found significant improvement in the responses on behavioral questionnaires (i.e., irritability, repetitive behavior) as a result of rTMS.

Conclusions: We proposed that 'slow' rTMS may have increased cortical inhibitory tone which improved discriminatory gamma activity at early stages of visual processing. rTMS has the potential to become an important therapeutic tool in ASD treatment and has shown significant benefits in treating core symptoms of ASD with few, if any side effects.

110.077 183 Spatial Processing and Contour Integration In Children with Autism 6-16 Years of Age. T. S. Altschuler*[1], S. Molholm[2], A. C. Snyder[3], A. B. Brandwein[3], N. N. Russo[2], H. Gomes[4] and J. J. Foxe[2], (1)*The Children's Research Unit (CRU),City College of New York & Albert Einstein College of Medicine Children's Evaluation Research Center*, (2)*Albert Einstein College of Medicine*, (3)*The Children's Research Unit (CRU), Program in Cognitive Neuroscience,City College of New York*, (4)*City College of New York*

Background: It has been observed with increasing frequency that, in addition to the behavioral manifestations of autism spectrum disorders (ASD) which present to the naked eye, there are atypicalities at more basic levels of processing. For instance, there is some suggestion that low level visual processing is atypical in individuals with autism (Vandenbroucke et al., 2008). The typical adult brain can interpolate object identity under less than optimal viewing conditions, permitting gaps to be bridged in the contours of incomplete or obstructed objects, a process called perceptual completion. Kanizsa-type illusory contours (IC) are a stimulus class frequently employed to study this phenomenon. When pacman-shaped disks are oriented so that the contours of their "mouths" are precisely aligned and not too far from one another, the viewer can close the gap between them, perceiving continuous contours even though none exist. Event-related potential studies (e.g. Murray et al., 2002, Foxe et al., 2005) have extensively investigated this phenomenon, establishing a set of robust dependent measures underlying the binding of components into objects within the ventral visual stream. An early, automatic, contour-dependent ERP component occurring at approximately 110-200 ms, termed the *IC effect*, appears to be the earliest sensitivity to IC stimuli measurable with ERP. It has been localized to a cluster of ventral stream regions known as the lateral occipital complex, associated with object processing.

Objectives: We sought to better understand the limits of the automatic, contour-dependent phase of perceptual completion by taxing IC processing in typical and ASD children. We hypothesized that differences in basic visual processing and/or the tendency of persons with ASDs to default to processing parts over wholes, might weaken the strength of the illusion or increase the processing requirements of binding, differences that would be made manifest in the amplitude or the latency of the well-characterized *IC effect*.

Methods: ERPs to IC stimuli were compared between typical and ASD children, in two age cohorts: 6-10 and 11-16, as well as in a normal healthy adult cohort. IC- inducing stimuli were presented at three retinal eccentricities (4, 7 and 10 degrees). IC-effect amplitudes and latencies were measured for each.

Results: Results from typical adults replicate Murray et al's (2002) *IC effect*, and demonstrate indifference of either effect amplitude or peak latency to the manipulation of eccentricity. This pattern appears to be replicated in typically developing children and ASD children ages 11-16, however, preliminary analyses indicate a less robust IC-effect for the ASD younger cohort as a result of the parametric manipulation.

Conclusions: These data indicate that automatic completion of object contours is accomplished by older children with ASD in a comparable fashion to their typical counterparts. Our preliminary analyses of the data suggest that there might be a deficit in contour completion in the younger ASD group.

However, additional analyses are required before strong conclusions can be drawn.

110.078 184 Multisensory Integration of Auditory Somatosensory Inputs In Children with Autism, Their Siblings and Typically Developing Children: a High-Density EEG Study. N. Russo*[1], J. J. Foxe[2], H. Gomes[3], A. B. Brandwein[4], T. S. Altschuler[4] and S. Molholm[2], (1)*Albert Einstein College of Medicince*, (2)*Albert Einstein College of Medicine*, (3)*City College of New York*, (4)*The Children's Research Unit (CRU), Program in Cognitive Neuroscience,City College of New York*

Background:

Evidence is beginning to accrue that multisensory integration is atypical among persons on the autism spectrum. For example, individuals with ASD are less susceptible to multisensory illusions such as the McGurk effect and basic electrophysiological metrics indicate a delay the onset of automatic multisensory integration among children with autism, at least where passive auditory-somatosensory inputs are concerned (Russo et al., 2010). In light of this, we sought to test whether these delays were related to the broader autism endophenotype or whether they were 'unique' to individuals with a diagnosis of an ASD.

Objectives:

Here, we present findings from an electrophysiological study in which we measured brain responses to multisensory auditory and tactile stimulation in three groups of children: siblings of children with ASD, children with ASD and typically developing (TD) children. Our goal was to determine whether multisensory integration deficits are endophenotypic or whether they have a potentially diagnostic value for persons with ASD.

Methods:

In this preliminary study, we present data from 7 siblings of children with an ASD, 7 TD, children and 7 children with an ASD matched on age and performance IQ. Participants completed a passive task in which auditory and somatosensory stimuli were presented either alone or simultaneously while they watched a movie with the sound turned down.

Results:

Preliminary analysis suggests that automatic multisensory integration in the siblings of children with autism resemble those of typically developing children.

Conclusions:

These findings are discussed with respect to their implications for the uniqueness and specificity of multisensory integration differences in children with autism.

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110.079 185 ERP Measures of Facial Negative Emotional Expression Recognition In Autism and ADHD. G. Sokhadze*, A. S. El-Baz, L. L. Sears, J. M. Baruth, E. M. Sokhadze and M. F. Casanova, *University of Louisville*

Background: Disturbances of affective reactivity and innate inability to perceive and respond to the social and emotional signals in a typical and appropriate manner are the hallmark deficits of autism spectrum disorders (ASD). Children with ADHD are characterized by early and persistent deficits in attentional functions, impulse and motor control, and most research on behavioral deficits in ADHD has focused on laboratory measures of attention and executive functions and less on emotion.

Objectives: However, a closer investigation of emotional reactivity in ASD and ADHD and its underlying neural substrates is highly justified, since emotional deficits have been found to affect social functioning and interaction with peers in both ASD and ADHD children. The study was aimed at investigation of ability of children with ASD and ADHD recognize differences in emotionally negative facial expressions during affective task.

Methods: This study used event-related potential (ERP) measures of facial emotional expression recognition to test cognitive functions and emotional responsiveness in autism and ADHD. In a forced-choice ERP test subjects were instructed in two blocks (60 trials each) to differentiate gender of faces with neutral and emotional expressions, and then in the following 2 blocks differentiate facial emotional expressions (e.g., fear vs. sadness; anger vs. disgust). ERP were recorded using 128 channel EGI Net Station EEG system. ERP and single-trial EEG responses at the frontal, temporo-parietal, centro-parietal, and occipital sites of EEG recording were analyzed and compared across 3 groups (ASD,ADHD, typical controls, N=10/group).

Results: Both ASD and ADHD groups showed higher error rates and slower reaction times in emotion recognition tasks as compared to typically developing children. ANOVA revealed groups differences in amplitude and latency characteristics at the centro-parietal and occipital ERPs (N170, N200, P3b).

There were calculated also difference waves between gender recognition and emotion prosody recognition tasks. These difference waves at the posterior topographies (e.g., N2d) showed statistically significant differences between ASD and ADHD group.

Conclusions: Results are discussed using the "theory-of-mind" construct. Differences in amplitude and latency characteristics of ERP waves and single-trial evoked EEGG responses in gender and emotion recognition conditions showed sensitivity to efforts associated with emotional prosody recognition and categorization. The study provides additional support for functional diagnostic usefulness of emotional reactivity tests using ERP and EEG biomarkers.

110.080 186 FACE Processing IN Children with AUTISM Through Dense-ARRAY EEG Recording. F. Apicella*, R. R. Federico, F. Sicca, G. Campatelli and F. Muratori, *Stella Maris Scientific Institute*

Background:

Face processing in autism has been widely investigated during the last decades, nonetheless many open questions still stay open. The special role of human face in human interaction since the very early epochs of life along with the easy to notice disturbance in ASD affected individuals in handling face to face contact and facial expressions are the main reasons of such a wide interest. Caveats in this kind of studies are mainly the usually limited cooperation by tested ASD subjects and the ongoing maturation of face processing specific ERP peaks which appears to keep going until late adolescence.

Objectives:

Our aim is to better characterize ERPs in response to stimuli consisting of emotional and neutral faces as well as matched non-face objects in a sample of children diagnosed with ASD who underwent an extensive neuropsychological and cognitive assessments.

Methods:

In order to overcome the cited common issues we employed an EGI dense-array EEG system (GES 300, 128 electrodes nets) and restricted the study to a relatively narrow age range. The hi-density approach was chosen mainly because it is a fast and comfortable way of mounting so many electrodes that provide two main benefits: higher topographical accuracy of ERP peaks and in particular a very reliable estimate of average used for re-referencing post processing. The experiment consisted of 4 blocks of 5 minutes each consisting in random presentations of 4 kinds ot stimuli (neutral, sad and happy faces, trees) and a fifth kind of stimulus that was used only to collects answers by a button press to keep the attention focused on the experiment. For every class of stimuli, a minimum of 50 artifacts free repetitions (80 when full run) was obtained for every subject. Every epoch consisted of a 500-1500 msecs displaing a fixation cross, followed by a stimulus for 850 msecs. Stimuli were converted to black and white pictures and standardized for luminance and contrast. We used a widely used standarzide database of facial expressions (ref NimStim). Raw data was 1-30 Hz filtered, segmented, re-referenced to average and averaged across categories for each subject. Artifacts detection and bad channels replacement where applied with both automatic and manual procedures.

Results:

We measured latency and amplitude of the occipito-temporal N170 and of the preceding and following peaks. In both groups we found a differential activation in response to faces vs trees stimuli: in the control group we found a big difference in amplitude between the two classes of stimuli, difference that was present but however smaller for the ASD group. In other words N170 peaks were significantly more negative for faces and more positive for trees in the typical developing group. Regarding latency, while the control group exhibited similar latency for both stimulus categories, the faces stimuli in the ASD group evoked a later latency peak. Moreover in several ASD subjects the N170 peak appeared bifid, as previously described.

Conclusions:

This work adds evidence to the growing data on a possible involvement of early face processing steps in the development of ASD.

110.081 187 Single-Neuron Correlates of Abnormal Face Processing by the Amygdala In Autism. U. Rutishauser*[1], O. Tudusciuc[2], D. Neumann[2], A. N. Mamelak[3], A. C. Heller[4], I. B. Ross[4] and R. Adolphs[2], (1)*California Institute of Technology*, (2)*Caltech*, (3)*Cedars-Sinai Medical Center*, (4)*Huntington Memorial Hospital*

Background: Face processing impairments in autism are hypothesized to result in part from amygdala dysfunction. During emotional judgments, people with autism fail to use information from the eye region of faces. Similar functional impairments are also apparent in patients with focal amygdala lesions. How neurons in the amygdala respond to the eyes and other features in faces, and how these responses might differ in people with autism, is unknown.

Objectives: To further elucidate the neural basis of face processing abnormalities in people with autism we used small randomly sampled pieces of faces as stimuli. This approach, called “bubbles”, was used by us previously to show that people with autism make abnormal use of the mouth region of faces rather than the eyes. Here we hypothesized that single neurons in the amygdala of people with autism would show a similar abnormality: responses driven more by the mouth than the eyes.

Methods: We recorded 145 single neurons in the amygdala from 6 neurosurgical patients undergoing epilepsy monitoring (2 of whom had a clinical and ADOS-verified diagnosis of autism) during presentation of random small pieces of faces (“bubbles”). Participants were asked to judge as fast as possible whether a presented piece of a face was happy or fearful. We also recorded responses to whole emotional faces, as well as to selected cutouts of eyes and mouth regions. The single-neuron responses were then regressed onto the regions of the face shown in the stimuli to tell us which parts of a face were most potent in eliciting responses from recorded amygdala neurons.

Results: Behavioral data confirmed that individuals with autism fail to make normal use of information from the eyes within faces, and instead make exaggerated use of the mouth (Spezio, Adolphs, Hurley & Piven (2007), JADD 37:929). A significant fraction of the 145 well-isolated single units responded selectively to full or parts of faces and not to control stimuli of equal contrast/luminance (scrambles). Neuronal classification analysis of spikes from these neurons revealed neurons driven by both the mouth and eye region in participants without a diagnosis of autism. By contrast, participants with autism showed neuronal responses that almost completely lacked eye-region driven responses and were instead driven predominantly by the mouth.

Conclusions: The previously reported bias in autism to overutilize information about the mouth region and underutilize information from the eye region of faces was reflected in the responses of single neurons recorded in the amygdala. This is the first demonstration of a direct link between behavioral judgment of faces and single-neuron responses in the amygdala. The findings provide a neural mechanism that may underlie abnormal face processing in autism.

110.082 188 Feature Binding of Social Versus Non-Social Stimuli In Children with ASD. A. Y. Nguyen-Phuc*, D. Perszyk, A. Naples and J. McPartland, *Yale Child Study Center*

Background: Observed differences in electrophysiological markers of face perception in ASD have been interpreted according to several theoretical frameworks. Social theories of autism, such as the social motivation hypothesis, posit that atypicalities in face processing reflect core dysfunction in social brain mechanisms or consequent developmental deviance. In contrast, neuropsychological theories of autism, such as the temporal binding deficit hypothesis, describe face processing anomalies as reflective of general differences in cognitive mechanisms, such as a bias towards local versus global processing. Nevertheless, both frameworks describe disrupted configural processing of faces. In EEG studies, configural processing is typically indexed by high-frequency gamma oscillations, presumed to mark integration of individual features of a familiar visual percept, or feature binding. Though gamma band activity (GBA) has been demonstrated to be affected in ASD during face perception, little is known about integrative visual processing of non-social stimuli in ASD.

Objectives: We compared feature binding, as indexed by GBA, in social versus non-social stimuli to investigate the specificity of perceptual coherence anomalies in ASD and to explore their consistency with cognitive-perceptual versus social theories of ASD. The former predicts atypical perceptual binding to both classes of stimuli, a reflection of problems with the feature-binding process itself; the latter suggests that anomalies would be evident only during perceptual binding of social stimuli, reflecting specific vulnerability with social information.

Methods: High-density event-related potentials (ERPs; 128 channel Hydrocel Geodesic Sensor Net) were recorded from 19 children with autism and 19 typically-developing peers matched for age (~12), sex, IQ (~110), and handedness. Participants viewed familiar social stimuli (faces, compared with inverted faces), and non-social stimuli (letters, compared with pseudoletters). Gamma band oscillations were extracted at frontal and occipital electrode groups spanning a 500 ms window concurrent with stimulus onset.

Results: Significantly different patterns of GBA were observed between groups when viewing social stimuli; during perception of non-social information comparable brain activity was observed. Comparing face and inverted faces, TD children showed a gamma burst elicited by faces that was attenuated by inversion. In contrast, children with ASD displayed reduced GBA to both faces and inverted faces. When viewing non-social stimuli children with ASD and typical counterparts displayed similar patterns of GBA, selective to letters compared to pseudoletters.

Conclusions: Results suggest that deficits in feature binding reflected by reduced GBA are specifically social in nature. When comparing social information, children with ASD exhibited a predicted reduction in feature binding. In contrast, when viewing non-social information children with ASD showed normative patterns of brain activity, reflecting intact feature binding. This pattern of results emphasizes the import of the visual content being processed when evaluating visual-perceptual mechanisms in ASD.

110.083 189 Electrophysiological Correlates of Face Processing In Simplex and Multiplex ASD Families. R. T. Lowy*, K. M. Venema, K. Ankenman, J. Gerdts, R. A. Bernier, E. M. Wijsman and S. J. Webb, *University of Washington*

Background: Broader autism phenotype (BAP) is the expression of mild autism-like traits in relatives of individuals with autism spectrum disorder (ASD). Dawson and colleagues (2005) demonstrated that parents of two or more individuals with ASD may exhibit atypical early ERPs to faces, suggesting that basic face processing may be an endophenotype for the disorder. Previous research suggests that a number of BAP traits, including social deficits, are more strongly expressed in parents of multiple children with autism than in parents of only a single child with autism, indicating that a greater number of variants in autism-related genes may be present in multiplex families (Losh et. al 2008). Face processing deficits may also differ in simplex vs multiplex families.

Objectives: ERP investigations have provided information about timing and specification of brain functioning related to early stage processing of faces; these processes occur < 200 ms after stimulus onset. The objective of this project is to extend the work of Dawson et al. (2005) to address the P1 attention component and the specialized face-processing N170 component in simplex parents, multiplex parents, and parents without a family history of ASD

Methods: Simplex parents were recruited from the UW Simons Simplex Collection; multiplex parents were recruited from the UW CPEA Family Study of Autism. EEG data was collected to upright and inverted faces and houses. The P1 and N170 ERP components were analyzed from occipital and posterior temporal regions. Preliminary data were available from 20 parents from simplex families and 24 parents from multiplex families; data collection is ongoing.

Results: Parents of children with ASD showed characteristic ERP responses that are similar to those found in neurotypical adults. Specifically the P1 and N170 was greater in amplitude to faces than houses and N170 latency was faster to faces than houses. The N170 was also faster but of lower amplitude to upright than inverted faces. In preliminary group analyses, multiplex families had significantly greater P1 amplitude and faster N170 latencies; group did not interact with stimulus type or orientation.

Conclusions: ERPs allow one to disentangle these early stage processing steps and assess whether there are basic level perceptual and attention impairments. Preliminary data suggest that multiplex and simplex families show ERP responses to faces and houses that are similar to neurotypical adults and ASD multiplex and simplex families do not differ in face processing. However, there may be subtle group differences in brain processes underlying attention and category processing as assessed by the P1 and N170. Additional analyses will examine behavioral face memory tasks and their relation to these ERP components. Further, data collection is ongoing and as the sample size increases, we will be able to examine heterogeneity in face processing.

110.084 190 Temporal Dynamics of Subliminal and Supraliminal Emotional Face Perception In Individuals with Autistic Traits. M. Viktorinova*, D. Perszyk, J. Wu, A. Naples, H. Rutherford, L. Mayes and J. McPartland, *Yale Child Study Center*

Background: Functional neuroimaging studies indicate that rapid emotion processing relies upon an early developing subcortical pathway involving the amygdala, pulvinar, and superior colliculus. Dysfunction in this circuitry has been implicated in the neuropathology of ASD, and individuals with ASD often demonstrate vulnerabilities in emotion perception. Abnormalities in this rapid route could also contribute to observed delays in face processing in ASD. While hemodynamic imaging studies have demonstrated functional abnormalities in this circuitry in ASD, temporal dynamics remain unexplored. Furthermore, since individuals with affective disorders also demonstrate abnormalities in rapid emotion processing, it is not known to what degree these abnormalities are unique to ASD.

Objectives: The objectives of the current study were two-fold. First, we sought to study unconscious modulation of affective perception across a range of negative emotional expressions. Second, we investigated whether subcortical pathway dysfunction, as revealed by subliminal processing of emotional faces, is evident in individuals with subclinical levels of autistic traits.

Methods: Healthy adults were pre-screened with the Autism Spectrum Quotient for high (H-AQ) or low (L-AQ) levels of autistic traits. Event-related potentials (ERPs) were recorded with a 128 channel HydroCel Geodesic Sensor Net during viewing of subliminal (16 ms) and supraliminal (200 ms) presentations of fearful, sad, and neutral faces, backward-masked by scrambled faces. Participants also completed self-report measures assessing cognitive (Systemizing Quotient) and empathic (Empathizing Quotient) style. Amplitude and latency were extracted for early components modulated by the subcortical processing route (N170, N2/P3 complex) and a subsequent component reflecting higher level processing (P3/N4 complex).

Results: Analyses in progress contrast amplitude and latency of ERP components using repeated measures analysis of variance with within-subjects factors of presentation speed (subliminal/supraliminal), emotion (fearful/sad/neutral), and hemisphere (left/right), as well as a between-subjects factor of group (H-AQ/L-AQ). We predict that, in contrast to L-AQ individuals, H-AQ individuals will fail to exhibit modulation of early ERP components in response to subliminally presented emotional expressions. Correlational analyses will explore interrelationships between neural response and cognitive and empathic characteristics.

Conclusions: Results will elucidate the temporal dynamics of emotional face processing and their relationship to subclinical autistic features. The experimental paradigm is the first to contrast conscious and unconscious processing for negative emotional expressions other than fear. Clarifying the integrity of subcortical face processing mechanisms in individuals without autistic social dysfunction is critical to defining the specificity of processing anomalies in ASD to differentiate between core features and broader characteristics distributed more widely in the population. Evidence of common patterns of function and dysfunction within and without the autism spectrum informs understanding of social processing mechanisms in both typical and atypical development.

110.085 191 Affective Modulation of the Startle Eyeblink Reflex In Autism Spectrum Disorder In Response to Social and Non-Social Stimuli. A. Sabatino*[1], J. W. Bodfish[2], N. J. Sasson[3], J. Franklin[4], S. D. Benning[5] and G. S. Dichter[1], (1)*University of North Carolina*, (2)*University of North Carolina - Chapel Hill*, (3)*University of Texas at Dallas*, (4)*University of North Carolina-Chapel Hill*, (5)*Vanderbilt University*

Background: Individuals with autism may have minimal or inappropriate affective response to social information yet can exhibit extreme affect to non-social aspects of their environment. An individual with autism may remain affectively flat when greeted by a familiar individual; however, respond enthusiastically at the sight of trains, road signs, or swirling water. These variable reactions have been conceptualized in terms of affective dysregulation and have been linked to core symptoms of the disorder due to their potential effects on social development and inappropriate social interactions. We have recently reported on anomalous affective responses to emotionally arousing images during a startle paradigm in an autism sample (Dichter et al., 2010).

Objectives: The purpose of the present study is to extend this line of research to examine responses to autism-relevant stimuli, namely faces and objects typically associated with circumscribed interests in autism (Sasson et al., 2008).

Methods: Participants with and without autism completed a startle eyeblink modulation session. Each trial consisted of a 6s picture presentation during which acoustic startle probes (50ms, 100dB white-noise bursts with instantaneous rise times) were binaurally-presented via headphones 3500-5000 ms after picture onset. Picture categories included negative, neutral, and positive IAPS images selected based on normative ratings of valence and arousal. In addition, social images (i.e., images of closed-mouth NimStim faces with neutral expression) and non-social images (i.e., images related to circumscribed interests derived from Sasson et al., 2008) were presented as well. To date we have assessed 6 typically developing individuals [mean age = 26.83] and 4 individuals with autism [mean age = 27.25]. By the annual IMFAR meeting in May 2011, we will have collected data on 20 individuals in each group.

Results: Peak EMG activity was calculated as the maximum response within a window of 10-250 ms following the acoustic probe and compared across picture categories. In response to IAPS images, the typically developing group is displaying classic linear valence modulation patterns with increased responses to negative relative to positive images. The autism group is showing preliminary evidence of anomalous eyeblink responses to IAPS images, relatively greater eyeblink response while viewing social stimuli, and relative decreased eyeblink responses to non-social stimuli associated with circumscribed interests in autism.

Conclusions: Preliminary analyses indicate anomalous eyeblink responses in individuals with autism in comparison to a typically developing sample to both standardized emotional stimuli and to autism-relevant stimuli. The relatively increased

eyeblink startle response to social images in the autism group suggests a heightened withdrawal response to this class of stimuli. The relatively decreased eyeblink startle response to non-social circumscribed interest images in the autism group suggests greater approach motivation to this class of stimuli. Implications for the social-motivation hypothesis of autism will be discussed.

110.086 192 EEG, Empathy, and External Monitoring. O. Johnston*[1], T. Newton[1], A. Clawson[2], N. K. Jamison[1], M. J. Larson[1] and M. South[1], (1)*Brigham Young University*, (2)*Brigham Young University-Psychology*

Background: Although it is generally accepted that empathy is impaired in autism spectrum disorders (ASD), there is not yet a complete understanding of how and when empathy becomes disrupted in the brain. Several models (e.g., Blair, 2008; Rankin et al., 2005) propose distinctions between "emotional" and "cognitive" components; however, the definition of cognitive vs. emotional aspects differs across studies. In the context of our ongoing studies of performance monitoring in ASD, we added an observational component to an explicit cognitive task.

Objectives: Using EEG, our aim was to investigate whether the neural signatures of children and adolescents diagnosed with an ASD differ from controls while watching a confederate research assistant perform a modification of the Eriksen Flanker task. Specifically, we hypothesized a diminished error-related negativity (ERN) in the ASD group.

Methods: Participants were 33 ASD and 28 age- and IQ-matched Typically Developing Controls (TDC) (total mean age = 13.24; Full Scale IQ = 108.22). Participants were instructed to watch their "teammate" do the Flanker task, who would be working for points to be awarded either to themselves or to the participant. Confederates deliberately made errors on about 33% of trials in order to ensure adequate numbers of error trials. Importantly, in order to make certain that participants were aware of error trials, we added a feedback display ("right" or "wrong") after each trial. Each participant also completed the children's version of the Interpersonal Reactivity Index.

Results: Our major hypotheses were analyzed using a 2 (accuracy) x 2 (points type) x 2 (diagnostic group) repeated measures ANOVA. As expected, there was a significant main effect for accuracy, $F = 14.48$, $p < .001$, driven by a stronger ERP response to Error than to Correct trials in both groups. There was no significant interaction of points type, nor was there any interaction with diagnostic group. Surprisingly, there were no between-group differences on any scale of the children's IRI.

Conclusions: We have recently reported impaired neural response in ASD on EEG tasks dependent on internal performance monitoring (South et al., 2010) but intact response when there is external feedback on the task (Larson et al., in press). In light of our added external feedback to the Flanker task, we interpret this study as further evidence for typical neural activity in ASD when the emotional valence is clearly delineated. We suggest that this cognitive component of empathy is not impaired, but that poor connectivity between social and emotional processing may lead to empathy deficits previously reported. However, in this high-functioning ASD sample there was no difference from controls on a standard, self-report empathy questionnaire, leaving further questions about the phenotype of everyday empathic behavior and attitudes in the absence of impaired verbal and cognitive ability.

110.087 193 Neural Mechanisms of Empathy for Physical and Social Pain and Their Relation to Autistic Traits. C. E. Mukerji*[1], R. A. Bernier[2], D. Perszyk[3], A. Naples[3], A. Fogel[4] and J. McPartland[3], (1)*Yale University*, (2)*University of Washington*, (3)*Yale Child Study Center*, (4)*Tufts University*

Background: Empathy is a core social ability affected in ASD and the broader autism phenotype. Empathic response relies on brain circuitry common to both the experience of pain and its observation in another. Event-related potential (ERP) studies reveal distinct stages of empathic processing of observed physical pain: an automatic, rapid (~140-80 ms) response and a subsequent, longer-latency component (~380 ms) that is modulated by attention and presumed to reflect cognitive appraisal. Recent neuroimaging research suggests that observation of social distress activates mentalizing circuitry, as well as social-pain related regions, including the insula and anterior cingulate cortex. The temporal dynamics of empathy for social pain remain unexplored.

Objectives: This study aimed to (a) describe the time course of empathic processing of social pain, (b) contrast it with response to observed physical pain, and (c) explore the relationship among these indices of social sensitivity and subthreshold autistic symptomatology. We predicted that oscillatory EEG would demonstrate activation common to both social and physical empathic processing; however, given more extensive cognitive appraisal required for detection of social distress, we predicted ERPs would reveal a slower time course for social empathic response. Autistic traits were hypothesized to correlate with attenuated empathic response.

Methods: Participants included 30 typical adults pre-screened for high versus low levels of 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 painful, socially painful, and matched painless contexts. Participants viewed stimuli under two conditions, 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 (video stimuli), and log ratios (empathic attention: distractor condition) were compared in social versus physical conditions. ERPs were extracted for each condition (static stimuli) at leads corresponding to those used in prior research on electrophysiological indices of empathy (F3/F4, C3/C4, T5/T6, P3/P4).

Results: Consistent with previous research, a short-latency ERP component differentiated painful and painless stimuli at frontal and central electrodes during observation of physical pain. Though social pain was not reflected in this early component, a subsequent component differentiated between painful and painless stimuli in both physical and social pain conditions but only in the pain evaluation task. Analysis of mu attenuation revealed comparable response to observing the physical and social pain of others; both conditions elicited greater mu attenuation than painless stimuli. Analyses in progress examine the correlation between ERP amplitude, mu power, and subclinical autistic symptoms.

Conclusions: This is the first investigation of the temporal dynamics of empathy for social pain, revealing a slower time course that is distinct from that observed for physical pain. Mu attenuation, which is presumed to reflect activity in an action-perception system and has been correlated with empathy in other studies, revealed common activation for observation of both physical and social pain in others. Analyses in progress will clarify the role of empathic processing in the broader autism phenotype.

110.088 194 Distinguishing Self and Other In High Functioning Autism. M. A. Stokes*[1], T. J. Perkins[1], J. A. McGillivray[1], J. A. Manjiviona[2], R. Bittar[3] and D. Kidgell[1], (1)*Deakin University*, (2)*Private practice*, (3)*Precision neurosurgery*

Background:

Rogers and Pennington (1991) proposed autistic subjects may have abnormalities in how they cognitively represent actions performed by the self and by others. Schutz-Bosbach et al. (2005) tested self and other representation in a sample of typically developing (TD) individuals, using the rubber hand illusion. Transcranial magnetic stimulation (TMS) was used to measure brain activity in motor regions when subjects (a) experienced an illusion that a confederates arm belonged to them (self condition), and (b) simply observed a confederates arm (other condition). They found that actions attributed to the self were associated with motor suppression, whilst actions attributed to another led to motor facilitation. This study provides evidence that the motor cortex represents actions attributed to self and other differently.

Objectives:

The present study applied this paradigm to a sample of high-functioning autistic (HFA) subjects, to determine if they represented actions attributed to the self and other differently. It was expected that autistic subjects would have an atypical pattern of activation in the self and other conditions. Given that TD individuals have been found to have *stronger* motor activation when attributing an action to another person, it is possible this activity reflects mirror neurons. Thus, two hypotheses were proposed for this study. Firstly, that TD subject's would demonstrate the same pattern of activity as Schutz-Bosbach et al. (2005) – stronger activity in the 'other condition' by comparison to the 'self condition'. Secondly, that HFA subjects would have reduced or equal levels of activity in the other condition by comparison to the self condition - attributable to a faulty mirror system.

Methods:

Subjects with a confirmed diagnosis of HFA were compared to TD (*N*=10 males in each group). All subjects were screened with tests on IQ, executive function, adaptive behavior, developmental history, and the AQ. An assessment was made by a clinical psychologist as to each subject's diagnosis or lack of one. Subjects then took part in three conditions; self (illusion elicited), other (illusion not elicited) and a baseline measure. In the self and other conditions, subjects observed the confederates finger making small contractions. In synchrony with the contractions, 20 motor evoked potentials (MEPs) were recorded from the subject's right index finger.

Results:

A mixed model ANOVA with group as the between subjects factor (HFAs and TD) and condition (self and other) as the within subjects factor was used for preliminary analyses. TD individuals have demonstrated stronger MEPs in the other condition by comparison to the self condition, whilst HFA subjects have demonstrated stronger MEPs in the self condition by comparison to the other condition. These findings have not reached significance due to an incomplete sample.

Conclusions:

Thus far control subjects have demonstrated the hypothesized trend (other condition providing stronger MEPs than self condition), supporting previous research by Schutz-Bosbach et al. (2005). HFA subjects have demonstrated the hypothesized trend (self condition providing stronger MEPs than the other condition), providing evidence of atypical self/other representation, which could be attributable to a disturbed mirror system.

110.089 195 Congruency Effects and Developmental Trajectories In Simultaneously Perceiving and Producing Facial Expressions and Hand Movements - An EMG Study. M. Schulte-Rüther*[1], E. Otte[2], I. Koch[2], B. Herpertz-Dahlmann[3] and K. Konrad[3], (1)*University Hospital Aachen* , (2)*RWTH Aachen University*, (3)*University Hospital Aachen*

Background:

It has been suggested that patients with autism spectrum disorders (ASD) have a fundamental impairment of the mirror neuron system (MNS). Several studies have reported deficits for the imitation and the automatic mimicry of facial expressions. Findings for hand- and finger movements are inconsistent. Thus, it remains unclear at which level an impairment in the MNS may occur. Furthermore, the developmental trajectories of these abilities in typically developing controls (TDC) are poorly understood.

Objectives:

We aimed at investigating the developmental trajectories of automatic mirroring of observed movements (hand movements and facial expressions) using electromyography (EMG) in patients with ASD and TDC.

Methods:

39 children and adolescents (aged 6 to 19 years) were investigated using EMG. We employed a paradigm that allowed testing for the effect of automatic mirroring effects (likely mediated by the mirror neuron systems) by using an observation/execution interference task. The participants were asked to execute pre-specified finger movements (lifting of middle or index finger) or facial expressions (smiling or frowning), as indicated by a color cue. Simultaneously, photos were presented that depicted either congruent, incongruent or non-moving/neutral finger movements or facial expressions. EMG signals were acquired at the musculus corrugator supercilii, musculus zygomaticus major (facial expressions), musculus extensor indicis and musculus extensor digitorum (finger movements). For each trial, the latency of muscle activity (as indicated by the EMG-signal) was determined, relative to the onset of the movement cue. Mean error rates and reaction times for congruent, incongruent and neutral conditions were calculated. To avoid a speed/accuracy trade-off effect, only correct trials were used to calculate reaction times. An additional sample comprising 20 adolescents with ASD is currently being collected.

Results:

Irrespective of age, a significant congruency effect could be observed for the TDC. In congruent conditions (i.e. observed and executed movements were identical) participants had shorter reaction times and made less errors than in incongruent and neutral conditions. Furthermore, we observed that the size of the congruency effect was modulated by age. Both reaction time and error rate effects decreased with age. Further analyses will show whether congruency effects can also be observed in patients with ASD and whether these are similarly modulated by age.

Conclusions:

The observed congruency effect is likely mediated by the mirror neuron system. Automatic mirroring of observed movements seems to be present from early childhood on and is subject to developmental change. The decrease of congruency effects with age suggests that in TDC, automatic mirroring can be overridden more effectively at older ages due to maturing control processes. In TDC, comparable results were observed for finger movements and emotional facial expressions. The paradigm is thus well designed to investigate differential impairments of the MNS in ASD for both modalities. Observed differences will give important insights into the nature of such impairments, whereas an intact congruency effect and comparable developmental changes would be a strong argument against a core impairment of the MNS in ASD.

110.090 196 EEG Measures of Social and Non-Social Autistic Traits within and Beyond the Autism Spectrum. K. J. Yoder*[1] and M. K. Belmonte[2], (1)*University of Chicago*, (2)*National Brain Research Centre*

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Background: Although autism's social communicative symptoms are amongst its most obvious, most diagnostic, and most debilitating aspects, differences in non-social cognitive domains -- both deficits and superiorities -- also appear.

Dimensional traits present in probands and relatives, and in fact are continuously distributed beyond the autism spectrum and into the normal population. Relating social and non-social traits at the levels of behaviour and physiology in typically developing individuals, individuals with autism spectrum conditions (ASC) and siblings without any clinical diagnosis will help elucidate behavioural and neural phenotypes related to autism, and to cognitive diversity in general.

Objectives: (1) Relate psychometric, behavioural and cognitive electrophysiological aspects of autistic traits within and beyond the autism spectrum. (2) Relate these aspects of autistic traits in social and non-social cognitive domains.

Methods: Three age-matched groups of children ages 10 to 15 years -- those with autism spectrum conditions (ASC), their clinically unaffected siblings, and unrelated controls -- were contrasted using event-related potentials, behavioural performance, and psychometric measures of autistic traits. EEG was recrded whilst children played a video game in which were embedded several cognitive tasks, including a go/no-go task and a task of motion coherence (moving dots) detection. Diagnostic group and psychometric measures were factors in an analysis of variance with ERPs or ERSPs as the dependent variable.

Results: The ASC and sib groups were marked by an early, long-lasting positivity (50-250 ms) and a decreased P3 (300-500 ms), at right centro-parietal sites during no-go trials, and this pattern was graded by groups: for the early positivity the siblings manifested the greatest effect, followed by the autism group, whereas this component was not present in the controls. For the P3, amplitude was greatest in the ASC group and least in the control group, with siblings between the two.

Performance on the Benton Facial Recognition test predicted P3 amplitude in the no-go minus go ERP difference wave. There was a significant Group x Benton interaction, wherein Benton was negatively correlated with mean amplitude for controls ($p<0.05$). For all groups, Benton score was correlated with decreased frontal alpha power (8-12 hz) during go trials (300-2000 ms post-stimulus; $p<0.05$). There were no group differences for go/no-go accuracy or reaction-time.

In the motion coherence task, the ASC group was differentiated by a longer latency of alpha suppression in response to motion onset, in an independent component sourced in ventral occipital cortex. Psychophysical thresholds for coherent motion in the ASC group were slightly elevated, with much greater variance than the controls.

Conclusions: In typically developing people, performance on a social task of face-recognition is related to electrophysiological measures of a non-social target detection task. Such a relationship suggests overlapping cortical networks for each of these task domains, social and non-social. Similar go/no-go behavioural performance in all groups suggests that the physiological differences may be the more fundamental ones, and these physiological results are consistent with fMRI results of early posterior and delayed frontal activations during visual attention in ASC probands and siblings.

110.091 197 Respiratory Sinus Arrhythmia: A Marker of Positive Functioning In Children with Autism Spectrum Disorders. M. A. Patriquin*[1], A. Scarpa[1], B. H. Friedman[1] and S. W. Porges[2], (1)*Virginia Tech*, (2)*University of Illinois at Chicago*

Background: Children with autism spectrum disorders (ASD) have difficulties modulating social behavior, including eye-to-eye gaze, vocalizations, and facial affect (American Psychiatric Association, 2000). Physiologically, children with ASD have less cardiac vagal tone relative to typically developing peers (Bal et al., 2010; Van Hecke et al., 2009). The Polyvagal Theory (e.g., Porges, 2007) suggests a neurobehavioral link between poor vagal regulation and social engagement deficits. The theory defines three neural circuits that provide adaptive responses to safe (social) interactions, danger, and life threat. These distinct pathways form a phylogenetically organized hierarchy with the most recent circuit supporting social communication involving a myelinated branch of the vagus and the striated muscles of the face and head. This network can be monitored by quantifying respiratory sinus arrhythmia (RSA), a measure of myelinated vagal influence on the heart. In ASD, low RSA has been related to function (e.g., Van Hecke et al., 2009) and problems with social engagement (Bal et al., 2010). We sought to replicate findings of RSA as a “marker” of positive social engagement in ASD and to extend this literature by examining the relationship between RSA and cognitive ability.

Objectives: In accord with the Polyvagal Theory, we predicted higher RSA would be associated with increased joint attention and higher cognitive functioning, as measured by receptive vocabulary scores on the Peabody Picture Vocabulary Test (PPVT-III).

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 diagnoses of Autistic Disorder (n = 12), Asperger’s Syndrome (n = 10), or Pervasive Developmental Disorder - Not Otherwise Specified (n = 1). Heart period (HP) data were edited with CardioEdit and CardioBatch (Brain-Body

Center, University of Illinois at Chicago; Porges, 1985). Data were analyzed to generate measures of RSA as a functional index of the myelinated vagus. Participants were administered the PPVT-III. After, baseline HP data (i.e., for the RSA analyses) were collected during a neutral 3-minute video with the LifeShirt® heart monitor. Then, children engaged in 10 minutes of structured play tasks, using the Social Interaction Coding Scale (SICS; Bazhenova, 2006). Frequency of joint attention was coded from the SICS.

Results: Higher RSA was significantly correlated with higher cognitive functioning (r = .44, p = .04) and increased joint attention (r = .48, p = .03). HP, however, did not show significant relationships with these measures (cognitive functioning: r = .36, p = .09; joint attention: r = .17, p = .47).

Conclusions: Higher RSA was related to better social and cognitive functioning as assessed by increased joint attention and higher receptive vocabulary skills, but HP was not. This suggests that RSA, as an index of myelinated vagus activity and the functional competence of the Social Engagement Systems, provides a unique neurophysiological portal into social and cognitive functioning. The results provide further evidence that vagal regulation of the heart is a marker for positive social and cognitive functioning in children with ASD.

134.077 197A Reduced Representational Momentum for Subtle Dynamic Facial Expressions In Autism Spectrum Disorders. S. Uono*, W. Sato and M. Toichi, *Kyoto University*

Background: Individuals with ASD are impaired in social communication via emotional facial expressions. Previous research have investigated facial expression processing in ASD, but reported inconsistent findings. Almost all of these studies used static facial expressions as stimuli. Emotional communication in daily life is mainly based on dynamic facial cues. A growing body of literature has shown that dynamic facial expressions enhance various psychological activities. The findings suggest that individuals with ASD may evidently have difficulty processing of dynamic facial expressions. A recent study (Yoshikawa & Sato, 2008) identified the representational momentum (RM) for dynamic facial expression. The study found that participants perceived the last image of dynamic facial expressions to be more emotionally exaggerated than the static facial expression.

Objectives: We examined the RM for dynamic facial expressions, which indicates more exaggerated subjective perception of last images of dynamic than static facial expressions. Based on the evidence that individuals with ASD are impaired in social communication via emotional facial expressions, we predicted that individuals with ASD show reduced RM for dynamic facial expressions

Methods: 12 individuals with ASD and 12 age- and gender-matched typically developing controls were participated in this study. We presented a total of 14, 20, and 26 image frames in succession in subtle (52%), medium (80%), and intense (108%) condition, respectively. In dynamic condition, each flame was presented for 10 ms. In static conditions, the last frame of dynamic facial expressions was presented. The total presentation time is the same as those of dynamic facial expression conditions corresponding with the intensity. Participants were asked to match a changeable emotional face display with the last image of presented dynamic and static facial expressions.

Results: The ratios between the intensity of responded and presented images were calculated and subjected to the group × presentation × intensity ANOVA. Most important, the results revealed a significant three-way interaction ($F(2,44) = 5.19$, $p < 0.05$). Follow-up analysis revealed that the simple interactions between group and presentation condition were significant only in 52% condition ($F(1,66) = 12.03$, $p < 0.05$). Follow-up simple-simple main effect analysis of group in 52% condition revealed that typically developing controls perceived more exaggerated images than individuals with ASD did in the dynamic condition ($F(1,132) = 6.27$, $p < 0.05$), but not in the static condition ($p > 0.10$).

Conclusions: Our results revealed reduced RM for subtle dynamic facial expressions in ASD. This group difference is in line with previous studies suggesting that dynamic information is more important for the processing of subtle, than intense, emotional expressions. Facial expressions are often displayed with subtle intensity in daily life communication. The RM for dynamic facial expressions might be useful to detect emotion in another's face, and to predict the behavior what person will take and the sudden change in the environment. The reduced RM for subtle dynamic facial expressions might prevent individuals with ASD to interact other people smoothly in real life communication.

Keynote Address Program

111 The Developmental Neurobiology of Autism: The First Steps and the Road Ahead

Speaker: E. Courchesne *University of California, San Diego*

Studies that identify early neurobiological defects in autism will open new avenues for iPS cell, animal model, postmortem and genetic research on autism. Knowledge gained from such developmental research will be essential to developing early biomarkers of risk for autism. Such knowledge will also be essential to developing behavioral and biotherapeutic treatments that ameliorate consequences of brain maldevelopment and enable optimal clinical outcome for each affected individual.

111.001 The Developmental Neurobiology of Autism: The First Steps and the Road Ahead. E. Courchesne*, *University of California, San Diego*

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Invited Educational Symposium Program
112 Adults with Autism Spectrum Disorders: Challenges for Epidemiological and Outcome Research
Moderator: P. Howlin *Institute of Psychiatry, King's College London*

Over recent decades there have been significant advances in diagnostic, epidemiological and intervention research involving children with autism. In contrast, the quality of adult ASD research is far more limited. Instruments that can be used reliably, either in research or clinical practice, to diagnose ASD in adults are few; there are no prevalence studies in adulthood that approach the standards of epidemiological research in children, and large randomised control trials of psychological interventions for adults are lacking. Knowledge about trajectories of development from child to adulthood, or of factors related to outcome is also limited. The proposed educational symposium will address issues related to the development of reliable and valid adult diagnostic measures; the need for studies of adult prevalence, and the clinical and social importance of longitudinal research on trajectories of development from child to adulthood.

112.001 Adults with Autism Spectrum Disorders: Challenges for Epidemiological and Outcome Research. P. Howlin*[1], T. S. Brugha[2], F. Scott[3] and M. M. Seltzer[4], (1)*Institute of Psychiatry, King's College London*, (2)*University of Leicester*, (3)*Autism Research Centre*, (4)*Waisman Center, University of Wisconsin-Madison*

112.002 Recognition, Diagnosis and Screening for ASD In Adulthood. T. S. Brugha*, *University of Leicester*

The findings from a survey of 7400 adults in the community throughout England will be used to illustrate the challenges facing screening studies, and the implications for public health services of identifying adults with unrecognised autism in the community. This is the first ever adult general population survey of autism outside clinic and treatment settings and confirms the high rates of ASD in adults, and their levels of social disadvantage.

112.003 Autism Trajectories and Outcomes In the Adult Years. M. M. Seltzer*, *Waisman Center, University of Wisconsin-Madison*

Data will be presented on the trajectories of the behavioral phenotype of ASD in adulthood, adult outcomes, and family relations. Findings are based on a 10-year study of adolescents and adults with autism and methodological issues related to conducting and analysing longitudinal research will be discussed.

112.004 Validitating ASD Instruments for Use In Screening and Prevalence Studies. F. Scott*, *Autism Research Centre*

Core issues around the strengths and limitations of using standardised instruments in ASD prevalence research will be addressed. This presentation will focus on the novel use of the Autism Diagnostic Observation Schedule in an adult sample initially identified from a general population screening study. We explore whether and how the ADOS needed to be adapted, and discuss how this may affect its validity and reliability.

112.005 Outcomes and Needs In Mid-Later Adulthood. P. Howlin*, *Institute of Psychiatry, King's College London*

The final presentation will focus on early predictors of adult outcome; the implications of findings from studies of older adults for existing adult services, and the impact on elderly parent carers. The results of a 40 year longitudinal study of 60 individuals with ASD (all of whom were of normal non-verbal IQ as children and now aged up to 65 years) will be discussed in the light of other recent long-term follow-up studies.

Treatments Program
113 Interventions: Psychopharmacology, Predictors, and Other Outcome and Related Factors
Moderator: C. McDougle *Indiana University School of Medicine*

113.001 A Pilot Naturalistic Trial of Acamprosate In Idiopathic and Fragile X-Associated Autism Spectrum Disorders. L. Wink*[1], C. A. Erickson[2], M. Early[3], K. A. Stigler[2] and C. McDougle[2], (1), (2)*Indiana University School of Medicine*, (3)*Notre Dame University*

Background: The central impairment in autism spectrum disorders (ASDs) is a disturbance in social relatedness. In persons with ASD, numerous systematic drug trials targeting core social impairment have yielded negative results. Acamprosate is approved for use in adults with alcohol dependence. Acamprosate has a novel mechanism of action including potential modulation of metabotropic glutamate receptor type 5 (mGluR5) and GABA neurotransmission. Dysregulation in glutamate and GABA neurotransmission has been implicated in the pathophysiology of idiopathic ASDs. Fragile X syndrome (FXS) is the most common single gene cause of ASDs. Excessive mGluR5 neurotransmission has been demonstrated in animal models of FXS.

Objectives: To complete a naturalistic pilot investigation of acamprosate in youth with idiopathic and FXS-associated ASDs.

Methods: Subjects were the first 13 persons with ASD treated with acamprosate at our clinic. Concomitant psychotropic drug use (except glutamatergic agents) was allowed with stable dosing for at least 8 weeks prior to the trial. Acamprosate was dosed starting at 333 mg per day increased as tolerated weekly by 333 mg/day up to a maximum of 1332 mg/day (weight ≤ 50 kg) or 1998 mg/day (weight ≥ 50 kg). Rating measures including the Aberrant Behavior Checklist (ABC), Clinical Global Impressions Improvement (CGI-I) and Severity (CGI-S) subscales, and Social Responsiveness Scale (SRS) were prospectively obtained at baseline, four weeks, eight weeks, and at last clinical visit. Treatment response was defined by a ≥ 30% improvement on the Social Withdrawal subscale of the ABC and a CGI-I score of 1 “very much improved” or 2 “much improved”.

Results: The treatment group included 7 persons (6 adults, 1 youth) with FXS-associated ASD, and 6 youth with idiopathic autistic disorder. Mean age for subjects with FXS-associated ASD was 20 ± 6.5 years, and 9.8 ± 2.4 years for those with idiopathic ASD; group mean 15 ± 7 years. Mean acamprosate dosing was 1284 ± 520 mg/day. Mean length of treatment was 22 ± 11.6 weeks. Mean CGI-I score at end point was 2; “much improved”. CGI-S scores changed from a mean of 4.29 ± 0.47 at baseline to 3.57 ± 0.51 at endpoint ($p< 0.0001$; effect size= 1.46). The ABC-Social Withdrawal subscale scores changed from a mean 15.2 ± 6.4 at baseline to 8.2 ± 4.8 at endpoint ($p<0.0001$; effect size= 1.57). The SRS total raw score changed from a baseline mean of 104.2 ± 22 to 89.5 ± 22.7 at endpoint ($p<0.001$; effect size= 0.7). Using our definition of treatment response, 10 of 13 subjects (77%) were treatment responders. Separate analysis of subjects with FXS-associated or idiopathic ASD did not yield significantly different results on any measure employed. Acamprosate was well tolerated with no drug discontinuations due to adverse effects noted. Adverse effects experienced by six (43%) subjects were primarily related to gastrointestinal function including nausea (n=4), reduced appetite (n=2), diarrhea (n=1), and sedation (n=1).

Conclusions: Acamprosate shows initial potential to improve social behavior in persons with ASD. Future systematic controlled study of acamprosate in FXS and idiopathic ASDs is warranted.

113.002 Stimulant Treatment Is Associated with Improvements In ADHD Symptoms—and Not with Increased Irritability or Social Problems—In Children with ASD with 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. Mansour[1], D. Lane[4] and S. Ezzell[1], (1)*University of Texas Medical School at Houston*, (2)*Ohio State University*, (3)*Carolina NeuroSolutions, LLC*, (4)*Rice University*

Background: Although psychostimulant treatment of ADHD symptoms in children with ASD has been shown to reduce symptoms of hyperactivity, and to some extent improve cognition, it has also been associated with undesirable increases in irritability and social withdrawal. To date, little is known regarding the behavioral effects of extended release stimulant medication, the current standard of treatment, in children with ASD and significant ADHD symptomatology.

Objectives: The primary objectives of this study were to to examine the effectiveness of extended release methylphenidate (MPH) on behavioral 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 behavioral declines) at higher doses.

Methods: The behavioral effects of four doses of MPH were investigated using a within-subject, crossover, placebo-controlled design in 24 children (mean: CA=8.6 yrs, FSIQ=84) 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. Parent and teacher behavioral ratings were obtained at each MPH dose.

Results: Both parents and teachers noted significant declines in symptoms of hyperactivity and impulsivity with MPH treatment. Although parents reported significant improvements in attention and social skills, teachers saw less evidence of improvement in these areas. Higher doses of MPH were associated with successive improvements in behavior. Interestingly, there was no increase in irritable behavior at higher MPH doses—in fact, there was a significant decline in irritability across the MPH dose range examined in this study. There was also no evidence of decline in social function with increasing MPH doses.

Conclusions: Our findings suggest that stimulant treatment using extended release MPH in children with ASD and significant symptoms of ADHD is associated with significant improvement in ADHD symptomatology, particularly with regard to hyperactivity and impulsivity. Interestingly, a comparison of parent and teacher ratings suggest that the effects of MPH treatment on attention and social skills may be somewhat less consistent between the home and school settings. These findings suggest that both parent and teachers provide crucial pieces of information when titrating MPH treatment in children with ASD who have significant ADHD symptomatology.

113.003 Parent and Teacher Perceptions of Important Behaviors for Change. T. Newton*[1], J. Ballard[2], A. de Bildt[3], M. Thompson[4], S. Stephens[5], C. M. Johnson[6], J. Palilla[1] and M. South[1], (1)*Brigham Young University*, (2)*Center for Change*, (3)*University Medical Center Groningen*, (4)*Nebo School District*, (5)*Giant Steps Preschool*, (6)*Wasatch Mental Health*

Background:

As the number of children diagnosed with ASDs increases, so too does the need for identifying effective treatments for the multiple concerns associated with these conditions. Due to the comorbidity of maladaptive behaviors including aggression and tantrums, the behaviors most important to target for change may or may not be part of the core symptoms of autism. Parents and teachers are in the best position to report outcome change over time, and information on the stability of behaviors across contexts is critical for effective program planning and monitoring (Yoder, 2008), especially including home and school contexts.

Objectives:

The purpose of this study was to determine which behaviors are most important to target for change during treatment, according to parents and educators of preschoolers age 3-5 who are diagnosed with an ASD.

Methods:

We conducted 2 focus groups (n = 16) with educational and administrative staff of autism-specific preschools (one group for each school); and 3 focus groups with parents (n = 19) of children at those schools. Guiding questions addressed a) which behaviors are most important and relevant in parents'/teachers' daily lives and b) ideas for specific questions to include in new measures. Participants were also given a copy of the Preschool Outcome Questionnaire (POQ; Wells and Plenk, 2002) and were asked to rate the relevancy of each question for evaluating the everyday behavior of the children. Data was analyzed by categorizing problematic behaviors discussed by participants from audio recordings as well as relevancy ratings from the POQ.

Results:

The five separate groups demonstrated remarkable consistency in their focus on several behavioral categories, including concerns about tantrums and aggression, and understanding instructions. Parents were much more likely to be concerned about communication skills while educational staff members were more concerned about attending behaviors. While many of the concerns participants mentioned were specific to autism (for example, communication and understanding social cues are closely aligned with the DSM-IV criteria of "impairments in social interaction and communication"), many of the participants' concerns were more general. Concerns about potty training or tantrums, for example, are not specific to ASDs. The POQ shows potential to measure behaviors that this sample deemed to be important, but would need extensive revision to capture additional areas of concern and to remove items that are not deemed important to everyday life.

Conclusions:

Although many behaviors mentioned in these focus groups are non-specific to autism, they lead to significant everyday challenges for parents and professionals who are closest to the children. Analysis of existing survey measures reveals these measures often fail to adequately address several key behaviors highlighted in the focus groups. Future treatment outcome measures should clearly address these and other topics important to parents and education staff.

113.004 Predicting Improvement In Social/Communication Symptoms of ASD Using Retrospective Treatment Data. M. O. Mazurek*[1] and S. M. Kanne[2], (1)*University of Missouri - Columbia*, (2)*Thompson Center for Autism and Neurodevelopmental Disorders*

Background:

Studies examining change over time in symptoms of autism spectrum disorders (ASD) have reported mixed findings depending on sample and design. Some have shown improvement in social/communication abilities, while others have shown worsening social impairment. Although early language and IQ have emerged as predictors of improvement in some studies, these models have not examined the role of previous treatment. Among smaller samples of young children, treatment-outcome studies have also found IQ and early language to be predictors of response to therapy; however, these findings have not been replicated among large community-based samples or among older children and adolescents.

Objectives:

Primary objectives were to: 1) examine the developmental course of social/communication symptoms across ages among a large sample of children/adolescents with ASD, and 2) examine potential predictors of symptom improvement, particularly the roles of community-based treatment type and intensity.

Methods:

The sample included 1433 children/ adolescents with ASD (ages 6-17) who participated in the Simons Simplex Collection (SSC), a North American multi-site study involving families with only one child with ASD. Measures for the current study included the Autism Diagnostic Interview-Revised (ADI-R), IQ test, demographic information, and parent-reported treatment history (including occupational, speech, and behavioral therapy). Baseline and current social/communication symptom severity scores were calculated using sums of “current” and “age 4-5” codes for 15 relevant ADI-R items.

Results:

The majority (95%) of the sample showed at least some improvement in social/communication symptom severity. Analysis of variance (ANOVA) revealed cohort effects based on age, with older children showing greater current and historical severity, lower likelihood of having received any type of treatment, and, for those who did receive treatment, a later age at first treatment ($p<.01$). With regard to improvement in social/communication symptoms, ANOVA revealed no gender, race, or age differences. Those who received speech, behavioral, or occupational therapy demonstrated greater improvement ($p<001$); and age at first treatment was correlated with improvement ($p<.01$). Linear regression examined potential predictors of current severity, controlling for initial severity and age. Gender, race and verbal status at age 5 were not significant predictors. Significant interactions between nonverbal IQ and treatment were found ($p<.01$), with all 3 treatment types associated with greater improvement for those with higher IQ. Separate regression models examined the effect of treatment intensity on outcome. Significant IQ by treatment interactions were found for all 3 treatment types, with age at first treatment predicting improvement for speech therapy and OT.

Conclusions:

Among a large, well-characterized sample of children and adolescents with ASD, we found improvement over time in social/communication symptom severity. Treatment was associated with improvement, but effects were most pronounced for individuals with higher IQ. Earlier age at first treatment (for speech and occupational therapy) also predicted improvement. Despite the limitations of the retrospective design, this study provides important information about the course and outcomes of ASD symptoms. Future large-scale studies with prospective designs will be essential in further elucidating these issues.

113.005 Predictors of Outcome In a Large, Community-Based Intensive Behavioural Intervention Program. A. Perry*[1], A. Cummings[2], J. Dunn Geier[3], N. L. Freeman[4], S. Hughes[5], T. Managhan[6], J. A. Reitzel[7] and J. Williams[8], (1)*York University*, (2)*Kinark*, (3)*Children's Hospital of Eastern Ontario*, (4)*Toronto Partnership for Autism Services*, (5)*Pathways*, (6)*Private Practice*, (7)*McMaster Children's Hospital/McMaster University*, (8)*ErinokKids*

Predictors of Outcome in a Large, Community-based Intensive Behavioural Intervention Program

Background: Intensive Behavioural Intervention (IBI) for young children with autism is widely regarded as an efficacious treatment but much less is known about the *effectiveness* of this intervention in community settings (where it typically occurs). The Provincial IBI Effectiveness Study (Perry et al., 2008) examined outcomes in the nine programs across Ontario, Canada, and showed that the majority of children made progress but that outcomes were highly variable, a

finding reported in virtually all IBI research. Thus, it is of great importance to try and determine what accounts for this heterogeneity.

Objectives: The purpose of the study was to examine the importance of four predictors, measured at intake to IBI: age, IQ, adaptive behaviour level, and severity of autism. Outcome variables were: autism severity, adaptive behaviour, cognitive level, rate of development during IBI, and categorical outcome (seven subgroups). The second objective was to examine two subgroups further, children with the most optimal outcomes (Average Functioning) and the group who made little or no progress.

Methods: This was a retrospective, file-review study of 332 children with an ASD aged 2 to 7 at entry to treatment, whose outcomes were described by Perry et al. (2008). Measures included adaptive level using the Vineland Adaptive Behavior Scale (VABS), cognitive level using one of several cognitive tests (Mullen, Stanford-Binet, WPPSI, etc.), and autism severity using the Childhood Autism Rating Scale (CARS).

Results: All four predictors were found to be related to children's outcomes. Age at entry to IBI was an important predictor but not in a simple, linear fashion. Children who began treatment younger than 4 years, versus over 4, had significantly better outcomes on all variables (except VABS Motor). However, a comparison of the age at entry of children subsequently classified in the seven outcome groups revealed that the Average Functioning group had been substantially younger at entry and none of the other groups differed from one another. Cognitive level (available for a subset of children) was a strong predictor and, in regression analyses, accounted for the largest proportion of variance in outcomes. Adaptive level was also a predictor of most outcomes. Autism severity was a significant predictor but accounted for quite a small amount of variance. Regarding the second objective, there was a fairly clear set of predictors for children who had achieved Average Functioning (they were younger, milder, and higher functioning) but initial variables were *not* found to be good predictors of children who had experienced poor outcomes.

Conclusions: All four predictors were found to be related to children's outcomes to some extent. The results have implications for eligibility decisions (especially related to the importance of beginning intervention early). However, there was considerable heterogeneity that went unaccounted for, suggesting other child characteristics not measured here, and/or other factors such as treatment quantity/quality and family factors may also be important in accounting for children's variable outcomes.

113.006 Factors Affecting Treatment Choices by Caregivers of Children with Autism. N. A. Call*, C. H. Delfs and A. J. Findley, *Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*

Background: Although it is clear that empirically unsupported treatments for autism are utilized, it is unclear how many individuals receive supported versus unsupported interventions. It is also clear that a variety of factors influence caregiver choices about the interventions they use. A deeper understanding of what interventions caregivers use and why they choose the ones they do is important to those who develop, evaluate, and use interventions for autism. Although treatment choices are likely impacted by restrictions on resources and availability, it is unknown the extent to which they impact caregiver choice of treatment. Perceived delay to treatment outcome may be another factor that contravenes the impact of empirical support on caregiver choice of treatment. That is, some empirically supported interventions take significant amounts of time to achieve meaningful progress. The delay from onset of intervention to achieving treatment goals may cause caregivers to perceive such treatments as less valuable.

Objectives: This study endeavored to answer the following questions:

1. What treatments do caregivers of children with autism currently use?
2. What treatments would caregivers use if resources and availability were not restricting their choices?
3. To what extent are choices about treatment influenced by empirical support relative to the immediacy of the outcomes of those treatments?

Methods: Caregivers of children diagnosed with autism served as participants. A literature review identified 206 treatments. Participants completed a questionnaire in which they indicated how knowledgeable they were about each treatment and how effective they perceived each treatment to be. Part 1: Participants were asked which of the 206 treatments they *currently* use. For each treatment selected, they were given two tokens to distribute among those treatments in proportion to how they allocate the resources (time, money, etc.) they currently expend on treatments. Part2: Replicated Part 1 with the exception that participants were asked which treatments

they *would* use if their choices were unconstrained by resources and availability. They were given 6 tokens per selected treatment to distribute as in Part 1. Part 3: Participants distributed 22 tokens among 11 treatments that varied in inverse proportion along two continua: degree of empirical support and delay to treatment outcome.

Results: Part1: The number of treatments currently used ranged between two and 12 (M= 7.8). Caregivers primarily use treatments they believed were effective and about which they believed they were very knowledgeable. Part 2: When unconstrained by resources or availability all caregivers increased the number of treatments they would use (M = 40.8; range, 21 to 58), and their overall knowledge and perceptions of efficacy for those additional treatments decreased significantly. Part 3: Significantly more participants responded in a manner suggesting that their choice of treatment is influenced by empirical support than by immediacy.

Conclusions: Caregivers choice of treatment appeared to be highly constrained by available resources. In addition, many individual participants paradoxically reported a tendency to be more influenced by empirical support than immediacy on Part3, but their actual choice of current treatments or unconstrained treatments contradicted that result in Parts 1 & 2.

113.007 The Therapeutic Alliance In a Social Skills Intervention for Adolescents with ASDs. M. D. Lerner* and M. Anthony, *University of Virginia*

Background: While social skills interventions (SSIs) for youth with autism spectrum disorders (ASDs) have recently accumulated sufficient evidence to be considered "empirically-supported" (Reichow & Volkmar, 2009), the essential therapeutic ingredients remain unknown. The relationship with those administering such interventions may represent such an ingredient (Gutstein & Sheely, 2002). That the relationship is a mechanism of therapeutic change is consonant with established literature on the therapeutic alliance. Alliance relates to outcomes in child psychotherapy (Shirk & Karver, 2003), is influenced by therapist experience with target populations (Ackerman & Hilsenroth, 2003), and may play a role in friendship-making in SSIs for other populations (Lerner, Mikami, & McLeod, *in press*). However, alliance has never been examined in SSIs for youth with ASDs. Identifying the role of alliance in this population could provide direction in unpacking essential components of SSIs for this population.

Objectives: 1. To examine baseline therapist characteristics related to alliance. 2. To assess the contribution of alliance to change in treatment outcomes.

Methods: Thirty-four youth (9 – 16 years; 23 male), primarily with ASDs, in a 6-week summer SSI with an explicit focus on fostering child-therapist relationships (Lerner, Mikami, & Levine, 2011) completed reports of their social skills (Social Skills Rating System; Gresham & Elliott, 1990) and social anxiety (Social Anxiety Scales; La Greca, 1999) immediately before and after the SSI. Additionally, they completed blinded sociometric ratings of their peers in their SSI group (Coie, Dodge, & Coppotelli, 1982), and alliance with group therapist (Therapeutic Alliance Scale for Children; Shirk & Saiz, 1992) after the first (early) and last (endpoint) week of the program. Their parents completed a baseline measure of child autism symptoms (Social Responsiveness Scale; Constantino & Gruber, 2005).

Results: Hierarchical Linear Modeling was used to control for nesting within therapists, and past experience with the rated therapist was controlled in all models. To assess Objective 1, after controlling for therapist gender and education, years of therapist experience with ASDs predicted higher early alliance (β_{04} = .11, p <.01), and therapist age predicted lower early alliance (β_{02} = -.02, p = .03). To assess Objective 2, after controlling for child autistic symptoms and early sociometric ratings, early alliance predicted increased friendship (β_{10} = .21, p < .01) and reciprocated friendship nominations (β_{10} = .15, p = .01), but not social preference (β_{10} = -0.01, p = .91). Additional analyses for Objective 2 were unavailable at time of submission, but will be available for conference presentation.

Conclusions: Therapist experience with ASDs predicted higher early child alliance, while therapist age predicted lower early alliance. Additionally, youth reporting higher early alliance increased in the number of reciprocated friends they made in the SSI relative to those with lower early alliance. These results suggest that alliance may play a role in friendship-making in SSIs for ASD populations, but vary based on therapist characteristics. Additional analyses predicting therapeutic change may augment these initial promising findings. Future research should expand upon this initial investigation into this underexplored treatment mechanism in SSIs for ASD populations.

113.008 Using Automated Audio Analysis to Assess Daily Vocal Interaction Patterns In Young Children with Autism. J. Gilkerson*[1], J. A. Richards[1] and D. Xu[2], (1)*LENA Foundation*, (2)

Background:

Children with Autism Spectrum Disorders (ASD) exhibit functional impairments in communication and social interaction. Assessment of these characteristics generally relies on professional observation, but unfamiliar clinical settings coupled with the need to interact with one or more strangers may influence a child's behavior during evaluation, potentially reducing the validity of the assessment. This problem can be eradicated by recent advancements in hardware and software technology that make it possible to collect a large volume of interaction data unobtrusively within a natural environment via digital audio recording, and to label and analyze these data automatically using speech recognition technology and statistical algorithms. Previously published research using such technology indicated that children with ASD differed from typically developing (TD) children on frequency of monologues and interactions with adults (Warren et al., 2009). Additional investigation showed that the frequency with which TD children initiate verbal interactions increases with age but found no such correlational patterns among children with ASD (Gilkerson, Richards & Xu, 2010).

Objectives:

The current study expands on prior work using these technologies to provide additional analyses of daily interaction patterns of children with ASD. Specifically, we examined child monologues (CMs) and child-initiated conversations (CICs) in relation to various symptom and performance measures. We also compared these interaction indicators during versus outside therapy sessions.

Methods:

The current sample includes 79 children 16-48 months of age diagnosed with autism (ASD). Participants wore a lightweight digital recorder that captured all their vocalizations and interactions throughout a 12-hour day, both in the naturalistic home environment and during therapy sessions. The included 383 recordings (4,596 hours) were processed using the LENA (Language Environment Analysis) framework to quantify child vocalizations and other details of the child's language environment. The software automatically identified periods of single speaker vocalization (child and adult monologues) and conversational interactions (parent/child alternations bounded by >5 seconds of non-interaction).The current analysis examines these daily interactional patterns (CICs and CMs) in relation to SCQ, M-CHAT, BRIEF-P and CSBS scores, and to behavior during and outside of intervention.

Results:

Age-standardized CIC frequency correlated negatively with SCQ ($r(75)=-.33, p<.01$) and M-CHAT ($r(77)=-.26, p<.05$) totals and positively with all three CSBS Composites: Social ($r(75)=.32, p<.01$), Speech ($r(75)=.59, p<.01$), and Symbolic ($r(75)=.43, p<.01$). Age-standardized CIC duration correlated positively with two CSBS Composites: Speech ($r(75)=.44, p<.01$), and Symbolic ($r(75)=.28, p<.05$) and with the Emergent Metacognition Index of the BRIEF-P ($r(31)=.48, p<.01$). The Inhibit scale of the BRIEF-P correlated negatively with both age-standardized CM frequency ($r(31)=-.37, p<.05$) and duration ($r(31)=-.44, p<.01$), and CM duration correlated positively with the CSBS Speech Composite ($r(75)=.30, p<.01$). Children produced significantly more CICs per hour during therapy sessions than on non-therapy days ($t(50)=4.65$, $p<.01$).

Conclusions:

These results demonstrate that automated audio analysis can provide meaningful information about children's daily interaction patterns within the natural home environment, and potentially can inform both evaluation and treatment of children with ASD. This presentation will discuss how automated analysis of conversation patterns could be used in a research and clinical capacity, both to measure intervention progress and as a supplement to assess symptom severity.

Genetics Program
114 Genetics, From Syndromes to GWAS
Moderator: J. Hallmayer *Stanford University*

114.001 Neuropathology of Idiopathic Autism and Autism Associated with Chromosome 15 Duplication. J. Wegiel*, I. Kuchna, K. Nowicki, S. Y. Ma, J. Wegiel, J. Frackowiak, B. Mazur- Kolecka, E. Marchi, I. L. Cohen, E. London, W. T. Brown and T. Wisniewski, *New York State Institute for Basic Research in Developmental Disabilities*

Background: Substantial evidence suggests that chromosomal abnormalities contribute to the risk of autism. Duplication of chromosome 15 (Dup15), characterized by alterations of the multi-disorder critical region (15q1-q13) is detected in from 1% to 4% of autism cases (Cook 1998, Gillberg, 1998). These genetic abnormalities are usually associated with autism, mental retardation (often profound), seizures, and increased risk of sudden death (Baker et al 1994, Bundey et al 1994). In idiopathic autism abnormalities of neurogenesis, neuronal migration and dysplastic changes were reported in 92% of

brains (Wegiel et al 2010) but neuropathology of Dup15 is not known. One may speculate that neuropathological studies of brains of subjects with autism and related disorders will help to identify common forms of pathology with major contribution to autism phenotype and comorbidity-associated modifications.

Objectives: The aim of this study is to detect differences between pattern of pathological changes in the brain of subjects with idiopathic autism and Dup15.

Methods: One brain hemisphere of 10 subjects diagnosed with idiopathic autism and 9 subjects with chromosome 15 duplication was fixed in formalin, dehydrated, embedded in polyethylene glycol (PEG) and cut into 50-µm thick serial hemispheric sections. In extended neuropathological protocol more than 220 serial hemispheric sections stained with cresyl violet or immunostained were examined in each case.

Results: Sudden unexpected death was more often in Dup15 cohort. Brain weight was lower by 295 g (1,234 g versus 1,529 g) than in idiopathic autism. In both cohorts defects of neurogenesis (subependymal nodular dysplasia), neuronal migration (heterotopias) and dysplastic changes were observed. However, Dup15 cohort was affected by a broader spectrum of dysplastic changes in neocortex, hippocampus, amygdala and cerebellum, and focal abnormalities were more numerous. Significantly smaller volume of neurons and neuronal nuclei was another marker of developmental defects in Dup15. Numerous corpora amylacea, accumulation of Aβ-positive rod-like inclusions in neuronal processes in the stratum lacunosum moleculare, and excessive cytoplasmic accumulation of amino-terminally truncated Aβ appear to be the marker of metabolic alterations leading to neurodegeneration. Signs of glial proliferation and activation in the subependymal and in subpial zone indicate that glia are also involved in developmental alterations in Dup15.

Conclusions: Dup15 cohort is characterized by a high prevalence of sudden unexpected death, lower brain weight, broader spectrum and severity of developmental alterations, degenerative changes and glial proliferation and activation. Common defects of migration and dysplastic changes may contribute to high prevalence of epilepsy, including intractable seizures.

114.002 Intergenerational Transmission of Quantitative Autism Traits In the General Population and Autism Families.

J. Steyaert*[1], W. De la Marche[2], I. Noens[1], E. M. Scholte[3], H. Peeters[1] and K. Devriendt[1], (1)*Katholieke Universiteit Leuven*, (2)*UPC-K.U.Leuven, campus Gasthuisberg*, (3)*Leiden University, Social and Behavioral Sciences*

Background:

Although autism spectrum disorders (ASD) are highly heritable, the genetic background remains largely unclear. Additive genetic effects of risk alleles, each having small effect sizes, have been hypothesized to cause ASD in at least a portion of affected families. Quantitative autism traits (QAT) are continuously distributed and moderately heritable in the general population. Although there is some debate on this matter, unaffected family members of children with ASD possibly show higher levels of QAT than general population controls. This has led to the assumption that QAT in the general population and full ASD might share the same genetic background. To our knowledge, only Constantino and Todd (2005) have ever directly assessed the intergenerational transmission of specific autism traits: children from parents with high levels of QAT appeared to have higher scores on the Social Responsiveness Scale (SRS) compared to children from low scoring parents in the general population.

Objectives:

1) To test the hypothesis of intergenerational transmission of QAT in the general population.

2) To study the intergenerational transmission of QAT in ASD families to affected and unaffected children.

3) To gain new insights in the genetic mechanisms underlying QAT in both affected and unaffected children.

Methods:

We collected SRS data on 280 parents-child trios from the general population. From the families participating in studies from Leuven Autism Research, we selected 96 parents-'child with ASD' trios and 65 parents-'unaffected sibling' trios, excluding children with intellectual disability and including only full siblings and biological parents. Using general linear models, we analyzed the effect of parent SRS scores, the effect of a parent scoring in the highest versus the lowest quartile of SRS scores and the effect of the number of high scoring parents on the SRS total score of the children, for the general population, unaffected siblings and children with ASD separately.

Results:

In the general population trios, the SRS scores of both father and mother had a significant effect on the child's SRS score.

Children of parents with an SRS score in the highest quartile had significantly higher SRS scores compared to children of parents with a lowest quartile SRS score. There was no difference in SRS scores of children with two compared to one high scoring parent, but both groups had higher SRS scores than children with no high scoring parents. Results were very similar in the unaffected siblings in ASD families. However, none of the independent variables had a significant effect on SRS scores of children with ASD.

Conclusions:

The intergenerational transmission of QAT is very similar in the general population and in unaffected siblings of ASD families. However, there seems to be no effect of the QAT of parents on the QAT of children with ASD. These results might indicate that QAT measured in the general population and QAT in unaffected family members of ASD families share the same genetic background, but that in subjects with ASD other genetic or non-genetic factors play an additional or dominant role.

114.003 Understanding Clinical Variability In Autism: Results From a California Twin Study. W. Froehlich*[1], S. Cleveland[1], A. Torres[1], J. M. Phillips[1], B. Cohen[2], A. Fedele[3], T. Torigoe[2], J. Collins[4], K. S. Smith[5], L. Lotspeich[1], L. A. Croen[4], S. Ozonoff[6], C. Lajonchere[3], J. K. Grether[5], N. Risch[7] and J. Hallmayer[1], (1)*Stanford University*, (2)*Autism Genetic Resource Exchange*, (3)*Autism Speaks*, (4)*Kaiser Permanente, Division of Research*, (5)*California Department of Public Health*, (6)*UC Davis MIND Institute*, (7)*University of California San Francisco*

Background: Autism spectrum disorder (ASD) is characterized by a range of behavioral deficits in several domains. One question is whether ASD represents a distinct clinical entity or simply the tail of a continuous distribution of behavioral traits. A second question is the etiologic basis (genetic versus environmental) for the continuous gradient of severity observed in ASD. Both questions can be addressed by a twin study.

Objectives: To use objective measures of behavior based on direct assessment of MZ and DZ twins to determine whether clusters can be defined based on these measures that correlate with diagnosis, and the degree to which affected MZ and DZ twin pairs and discordant MZ and DZ pairs are correlated for these measures, and factor scores representing severity derived from them.

Methods: 210 twin pairs (60 MZ; 150 DZ) with at least one twin carrying a clinical diagnosis of ASD were assessed using the Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview-Revised (ADI-R), Stanford-Binet and/or Mullen Early Learning Scales, Vineland Adaptive Behaviors Scale (VABS), Social Responsiveness Scale (SRS), and Peabody Picture Vocabulary Test (PPVT). Statistical analysis included cluster analysis and factor analysis, as well as intraclass and interclass correlations and comparison of group means for quantitative variables (Full Scale IQ, Nonverbal IQ, Verbal IQ, VABS composite score, PPVT composite score, SRS T-score, and ADOS severity score.)

Results: Cluster analysis of the quantitative variables first sorted twins into two distinct clusters that correlated very highly with ASD diagnosis. Additional clusters were defined along a single continuously distributed severity gradient across all quantitative measures within the affected subjects. Factor analysis suggested that variability amongst the twins with ASD was largely attributable to a single factor based on IQ, VABS composite score, and PPVT composite score. For concordant ASD twin pairs, intraclass correlations of quantitative variables and the derived severity factor were highly significant and comparable in monozygotic (MZ) pairs (average r of 0.52) and dizygotic (DZ) pairs (average r of 0.479) . Correlations were not significantly higher in MZ as compared to DZ twins. Similarly, interclass correlations between affected and unaffected twins in discordant pairs for the quantitative variables were high and comparable for the MZ and DZ pairs. Comparisons of group means demonstrated that MZ twins appear to be more severely affected than DZ twins on all quantitative variables; this was true for both the affected and unaffected twins.

Conclusions: ASD appears to be a discrete clinical entity rather than the tail of a continuous behavior distribution. However, there appears to be a single continuous severity gradient affecting all aspects of behavior characteristic of ASD among affected individuals. Although twins correlate with one another with regards to severity, the correlations are relatively equal in MZ and DZ twins indicating that severity itself is not inherited. Rather, severity is likely due to environmental factors shared by twins. Additionally, MZ twins appear to be more severely affected than DZ twins suggesting that monozygosity may be an environmental risk factor for the development of ASD and its severity.

114.004 Reanalysis of Published Genome-Wide Association Data From the Autism Genetics Resource Exchange (AGRE): The Use of Quantitative Traits and Subphenotypes for Association Analyses Reveals Novel Autism Subtype-Dependent Genetic Polymorphisms. V.

Hu*[1], A. M. Addington[2] and A. Hyman[1], (1)*The George Washington University Medical Center*, (2)*NIMH, NIH*

Background: The heterogeneity of symptoms associated with autism spectrum disorders (ASD) has presented a significant challenge to genetic analyses. Even when associations with genetic variants have been identified, it has been difficult to associate them with a specific trait or characteristic of autism.

Objectives: The primary objectives of this study were: 1) to assess the potential of quantitative trait association analyses coupled with subphenotype analyses to uncover novel single nucleotide polymorphisms (SNPs) associated with ASD; 2) to examine the genetic heterogeneity of the ASD population with regard to the identified SNPs.

Methods: Genome-wide association data from the study by Wang et al. (*Nature* 459: 528-533, 2009) was downloaded from the Autism Speaks website at ftp://ftp.autismspeaks.org/Data/CHOP_PLINK/AGRERELEASE.ped. The file named CHOP.clean100121 where the data was "cleaned" by Jennifer K. Lowe in the laboratory of Daniel H. Geschwind (UCLA) was used for this analysis. Raw ADI-R scores for subjects in this study were obtained through Dr. Vlad Kustanovich of AGRE. Quantitative traits were determined for each individual by summing relevant ADI-R item scores, and ASD subtypes were identified through cluster analyses, both as described by Hu and Steinberg (*Autism Res*. 2:67-77, 2009). PLINK software (Purcell et al., *Am. J. Hum Genet*. 81: 559-575, 2007) was used for all association analyses.

Results: We demonstrate that quantitative trait analyses of ASD symptoms combined with case-control association analyses using distinct ASD subphenotypes identified on the basis of symptomatic profiles results in the identification of statistically significant associations with 18 novel single nucleotide polymorphisms (SNPs). The symptom categories included deficits in language usage, non-verbal communication, social development, and play skills, as well as insistence on sameness or ritualistic behaviors. Ten of the trait-associated SNPs, or quantitative trait loci (QTL), were associated with more than one subtype, providing replication of the identified QTL. Several of the QTL reside within chromosomal regions associated with rare copy number variants that have been previously reported in autistic samples (Pinto et al., *Nature* 466: 368-372, 2010). Pathway analyses of the genes associated with the QTL identified in this study implicate neurological functions and disorders associated with autism pathophysiology.

Conclusions: While quantitative trait association analyses help to filter and prioritize functionally relevant SNPs, subphenotype genetic association analyses based on the identified QTL reveal the genetic heterogeneity of the ASD population. This study thus underscores the advantage of incorporating both quantitative traits as well as subphenotypes into large-scale genome-wide genetic analyses of complex disorders.

114.005 Evaluation of Copy Number Variations In Autism Spectrum Disorders. D. Ma*[1], A. J. Griswold[1], H. N. Cukier[1], J. Jaworski[1], L. D. Nations[1], D. Salyakina[1], M. A. Schmidt[1], I. Konidari[1], P. Whitehead[1], H. H. Wright[2], R. K. Abramson[2], E. R. Martin[1], J. L. Haines[3], J. R. Gilbert[1], M. L. Cuccaro[1] and M. A. Pericak-Vance[1], (1)*John P Hussman Institute for Human Genomics*, (2)*University of South Carolina*, (3)*Vanderbilt University*

Background: The genetic landscape of autism risk is far from established. However, recent studies have demonstrated a consistent correlation of rare copy number variations (CNVs) with ASDs.

Objectives: Given the extremely heterogeneous nature of ASDs, independent studies are required to identify novel candidate genes and refine previously identified genes and regions for further clarification of their potential pathogenic effect.

Methods: A genome-wide SNP-array was utilized for CNV detection in an ASD case-control dataset with samples of European ancestry. A total of 813 unrelated ASD cases and 592 unrelated healthy pediatric controls survived stringent sample and intensity quality control criteria. High confidence CNVs were identified through two distinct CNV-calling algorithms.

Results: Our results demonstrate a significantly heavier burden of deletions in cases as compared to controls, indicating that cases carry more and larger CNVs on average and that these CNVs are more likely to disrupt genes and have frequencies of less than 5%. A size-based examination reveals deletions larger than 1Mb were exclusively detected in cases, implicating novel CNV regions at 10p15.2, 13q12.12, 13q33.1, 14q23.2-3, and 17p12. CNV region- and gene-based association analyses consistently indicated the involvement of the regions containing *ASH1L, NCOA6, OMG,* and *SETDB1* in ASD risk. Gene set enrichment analysis suggested a possible link of REACT_383 [DNA replication], KEGG: hsa04612 [Antigen processing and presentation], KEGG: hsa04514 [cell adhesion molecules] and GO:0003713 [transcription coactivator activity] in ASDs. Examination of 472 rare case-

specific *de novo* CNVs revealed several novel candidate genes within several previously implicated pathways, including the ubiquitin signaling pathway (*ITCH, UBAP2, UBE2B, UBR2,*and *USP3*), neural development (*ANK2, NFASC, NMU, NRG4* and *OMG*), synaptic transmission (*RIMS2*), and members of the methyl-CpG-binding domain family (*SETDB1* and *SETDB2*).

Conclusions: Cases tend to have a heavier mutational burden, mainly from genic CNVs with rare to low frequencies. Another five potential pathogenic novel large deletions were identified in ASDs. The study further supports the potential involvement of previously implicated signaling pathways and reveals several new genes in these pathways.

114.006 Association Between Autism Spectrum Disorders (ASD) In VCFS Patients and SNPs In PRODH and COMT. P. D. Radoeva*[1], I. L. Coman[1], F. A. Middleton[1], K. M. Antshel[1], W. Fremont[1], R. J. Shprintzen[1], B. E. Morrow[2] and W. R. Kates[1], (1)*SUNY Upstate Medical University*, (2)*Albert Einstein College of Medicine*

Background: Velocardiofacial syndrome (VCFS; 22q11.2 deletion syndrome) results from a microdeletion of the 11.2 band of one copy of chromosome 22. Notably, 11% to 33% of VCFS patients have narrowly defined autism and up to about 40% have Autism Spectrum Disorders (ASD) (based on the ADI-R). Genes in the 22q11.2 region have diverse functions and many are expressed in the brain. These genes may play a role in brain development, neurotransmitter levels, and myelination. COMT (catecholamine-O-methyl transferase), for example, participates in the degradation of catecholamines (including dopamine), and affects the dopamine levels in the prefrontal cortex. Notably, the low-activity allele of COMT has been associated with social cognition impairments in VCFS patients. PRODH (proline dehydrogenase (oxidase)), another gene that is deleted on one copy of the 22q11.2 region, participates in the degradation of the amino acid proline, and the low-activity alleles of PRODH may be associated with ASD and mental retardation.

Objectives: Our goal was to explore the association between SNPs (single nucleotide polymorphisms) in COMT and PRODH on the remaining copy of chromosome 22, and ASD in VCFS patients.

Methods: We selected to study rs4680 in COMT and rs367766 (a surrogate marker in linkage disequilibrium with rs4819756 (r^2=0.833, for HapMap-CEU)) in PRODH. As part of a larger study, we genotyped rs4680 and rs367766, and conducted the ADI-R. We classified subjects as having ASD if they met criteria for qualitative impairments in reciprocal social interaction, and for deficits in either communication or repetitive behaviors and stereotyped patterns (or both). We had 60 patients on which we had both rs4680 and rs367766 genotypes, and ASD categorization. We conducted Fisher's exact tests and calculated odds ratios to look for associations between the SNPs and ASD.

Results: We found a significant association of ASD with rs367766 (Fisher's Exact test: p=0.006; OR=7.4 (95% CI=1.9-28.6)). In addition, COMT and PRODH showed an interaction, such that VCFS patients with both low-activity COMT and low-activity PRODH alleles (rs4680A and rs367766C, surrogate marker for rs4819756A, respectively) seemed more likely to have ASD, as compared to VCFS patients with high-activity COMT and high-activity PRODH alleles (Fisher's Exact test: p=0.003; OR=16 (95% CI=2.6-100.1)).

Conclusions: The combination of low-activity alleles of COMT and PRODH appear to be associated with ASD in VCFS patients, and might be a risk factor for the development of ASD in the VCFS population. Further studies could explore whether low-activity alleles of PRODH and COMT may be associated with ASD in the general population as well (ie, in individuals without a 22q11.2 deletion).

114.007 Maternally Acting Folate-Related Gene Alleles along with Maternal and Possibly Grandmaternal Folate Status May Contribute to Epigenetic Abnormalities In Autism and Down Syndrome. W. G. Johnson*[1], S. Buyske[2] and E. S. Stenroos[3], (1)*UMDNJ-RWJMS*, (2)*Rutgers University*, (3)

Background: Maternally acting gene alleles (MAGAs) are known to contribute to autism and other neurodevelopmental disorders directly, and they may contribute indirectly as well through their influence on epigenetic factors. Epigenetic factors are believed to contribute to autism and other neurodevelopmental disorders. MAGAs are a type of maternal effect where maternal alleles contribute to a disorder in the embryo/fetus whether the embryo/fetus inherits the allele or not. From the perspective of the embryo/fetus, MAGAs are an environmental effect. MAGAs may act during pregnancy to contribute to autism, but they may also in principle act before pregnancy.

Objectives: To determine whether MAGAs can act prior to pregnancy, and if so by which mechanisms, to contribute to autism and other neurodevelopmental disabilities in the embryo/fetus.

Methods: We identified reports of maternal genetic effects and excluded those resulting from: maternal environmental effects on the fetus or interacting with fetal genotypes; mitochondrial genes; microchimerism; or known genomic imprinting alone. We included MAGAs affecting phenotype of the embryo/fetus. We determined possible mechanisms of action, considering that genes may have more than one mechanism and considering the possibility of ascertainment bias.

Results: We found 67 reports of MAGAs. Since both autism and Down syndrome (DS) have epigenetic effects that may contribute to the phenotype, we focused on these disorders: 6 reports of MAGAs involved autism and 26 involved DS. Since most non-disjunction in liveborn DS individuals occurs in maternal gametes in the extended first meiotic division (which begins in the mother's own third month of gestation *in utero* and ends just before fertilization of the maternal gamete), MAGAs contributing to non-dysjunction in DS must act before pregnancy onset and possibly long before pregnancy onset. 8 MAGAs involved DS, all of them folate-related: *MTHFR*C677T, MTHFR*A1298C, MTRR*A66G, RFC1*A80G, TYMS*28bp-repeat-2R, MTHFD1*G1958A, MTR*A2756G, and TC*C776C.* 4 MAGAs involved autism, one of them folate-related: *RFC1*A60G, GSTP1*313A, HLA*DR4, and C4B*0*.

Conclusions: Since folate-related MAGAs were found for both autism and DS, and since folate metabolism contributes through S-adenosylmethionine to biological methylation of DNA as well as that of proteins and lipids, it is possible that alteration of folate metabolism through folate-related MAGAs could contribute to epigenetic abnormalities in both autism and DS and perhaps other neurodevelopmental disorders. Adequate maternal folate status contributes to prevention of chromosome breakage and prevention of DNA hypomethylation. Maternal folate abnormality may contribute to demethylation of heterochromatin and histones and contribute to structural centromeric defects leading to aneuploidy in DS. Maternal folate abnormalities may also contribute to epigenetic abnormalities of imprinted chromosome regions in autism, e.g., maternally derived duplications of the imprinted domains on chromosomes 15q11-13 and 7q leading to parent-of-origin effects. Effects of folate deficiency in mothers of individuals with autism may be potentiated by the folate-related MAGAs noted earlier to contribute to DS. Evidence suggests that some maternal abnormalities, e.g., the trisomy 21 mosaic carrier state, may originate with the maternal grandmother. Thus, some effects of folate deficiency, potentiated by MAGAs, originate in mothers, and some possibly in maternal grandmothers of individuals with DS and autism.

114.008 The Genetics of Agenesis of the Corpus Callosum and Its Connection to Autism. E. Sherr*[1], S. Sajan[2], L. Fernandez-Betancourt[1], J. Glessner[3], H. Hakonarson[4] and W. B. Dobyns[2], (1)*UCSF*, (2)*Seattle Childrens Hospital*, (3), (4)*CHOP*

Copy Number Variants and Agenesis of the Corpus Callosum: A Significant Etiologic Mechanism that Overlaps with Autism

Background: Autism is a clinical syndrome with a complex interplay of etiologies. One major causative hypothesis specifies that alterations in long-range cortical connectivity underlie the pleiotropic manifestations of autism. Agenesis of the corpus callosum (AgCC) is the most common CNS malformation after spina bifida, with a birth incidence in excess of 1:4,000. Many AgCC individuals have a clinical diagnosis of autism or have social cognition deficits on the autism spectrum. Also like in autism, AgCC patients can have alterations in other major ipsilateral white matter tracts, including the cingulum bundle. Like autism, the genetics of AgCC is likely to be complex and prior case reports have suggested that de novo copy number variants (CNV's) may play an important causative role.

Objectives: We hypothesized that the altered connectivity of AgCC overlaps with that of autism. We also hypothesized that AgCC patients would have a significant number of large candidate CNV's and that these CNV's may overlap with those identified in autism.

Methods: We identified patients with AgCC by a comprehensive radiological and clinical review. All participants or their legal guardian gave informed consent through an IRB approved human research protocol. Patients with complete or partial AgCC were included. Patients with globally diminished white matter volume or where other etiologies may secondarily result in AgCC were excluded (PMID: 17056927). Blood samples were obtained from the proband and both biological parents, when available. DNA was extracted and run on a Illumina 610 Quad Chip array. Data were analyzed using PennCNV. CNV's that were selected for analysis contained greater than 9 SNPs, were longer than 30 kb, had a PennCNV confidence level above 10 and contained one or more genes. Manual curation and merging of contiguous large CNVs were conducted.

Results: 271 patient samples were run and high quality data were obtained from 96%. These data were compared against 1953 ethnically matched controls that were separately collected but run and analyzed on the same platform. We compared both

CNVs binned by size and grouped by associated genes. Rare deletion CNV's larger than 500 kb were significantly associated with AgCC patients as compared to controls (OR = 3.14; p = 0.0005). A complex deletion-duplication on chromosome 8p was recurrent in the AgCC cohort and at other loci, both the deletion and reciprocal duplication were found both with AgCC. We also analyzed the enrichment of genes within CNVs previously associated with autism and schizophrenia and found that CNV duplications in AgCC patients were significantly correlated with CNVs in these related neurodevelopmental patient cohorts (p = 0.004).

Conclusions: AgCC is a relatively common malformation of brain development often associated with ASD. Large CNV's are highly correlated with AgCC patients and there is a specific enrichment of autism genes with AgCC CNV's. These data support a strong etiologic link between autism and AgCC and suggest that further research is necessary to explore shared molecular and developmental pathways.

Neurophysiology Program
115 Neurophysiology: Social, Perceptual & Learning Processes
Moderator: S. J. Webb *University of Washington*

115.001 Face Processing Delays In ASD Are Robust to Variations In Visual Attention. A. Naples*, D. Perszyk, M. J. Crowley, J. Wu, L. Mayes and J. McPartland, *Yale Child Study Center*

Background:

Face perception is a critical facet of social cognition that develops early in life and plays an enduring and important role in social interaction. It is subserved by distinct brain mechanisms; event-related potential (ERP) studies reveal an early negative peak (N170) marking initial stages of face processing. Delays at this stage of face perception have been demonstrated in individuals with ASD, suggesting inefficiency of social perception at its most basic stages. N170 latency is modulated by visual attention to different regions of the face (i.e., eyes evoke a faster N170). Because individuals with ASD show reduced attention to the eyes, it has been suggested that processing delays may reflect differences in visual attention, rather than inefficient processing in face perceptual circuitry.

Objectives:

The study investigated whether face processing delays in ASD reflect inefficient social processing, per se, versus different patterns of attention to the face. We directed visual attention to different parts of the face in typically developing children and children with ASD and analyzed the influence of point of gaze on N170 latency.

Methods:

ERPs were recorded from 13 high-functioning children with ASD and 13 age (~10 years) and sex-matched typical counterparts using a 128 electrode Geodesic Hydrocel Net. In the first condition, point of gaze was manipulated by preceding presentations of neutral faces with fixation points directing attention to the eyes, nose, or mouth; a fourth presentation condition used no fixation crosshair. Attention to intended fixation points was confirmed with a target detection task. In a second condition, we employed a comparable experimental manipulation but integrated eye-tracking (SmartEye Pro v5.5) with EEG recording for a gaze contingent paradigm that presented face stimuli only when participants attended to a fixation point.

Results:

In the first condition, both groups displayed shorter N170 latency when visual attention was directed to the eyes [$F(3,72)=38.154$; $p<.01$]; however, irrespective of point of gaze, individuals with ASD displayed longer N170 latency [$F(1,24)=7.946$; $p=.01$]. Data analysis for the gaze-contingent condition is in progress, as are analyses relating N170 latency to behavioral measures of social perception.

Conclusions:

Current results replicate findings of slowed face processing in individuals with ASD. These delays are not simply byproducts of differences in visual attention; like typical counterparts, children with ASD display faster neural responses when looking at the eyes, but responses are unilaterally delayed irrespective of point of gaze on the face. This pattern of results is consistent with theories implicating inefficient social information processing as a contributor to the social difficulties experienced by individuals with ASD. Our pending results represent the first integration of concurrent EEG and eye-tracking to create an interactive experimental paradigm responsive to participants' visual attention. In addition to providing a more rigorous control of attention, this technical advancement supports development of innovative paradigms for investigating dynamic social interactions.

115.002 Developmental Trajectory of the N170 Marker of Face Processing In Children with ASD. S. J. Webb*[1], E. Jones[1], K. M. Burner[1], C. Robertson[1], R. Edwards[1], A.

Tattersall[1] and G. Dawson[2], (1)*University of Washington*, (2)*Autism Speaks, UNC Chapel Hill*

Background: Face processing and its role in the social phenotype of autism spectrum disorders (ASD) has received much attention in the past decade. Behavioral studies of individuals with ASD consistently note impaired performance on basic tests of face memory and face processing during the early and mid-childhood years. Electrophysiological studies of face processing have noted developmental delays in the event-related N170 response to faces in young toddlers and children with autism (Dawson et al., 2002; Webb et al., 2006; 2010), but less obvious impairments in adults (Webb et al., 2009). The developmental trajectory of face processing in ASD has not been studied.

Objectives: In a longitudinal study of children with autism spectrum disorders (ASD) at 3, 6 and 9 years of age, face processing and face memory were assessed using event-related potentials. This analysis will focus on the specialized face-processing component (the N170) at these three time points, examining individual and group change over time.

Methods: Data were collected using a high density EEG array in children who met gold standard diagnostic criteria for ASD; comparison data from groups of age-matched children with developmental delay (DD) and neurotypical development (NT) were also collected. Participants watched pictures of a familiar and unfamiliar face (at 3 and 6 years) or a series of unfamiliar faces (at 9 years). Data were available for 24 3-yr old, 30 6-yr old, and 39 9-yr old children with ASD; of this sample, 15 children provided data at all 3 time points. Analyses examined the latency and amplitude of the N170.

Results: Preliminary analyses suggest that across the three time-points, the N170 response to faces in the ASD group was consistently slower than in the NT group; the DD group showed intermediate responses. However, the N170 became more negative and faster with development in all three groups; for example, from 6 to 9 years of age processing speed increased by 50 ms in both the ASD and NT groups. These findings suggest that children with ASD continue to show temporal face processing delays through early and middle childhood relative to children with neurotypical development. However, between age 3 and age 9 years developmental change in the speed of face processing proceeds at a relatively typical rate in children with ASD.

Conclusions: In a passive face processing task, children with ASD demonstrate a temporal delay in the neural correlates of face processing that is evident by 3 years of age and is maintained across childhood. The rate of increase of face processing speed from 3 to 9 years was similar in the NT and ASD groups, suggesting that later maturation of basic-level face processing systems is relatively typical in children with ASD. Additional analyses will examine developmental trajectories of ERP responses to object and facial emotion from the same group of children.

115.003 Using Event-Related Potentials to Explore Age-Related Changes In Infant Responses to Faces. R. J. 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: Within the first year of life, there are important changes in an infant's neural response to social stimuli. One replicated finding documents age-related changes in infant response to familiar versus unfamiliar faces, such that younger infants show a larger neural response to familiar faces, whereas older infants show a larger neural response to unfamiliar faces. This shift is thought to be associated with important milestones in social development and occurs around the first birthday. It is not known whether infants at risk for ASD – a population at risk for early social impairments – exhibit this pattern of age-related changes in neural response to faces.

Objectives: The objective was to determine whether children at risk for ASD show the anticipated age-related pattern of neural response to faces. The expected pattern was characterized by a shift from a larger response to familiar (i.e, mother's) face at younger ages, followed by a larger response to unfamiliar (i.e., stranger's) face at older ages.

Methods: Data were collected from infants at high risk for ASD (HRA) and low risk control (LRC) infants at 6, 9 and 12 months of age. ERPs were recorded using a 64- or 128-channel Hydrocel Geodesic Sensor Net. All signals were referenced to a single vertex electrode, sampled at 250 Hz, and filtered using a bandpass of 0.1 to 100 Hz. Stimuli included images of the infant's mother and an unfamiliar stranger. The component of interest was the Nc, a negative-going fronto-central deflection occurring 400-850 milliseconds after stimulus onset. Mean amplitude was calculated from a region of interest that included 14 electrodes.

Results: A 3 (age: 6, 9, 12) X 3 (hemisphere: left, midline, right) X 2 (condition: mother, stranger) mixed model examined effects on mean amplitude of the Nc. There was a main effect of hemisphere $F(2, 174) = 5.75$, $p < .01$, such that the neural response was smaller over the right hemisphere than over the

left hemisphere (p<.01) and midline leads (p=.01). In addition, an age X condition X group interaction was found. Follow-up tests revealed no within- or between- subject differences at 6 months of age. By 9 months of age, the LRC group demonstrated the anticipated effect of condition (i.e., larger response to mother's face than stranger's face, t = 2.00, p=.04), where the HRA group did not show a difference across conditions. Analyses at 12 months indicated that the LRC revealed the expected age-related shift, with a larger response to stranger than mother (t=2.87, p<.01), while the HRA group again showed no difference across conditions.

Conclusions: In the present investigation, the control infants at low risk for ASD showed the anticipated age-related changes in response to familiar and unfamiliar faces, showing differential responses starting at 9 months of age. However, the infants at high risk for ASD did not show a differential response between their mother's face and a stranger's face at any age, suggesting that the processing of important social stimuli may be atypical in children with a family history of ASD.

115.004 Social and Attention Factors During Infancy and the Later Emergence of Autism Characteristics. M. Elsabbagh*[1], K. Holmboe[2], E. Mercure[3], T. Gliga[1], K. Hudry[4], T. Charman[5], S. Baron-Cohen[6], P. Bolton[7], M. H. Johnson[8] and .. The BASIS Team[9], (1)*Centre for Brain and Cognitive Development, Birkbeck*, (2)*Centre for Brain and Cognitive Development*, (3)*Birkbeck, University of London*, (4)*Olga Tennison Autism Research Centre, La Trobe University*, (5)*Institute of Education*, (6)*University of Cambridge*, (7)*Institute of Psychiatry (The)*, (8)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (9)*BASIS*

Background: Characteristic features of autism include atypical social perception and visual attention. Debate has focused on whether the later emergence of atypical social skills is a consequence of attention problems early in life, or, conversely, whether early social deficits have knock-on consequences for the later development of attention skills. We investigated this question based on evidence from infants at familial risk for a later diagnosis of autism by virtue of being younger siblings of children with a diagnosis.

Objectives: We previously reported that around 9-10 months, at-risk siblings differ as a group from controls with no family history of autism, both in social perception, measured using Event Related Potentials (ERPs; Elsabbagh et al., 2009) and inhibitory control (Holmboe et al., 2010). We present data from an ongoing longitudinal research program suggesting clear associations between some of these infant measures and autism-related characteristics at 3 years.

Methods: Participants were from the British Autism Study of Infant Siblings (BASIS). Around 9-10 months of age, ERPs were recorded while the infants viewed static images of direct or averted gaze. The same infants also completed an inhibitory control task: the "Freeze Frame task". The latter measured attentional flexibility and regulation of looking behaviour in response to changes in the visual environment. Specifically, the task examined whether the value of a centrally presented fixation target modulates automatic orienting responses to briefly presented peripheral distractors. At three years of age, the same infants were followed up using a number of measures including the Autism Diagnostic Observation Schedule (ADOS).

Results: In the group of infant at-risk, the N290 and P400 ERP response to static faces displaying direct or averted gaze was most associated with emerging difficulties in the social domain at three years. Moreover, differential P400 response to direct relative to averted gaze displayed on faces was associated with later emerging non-social characteristics. Results from the Freeze-Frame task indicated that at-risk infants' propensity to be engaged by a repetitive non-social stimulus predicted later social functioning. The best predictor of later autism-related social characteristics was the overall rate of looking to the distractors in the boring trials (suggesting an increased preference for the central 'boring' stimulus), not the initial response to the two trial types or changes across the session.

Conclusions: Response characteristics in a social eye gaze task and a non-social inhibitory control task were both associated with later emerging social and non-social characteristics of autism, suggesting some interdependence of social and non-social circuits early in development. We discuss the findings in terms of the emergent nature of autism as a result of complex developmental interactions among brain networks.

*The BASIS team: Bedford, R., Chandler, S., Clifford, S., Fernandes, J., Garwood, H., Leonard, H., Tucker, L., and Volein, A.

115.005 Superior Temporal Gyrus Spectro-Temporal Abnormalities In Autism Spectrum Disorders. J. C. Edgar*, S. Y. Khan, K. Cannon, S. Qasmieh, L. Blaskey, L. A. Cornew and T. P. L. Roberts, *Children's Hospital of Philadelphia*

Background: Considerable evidence indicates auditory processing abnormalities in autism spectrum disorders (ASD),

including latency delays as well as deficient evoked gamma (e.g., 30 to 50 Hz) oscillatory activity in the superior temporal gyrus (STG).

Objectives: The aim of the study was to examine the full extent of auditory phenomena – in terms of both time and frequency - in children with ASD.

Methods: Magnetoencephalography (MEG) was used to assess baseline and post-stimulus activity in left and right STG auditory areas in a large sample of 73 children with ASD and 34 typically developing (TD) controls. During the MEG exam, 500 Hz sinusoidal tones of 300 ms duration were binaurally presented with a 1 second interstimulus interval. Approximately 105 trials were collected. Measures of time and frequency domain activity at left and right STG auditory areas were obtained by applying a source model to transform each individual's raw MEG surface activity into brain space.

Results: The right-hemisphere 500 Hz 100 ms auditory response peaked later in ASD than TD, $t(97)=-2.15$, $p<0.05$. Examining left and right STG oscillatory activity, findings revealed a profile of ASD such that auditory STG processes were characterized by baseline abnormalities across multiple frequencies, then early high-frequency abnormalities followed by theta and alpha abnormalities, then followed by (or concurrent with) beta desynchronization abnormalities. Analyses examining associations with patient symptoms and cognitive ability showed that the STG oscillatory abnormalities in ASD are of clinical significance, with increased baseline gamma activity associated with higher Social Communication Questionnaire scores as well as lower IQ scores.

Conclusions: It is hypothesized that deficits in synaptic integration in the auditory cortex are associated with oscillatory abnormalities in ASD as well as patient symptoms and cognitive ability.

115.006 Luminance- and Texture-Defined Spatial Information Processing In School-Aged Children with Autism.

J. B.Rivest*[1], P. Vannasing[2], M. McKerral[2], A. Bertone[3], M. Lassonde[2] and L. Mottron[1], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Centre de Recherche en Neuropsychologie et cognition de l'Université de Montréal (CERNEC)*, (3)*Perceptual Neuroscience Laboratory for Autism and Development, CETEDUM*

Background: Low-level visual perception in adult individuals with Autism Spectrum Disorders (ASD) is different from that of neurotypical individuals. For example, sensitivity to luminance-defined spatial information has been demonstrated to be superior in ASD, whereas sensitivity to texture-defined information is less efficiently perceived (Bertone et al., 2005; Vandenbroucke et al., 2009). These results have been interpreted as resulting from atypical connectivity both (i) within the primary visual cortex (V1), where luminance information is extracted, and (ii) between primary and adjacent extra-striate visual areas (V2, V3) where recurrent neural interactions mediate texture-defined information (Baker & Mareschal, 2001). However, it is currently unknown if the neural alterations underlying such elementary visual processes are present in children with ASD.

Objectives: To assess luminance- and texture-defined spatial information processing in children with autism using behavioural (psychophysical) and electrophysiological (visual evoked-potentials: VEPs) approaches.

Methods: Seventeen autistic and 25 typically developing children, aged 6 to 10 years, with normal or corrected-to-normal vision, were matched on age, gender and intelligence. The visual stimuli were luminance- and texture-defined gratings, presented either vertically or horizontally within a circular aperture for 750 ms.

Psychophysical task: Participants were asked to discriminate the orientation of luminance- and texture-defined gratings presented at five contrast levels (luminance modulations: 0.25%, 0.5%, 1%, 2%, 5%; texture modulations: 5%, 10%, 15%, 20%, 50%). Each pattern was shown 10 times in a pseudo-randomized order. Orientation-identification thresholds were obtained using a method of constant stimuli, and defined as the contrast level needed to attain a 75% correct level of performance.

Electrophysiological task: Participants were presented with luminance- and texture-defined gratings with contrast levels of 6% and 100%, respectively, in order to equate their visibility. Gratings from each condition were presented 160 times (80 vertical and 80 horizontal presentations). Participants were asked to fixate the center of the display while their brain activity was recorded using a high-density electrophysiological system. At posterior sites on the scalp, the early VEP component associated with pattern processing (P1) was examined for latency, amplitude and scalp distribution.

Results: Psychophysical results suggest comparable mean contrast sensitivity between autistic and control children for both luminance- ($p = .70$) and texture-defined conditions ($p = .42$). Additionally, no group differences were found for

electrophysiological measures. Nonetheless, we observed that the P1 component was modulated by the type of information presented in the expected direction. Specifically, P1 amplitude was greater at occipital midline (Oz) for luminance-defined gratings ($p < .05$), while occipitotemporal sites (PO7; PO8; P7; P8) tended to be more responsive to texture-defined information ($p = .09$).

Conclusions: School-aged children with autism appear to process luminance- and texture-defined spatial information similarly to typically developing children, therefore contrasting with adolescent/ adult findings. Given the important developmental changes that occur during the school age years, we are presently analyzing and comparing behavioural and electrophysiological data as a function of age within each group. Findings will be discussed within the context of the Enhanced Perceptual Functioning (Mottron et al., 2006) and the Complexity-Specific (Bertone & Faubert, 2006) perceptual hypotheses in ASD.

115.007 The Relationship of Epileptiform Discharges to Sleep, Cognition, and Behavior In School Age Children with Autism Spectrum Disorders. G. Barnes*[1], B. A. Malow[2], J. Paolicchi[3], K. Adkins[2] and P. Howard[3], (1)*Vanderbilt*, (2)*Vanderbilt Medical Center*, (3)*Vanderbilt University Medical Center*

Background:

The role of epileptiform activity in neural circuitry and how that influences sleep, behavior, and cognition in autism spectrum disorders (ASD) is unclear. From a theoretical standpoint, epileptiform activity could have a significant disruptive effect on circuit function, thereby contributing to sleep problems, behavioral issues, and cognitive dysfunction.

Objectives:

To define the relationship of epileptiform activity to sleep, behavior, and cognition in a previously well characterized cohort of children with ASD and normal IQ, and free of medications and seizures.

Methods:

Children with a diagnosis of ASD (autism, Asperger disorder, or PDD-NOS) confirmed by Autism Diagnostic Observation Schedule (ADOS), age 3-7 years, were enrolled. Upon entry into the study, parents completed the Repetitive Behavior Scales (RBS), Children's Sleep Habits Questionnaire (CSHQ), and Child Behavior Checklist (CBCL). Subjects also underwent IQ and language testing. Two nights of overnight polysomnography with 21-channel EEG was also performed in each child.

Results:

A total of 52 children completed the study , including 13 typically developing age-matched children and 39 children with ASD. Ten of 39 children had an epileptiform EEG compared to one of 13 typically developing children (26% vs 7%, $p<0.01$; Fisher-exact test). Most epileptiform EEGs had epileptiform activity in frontal, central, or temporal leads. On the CBCL, only the aggression score and externalizing score were significantly increased those with ASD and epileptiform EEGs compared to those with ASD alone and no epileptiform EEGs ($p<0.05$). On the RBS, there was a non significant trend ($p=0.07$) to enrichment of stereotyped behaviors in ASD with epileptiform EEG group while increased repetitive behaviors were detected in the ASD alone without epileptiform EEG group. Sleep latency on night two was significantly decreased in those with ASD and epileptiform EEGs compared to those with ASD alone and without epileptiform EEGs ($p<0.05$). Groups showed no significant differences in age, CHSQ, IQ measures, and scores on Peabody Picture Vocabulary testing.

Conclusions:

While this work requires replication in larger samples and a broader ASD population, our findings suggest that children with ASD, even if medication free, seizure free, and with a normal IQ, have epileptiform EEGs in the central, frontal, and temporal regions. Furthermore, epileptiform activity in this group of children with ASD was associated with differences in mood, sleep parameters, and indices of repetitive/restricted behaviors among the ASD groups. Interventional studies will be necessary to determine the directional relationship between epileptiform activity and sleep and behavior.

115.008 Slow-Wave EEG Activity During Sleep In Adults with Autistic Spectrum. A. C. Rochette*[1], E. Chevrier[1], L. Mottron[2] and R. Godbout[3], (1)*Hôpital Rivière-des-Prairies*, (2)*Université de Montréal*, (3)*Universite de Montreal*

Background: Polysomnographic recordings show that the sleep of autistic adults is characterized by low amounts of nonREM sleep (stages 2+3+4), including diminished Slow Wave Sleep (SWS: stages 3+4) (Limoges et al., 2005). The main polysomnographic feature of nonREM sleep is Delta activity, a low frequency EEG signal peaking over frontal recording sites. Delta EEG activity is thought to reflect at least

three characteristics of the cortex: synaptic density, maturity, and metabolic rate (Feinberg et al., 1990).

Objectives: To map the quantified slow wave EEG activity of autistic adults during nonREM across the scalp using a full EEG montage in order to verify its amplitude and distribution vs. a group typically developed individuals.

Methods: Sixteen autistic adults (ASD: 15 M, 1 W, 22.0±3.8 years old) and 18 comparison participants (COM: 17 M, 1 W, 21.0±4.2 years old) were recorded for two consecutive nights in a sleep laboratory using a 19 recording electrodes (Fp1, Fp2, Fz, F3, F4, F7, F8, Cz, C3, C4, T7, T8, Pz, P3, P4, P7, P8, O1, O2). Spectral amplitude of nonREM Delta EEG activity (0.75-3.75 Hz) was computed for the first seven hours of sleep of night 2; analysis of EEG during SWS was restricted to the first hour of the night, due to its natural temporal distribution. Groups were compared using one-way ANOVAs, with a significance level set at .05, in two separate sets: 1) The seven frontal electrodes; 2) The remaining electrodes.

Results: 1) Frontal EEG activity. When considering the total amount of nonREM sleep during the first 7 hours of the night, Delta EEG activity was significantly *decreased* for ASD compared to controls for Fz (ASD=2.7±0.06, COM=2.9±0.06) and F3 (ASD=2.7±0.06, COM=2.8±0.06). A closer stage-by-stage analysis (comparing groups on stages 2, 3 and 4 separately) showed that differences were restricted to stage 2; moreover, this analysis disclosed *increased* Delta activity for the F7 electrode in the ASD groups (ASD=296.13±52.06, COM=158.22±11.43) and a same trend at T7. 2) Remaining electrodes. The analysis of Delta EEG over more posterior recording sites disclosed a decreased activity over C3, C4, Pz, P3, P4, O1 and O2 both during stage 2 and SWS.

Conclusions: Delta activity during nonREM sleep is *decreased* over most of the recording sites of the ASD group while it is *increased* over the left temporal lobe (F7, P7). These results further support the hypothesis of an atypical cortical connectivity in ASD, possibly due to altered synaptic density, maturity, or due to altered cortical metabolic rate during nonREM sleep.

116 Innovative Technologies Demonstration Session

116.144 1 Bioinformatics Platform Allowing Data Aggregation Across Projects and Repositories In Autism Spectrum Disorder Research: Interactive Demonstration. D. Hall*[1], M. McAuliffe[2], M. Dimitrov[3], S. Novikova[3], G. Navidi[1], E. Stanton[3], M. P. Freund[4] and M. F. Huerta[4], (1)*National Institute of Mental Health (NIMH)*, (2)*NIH Center for Information Technology*, (3)*NIMH*, (4)*National Institute of Mental Health*

Background: The National Database for Autism Research (NDAR) was designed to help the ASD research community to accelerate discoveries by facilitating scientific collaboration, communication, and sharing of detailed research data. NDAR supports all types of research data, including clinical assessment, imaging and genomics, and enables researchers to search and aggregate data from multiple projects across multiple data repositories. Meaningful sharing, reaggregation, and reanalysis of data are made possible by having investigators define their data via the NDAR Data Dictionary and by their use of the Global Unique Identifiers (GUIDs). Such unifying approaches, coupled with cutting-edge grid architecture and an active partnership with other major public and private ASD-relevant informatics resources, are providing the foundation for a common informatics environment for the ASD research community, and may transform the paradigm of ASD research to one of community science.

Objectives: The objectives of this unscripted interactive demonstration are: to illustrate NDAR's user-friendly interface and useful built-in data standardization, organization and validation tools; to demonstrate the ease with which data can be submitted to NDAR, requiring only minimal adjustments to the way data are collected; to update IMFAR 2011 attendees on the progress of establishing data federation with other informatics resources (e.g., IAN, AGRE, dbGaP); and to emphasize the power of federating available public and private ASD-related resources and repositories by demonstrating how a single query in NDAR can yield results across all repositories.

Methods: NDAR's tools define data structures in a clear and simple way; they were developed after thorough analyses of the needs of the ASD investigators. The NDAR Data Dictionary currently defines over 25,000 variables for clinical assessments, imaging, and genomics; it allows researchers to define their own data structures and operates with NDAR's validation tool to ensure data quality and standardization of data. NDAR's Genomics Tool standardizes the naming of data processing and analysis protocols; it requires entering sufficient details and enforces unambiguous interpretation of the entered information. NDAR's global unique identifiers (GUID) protect the identity of research subjects, while allowing for the collection and analyses of data across time and projects.

Results: To date, ASD researchers have submitted and shared data from more than 12,000 subjects. Many others are in the process of being shared, and NDAR has as its goal to make available data from 90% of all human subject studies that

commence in 2012. Launched in December of 2010, the NDAR Genomics Tool will be used by ASD investigators to define their genomics data allowing data reaggregation across projects and repositories. NDAR not only continues to develop its methodology and capabilities, but is also working closely with the research community and other major private and public informatics efforts to form a rich global network of data and tools.

Conclusions: This is a demonstration how NDAR will add value to ASD research beyond the sum of the contributors of the individual projects and platforms, giving researchers access to more data than any one researcher or any one lab could collect, along with access to a range of robust analytical tools.

116.145 2 Meta-Search: Automatic Indexing of Meta-Data and Data Can Dramatically Improve Variable Discovery In Very Large Autism Data Sets Like the Simons Simplex Collection (SSC). L. Rozenblit*[1], A. Voronoy[1], M. Peddle[1], D. Voccola[1], C. C. Evans[1] and S. B. Johnson[2], (1)*Prometheus Research, LLC*, (2)*Columbia University*

Background: The sheer size of large autism data sets, such as the SSC, NDAR, AGRE, or IAN, poses a serious barrier to their utilization. The SSC, for example, includes nearly 6000 phenotype variables, and identifying those relevant to a research project can be a challenge. Recent approaches to this problem have focused on developing ontologies. However, these approaches require the user to invest in learning a new, often complex, categorization scheme before getting started, and take many years to develop.

Objectives: We set out to develop "meta search", a light-weigh approach to quickly identifying variables of interest via intelligent automated indexing of both data and meta-data in a relational database. From the perspective of a researcher using the system to discover variables, the tool should present a "Google-like" search interface. The researcher should be able to type in search terms, drawing from their own conceptual scheme, and get back a list of variables that match their interests. Sufficient descriptions of each variable should be provided in the output to determine relevance and refine the search and results should be sorted by relevance. Importantly, the tool must work in the absence of any manual tagging of variables with keywords, but should support the addition of manual tags. The tool should also support future integration with external ontology efforts, such that if the researcher used an ontology term in a search they would get the expected results.

Methods: We used an agile software development methodology, iterating over a 2-week cycle for 3 months. Each iteration incorporated feedback from test users, familiar with the SSC data set. The system uses data in SFARI Base (a data management system developed by Prometheus Research that stores SSC data) to automatically populate an SQLite database, building for each variable (1) a structured search index, and (2) a configurable "column report" that provides useful information about the variable. We developed a Google-like GUI to enter arbitrary search terms, and were able to utilize an existing full-text search mechanism provided by SQLite to locate keywords in the structured search index. For each match, meta-search returns the content of the "column report", sorted by relevance.

Results: Testing with pilot users suggests that meta-search delivers intuitive and useful results with the SSC. The content of column report is configurable, and currently provides information like column names, table names, data type, examples of actual data stored in the column, manual keyword tags, if any, and column statistics. Researchers can use the output of the system to further explore each variable or to build more complex queries that return multiple variables.

Conclusions: Meta-search can run on top of any relational database, is accessible via the web, and anticipates future integration with ontology efforts. If successful, this system can be deployed at low cost on top of other large research data sources such as NDAR, AGRE, or IAN. Meta-search is a promising addition to the set of tools that help autism researchers make sense of very large data sets.

116.146 3 Web Application for Genetic and Phenotypic Data From Families with Autism Spectrum Disorders to Support Multidisciplinary Research. S. Wang*[1], R. Sasanfar[2], J. O'Rourke[1], J. Teraiya[1], S. Koduru[1] and D. L. Pauls[1], (1)*Massachusetts General Hospital*, (2)*Department of Psychiatry, Harvard Medical School*

Background: The current landscape in the research of Autism Spectrum Disorders (ASD) is becoming increasingly diverse, and there has been a shift to encourage and emphasize collaboration from multidisciplinary researchers to accelerate progress in understanding ASD. The informatics team at the Massachusetts General Hospital is aiding multidisciplinary researchers by creating a platform through which users can query phenotypic data and genetic information collected by studies conducted under the auspices of the Autism Consortium in Boston.

Objectives: The informatics team's objective is first and foremost to aid multidisciplinary researchers in conducting novel and varied research. In order to achieve this goal, the focus has been to: 1) ensure quality of data and provide necessary metadata (data about data) taken from experts in the field, 2) create a user interface for ease of access to the data and 3) facilitate data querying by implementing search and filter capabilities.

Methods: Both phenotypic and genetic data are collected by members of the Autism Consortium from six research institutions, and the data encompass over 500 ASD families. Phenotypic data consists of over 40 validated and widely used instruments which are collected from all family members. These instruments span multiple domains of research: e.g. autism diagnosis (Autism Diagnostic Interview-Revised), cognitive abilities (Wechsler measures), executive functioning (Brief Rating Inventory of Executive Function), life skills (Vineland Adaptive Behavior Scales), the broader autism spectrum (Broader Phenotype Autism Symptom Scale) and medical history. Data is not only looked at microscopically but also macroscopically. Each data point is checked for accuracy, but each data point within a given instrument and each instrument within a categorical domain is explained, and additional information, or metadata, are provided to aid researchers in understanding the data. The data itself is expanded to include additional scores or data values from recent autism research. In this way the data is also able to build upon previous research findings. A web-based application has been created to give access to approved researchers to query and download the data. The application has been enhanced to not only allow downloading, but also to filter data by various criteria, download data into various formats, and save past queries for future sessions.

Results: Data have been collected from over 1400 individuals, and that number is continuing to increase. Thus, each individual accounts for thousands of data points in addition to his or her genetic information. Researchers can submit a proposal to have access to this improved, enhanced, and enriched data through the Autism Consortium's standard policy for research.

Conclusions: Access to data for multidisciplinary research will be the key to furthering the progress already being made in understanding the pathology of ASD. Data access and availability, an extensive breadth of information, and essential metadata will allow researchers of varying expertise to bring forth new information that will be integral to the diagnosis and treatment of ASD.

116.147 4 Improving the Quality of Diagnostic Procedures of Autism Spectrum Disorders by Telemedicine.

T. Maffre*[1], F. Le Deist[2] and J. P. Raynaud[1], (1)*CHU de Toulouse*, (2)*Toulouse Business School*

Background: Despite a widespread assumption of the advantages of telemedicine, medical and economic interest has been rather limited to date. Nevertheless, with developments in information and communication technologies increased interest is apparent in telehealth and telemedicine. The World Health Organization and the European Commission have encouraged the development of the sector, viewing these as means streamline the organization of the health system and the distribution of health care provision at local level, as well as a vehicle for economic growth. In the context of autism spectrum disorders (ASD) in France, diagnostic assessment tools ADOS and ADI, which are considered as gold standards in the domain, remain insufficiently disseminated. They are mainly used by regional centres for diagnostic assessment, where access may be difficult for children with suspected ASD who do not live nearby.

Objectives: We made the assumption that telehealth tools could facilitate the use of ADOS by practitioners and thereby improve the quality of diagnostic procedures to the benefit of patients.

Methods: This paper provides an account of an experiment of practice exchanges using videoconferences, a process akin to distance learning, conducted from the regional unit of ASD assessment at the University Hospital of Toulouse (Midi-Pyrenees region, France), with the support of a regional telemedicine network. It took place over six months during 2010, involved six primary care teams for patients away from the regional capital, and included 22 professionals. Each was offered the opportunity to participate in 3 videoconferences, with the ultimate goal of improving the compatibility of autism diagnostic procedures with national professional guidelines. The evaluation of the experimental protocol was aimed at both the acceptability of the technical sessions, the perception of skills transfer and the prospects for change in clinical practice. It relied on answers to questionnaires about qualitative and quantitative perceptions of these aspects. In a medico-economic approach, a cost / benefit analysis was also based on a comparison with traditional training tools.

Results: The protocol was very well received by the local professionals involved, who appreciated the positive transfer of skills despite a technical context that could be improved. After

three sessions of exchange of 150 minutes, the level of knowledge of ADOS improved threefold, and half of the professionals said they were ready to use the tool.

Conclusions: We conclude that the acceptability of this approach to distance education is quite good, and that the economic balance is positive. Demonstrating improved quality of diagnostic procedures by primary care teams will require extending the protocol, but these early results are sufficiently encouraging to warrant further studies on teleconsultation and teleexpertise in autism and ASD.

116.148 5 Treating Autism In Toddlers and Adolescents Remotely with Behavior Imaging-TM. T. T. Whitney*[1] and R. Oberleitner[2], (1)*Intermountain Center For Autism and Child Development*, (2)*Behavior Imaging Solutions*

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Background:

The application of technology is changing the way in which medical and clinical services are delivered today. Select telehealth technologies can revolutionize clinical care, integrating providers across many systems of care (schools, outpatient treatment centers, and hospitals), and provide new methods for data acquisition and longitudinal follow-up. As part of a national Operational Assessment project for the U.S. Air Force, Intermountain Center For Autism and Child Development (ICACD) and four other autism service agencies used Behavior Imaging, a store and forward telehealth technology for behavior treatment, in order to show benefit in terms of remote consultation for families with children and adolescents with autism spectrum disorders.

Objectives:

Assess if remote supervision of behavior treatment with Behavior Imaging can enhance the delivery of ABA services, and evaluate system utility, usage, perceived effectiveness, strengths, and limitations.

Methods:

Thirty-three families were recruited for this study. Each had at least one child with autism who was a TRICARE beneficiary (TCB), and was receiving applied behavior analysis (ABA) services at home or in a clinical environment. The family and tutors were provided a novel Behavior Imaging technology to use in their homes free of charge. Families, ABA tutors, and ABA therapy supervisors from 5 sites could use live (synchronous) web-conferencing and / or an asynchronous approach that allowed them to record, annotate, tag, and share video clips of sessions via Behavior Connect, a secure online consultation and collaboration platform. Supervision was provided to designated tutors as well as family members who delivered ABA therapy when tutors were not available. Pre-study and post-study questionnaires were administered to clients and therapists in order to evaluate system utility, usage, perceived effectiveness, strengths, and limitations.

Results:

Results from the national assessment indicated that remote supervision of treatment delivered in the home setting with Behavior Imaging can enhance the delivery of ABA services, and can enable service providers to modify their clinical protocol to be effective without as frequent in-person visits.

Conclusions:

More meaningful and as needed frequent contact with patients and their family allows providers to better understand their patient and meet the needs of the family. More control of patient flow in a clinic allows for more patients to be seen. The use of Behavior Imaging requires comfort with these technologies and recognition of what is beneficial during remote consultation.

116.149 6 Increasing Accessibility to Behavioral Evaluation and Treatment Through Telehealth. T. Kopelman*[1], K. E. Pelzel[2], D. P. Wacker[2], S. D. Lindgren[2], Y. Padilla[3], J. F. Lee[4] and D. B. Waldron[2], (1), (2)*University of Iowa Hospitals and Clinics*, (3)*University of Iowa Children's Hospital*, (4)*University of Iowa*

Background: The effectiveness of behavioral procedures, including functional analysis (FA) and functional communication treatment (FCT), for decreasing problem behaviors displayed by some young children with autism spectrum disorders (ASDs) has been well-documented. Unfortunately, access to evidence-based behavioral services can be challenging in rural areas due to the limited availability of trained professionals. The use of telehealth may reduce barriers to accessing high quality behavioral services. To date, limited research has been published on the efficacy of using telehealth to conduct function-based evaluations and treatment with young children with ASDs.

Objectives: This investigation will determine the efficacy of conducting FA and FCT via telehealth with young children (ages 18 months - 6 years) with ASDs who engage in problem behaviors, including aggression, destruction, and self-injury. Data on the number of children receiving behavioral services,

the number of children with an identified social function identified by functional analysis, the mean decrease in problem behavior during functional communication, the costs of service delivery, and parent acceptability will be collected and compared with the outcomes of previous studies by the authors in which similar procedures were delivered in the home setting.

Methods: Each child was evaluated in a university hospital outpatient clinic to confirm a diagnosis of ASD. Following confirmation, a FA of problem behavior (Iwata et al., 1982/1994) was conducted to identify the environmental variables maintaining the child's problem behaviors. FA sessions were conducted at a university-affiliated regional outpatient clinic located near the child's home. Parents were provided with remote coaching on procedures from a behavioral specialist located the university hospital. FCT was initiated after completion of the FA. All FCT sessions were conducted by parents with coaching provided by behavioral specialists through telehealth. FA and FCT sessions lasted for 1 hour weekly for up to 6 months for each child. Sessions were conducted using H.323 compatible video conferencing software, with the Emblaze-VCON vPoint HD software running on Windows XP workstations. All sessions were recorded and later coded for both prosocial and disruptive behaviors.

Results: To date, FAs have been completed with 12 participants. A clear social function (escape and/or gain) has been identified for 10 of these children. FCT has been completed with 8 participants. The mean reduction in problem behavior after FCT treatment was 97%. Transportation costs and staff time are substantially lower when compared to the costs of sending behavioral therapists to children's homes ($58 versus $333 per child per week if services were provided in the home). Parent acceptability of treatment has been high (average rating of 5.9 on a 1-7 scale).

Conclusions: Expanding access to behavioral services for children with ASDs is an urgent public need in rural states. Preliminary outcomes indicate that parents can be successfully coached using telehealth to conduct FA and FCT. Compared to an in-home service delivery model, the use of telehealth has resulted in increased efficiency (i.e., ability to conduct a greater number of evaluations within a standard of time), cost savings, and comparable reductions in problem behavior and treatment acceptability.

116.150 7 Family Centered Occupational Therapy and Telerehabilitation for Children with Autism Spectrum Disorders. V. D. Gibbs* and S. Toth-Cohen,

Background: The growing incidence of Autism Spectrum Disorders (ASD) has created an increased demand for outpatient therapy services (Shimabukuro, Gross, & Rice, 2008), including clinic-based occupational therapy (OT). Since parental involvement is crucial to the success of intervention for children with ASD (Cohn, Miller, & Tickle-Degnen, 2000), it is imperative to create more efficient and effective methods to ensure carryover of therapeutic techniques Technology now exists that may allow more convenient ways to partner with parents (Klein, 2002). Parent collaboration sessions can occur in the clinic, but other options exist, such as virtual involvement using webcams. The use of virtual collaboration allows another opportunity for therapists to develop ways to partner with and support families. Most importantly, virtual collaboration may provide families with choices as to how they want to collaborate. Virtual collaboration may also improve participation in therapy while reducing the costs incurred by families.

Objectives: This pilot project explored the use of telerehabilitation for collaborative OT sessions with parents of children with ASD. The aim was to improve carryover of therapeutic strategies by parents to address children's sensory modulation in their natural environments.

Methods: Four families participated in the project. Families initially participated in clinic-based collaboration sessions with the therapist. These sessions were followed by on-line sessions that used a website and webcams. Methods of data collection consisted of family needs assessment surveys, family schedules completed by the parents, sensory diets collaboratively developed by the therapist and the parent, observation and recording of web sessions, and the Sensory Processing Measure (SPM) Home Form before and after initiation of the telerehabilitation sessions.

Results: The family needs assessment revealed one parent strongly supporting family centered care. All other scores fell within the range of fair. Eight web sessions were reviewed. All web sessions included review of specific techniques in the home program and discussion of the child's response to the home program. Specific techniques were reviewed by the therapist observing the parent or child performing the technique and providing feedback, the therapist showing a web video of correct performance, and by the therapist demonstrating the proper technique. In the majority (5/8) sessions, parents asked the therapist for specific guidance about correct performance of the home program. Education of the parent about the reasoning behind specific components of the home program occurred in 5/8 sessions. With the exception of one child, total SPM scores remained stable or improved after contact phase. As

anticipated, sub scores on initial and follow up assessment varied among subjects.

Conclusions: Telerehabilitation provided a supplemental service for families of children with ASD. Preliminary results indicated telerehabilitation enabled improved carry-over of home therapy programs by providing opportunities for parents to ask questions and for therapists to review sensory techniques and the reasoning behind these techniques to facilitate parents' understanding of the child's home program. Although improvement, as reflected by the SPM, was minimal, parents reported that they valued the collaboration with the therapist that was provided through the telerehabilitation program.

116.151 8 Using An Internet-Based Training Program to Introduce Naturalistic Behavioral Techniques to Individuals Working with Young Children with Autism. A. L. Wainer* and B. Ingersoll, *Michigan State University*

Background: There is an increasing need for the adaptation of training in evidence-based interventions to non-traditional service delivery methods, particularly for individuals working with children with autism. Internet-based instructional formats have been shown to be an effective means of dissemination of intervention training for various clinical populations. Recently, research has begun to examine the potential of innovative computer technology to provide training to service providers and parents of children with autism. The use of a remote, internet-delivered, intervention training program has the potential to surmount many of the challenges typically associated with accessing and implementing such programs.

Objectives: An internet-delivered intervention training program was created to introduce service providers and parents to Reciprocal Imitation Training, a naturalistic behavioral intervention that has been shown to increase imitation on objects and gestures in young children with autism.

Methods: Two separate multiple-baseline design studies were conducted to assess the impact of an internet-based training program on changes in knowledge and behavior for service providers (Study 1) and parents (Study 2). In both studies, participants were randomly assigned to a predetermined number of video recorded baseline sessions. After completing baseline sessions, all participants were given access to the internet-based training program. Participants were then video recorded implementing the intervention techniques. If necessary, additional feedback was given to participants until fidelity of implementation was achieved. Changes in participant knowledge and implementation of intervention were assessed at pre- and post-training. Additionally, data examining the internet-based training program's strengths and suggestions for improvement were collected.

Results: Results suggest that providers and parents improved their knowledge and use of the intervention strategies in response to the internet-based training program. However, some individuals required additional live coaching in order to reach fidelity of implementation.

Conclusions: An internet-delivered, intervention training program may be an effective method for disseminating training in evidence-based practices to individuals working with children with autism. A more supportive and interactive training program, providing additional feedback and coaching, may be particularly beneficial for some consumers.

116.152 9 Web-Based Training In Early Autism Screening with the STAT: Results From a Pilot Study. A. Swanson*[1], W. L. Stone[2], O. Ousley[3] and K. A. Kobak[4], (1)*Vanderbilt University*, (2)*University of Washington*, (3)*Emory University School of Medicine* , (4)*Center for Psychological Consultation*

Background: Early identification of autism is a critical first step toward providing the specialized intervention services that are associated with significant gains in learning and behavior. Yet there is a considerable delay between the average age of initial parent concerns (16-20 months) and the age at which children receive a definitive diagnosis (3-4 years). This delay is due in part to a lack of familiarity with the early behavioral manifestations of autism by community service providers. The Screening Tool for Autism in Toddlers and Young Children (STAT) (Stone et al., 2004; 2008) is a level 2 screening tool specifically developed to help community service providers identify early behavioral features of autism, thus facilitating earlier referral and treatment. Because of the interactive format of the STAT and the subtlety of the early social-communication markers of autism, training is necessary to ensure appropriate administration and interpretation. Although STAT training workshops are available, the limited number of trainers and training locations can impede access. One way to increase accessibility to this training is through interactive, multi-media, web-based technologies.

Objectives: To develop and evaluate the efficacy and acceptability of a web-based, multi-media, interactive tutorial for community service providers on the administration and scoring of the STAT.

Methods: Thirty community health care professionals from 3 geographic areas (Madison, WI; Nashville, TN; and Atlanta,

GA) participated. Professional backgrounds included psychologists, pediatricians, speech-language pathologists, research assistants, nurses, and occupational therapists. The average length of time working in their current occupation was 11.4 years (range 1-36 years, mode = 2 years). Roughly 1/3 reported having little or no training on autism assessment.

The STAT consists of 12 play-based items that evaluate behaviors in four social-communicative domains: Play, Requesting, Directing Attention, and Motor Imitation. The STAT Training Tutorial contains a general overview on the structure of the STAT; general administration conventions; item-specific content, concepts, and scoring conventions; and a 25-item pre-and post-test to assess understanding. Completion of the tutorial takes about 3 hours. Participants first completed the pre-test, then completed the STAT tutorial at their own pace, and then completed the post-test and a user satisfaction questionnaire.

Results:

Mean scores on STAT concepts improved after taking the tutorial, from 15.7 (SD=2.2) at pre-test to 21.4 (SD=1.8) at post-test (mean change = 5.7 (SD=2.7), $t(29) = 11.5$, $p < .001$. At pre-test, only 1 person (3%) obtained correct scores on at least 80% of the items (our a priori cutoff for a 'pass'), compared to 22 (73%) at post-test, $c^2(1)=31.09$, $p < .001$. The majority of trainees "agreed" or "strongly agreed" with statements indicating they enjoyed taking the tutorial; thought it was well organized, relevant, interesting, and useful; thought the time allotted to each section was about right; and felt it was easy to understand and operate.

Conclusions: The STAT Training Tutorial was successful in increasing community providers' knowledge of STAT concepts, administration, and scoring, and was rated highly in user satisfaction. As such, the tutorial promises to be an effective educational tool for promoting early identification of autism.

116.153 10 Randomized Study of Web-Based Teacher Coaching: Promising Practice and Lessons Learned. L. A. Ruble*[1], J. H. McGrew[2] and R. Johnson[1], (1)*University of Kentucky*, (2)*Indiana University - Purdue University Indianapolis*

Background:

The critical shortage in the numbers of special education teachers with appropriate training and available to respond to the epidemic increase in the prevalence of children with autism spectrum disorders (ASD) is a major challenge for schools. Shortfalls in the current training system have given impetus to the investigation of innovative professional development models. Research that provides scientific decision making in the selection and use of professional development models has the potential for major impact in both urban and rural areas.. Access to specialists in ASD is especially problematic for rural communities, and is exacerbated when communities are geographically isolated and impoverished such as those in Appalachian Kentucky. Urban schools also face similar challenges because the number of students with autism can easily exceed the availability of autism consultants and supports for classroom teachers. Moreover, the costs associated with professional development, consultation, and travel typically far exceed available resources for urban and rural schools alike.

Objectives:

The primary goal is twofold: (a) to present results of a randomized controlled trial of teacher consultation utilizing web-based technologies and (b) to include a description of lessons learned before implementing web-based technologies.

Methods:

Forty-three special education teachers were recruited from South Central and Eastern Kentucky and South Central Indiana. Participants were randomized into one of three groups: (a) placebo control, $n = 15$; (b) face-to-face coaching, $n = 14$; or (c) web-based coaching, $n = 14$. The participants in the two experimental groups received a manualized consultation intervention called COMPASS (Ruble, Dalrymple, & McGrew, 2010). Following the initial consultation at the beginning of the school year, teachers in both groups received four coaching sessions. During the coaching phase, a video recording was reviewed of the teacher instructing the child with ASD using the teaching plan from the consultation and a semi-structured interview using a problem solving approach was applied. Face-to-face coaching was onsite whereas web-based coaching occurred via Adobe® Connect Pro™ video conferencing technology. The placebo control group received online autism training.. Child outcomes were measured at the end of the school year using goal attainment scaling (GAS) of curriculum based assessment and direct observation by a research team member unaware of group assignment. Comparative analysis of child outcome will be conducted at Time 2 using analysis of covariance, with Time 1 GAS scores as the covariate.

Results:

The study is currently underway. Final data collection will occur in April/May 2011. Based on prior research (Ruble, McGrew & Dalrymple, 2010), we expect that students whose teacher receives COMPASS will demonstrate higher achievement GAS scores than students whose teacher do not receive the training. We also predict that the face-to-face experimental group will have higher goal attainment compared to the web-based group.

Conclusions:

We believe that the COMPASS intervention plus web-based technologies provide a promising avenue for improving educational outcomes. We will also provide a demonstration of the web-based technology we employed as well as lessons learned for future research and practice.

116.154 11 Evaluation of An Elearning Training Program for Behavioral Therapists. A. Najdowski*[1], D. R. Dixon[2] and J. Tarbox[2], (1), (2)*Center for Autism and Related Disorders*

Background:

Applied Behavior Analytic (ABA) treatment for children with autism spectrum disorders (ASDs) has been demonstrated to produce significant treatment effects across multiple studies (Eikeseth, 2009; Eldevik et al., 2009). Despite the demonstrated effectiveness of ABA, there continues to be a lack of trained clinicians to provide the treatment. Traditional training approaches include lecture, group discussion, and role-playing formats. However, alternative training approaches may increase the efficiency of training as well as dissemination to remote regions. One such possibility is eLearning, wherein trainees interact with computer programs, rather than, or in addition to, live human trainers.

Objectives:

The purpose of this study was to evaluate an eLearning tool that was developed for training newly hired behavioral therapists in academic knowledge of ABA treatment for children with autism.

Methods:

A randomized between-groups design was used. Ten training sites across 4 states (Arizona, California, Texas, and Virginia) were included in the study. Cohorts were randomly assigned to either the eLearning training group or the standard in-person training group. The dependent measure consisted of a written examination that was given prior to training and following training. Additionally, participants were evaluated again following a 3-month delay during which time they received hands-on training.

The eLearning training procedure involved individual trainees interacting with a computer program. The computer program was developed specifically for the purpose of training entry-level employees on the principles and procedures of ABA treatment for children with autism. After trainees completed the eLearning, they attended a two-hour follow-up discussion session with an in-person trainer.

The in-person training consisted of the standard training procedure for newly hired behavioral therapists that the service provider implemented on a regular basis. Trainers at all sites lectured using the same PowerPoint presentation. Group discussion was conducted throughout the lectures. Following the lecture and discussion for a particular topic, trainees were placed into pairs and engaged in role-playing to practice the procedures that were covered in the lecture and discussion. The topics covered in the in-person training were identical to those covered in the eLearning training and included the same video clips that were included in the eLearning training.

Results:

Test scores increased significantly for both groups, with the traditional didactic group achieving scores slightly higher than the eLearning group. The field performance of these therapists was compared to a group of therapists who received traditional in-person training on the same topics. No significant difference between the groups was found following field training, suggesting that therapists trained through an eLearning format can perform satisfactorily, given the proper hands-on experience.

Conclusions:

These results suggest that eLearning tools may be a useful strategy for extending training in ABA principles and procedures to settings in which limited or no contact with live professional trainers may be available.

116.155 12 Discovering Behavioral Intervention: A Parent's Interactive Guide to ABA. R. K. Fleming*,

Background:

Behavioral intervention (BI) is an evidence-based approach for teaching critical developmental skills and preventing/treating challenging behaviors in children with autism spectrum

disorders (ASD). Parents of children with ASD are often unprepared to communicate knowledgably with professionals as BI services are being considered and arranged. Online courses, if well designed, may help parents understand the fundamentals of BI such that they might better participate in decisions about specific approaches for their child, evaluate child outcomes, and more. Such courses are apt to be most effective if they are developed in concert with parents, made understandable and engaging through the use of video and interactive media, and made available "any time, anywhere."

Objectives:

This two-phase, NICHD-funded project was designed first to test the feasibility of an online module in BI with parents (Phase I), and then (Phase II) to design, develop and evaluate a commercially-viable10-module course, *Discovering Behavioral Intervention: A Parent's Interactive Guide to ABA*. This presentation will: 1) present formative and summative evaluation data from both phases; 2) display and demonstrate course features, including navigation tools, three forms of video (parent stories, BI demonstrations and interactive exercises) and interactive graphic objects; and 3) describe current product dissemination steps.

Methods:

Formative evaluation included parent focus groups and usability testing, and professional review. Course development followed a systematic instructional design protocol and utilized a research team comprised of parents of children with ASD, BI content experts, a professional filmmaker, a Flash® programmer and staff in two BI provider agencies. Summative evaluation (field testing), completed with convenience samples of N=21 (Phase I) and N=66 (Phase II), included participant demographics and goals, pre- and post-tests of knowledge and simulated application, and satisfaction surveying.

Results:

Phase I participants were mainly mothers of children with ASD (95%), primarily white (81%) and with internet experience (52% moderate daily usage). Most had the goal of seeking more advanced knowledge, particularly as it pertained to advocating for services (81%), although 33% sought general knowledge of BI. Knowledge testing showed substantial pre- to post-test gains (56.2% to 85.2%), with little difference between participants whose children had received BI services for <18 months vs. >18 months. Data did not closely approximate a normal distribution, so we performed a nonparametric test, the Wilcoxon signed rank test. The Signed Rank for this treatment effect was S=155.5, which was highly significant ($p < .0001$, two-tailed). Participants were moderately to extremely satisfied with course features, including navigation, understandability and practical importance of content. Phase II results are being analyzed, but we achieved far more diversity (e.g., broader ethnic representation, 13% fathers), and pre- to post-test scores across four new and more diverse modules of 66.5% to 80.6%, 76.2% to 93.7%, 56.3% to 87.3% and 63.3% to 64.8%, respectively.

Conclusions:

Discovering Behavioral Intervention received high usability and satisfaction ratings and significantly increased parents' knowledge in field testing. Research in needed on the potential impacts of this course on a host of family and child outcomes.

116.156 13 Collaboration and Perspective-Taking In Collaborative Virtual Environments by Young People with Autism Spectrum Conditions: A Pilot Study. S. Garib-Penna* and S. Parsons, *University of Birmingham*

Background: **:** Collaborating with others requires the ability to communicate as well as to understand and interpret their perspectives. However, these abilities are well established core difficulties for people with autism spectrum conditions (ASC). Attempts have been made to facilitate understanding in these domains including explicit teaching of cognitive concepts using Theory of Mind tasks, involving video, pictures and real-world role play of skills. Such studies report varying degrees of success, with generalisability of understanding to real-world behaviours and contexts proving difficult to achieve.

Objectives: This pilot study aimed to evaluate the potential of training young people with ASC on collaboration skills, including communication and perspective-taking, with the use of Collaborative Virtual Environments (CVEs). These virtual reality technologies allow multiple users to occupy the same virtual space, enabling them to adopt different viewpoints within a task.

Methods: Our 'Block Party' task utilised this affordance to encourage children to work together to achieve a shared goal: to collaboratively build a tower out of coloured blocks. Each child had a different target colour pattern to achieve and therefore had to communicate with each other in order to jointly select a block with the colour combination which suited both their needs from a selection of blocks. To do this they needed to understand that the other person's perspective was different to their own and communicate effectively with their partner about which block they needed to choose. Three pairs of high functioning young people with ASC, and four pairs of typically

developing (TD) peers took part. Background measures of language and general cognitive ability were taken and the Social Communication Questionnaire administered to parents of the ASC group.

Results: Performance on the Block Party task was videotaped and a preliminary analysis for quality and nature of the collaboration conducted. The analyses revealed that both diagnostic groups were generally able to cope with the task demands. The analyses also revealed qualitative differences in the way the ASC group interacted to achieve collaboration in comparison to TD pairs of children. Initial observations indicated that young people with ASC were more likely to try to complete the task without communicating with their partner and interacted with each other less spontaneously. More detailed results and their implications will be presented and discussed at this conference. These will include categorisation of types of collaboration as well as the acceptability and usability of the task within the CVE. We will also comment on how children's understanding requires scaffolding within the game, either through the facilitation of computer-assisted mediation by a virtual character or via a human mediator.

Conclusions: Initial observations would indicate that the Block Party CVE task has potential for practicing ASC children's communication and perspective-taking skills, as preliminary video-observations would indicate that they were less likely to communicate with their peers to complete the task collaboratively. In the next phase of the project, the Block Party task will be implemented by teachers in schools as part of a social competence training intervention over a 10 week period.

116.157 14 Virtual Reality Methods for the Study of Talking and Looking Behavior In People with High Functioning Autism (HFA). N. V. Hatt*, W. Jarrold, M. V. Gwaltney, N. McIntyre, M. Solomon, S. Ozonoff, K. Kim, B. E. Seymour and P. C. Mundy, *UC Davis*

Background: Virtual reality (VR) may enable a novel means of studying variables relevant to social attention in HFA because looking behavior is not simply a dependent measure as in traditional studies. Rather it can interactively affect experimental phenomena. Social attention in school-age populations is relatively under-studied in comparison with younger children. It involves coordinating visual orienting to multiple social partners while speaking to them.

Objectives: To address the challenge of measuring associated behavioral variables we have computationally analyzed visual orienting (a.k.a. "looking behavior") and speech produced during a social VR task. We propose to provide an interactive demonstration of this VR task.

Methods: Participants were children aged 8-16 years with HFA (n= 20) and matched typically developing (TD) controls (n = 20). The task required participants to respond to questions while looking at 9 avatars in a virtual classroom. Looking behavior was measured via head-tracker telemetry. Social attention was defined as the Total Number of Looks to avatar head regions. In the Cued Condition avatars became translucent if they did not receive attention, but became opaque again once fixated. In the Non-Cued condition avatars remained opaque. Speech during the task was transcribed and from that word count and frequency of dysfluencies (e.g. "uh", "um", etc) was computed.

Results: Results revealed no significant differences between the preadolescent (8-11 years) HFA and TD groups who displayed comparable rates of Social Attention or the Number of Looks to Avatars across 2 three minute trials (106.8 vs. 98.3 Looks respectively). In contrast, there was a robust difference between the HFA and TD adolescents groups (12-16 years), $F(1,14) = 6.28$, $eta^2 = .31$ (105.4 vs. 144.5 Looks respectively). Thus, similar to O'Hearn et al. (2010) results revealed typical adolescent advances in social attention capabilities not seen in the Adolescent HFA sample. Additionally, HFA children with higher ADHD scores (T-score > 75) displayed significantly lower Social Attention compared to all other subgroups (82.93 looks, $F = 6.15$, $eta^2 = .20$).

Speech measures were reliable across cuing conditions for word count and dysfluency frequency ($r = .85$, $r = .71$ respectively). Word count was not significantly correlated with dysfluencies suggesting the two distinct behavioral dimensions. Contrasting Cued versus Non-Cued conditions revealed decreased word count (paired $t(38) = -2.04$, $p = 0.048$) and increased dysfluencies (paired $t(38) = 1.97$ $p = 0.057$) in the Cued condition, consistent with the hypothesized increased cognitive load of that condition.

Conclusions: Social attention in HFA was poorer than TD but only in the older age group suggesting a late onset developmental disturbance in HFA. Our VR Social Attention measure is associated with a standard attention measure. Additionally, a hypothesis that increased cognitive load of Cued condition would manifest in terms of increased dysfluency frequency and decreased word count was supported. In sum, VR-based social orienting and speech analytic measures were associated in reliable and/or meaningful ways with independent clinical and VR cuing variables.

116.158 15 A Pilot Investigation Of Visual Exploration During Face-To-Face Social Interaction In Virtual Reality. O. Grynszpan*[1], J. Constant[2], J. C. Martin[3], J. Simonin[4] and J. Nadel[5], (1)*CNRS USR 3246, Université Pierre et Marie Curie*, (2)*Hôpitaux de Chartres*, (3)*LIMSI-CNRS, Université Paris Sud*, (4)*Holo3 Inc.*, (5)*CNRS USR 3246*

Background: Individual with High Functioning Autism Spectrum Disorders (HFASD) exhibit profound pragmatic difficulties that have been linked to atypicalities in the visual exploration of facial expressions. While most studies have focused on difficulties in recognizing emotions and attending to relevant features of the face, little is known about the ability to regulate one's own eye movements in a conversational context.

Objectives: The present study investigates the existence of impairments in the self-monitoring of eye motion during social interactions.

Methods: We designed a task where a virtual character addresses the participants and utters a key sentence that can be interpreted either literally or non-literally. The character's facial expressions enable disambiguating this key sentence and therefore understanding the whole message. After each such animated scenario, participants are asked two closed-choice questions that evaluate their performance in non-literal interpretations. Sixty different social scenarios were constructed using two virtual characters, a female and a male, that were embedded in videos of real life settings, thus providing a naturalistic context. Thirteen adolescents and adults with HFASD and fourteen typical individuals were assessed with this task according to two conditions. The experimental condition relied on an eye-tracking system that simulated a gaze-contingent lens: the entire visual display was blurred in real-time, except for an area centred on the focal point of the participant. In the control condition, the participant's eye movements were merely tracked. A remote eye-tracker was used so that the participants were not constrained by a helmet. The experimental protocol followed an ABA design: the gaze-contingent lens was first deactivated (baseline condition), then activated (experimental condition) and finally deactivated again (final condition). At the end of the experiment, participants were inquired on whether or not they had noticed that they were in control of the lens. The gaze data was analysed with a software prototype, adapted for the present study, which could handle eye-tracking on dynamic visual displays. The data was analysed using an ANOVA with Condition as the within-subjects variable and Group (HFASD vs. typical) as the between-subjects variable.

Results: Fixation data revealed that the HFASD group did not modulate their eye movements in the experimental condition as efficiently as the typical group. Additionally, significantly fewer participants with HFASD noticed that the lens was controlled by them. Finally, for the HFASD group, performances on the task were correlated with the time spent on fixating the face in the experimental condition, but not in the control condition.

Conclusions: This experiment provides some direct evidence for impairments in self-monitoring of eye movements in HFASD and, consistently, suggests an alteration in the sense of agency. This outcome seems conducive in characterizing the atypicalities of visual exploration in HFASD. Additionally, by constraining the visual field, the gaze-contingent lens presumably hindered compensatory strategies based on lateral vision, thus yielding a setting that might prove highly beneficial for educational purposes. The presentation will involve interactive demonstrations of the virtual environment, the associated eye-tracking analysis tools and videos of the visual exploration patterns taken from case examples in our study.

116.159 16 Virtual Reality Based Gaze Sensitive System for Children with Autism Spectrum Disorder: Implications on Behavioral Viewing Patterns. U. Lahiri*, Z. Warren and N. Sarkar, *Vanderbilt University*

Background: Appropriately individualized behavioral interventions can improve social communication vulnerabilities of individuals with autism spectrum disorder (ASD). For dyadic communication eye-gaze is an important ingredient. Individuals with ASD often exhibit atypical gaze patterns characterized by greater fixation towards non-social objects than faces of individuals. While many individuals with ASD are capable of yielding correct performance on objective social communication task measures, it is their vulnerabilities surrounding elements of social communication that is closely tied to their functional social impairments. Thus, the development of a technology that may provide an enhanced methodology for individualized services wherein an interactive Virtual-Reality (VR) based system can incorporate one's dynamic eye-gaze data and performance metric simultaneously in order to guide intelligent decisions about one's participation in the social communication task is critical.

Objectives: In the present study, we developed a system that seamlessly integrates VR technology with dynamic eye-tracking to create virtual gaze-sensitive social communication scenarios capable of delivering individualized feedback. Subsequently, we studied the implications of such individualized feedback for adolescents with ASD.

Methods: Six adolescents with ASD (age 13-18 years) participated in this study. VR-based social communication tasks (Trial1-5) were designed to project human characters (avatars or, virtual classmates) telling personal stories with context-relevant objects in the background. The participants were asked to try to make their virtual classmates as comfortable as possible while listening to their presentation. However, it was not explicitly stated that in a presentation a speaker feels good when the audience pay attention to him/her (by looking towards the speaker). The idea here was to give indirect feedback to the participants about their viewing patterns and thereby study how that affects them as the task proceeded. The presented visual stimulus was segmented into Regions of Interest (ROIs). We computed real-time behavioral viewing indices (fixation duration (FD) and object-to-face ratio (OFR)) of the participants. At the end of each trial, the participant was asked a story-related question. Based on the participant's response and the percentage of FD on the avatar's face (Face_ROI), our system generated individualized feedback. We examined the impact of the individualized feedback on their viewing indices.

Results: The participants' behavioral viewing indices, such as FD towards the Face_ROI, and OFR showed improvement across trials. Specifically, all participants demonstrated improvements in terms of time spent looking at the Face_ROI from first to fifth trial (i.e., end of four trials with individualized feedback), with a dependent samples t-test indicating a statistically significant change for the groups. Also, all participants demonstrated an improvement in OFR from the first to fifth trial with statistically significant change in OFR for the groups.

Conclusions: The results show the feasibility of a VR-based gaze-sensitive system to provide individualized feedback on one's behavioral viewing in an on-line, continuous manner. Investigation indicates that such feedback can contribute to improvement in one's behavioral viewing patterns during social communication. Such capability suggests that this developed technology could be integrated into a more complex and sophisticated social interaction task to achieve targeted goals if paired with appropriate reinforcement paradigms.

116.160 17 Exploring Responses of Children with ASD to a Virtual Character In the ECHOES Technology Enhanced Learning Environment. G. Rajendran*[1], A. Alcorn[2], H. Pain[2], T. Smith[3], O. Lemon[4], K. Porayska-Pomsta[5], M. E. Foster[4] and C. Frauenberger[6], (1)*University of Strathclyde*, (2)*University of Edinburgh*, (3)*Birkbeck, University of London*, (4)*Heriot Watt University*, (5)*London Knowledge Lab, Institute of Education*, (6)*University of Sussex*

Background: Virtual environments and characters allow individuals with an autism spectrum disorder (ASD) to practice skills repeatedly, in a way that may be less threatening, less socially demanding, and more controllable than is face-to-face interaction with a human partner. To date, their use as an intervention tool has focused on teaching situation-specific social skills to older children or adolescents (e.g. navigating through a bus or restaurant). Little is known about how young children with ASD interact with virtual characters and whether or not they perceive them as being intentional. Even less is known about which *specific* agent behaviours or combinations of behaviours are particularly effective for capturing, directing, and eliciting responses to attention within a virtual environment.

Objectives: The ECHOES technology enhanced learning project has developed a multi-modal virtual learning environment to support joint attention initiation and response in young children (aged 5-8) with and without an ASD. Gathering qualitative data while children interact with ECHOES illuminates general research questions about whether children with ASD treat virtual characters as intentional social beings with whom they are willing to engage. Reaction time and accuracy data were gathered to assess the effectiveness of specific agent cueing behaviours in attracting and directing a child's attention during a task in the virtual environment.

Methods: 30 children with ASD (aged 5-14) individually completed a flower-selection task in the ECHOES environment in cooperation with the virtual agent, Paul. To complete each trial successfully, participants had to respond to Paul's joint attentional initiations via a touch screen. Initiations varied on the mutuality of Paul's gaze and the presence or absence of a distal pointing cue.

Results: Participants had a mean accuracy of 88.12% (SD=20.22%, Median accuracy 95.14%). Accuracy did not vary significantly across the four trial types, nor was it correlated with age ($r=0.23$, $p=0.21$). Examining *patterns* of errors provided a useful basis for classifying participants into different categories of learners. A 2 (mutual gaze) x 2 (gesture) repeated measures ANOVA of reaction time data showed a interaction of mutual gaze and pointing cues, $p=<.01$ ($F=1, 30$), with a strong effect size (Cohen's $f= 0.48$). The lack of a strong main effect driving this ANOVA suggests that it is the *conjunction* of gaze and pointing cues which results in the fastest reaction times.

Conclusions: Qualitative data and high accuracy indicate that children with ASD successfully engaged with agent Paul and followed his joint attentional bid to complete the selection task. Almost all children treated Paul as intentional, attributing his behaviours to a variety of mental states and greeting or addressing him directly. These preliminary results are encouraging for further use of virtual agents as an intervention tool. Results of the reaction time analyses suggest that ASD children may be able to more rapidly process and respond to combined gaze and gesture cues in a virtual environment than to single cues, emphasising the importance of including both in future design.

116.161 18 Integrating Authorable Virtual Peers Into Social Groups. A. Tartaro*,

Background:

Our previous work (IMFAR 2009) introduces Authorable Virtual Peers (AVPs), a technology tool designed to scaffold contingency and reciprocity skills during peer social interactions. An AVP is a life-sized, child-like, animated character that interacts with children in three modes: children can collaborate face-to-face with the virtual peer, using speech and gestures, to create a story; they can create new stories for the virtual peer to tell with other users; and they can select pre-planned responses for the virtual peer while it interacts with another person. In this study, we developed and evaluated a comprehensive group intervention program incorporating the AVP.

Objectives:

We asked, (1) can an AVP be integrated into a group intervention program? and (2) Do AVP interactions help children with ASD engage in reciprocal social interactions with their peers?

Methods:

Working with two therapists at a developmental disorders clinic, we created a 10-week program that incorporated the AVP as a component of a social group curriculum (Baker, 2001). The program included didactic instruction on specific social skills, group activities and dyad role-play. Each week, four of the children used the AVP system prior to the role-play task. They create new story components for the virtual peer, and then took turns with a partner controlling and interacting with the virtual peer. The analysis examined appropriate use of reciprocity skills during the role-play task. We used standard least-squares regression to see if using the AVP, the number of weeks in the intervention or language ability, along with interactions, were significant predictors of appropriate reciprocity. Eight children, ages 8-12, participated (7 included in the analysis).

Results:

We found a significant effect due to the AVP ($p<.003$) that suggests children were more likely to use appropriate reciprocity during the dyad role-play if they first interacted with the AVP. We found a significant effect due to week ($p<.002$) that suggests children's use of appropriate reciprocity increased over the course of the intervention program. We also found a significant effect due to the interaction of language and week ($p<.01$), suggesting language ability negatively impacted the increased use of appropriate reciprocity.

Conclusions:

Thus children were more likely to use appropriate reciprocity skills after using the AVP, and their appropriate use of reciprocity increased over the course of the intervention. In this technology demonstration, we will present the software, results of our study, and video examples of children engaging in AVP interactions.

116.162 19 Results of An RCT of FaceSay In Public Elementary Schools. C. Wimsatt*, *Symbionica, LLC*

Background:

A 2007 RCt of FaceSay (N=49, submitted), showed promising outcomes, particularly in naturalistic playground observation measures. While the 2007 study was done in private school settings for special needs students, this 2010 study (N=31) evaluated FaceSay in a more typical community setting, public elementary schools. To address the more challenging environment, a higher dose of FaceSay was planned. In practice, a lower dose of FaceSay was all that was feasible. The results were a mix of expected - no in-vivo, but good in-vitro - and a surprisingly strong results on a standardzied Theory of Mind measure.

Objectives:

Aim 1: The primary aim was to evaluate whether FaceSay could improve student performance on standardized neuropsychological assessments of ER and theory of mind in a community setting. It was predicted that the intervention group would have significantly higher mean pre-to-post intervention scores on ER (hypothesis 1) and ToM (hypothesis 2) after the intervention, as compared to the control group.
Aim 2: The secondary aim was to evaluate if FaceSay could improve social skills including the generalization of those skills

to natural settings, such as the classroom and the playground in a community setting. It was predicted that the intervention group would show a greater improvement in classroom (hypothesis 3) and playground observations (hypothesis 4 and 5) after the intervention, as compared to the control group.

Methods:

31 children met the inclusion criteria of being a K-5th student in the district eligible for special education services under the educationally based handicapping condition of autism high functioning. Participants were randomized to either treatment (FaceSay) or control (SuccessMaker). Participants met once per week for 10 weeks as part of their regularly scheduled computer lab time.

Measures:

Emotion Recognition: Nepsy II Affect Recognition subscale
Theory of Mind: Nepsy II ToM subscale
Classroom Observations: SRS (completed by teachers blind to the assignments)
Playground Observations: Hauck (completed by research assistants blind to assignments)

Results:

Analyses used an independent samples t-test, with group as the independent variable, the post test score as the dependent variable and the pre-test score as the covariate.

Hypothesis 1: Improved Emotion Recognition on standardized neuropsych assessment. Significant. ($p < .001$)
Hypothesis 2: Improved Theory of Mind on standardized neuropsych assessment. Significant. ($p < .001$)
Hypothesis 3: Improved Social Interactions in the Classroom. Not significant.
Hypothesis 4: Increased Positive Interactions on the Playground. Not significant.
Hypothesis 5: Decreased Negative Interactions on the Playground. Not significant.

Conclusions:

The results from this RCT provide interesting new data about FaceSay. In a public school setting, lower doses of FaceSay are probably not sufficient for a measured impact in naturalistic settings. The strong results on Theory of Mind are encouraging and provide additional support for the notion that awareness of the face is central to social learning. The ToM results also suggest an interesting meta-question about states of mind. If you assumed that all communication is explicit, would you be inclined to wonder about others' states of mind?

Acknowledgements:

This study was designed and conducted by Linda Rice in fulfillment of her PhD in School Psychology.

116.163 20 Rachel: A Data Collection Paradigm for the Quantitative Assessment of Children's Speech Patterns. E. Mower*[1], M. P. Black[1], M. E. Williams[2] and S. S. Narayanan[3], (1)*University of Southern California*, (2)*University of Southern California Keck School of Medicine*, (3)*Signal Analysis and Interpretation Laboratory (SAIL), University of Southern California*

Background:

Engineering systems provide controlled platforms for interaction and automatic tools to quantify aspects of the resulting behavior. The measures derived from these tools can be used to aid clinicians in diagnostics and in the development of individualized therapeutic interventions. In this work we present Rachel, an Embodied Conversational Agent (ECA), for the collection of interaction data from children with autism and their parents. This work was demoed at IMFAR 2010. ECAs are an important tool for natural, repeatable, and structured interaction behavior collection. The goal of this work is to explore how an ECA platform can elicit conversational behavior for automatic and manual analysis.

Objectives:

The ECA used in the study is designed to elicit natural affective communication through the interaction protocol and accompanying scenarios. The recorded communication is automatically assessed using: speaker clustering, interaction modeling, and a statistical analysis of prosody. The manual analyses include transcription and speech act coding.

Methods:

Rachel is an ECA designed to elicit affective and social child-parent-computer interaction behavior for analysis in a four-session emotion problem-solving study. The ECA serves as the moderator and coach, introducing the scenario and querying the child for detail. The interactions use the Wizard-of-Oz paradigm allowing for controlled and repeatable interactions while avoiding the technological challenges associated with speech recognition and understanding. The child and parent interact with the ECA either audibly or using a touch monitor.

The interaction is recorded using audio-visual sensors and the ECA behavior is logged.

The audio data were manually segmented by speaker and transcribed as a ground truth. Speaker clustering was conducted using the audio data and Rachel log files, allowing us to identify the speaker at each instant in time (the transcription data is used to validate the accuracy). The results of the speaker clustering data were leveraged to model the child-parent-ECA interaction patterns, providing a quantitative description of the observed speech patterns. The results of the speaker clustering can also be used to isolate the child's speech for prosodic assessments. The transcription data were manually coded with speech act tags to provide statistical relationships between the ECA's speech acts and the child's and parent's responses.

Results:

The ECA technologies were tested on two children with autism. The inclusion criteria included: 1) a diagnosis of autism (confirmed through an administration of the Autism Diagnostic Observation Scale (ADOS) by a psychologist with a research certification in the ADOS); 2) age 5-13 years; 3) a score on the Vineland Behavior Scales at or above an age equivalent of 2 years, 6 months, and 4) both the parent and the child were English-speaking. The children included two boys: one 6 and one 12. The results of the automatic assessment will be discussed at the workshop.

Conclusions:

ECA technologies can elicit social interactions for post-hoc analysis. The Rachel interaction data were recorded using audio-visual and log files to facilitate post-hoc analysis to identify aspects of social deficits in children with autism. This work is supported by the National Science Foundation and Autism Speaks.

116.164 21 FaceStation: Computer Games That Train Face Perception and Reward Circuitries In Autism. G. Kohls*[1], S. Faja[2], E. N. Madva[1], S. J. Cayless[1], S. Zayat[1], W. C. Longmire[1], J. S. Miller[1] and R. T. Schultz[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Washington*

Background: Perceiving facial information is challenging for many children with an autism spectrum disorder (ASD). Moreover, functional brain imaging studies have shown that activation in face processing and reward circuitries differ between individuals with and without ASD when dealing with faces. However, recognizing and understanding facial information are essential skills for competent social functioning, and can be enhanced for individuals with ASD by using computer-based interventions. The Center for Autism Research at the Children's Hospital of Philadelphia has developed a new set of computer games, called *FaceStation*, designed as a training tool to enhance face perception abilities among children with ASD. This novel treatment is modeled after an existing set of similar games – *Let's Face It!* (*LFI*) (Tanaka et al., 2010), and while *FaceStation* is a stand-alone application, it can be used in combination with *LFI* to increase "treatment dosage." Computer games are an especially promising intervention tool, because they are naturally engaging and allow the child to learn the critical social perceptual skills in the context of an activity that is intrinsically rewarding and self motivating.

Objectives: *FaceStation* has been developed as a part of a study aimed at testing the effectiveness of computerized gaming interventions for remediating social perceptual deficits in ASD. It is composed of a suite of 7 games, each designed to foster perceptual skill development in a manner that is intrinsic to the game play. We will demonstrate this new suite of games and discuss the rationale for each game, and how the combination of games forms an effective treatment vehicle.

Methods: Efficacy of *FaceStation* is being assessed in an ongoing randomized control study of 40 children with ASD using pre- and post intervention behavioral measures of perceptual skills and fMRI measurement of key brain regions involved in social perception and reward. Forty 8-13 year olds with ASD with impaired face perception skills are being randomized to two groups: active intervention or waitlist control. Twenty non-ASD typically developing controls (TDC) are being studied at baseline for normative comparison. The treatment group receives software to play *FaceStation* on a personal computer at their home or school. Both ASD groups are assessed before and after the game play (or waiting) period. The main outcome measures are performance on a face recognition skills battery and fMRI activation in face and reward brain circuitries.

Results: Data collection is ongoing. In this presentation, the developers of *FaceStation* will explain their game design process, from concept to completion. Preliminary data from children with and without ASD who played the games will be discussed. The presentation will include a live demo of selected games.

Conclusions: Our project is intended to increase the neurobiological understanding of the predictors of game playing

(such as neural reward responsivity) and the outcomes of game playing (brain plasticity) to enrich our knowledge of how, why, and when rehabilitation games are most effective, particularly in children with developmental delays such as ASD.

116.165 22 Using Robots to Facilitate Child-Child Interaction to Promote Social-Cognitive Behaviors. K. Boser*[1], C. Lathan[2], C. Samango-Sprouse[3] and M. Michalowski[4], (1)., (2)*AnthroTronix*, (3)*George Washington University, Washington, D.C.* , (4)*Beatbots*

Background:

Prior studies of children with Autism Spectrum Disorder (ASD) with low verbal skills have demonstrated an increase of social behaviors in the presence of a robot as measured by imitation, touch, proximity, and gaze (Michaud et al. 2003, Robins et al. 2004, 2006). Studies have demonstrated a clear preference for plain, non-human features of robots over more human-like features by children with ASD. The ASD children's preference for and increased social behavior with robots arises due to their social simplicity, predictability, and responsiveness (Robins et al. 2003).

Objectives:

Our aim in this study was to examine: (1) ASD children's reactions to various mechanical toys, including teleoperated robots and animatronic animals, to determine which features lead to increased social interaction between the mechanical toy and the child; and (2) ASD children's interaction with typically developing (TD) peers in the presence of the various mechanical toys. We sought to extend our trials from a single child interacting with the toys to interactions between two children while engaging with the toys. Shared play was observed in the context of a variety of different toys in order to understand what characteristics led to increased social-engagement behaviors.

Methods:

Trials were conducted with ten pairs of children aged 2 to 8, each pair consisting of one child with ASD and one TD child. Seven pairs included ASD subjects with very low-verbal ability. Each pair of children was led into a child-centered playroom that contained one of four mechanical toys that represented a range in complexity of features. Two of the toys were teleoperated robots: the simplest, "Keepon," can bounce up and down, turn and nod its head, and lean side-to-side on a stationary platform. "Cosmo" had similar complexity but could also move on a wheeled platform. These two robots were human-controlled in response to social-interactive child behaviors (e.g., nearness, gaze, smile, touch). The other two toys were animatronic animals, which behaved autonomously but whose sounds and movements were not always predictable (e.g., a dog that barked and moved). These toys also had much more complex features as they were meant to look lifelike.

Results:

Seven of the ten children with ASD demonstrated greater interest in the teleoperated robots than in the animatronic toys. The majority of these subjects also demonstrated greater imitative behaviors with their peers in the context of the robots. Seven of the ten children with ASD turned or walked away from mechanical animals. A number of different types of social interactions were observed with the two robots (smiles, vocalizations, gestures, gaze). As verbal abilities increased, engagement with the animatronic animals increased.

Conclusions:

Results indicate that the lower the child's verbal abilities, the simpler their preferred robotic toy. In other words, higher-functioning children preferred the animatronic toys, whereas the more nonverbal children showed a definite preference for the robots. The next steps will be to determine which features lead to greater shared and social responses between children with ASD and their peers and expand on these findings regarding the response hierarchy.

116.166 23 Detection and Classification of Positive Vs. Negative Robot Interactions with Children with Autism Using An Automated System. D. Feil-Seifer* and M. J. Mataric, *University of Southern California*

Background: A recent feasibility study involving children with autism spectrum disorders (ASD) interacting with a socially assistive robot showed that some children have positive reactions to robots, while others may have negative reactions, easily observable in the child's distances from the robot, parent, and the walls of the room. A positive reaction with the robot included time standing in front of the robot at a close distance, a negative reaction was indicated by moving away from the robot, and staying close to a wall or to a parent. Since it is unlikely that children with ASD will enjoy any robot 100% of the time, it is important to develop methods for detecting negative child behaviors in order to minimize distress and facilitate effective human-robot interaction.

Objectives: The goals of this work are 1) to model the interaction state of children with ASD as they interact with a

robot and a parent using distance-based features obtained automatically from an overhead camera, and 2) to determine if such automatically coded distance state are comparable with a human rating of the interaction state.

Methods: We recorded 8 children with ASD as they interacted with their parent and a robot in the experimental space for multiple 5-minute sessions. A human rater annotated the sessions for child response to the robot, overall positive or negative interaction during the session, and current behavior of the child including: interaction with the robot; huddling near parent; huddling near wall; and avoiding the robot.

We equipped the experiment space with an overhead camera. Using an in-house overhead vision system, the positions of the child, robot, and parent can be automatically determined. A spatio-temporal model of social behavior using and 8-dimensional feature vector, including distances and velocities, between the child and robot, parent, and wall was computationally obtained using the overhead data and clustered using expectation-maximization to a Gaussian Mixture Model (GMM) into 50 clusters. These clusters were then classified using a naïve Bayes classifier, based on a human rating for training data into the above described behavior. The model was trained on 20% of the recorded data, and tested on the remaining 80%.

Results: The approach achieves a 91.4% accuracy rate in classifying robot interaction, parent interaction, avoidance, and hiding against the wall behaviors and demonstrates that these classes are sufficient for distinguishing between positive and negative reactions of the child to the robot.

Conclusions: The overhead camera system discussed in this work was able to extract the relevant features from the recorded data. The GMM-based method for state clustering can efficiently and effectively cluster the 8-dimensional feature space. These states are easily labeled by using annotated training data and could be used for partial behavior transcription. Potential concerns include over-generalization that can happen with human labeling, and over-specialization given the heterogeneity of the participant population.

116.167 24 Robot-Mediated Joint Attention Tasks for Children at Risk with ASD: A Step towards Robot-Assisted Intervention. E. T. Bekele*, U. Lahiri, J. A. Davidson, Z. Warren and N. Sarkar, *Vanderbilt University*

Background:

Emerging technology has the potential to play a crucial role in providing powerful, accessible, and individualized interventions to young children with Autism Spectrum Disorders (ASD). Specifically, adaptive robotic technology appears to be very promising in this regard, as the technology may generate intrinsic interest for some children and has the potential to flexibly adapt, scaffold, and reinforce micro-level skills in a manner that may not be possible within traditional intervention modalities. *In this work we developed a novel adaptive and individualized, robot-mediated; intervention technology for children with ASD focused on joint attention related skills*.

Objectives:

The objective of the work was to develop robot-mediated technology for children with ASD with a potential for assessment and intervention surrounding joint attention skills. Specifically, we attempted to endow this technology with the capacity to automatically detect and respond to shifts in looking patterns and simultaneously adjust joint attention prompts and cues based on performance.

Methods:

We have implemented a multi-camera, distributed head tracker system and integrated it with a small humanoid robot. The robot can initiate joint attention and dynamically generate individualized feedback based on the participant's viewing pattern inferred from his/her head movement. The tracker uses viewing pattern to trigger the robot or a therapist to give reinforcements. The procedure employs both the humanoid robot (non-social, NS) and a human therapist (social, S) in a single subject multiple baseline strategy. A group of 6 children at risk with autism and a control group of 6 typically developing children of ages 2 – 5 are currently being recruited for this study. A human therapist and the humanoid robot will take turns to initiate the joint attention tasks.

Results:

The head tracker accuracy, consistency, and sensitivity in manual initialization were tested on a 24 inches LCD monitor, which was located 1.5 meter away in front and 0.2 meter above the head of the subject. The average error was 2.6cm with a speed of up to 20 frames per second over 20 target points uniformly distributed across the screen. The functionality of the system was tested with a typically developing child of age 12. In three tests, the child: 1) follows the prompt normally; 2) follows the prompt with frequent head movement; and 3) intentionally delays in following the prompt. The system measures performance metrics for these trials such as the latency of the head movement, fixation durations, and frequency of looking. Finally, the system's hierarchical

prompting protocol was validated: if the child did not look, the robot adds the child name in the prompt; and if the child still did not respond, the robot adds pointing gesture.

Conclusions:

Initial study with children with ASD will help assess the effectiveness of the system. We are endowing the system with dynamic reinforcement given through the targets in a context aware manner. The system can be extended to other tasks beyond the joint attention task. This can potentially lead to the development of robot-assisted systems for early diagnosis and treatment for children at high-risk with ASD.

116.168 25 Computer-Assisted Literacy Training for Nonverbal Children with Autism: A Pilot Study. M. B. Cull*[1], A. Whitaker[1], J. F. Feldman[2], K. J. Hoyte[2], M. Algermissen[2], M. McSwiggan-Hardin[1], S. Goh[3] and B. Peterson[2], (1)*Columbia University Medical Center*, (2)*Columbia University, NYS Psychiatric Institute*, (3)*Columbia University*

Background: Research on literacy in children with Autism Spectrum Disorders (ASD) has neglected those who are nonverbal, perhaps based on the assumption that in the absence of spoken language, written language is impossible. Case descriptions, however, challenge this assumption.

Objectives: To conduct a preliminary study of the effectiveness of a novel computer-assisted program specifically developed for teaching literacy to non-speaking children with ASD.

Methods: Eighteen nonverbal children meeting criteria for ASD on both the Autism Diagnostic Interview Schedule-Revised and the Autism Diagnostic Observation Schedule were tested with the Leiter-Revised nonverbal test of intelligence. Each child was then randomly assigned to one of two groups (9 each). The target group participated in a literacy program (A Light on Literacy) while the control group participated in a math program. The programs were comparable in time, individual attention, and style of instruction. Both programs were developed by Marion Blank, Ph.D. and use computer-assisted methods that do not rely on spoken language. Literacy instruction involved not only decoding but also comprehension as evidenced by following written directions and answering questions. All language production involved writing (hand-writing and keyboarding). Using criterion-referenced tests, all children were assessed on literacy and math proficiency before and after instruction. The examiner was blind to group status. A liberal threshold for significance (0.1) was employed because of the small sample size and consequent low power for detecting significance.

Results: Nine children, five in the Literacy group and four in the Math group, completed the program. Of the nine non-completers, eight were in settings that did not allow for fidelity of administration and one moved away. Among completers, the male to female ratio did not differ significantly between the Literacy and Math groups (4:1 and 3:1, respectively) nor did IQ (60.4 and 51.2 respectively). Of the five children in the Literacy group, three showed significant gains on the literacy test (by paired t-test over the 9 sections of the test) while one child stayed at the same level and one declined slightly. Of the four children in the Math group, two showed significant gains on the math test (by paired t-test over the 14 sections of the test), while one stayed at the same level and one declined. At the group level, there was a significant triple interaction, reflecting greater improvement pretest-to-posttest on the literacy test by the literacy group than the math group and greater improvement on the math test in the math group than the literacy group, Hotelling's Trace = .553, $F(1,7) = 3.862$, $p = 0.090$, $\eta_p^2 = 0.356$.

Conclusions: This computer-assisted program of teaching literacy to non-verbal children with autism shows promise. If any percentage of non-speaking children with ASD attains language via literacy, then a significant cognitive and communication skill becomes available to them. In addition, this achievement may expand our understanding of potential skills available to at least some non-speaking children with ASD. This computer-assisted program deserves further investigation.

116.169 26 Media-Based TeachTown Interventions for Teaching Early Developmental Skills. C. Whalen*, L. Lara-Brady, M. Rearick and K. MacDonald, *TeachTown*

Background:

TeachTown: Basics, a computer-assisted behavioral intervention, has been shown in studies to be a promising tool for teaching early developmental skills to students with autism and other special needs. Recent studies have replicated positive results with preschoolers using a standardized developmental outcome measure and have demonstrated usage patterns of discrete trials (e.g. reaction time, accuracy, prompting) for thousands of existing students. TeachTown has been in the development stages for a new product, *TeachTown: Social Skills,* that utilizes the science of video modeling, social stories, narrative language, and social development to teach social skills to young children in a group instructional model. Each volume includes day-to-day group lessons and 1:1 assignments to teach 10 different social skills. The first volume, *Following Rules,* is currently being piloted in multiple classrooms across the U.S. Both products include

engaging animated characters and professional media design to enhance motivation and improve maintenance of intervention over time.

Objectives:

1) To demonstrate 2 products designed to target early developmental skills including language, social skills, cognitive, play, and academic skills. Demonstration will include engaging hands-on experience with the products; 2) To show the most current research results on each product; and 3) To provide a description of each product including the science behind each of them using hand-outs and samples of each product.

Methods:

Current research on *TeachTown: Basics* and pilot data for *TeachTown: Social Skills* will be presented. Both products will also be demonstrated and will include the opportunity for children, parents, or researchers to try out each product at IMFAR and to take a sample of both products for further evaluation. Data from *TeachTown: Basics* was analyzed regarding choice making of students using the software. Reward game/cartoon selection, task choice, position preferences, and other decision making data points for over 2,000 students was measured via automatic data collection on the computer. A pilot study was conducted with 15 preschool and kindergarten students with autism using the first volume of the *TeachTown: Social Skills* program.

Results:

Results from the *TeachTown: Basics* study show distinct patterns of choice making that demonstrate the popularity of rewards, the types of choices students tend to make, and highlight issues in the software that need modification in future versions.

Results from the *TeachTown: Social Skills* study focus on the usability and feasibility of the program for use by teachers in a group environment. Students demonstrated success with the lessons as shown by teacher data collection, and teachers reported positive experiences with the program.

Conclusions:

The potential benefits of media-based interventions are clearly demonstrated in both TeachTown products and the research to date provides a strong framework for using these types of interventions with students with autism. Research is conducted on TeachTown products at all stages including development, feasibility and usability, pilot testing, effectiveness testing, qualitative data analysis, social validity, and large-scale clinical trials. In addition to the strong research base, these products offer a motivating learning experience for students and conference attendants will enjoy a fun, hands-on experience with both products.

116.170 27 Computer-Mediated Exposure Therapy for Auditory Sensitivity In Autism Spectrum Disorder. R. R. Morris*[1] and R. W. Picard[2], (1)*Massachusetts Institute of Technology*, (2)*Massachusetts Institute of Technology, The Media Laboratory*

Background: Many individuals diagnosed with Autism Spectrum Disorder (ASD) experience extreme sensitivity to sound. Efforts have been made to manage this condition, but there is wide room for improvement. One approach - exposure therapy – has been shown to help several individuals diagnosed with ASD manage their sound sensitivities. A computer-mediated version of this approach would be cost-effective and could be widely proliferated. The work we present here appears to be the first to adapt a computer-based exposure approach for individuals with auditory sensitivities and ASD. Our approach is customizable, free, and easy to use, and it could be relevant to many individuals suffering from sensory hypersensitivities.

Objectives: Our goal was to create computer-mediated exposure therapies for individuals with ASD diagnoses, using free, open-sourced software. Our approach was specifically designed to accommodate individuals of all ages and intellectual abilities. While we focused specifically on auditory sensitivity, our overall approach could potentially be used to address other sensory challenges.

Methods: Three individuals diagnosed with ASD were enrolled in our study. All participants had issues with auditory sensitivity and their families identified one specific category of sound that caused them particular distress. Different games were created for each participant using “Scratch” – an open-sourced software for building customizable games and visualizations. We used a participatory-design approach and actively solicited advice from the caregivers of our participants. After the design phase, we uploaded exemplars of each participant’s aversive sound into each program. We programmed these target sounds to coincide with positive, rewarding events on the screen, and they were set to occur for 2-3 seconds every 10-15 seconds. Exposure sessions ranged from 5-10 minutes and were conducted every other day for up to two weeks. Target sounds increased in volume from session

to session, and spanned the full dynamic range of the laptop speakers.

Results: Two out of three participants completed all experimental sessions and eventually tolerated the target sounds at the maximum volume. The other participant was withdrawn prematurely because his parents could not manage the specific time demands of the experiment. The two participants that completed the study both tolerated, and even enjoyed, the intervention; they both asked to interact with our software program, even on days when they were not scheduled to do the experiment. Both participants also showed objective improvements in their auditory sensitivity, as assessed by their ability to listen to the target sounds on the computer. A one- and two-month follow-up session was conducted with one participant, and he continued to tolerate the sounds even when played at their maximum volume.

Conclusions: While further experiments are needed to confirm the therapeutic efficacy of this approach, these case studies suggest that exposure-based treatments for auditory sensitivity can be effectively embedded into multimedia software and easily used at home by non-experts. Future work should be done to disseminate this knowledge and to help individuals design their own programs, perhaps through the creation of a community-driven effort to build new desensitization games and media that support sensory needs.

116.171 28 An Investigation of Video-Based Social Skills Training for Children and Adolescents with Autism Spectrum Disorders. K. Johnston*[1] and G. Iarocci[2], (1), (2)*Simon Fraser University*

Background: Video-based social skills programs (e.g. Socialskillbuilder.com, Modelmekids.com, and watchmelearn.com) are used extensively as teaching tools for children with autism yet they have not been examined empirically. Although the use of videos on a computer format may be generally motivating for children with ASD (Bellini & Akullian, 2007) and individualized modeling of social behaviour in video-format has been shown to be effective in improving a variety of meaningful social behaviours (Bellini & Akullian, 2007), generic social skills programs available on the web may not suit the needs of all children with ASD.

Objectives: As an initial attempt to explore video-based software programs as a method of teaching social skills to high functioning (HF) persons with ASD we posed three research questions: How do children and adolescents with ASD perform on select Social Skill Builder (Jacobs & Jacobs, 2005) software tasks in comparison to their typically developing (TD) peers? Do scores on the software tasks correlate with parent reports of their real-life social impairments? How does performance on the different types of tasks used (videos and pictures) compare?

Methods: Participants were 26 youth with ASD and 16 TD peers between 9 and 17 years of age and one of each of the youth's parents. The Social Responsiveness Scale (SRS; Constantino, 2005) was selected as a measure of parent reported real-life social functioning. Higher scores on the SRS are strongly associated with a clinical diagnosis of ASD and represent a higher level of social impairment.

Results: No significant differences in performance on the software tasks combined were found between the two groups at the .05 level ($p=.091$) and no correlation between scores on the software tasks and the SRS for both groups (ASD: $r=.026$, $p>.05$; TD: $r=.039$, $p>.05$). Finally, results showed no significant difference in scores between the two groups on the picture task at the .05 level ($p=.072$), but a significant difference between the groups on the video tasks at the .05 level ($p=.002$).

Conclusions: Given the high degree of social impairment observed in the ASD group, as indicated by their high SRS scores (85% of the sample obtained a score in the most severe range), the finding of no significant differences in performance between the groups on combined and picture-based video tasks and no correlation with parent reported real-life social impairments points to a problem in the design of these tasks for the purpose of teaching social skills to children with autism. Computer based video software programs may be motivating for children with autism and have the potential to provide a training environment that decreases the anxiety and stress associated with social situations. However, research is needed to determine how best to design these software programs to tailor the teaching goals based on an assessment of the social difficulties and effectively improve the social competence of HF individuals with ASD.

116.172 29 Teaching Persistence In Social Initiations to High Functioning Children with Autism: A Portable Video Modeling Technology. D. Grosberg*[1] and M. H. Charlop[2], (1)*Claremont Graduate University*, (2)*Claremont McKenna College*

Background: We designed a Portable Video Modeling Intervention (PVMI) using an iTouch to teach persistence in social initiations to high functioning children with autism. We

hypothesized that the iTouch would contribute to participants' learning by: 1) allowing use of the intervention tool independent of adult assistance, 2) affording the potential for learning beyond traditional therapy settings, and 3) making social skills training less stigmatizing.

Objectives: Participants were expected to learn persistence in making social initiations to typical peers using a PVMI on the iTouch, generalize this skill across settings and peers, and maintain this skill after one month.

Methods: Four children with autism aged 6-9 participated in the study. Our goal was to teach each child to: a) make initiations to a neurotypcial peer to play, and b) persist in making initiations to other peers even if their first few attempts are declined. Each child watched three video clips of four student "actors" on an iTouch. One student actor represented the child's role, and the other three students represented the roles of the neurotypical peers. In Clip #1, the actor made a play bid which was immediately accepted by her peer to play. In Clip #2, the peer declined the actor's play bid. The actor then had to walk across the playground to ask another peer before her play bid was accepted. In Clip #3, the actor's play bid was declined by both the first and second peers, so the actor needed to persist by approaching a third peer to make an initiation to play (and was subsequently reinforced). After viewing all the clips, it was the child's turn. The experimenter said, "Now it's time to play, pick a toy and choose a friend to play with." The child was then escorted to the outdoor play setting with at least three neurotypical peers. Sometimes the first peer said "yes", other times the child had to approach two or three peers before getting his bid accepted. Criterion was reached once s/he was able to persist in asking up to three friends to play over two consecutive sessions (this equates to 100% accuracy). If the child was not successful, s/he received the PVMI with the iTouch again. To assess generalization, the child was given one session (three trials), to persist in asking up to three friends to play in an indoor community recreation room and at a community park with unfamiliar peers. Maintenance of the target behavior was assessed after one month.

Results: All four children learned persistence in social initiations using the PVMI iTouch protocol. Moreover, these children showed generalized persistence in at least one untrained setting and maintained the persistence at one-month follow-up.

Conclusions: Our study demonstrates the effectiveness of devices like the iTouch as potential intervention tools for children with autism. Clearly, the ability to persist in social initiations is significant not only for the immediate social benefits for a child with autism, but also increases opportunities for friendships, responsiveness to others, and successful adult relationships in the future.

116.173 30 Animated Visual Supports for Social Skills. J. Ehrlich*[1] and S. Smith[2], (1), (2)*University of Kansas*

Background:

One of the most socially devastating outcomes during the development of those with Autism Spectrum Disorder (ASD) is not learning social skills that neurotypicals (NTs) experience through hidden curriculum, yet these skills are difficult to teach in a meaningful way since those with ASD tend to lack the ability to generalize lessons from traditional interventions and the fear of failing in the real world is prohibitive to teaching through doing. Recent research has demonstrated that Virtual Reality (VR) may be able to overcome these barriers by allowing those with ASD to learn and generalize material in a safe and novel way, yet much work needs to be done in determining the efficacy of VR at teaching social skills.

Objectives:

Thus in this present study we investigated the effectiveness of incorporating traditional social skill interventions with VR. We created an automated virtual environment (VE), which uses social narratives to teach hidden curriculum in a non-invasive and simple way. To evaluate the effectiveness of a social skill-teaching tool with a PVE on a standard desktop display, we needed to answer two questions:

1) Can students with ASD acquire social skills from a virtualized intervention?

2) How much more effective, if any, is a virtualized intervention compared to a traditional intervention?

Methods:

To answer the first question, we conducted a within-group study for students using our intervention. The evaluation was done with a pretest and posttest that tested social skill ability. If results from the posttest showed a significant improvement over the pretest, the students must of accepted the VE and learned from the intervention. Further, we added questions on the posttest to determine the ability to generalize the specific social skills taught with the intervention.

To answer the second question, we conducted a between-group study comparing social skill learning between two different groups of students with ASD. The control group

experienced a traditional intervention and the second group experienced the VR intervention. The social skill learning was measured using a written posttest.

Results:

The participants in our study demonstrated the learning of social skills by using a virtualized school environment, indicating that a virtualized intervention is effective at teaching social skills. Likewise, individual users reported a deep sense of presence within the environment, demonstrating the ability of VR to create a meaningful environment for future learning/application that may be used as a safe and controlled alternative to real-world learning. Further, the students generalized social skill development beyond the VR setting indicating the ability to transfer knowledge outside of the VR experience.

Conclusions:

In conclusion this work has demonstrated, through a human-based empirical study, that students with ASD not only are able to learn hidden curriculum-based social skills through VR, but VR is more effective than traditional interventions at teaching these social skills. This work has immediate practical use, as we plan on releasing the VR intervention soon. Additionally, the approach we took on virtualizing social narratives can be applied to other interventions, which may chave broad implications on future assistive technology.

116.174 31 Anxiety and Asperger's Syndrome: Experience of Everyday Anxiety and An Investigation Into A Novel Real-Time Stress Management Approach. C. Gracey*,

Background:

For many people with Asperger's syndrome (AS) anxiety is a major problem. A number of studies have highlighted the high frequency and severity of anxiety in this group. Cognitive Behavioural Therapy (CBT) is recommended as the psychological treatment of choice for anxiety disorders in people without AS, but little is known about its suitability for people with AS. People with AS often show a different cognitive profile to individuals without AS and it is possible that that they have qualitatively different fears. Despite the high occurrence of anxiety in this group, there has been relatively little research. The research that has been conducted has tended to use measures which have been developed for the population without AS and rely on reporting past experiences of anxiety. This may be difficult for people with AS because they may have idiosyncratic experiences of anxiety which do not map onto the tools developed for non-AS people. They may also find reporting past experiences difficult due to problems with autobiographical memory which are often reported in this group.

Objectives:

This study aimed to explore the phenomenology of everyday anxiety in this population and explore the feasibility of using hand-held computers (Personal Digital Assistant, PDA) to deliver a real-time stress management intervention.

Methods:

The present study used experience sampling methodology via PDAs to a) capture everyday experiences in 20 adults with AS and 20 adults without AS and b) deliver directive stress management techniques to 10 adults with AS.

Results:

The study found that the AS group were significantly more anxious than the comparison group. Factors associated with feelings of anxiety in the AS group were high levels of self-focus, worries about everyday events and periods of rumination lasting over ten minutes. Individuals in the AS group also thought more often in images, although this was not associated with feelings of anxiety. Furthermore, the real-time stress management techniques reduced subjective ratings of anxiety in individuals with AS.

Conclusions:

The results of this study suggest that individuals with AS may differ in their experience of anxiety and the use of PDAs provided a feasible mechanism for treatment. Hand-held computers offer the possibility of a more didactic intervention for anxiety within this population. High levels of anxiety and the paucity of research into psychological treatment for adults with AS speaks to the need for more appropriate interventions.

116.175 32 Externalization and Interpretation of Autonomic Arousal In Teenagers Diagnosed with Autism In a Relaxation Experiment. J. C. Lee*[1], M. S. Goodwin[1] and R. W. Picard[2], (1)*Massachusetts Institute of Technology*, (2)*Massachusetts Institute of Technology, The Media Laboratory*

Background:

Heart rate (HR) is a robust physiological indicator of stress and arousal, and has been shown to have atypical ranges in school-age children diagnosed with autism (Goodwin, 2006). Progressive muscle relaxation is routinely used as a technique

to decrease and manage stress and arousal. However, it is often difficult for teachers and caregivers to objectively determine a child with autism's internal arousal state and thus to know if relaxation techniques are effective. Researchers in the MIT Media Lab have developed a wireless ear-mounted sensor capable of comfortably recording HR and displaying real-time data in various ways.

Objectives:

We wanted to assess HR using a wireless ear-mount sensor in a group of children diagnosed with autism while they participated in progressive muscle relaxation to see if it lowered their HR as it is expected to do. We also experimentally manipulated teacher access to the data (i.e., no view, laptop display of HR in real-time, LED-vibrotactile device that pulsed in synch with real-time HR) to see how visualizing HR affects teacher's appraisal of student arousal during the procedure.

Methods:

7 participants (age 7-17, 5 male and 2 female) diagnosed with autism (via ADOS) enrolled in this MIT IRB-approved study involving an ABAB single case design of progressive muscle relaxation. In a quiet testing room, a familiar teacher led students through the following 7 phases: 0. Preparation (e.g. helped put ear-mounted sensors on student and began recording), 1. Baseline (2min), 2. Guided Relaxation with intervention 1 (2min), 3. Rest (1min), 4. Guided Relaxation with intervention 2 (2min), 5. Rest (1min), 6. Guided Relaxation with intervention 3 (2min), 7. Baseline (2min).

In the three guided relaxation phases the teacher experienced three intervention conditions, in randomized order: 1) no real-time data display, 2) screen-based display showing the student's real-time HR in beats-per-min (BPM), 3) physical tactile device that blinked and vibrated according to the student's real-time BPM. Teachers also rated how behaviorally aroused the student appeared (1: very relaxed to 7: very aroused) after each experimental phase, and were interviewed after the study.

For data analysis, we first computed average HR in each phase per student. We then compared HR averages in each adjacent phase per student using two sample one-tail T-tests. Finally, we compared teacher ratings with each student's per phase HR averages.

Results:

a. 5 out of 7 participants completed the study. The 2 who did not appeared to be tactile averse to the ear-mounted sensor.

b. Comparing teachers' ratings and students' average HR per phases, we found 77% agreement overall when using the screen-based display, 46% agreement overall when using the tactile device, 58% agreement overall when no data was displayed.

c. In several cases, HR did not decrease during guided relaxation.

Conclusions:

Emerging physiological sensors can comfortably reveal arousal characteristics during guided relaxation exercises for some people on the autism spectrum. When viewed, it may help teachers more accurately assess their students' internal state of arousal and enhance efforts to teach self-regulation.

116.176 33 Autonomic Sleep Patterns In Children with Autism Spectrum Disorders. A. Sano*[1], R. W. Picard[1], R. E. Kaliouby[1], B. A. Malow[2] and S. E. Goldman[2], (1)*Massachusetts Institute of Technology, The Media Laboratory*, (2)*Vanderbilt University*

Background:

Children diagnosed with autism spectrum disorders (ASD) often suffer from sleep disorders such as insomnia, which generates long sleep latency and fragmented sleep. Sleep disorders reduce children's concentration for learning and contribute to increased stress for them and their families. Polysomnography (PSG) is a gold standard to evaluate and diagnose sleep patterns, but the sensors tend to be uncomfortable and expensive, and may interfere with sleep.
Actigraphy is a non-invasive method to evaluate daytime and sleep activity with a wrist device. In addition, we have developed a wireless non-invasive sensor to measure electrodermal activity (EDA) to observe sympathetic nervous activity. Combining actigraphy and EDA can provide details of children's sleep and can be comfortably used for low-cost sleep monitoring at home..

Objectives:

We aimed to evaluate sleep patterns in children with ASD using both PSG and a wearable sensor that enables comfortable measurement of EDA through skin conductance, skin temperature, and actigraphy on the wrist.

Methods:

Six children diagnosed with ASD (ages 3-8) participated in overnight measurement in a sleep lab. One group (N=3) were good sleepers, who took melatonin before sleep and the other group (N=3) were poor sleepers. We examined skin conductance, actigraphy, and skin temperature during sleep from the inside left and right wrists (N=5, only right wrist for N=1) and compared the behavior of these signals to PSG. We obtained thirty-second epochs of labeled sleep stages (Wake, REM, Stage1, 2 and 3).

The data was analyzed as follows:

1. Pre-processing: zero-crossing and Cole's function were applied to the accelerometer data to discriminate between sleep and wake. EDA data was low-pass filtered (0.4 Hz).
2. We compared the amplitude of left and right EDA in sleep stages.
3. We analyzed "Storm" regions with high-frequency EDA, more than 6 peaks/min. We counted the number of storms per night as well as the number of peaks per storm. We also calculated areas, durations of storms and onset intervals between storms. We compared these storm characteristics to sleep stages.

Results:

Four out of five subjects showed that EDA on the left wrist was higher than that on the right wrist. Most EDA storm patterns occurred during stage 2 and 3 (slow-wave) sleep. Larger amplitude storms occurred earlier in the evening. The poor sleepers had shortened latency of the first storm (it came earlier for poor sleepers).

Conclusions:

We measured continuous EDA, actigraphy and skin temperature on children diagnosed with ASD with a comfortable wearable sensor and evaluated the relationship between EDA characteristics, laterality, and sleep stages from simultaneously recorded PSG. On most children, EDA on the left wrist was higher than EDA on the right wrist. Moreover, EDA showed characteristic high-frequency storms that occurred during stage 2 and 3 (slow-wave sleep) with larger areas under the curve earlier in the evening. The group of poor sleepers showed shorter latency of the first storms than the group of good sleepers. The comfortable wearable sensor showed new sleep characteristics on children diagnosed with ASD that could be measured easily at home.

116.177 34 Comparing Stereotypical Motor Movement Pattern Recognition Performance Using Mobile Phone Annotations From Experts and Non-Experts.

M. S. Goodwin*[1], F. Albinali[1], D. Aube[2] and S. S. Intille[1],

(1)*Massachusetts Institute of Technology*, (2)*The Groden Center, Inc.*

Background:

Individuals with Autism Spectrum Disorders (ASD) frequently engage in stereotypical motor movements, but they are not well understood. One reason why stereotypical motor movements may not be as thoroughly studied is because efficient and accurate tools for measuring these behaviors are not available to the research community.

Objectives:

We previously demonstrated that wireless 3-axis accelerometers and pattern recognition algorithms could accurately detect (.90) stereotypical hand flapping and body rocking in six children with ASD both in laboratory and classroom settings (Goodwin, Intille, Albinali, Velicer, 2010). While promising, this work relied on offline video annotations by clinical experts to train recognition algorithms. In real-world environments, expert annotators are rarely available. Thus, in the current work, we sought to assess how well a non-expert could use software on a mobile phone to annotate stereotypical motor movements in real-time for classifier training, and evaluate the impact these annotations have on algorithm performance.

Methods:

We ran four 30-minute data collection sessions alternating between the laboratory and classroom (Lab1, Class1, Lab2, Class2) with one of the participants involved in Goodwin et al. (2010). We undertook data collection in both laboratory and classroom settings to determine the accuracy of annotation and recognition performance across both constrained and real-world environments. During these sessions, one expert annotator (a trained behavioral scientist familiar with the child) and one non-expert annotator (a teacher not familiar with the child) simultaneously coded start time, end time, and type of stereotypical motor movement using a Windows Mobile phone running custom annotation software. Pressing a button once on the phone marked the start of a corresponding stereotypical motor movement, which included three behaviors: flapping, rocking, and simultaneous flapping and rocking. Pressing a button a second time on the phone marked the end of a corresponding stereotypical motor movement.

Results:

Overall accuracy (A), precision (P), and recall (R) for the algorithm across all sessions when training and testing using

expert annotations (A: .82, P: .80, R: .79) and non-expert annotations (A: .78, P: .79, R: .76) was relatively high. Accuracy achieved for different sessions for both expert (Lab1: .85, Lab2: .89, Class1: .82, Class2: .74) and non-expert annotations (Lab1: .79, Lab2: .86, Class1: .81, Class2: .69) was also relatively high. The non-expert annotator had an average delay of 3.25 seconds in labeling movement onsets and 1.23 seconds in labeling movement offsets compared to the expert. The frequency of delays in the onset (5.25) was much lower than the frequency of delays in the offset (9.25). However, this did not seem to impact performance of the activity recognition algorithm.

Conclusions:

Our preliminary results suggest that a non-expert conducting real-time annotation using mobile phones is a viable approach for gathering person-dependent data needed to train accurate pattern recognition algorithms in this domain. Enabling non-experts to easily train pattern recognition algorithms capable of automatically detecting stereotypical motor movements could advance autism research and enable new intervention tools for the classroom that help children and their caregivers monitor, understand, and cope with this potentially problematic class of behavior.

116.178 35 Perceived Acceptance of the Mobile Social Compass. M. Tentori*[1], L. E. Boyd[2], W. Roxas[3], D. H. Nguyen[4] and G. R. Hayes[4], (1), (2)*NOC SELPA*, (3)*Arthur F. Corey Elementary School*, (4)*University of California, Irvine*

Background:

The Social Compass is a social skills curriculum for children with autism that combines visual supports, visual schedules and story-based interventions to develop age and functioning-level appropriate social skills. To augment the Social Compass curriculum, we developed a Mobile Social Compass system that extends the curriculum with a tool that allows children learn social support outside classrooms. The *Mobile Social Compass* is a mobile interactive system that uses a visual schedule to guide children throughout an interaction, helps them detect potential interaction partners, and gives them social cues. In this work, we present the results of a preliminary evaluation with potential users of the system to determine how the design and development of the Mobile Social System can and should be improved in future iterations.

Objectives:

Evaluate the Mobile Social Compass's core characteristics, the potential users' intentions for using the system, and their perception of system utility and ease of use.

Methods:

For a period of two months, we conducted seven focus groups with potential users, including fourteen children with autism aged between seven and ten, four teachers and four autism coordinators. We presented to participants mockups of the Mobile Social Compass System and animations of four scenarios depicting the system's use. Each focus group lasted around one hour on average where participants discussed changes for the system and examples of how the system might positive or negative impact children's interactions. We posed additional questions to validate our findings and to gather new design insights for the system's redesign. We finally asked participants to answer a questionnaire aimed at predicting user acceptance based on the Technology Acceptance Model.

Results:

Our results indicated that children perceived the system as fun, cool and appealing, a child commented: *"This system is really cool, I can't wait to use it."* The results from our predicted adoption showed that 94% of the participants would use the system, 91% believed the system would enhance their everyday interactions and 85% perceived the system would be easy to use. Autism coordinators had the lowest ease-of-use ratings, which could in part be because they were worried about liability issues or their capability to use and teach the system to the children. User training before system deployment might help alleviate this issue. Both children and teachers also gave us insights to improve our design by including mechanism for privacy management and a potential for a game-like interaction where children could earn points and rewards. This evaluation helped us improve the system's current prototype.

Conclusions:

We have developed and evaluated a Mobile Social Compass system to help children with autism improve their social skills outside classrooms. The results of our evaluation demonstrate that overall the application was perceived to be efficient and useful in improving the quality of interactions held by children with autism. We plan to evaluate this system in a public school in Southern California with three children with autism and nine neurotypical children to uncover emergent practices with using the system in a naturalistic environment outside classrooms.

116.179 36 Naturalistic Daylong Audio Recording: A New Way for Child Behavior and Environment Monitoring. D. Xu*[1], J. Gilkerson[2] and J. A. Richards[2], (1), (2)*LENA Foundation*

Background: Objective data about child behavior, their environment and how they interact with the environment are critical for child study and autism research. Audio recording contains rich information about children's social-emotional interaction, verbal communication, behaviors such as echolalia, articulatory motor patterns and their environment. There are advantages of audio signal over the other signals in terms of convenience, required condition and so on. This study and the proposed hardware-software framework address the issues of unobtrusive daylong recoding in children's environment and the information extraction and data analysis, targeting a new audio based data collection and analysis which is objective, naturalistic, scalable, automatic and convenient. Large amount of samples can be easily collected, and is anticipated to produce stable, reliable and accurate macro-statistics in characterizing children's behavior and environment, providing important information for research, clinical practice and parenting, potentially leading to many applications.

Objectives: We focus on childhood autism risk estimation. The new effort extends the previous child vocalization features to the interactive and environmental ones, demonstrating the richness of the information that audio signal can provide. The presentation interactively demonstrates the hardware-software framework, the obtained features of stable macro-statistics, the related developmental trends, patterns and final results for children with typical development, language delay and autism.

Methods: A lightweight digital recorder is worn by a child for a whole day to collect his/her sound and environment sound. Pattern recognition is used to automatically detect different sound segments, including key-child, other-child, adult-male, adult-female, overlapped-sounds, noise, TV and silence, producing a sequence of segment labels. Key-child segments are further decomposed to generate vocalization composition features. The overlapped sounds that a key-child collides with other sounds can reflect certain interactive behavior and can be characterized by the same decomposition scheme. The Markov-chain-type statistics of segment sequence related to a key-child are also characterizing the way the child interacts with the environment. It was also found that parents and children with autism tend to have more "near-distance-talk" than "far-distance-talk" and the distance-correlated loudness (dB-level) can also be utilized. All these features are modeled with a proposed Ada-Boosting method for autism risk estimation. Leave-one-child-out cross-validation is used to validate the obtained results.

Results: Data set: Typical-development: 802-recordings, 106-children; Language-delay: 333-recordings, 49-children; Autism: 228-recordings, 71-children. Age: 8-48-month. No recording is under 9 hours and contains therapy which may interfere with interactive-environmental-features. Equal sensitivity and specificity (ESS) is used as performance-measure for 3 tasks at recording or child level (by combining recordings for a same child): autism-versus-others (ASD-OTH); autism-versus-typical-development (ASD-TD); autism-versus-language-delay (ASD-LD). The previous vocalization features yield ESSs: recording: ASD-OTH-88.2%, ASD-TD-89.7%, ASD-LD-80.8%; child: ASD-OTH-89.1%, ASD-TD-90.6%, ASD-LD-81.7%. By incorporating new features, the ESSs are: recording: ASD-OTH-91.3%, ASD-TD-93.9%, ASD-LD-86.5%; child: ASD-OTH-93.0%, ASD-TD-94.4%, ASD-LD-88.8%.

Conclusions: The results demonstrate the effectiveness of the innovative way for child behavior and environment monitoring, and the power of macro-statistics of large samples and its robustness to variations, noises and machine errors. The developed framework is highly potential as an effective and efficient autism screen tool, and can be used for treatment and effect monitoring.

116.180 37 PinPoint: Computer-Assisted Digital Video Coding. W. V. Dube*[1], N. Dorn[2] and L. Hebert[3], (1)*University of Massachusetts Medical School*, (2)*Advantage Learning Group Inc.*, (3)*Praxis, Inc.*

Background: Clinicians treating individuals with autism are making increased use of digital video to record behavioral data. This trend is spurred in part by the increasing availability of affordable digital video cameras, technological solutions for remote monitoring via web-based cameras, and media-based information networks. *Video coding* refers to the process of identifying and recording events of interest within video content. Typically, a computer program displays the video, the observer views the video and records events by pressing designated keys, and the program creates a record of events and associated time stamps. Alternatives to coding the entire video include the widely used observational techniques of Partial Interval Recording (PIR) and Momentary Time Sampling (MTS). For both PIR and MTS, the video is divided into equal recording intervals (e.g., 15 seconds). With PIR the observer records whether the event occurred during each interval; with MTS, the observer records whether the event occurred during a brief (e.g., 2 s) observation period at the end of each interval.

The dependent measure for each method is percent of intervals in which the event occurred.

PinPoint is a software application that can increase the efficiency of PIR and MTS for digital video. As each event is recorded, the software automatically advances the video playback to the next point at which an observation is required; the user need observe only those portions of the video that are necessary for the chosen coding technique. Technology development was supported by an STTR Technology Transfer grant from the National Institute of Child Health and Human Development.

Objectives: The objectives of this presentation are (1) to present data that directly compared accuracy and efficiency of MTS with standard procedures and with computer-assisted procedures, and (2) to offer a hands-on demonstration of the software application.

Methods: Eighteen clinical professionals coded video samples of children with autism engaging in vocal or motor stereotypy. With the Standard procedure, the video was presented and an auditory beep at each observation period cued the observer to look at the video screen and record behavioral occurrence/non-occurrence on a prepared data sheet. With the Computer-assisted procedure, the software displayed only the observing periods and the observer pressed a Yes or No button after viewing each one.

Results: Inter-observer agreement and coding accuracy did not differ between procedures ($p > 0.50$, paired t-test). Savings in mean time to complete coding sessions with the Computer-assisted procedure was 79% ($p < 0.001$).

Conclusions: The automatic video advance feature of the computer-assisted method did not distort the coding process in any way, and it produced a highly significant increase in efficiency. Visitors to the proposed poster/demonstration will have the opportunity to test-drive the software's coding interface and review its capacity to predict the effects of adjustments in PIR or MTS parameters.

116.181 38 Signal Processing Tools for the Automatic Analysis of Child-Psychologist Interactions. M. P. Black*[1], D. Bone[1], T. Chaspari[1], A. Tsiartas[1], P. Gorrindo[2], M. E. Williams[3], P. Levitt[2] and S. S. Narayanan[1], (1)*Signal Analysis and Interpretation Laboratory (SAIL), University of Southern California*, (2)*Keck School of Medicine, University of Southern California*, (3)*University of Southern California Keck School of Medicine*

Background:

The Autism Diagnostic Observation Schedule (ADOS) is one of the most useful clinical instruments for the diagnosis and assessment of autism spectrum disorders (ASD) for at-risk individuals with varying verbal abilities. The semi-structured 30-60 minute interaction provides a trained psychologist with behavioral evidence that can be evaluated along dimensions pertinent towards a diagnosis of autism. One challenge in using the ADOS (and with observational methods in general) is the subjective nature inherent to the rating system. Moreover, many of the sub-assessments have qualitative descriptions, making the instrument less useful for population stratification.

Objectives:

Technology can assist with this process in a number of ways. Audio-video sensors can record the child-clinician interaction, and state-of-the-art signal processing methods can facilitate quantitative data collection, analyses, and modeling using objective audio-video signals. Behavioral cues (e.g., speech prosody, hand gestures) can be automatically estimated and quantified in a consistent fashion and could provide researchers with an orthogonal source of information. We have two immediate goals for this work: 1) to collect a large audio-video corpus (>100 subjects) of ADOS sessions, and 2) to automatically process and analyze the data by extracting multimodal behavioral cues. Our ultimate goal is to develop tools and signal processing algorithms to produce quantitative data of social interactions, and to support psychologists' analysis and decision capabilities.

Methods:

We designed a portable audio-video recording set-up, consisting of two high-definition camcorders and two high-quality shotgun microphones. All sensors operate unobtrusively within the clinical space to ensure that the experiments are ecologically valid. Our initial analysis of the corpus will focus on automatically detecting when the subjects are speaking and automatically assessing the subjects' use of prosody (e.g., rate, rhythm, intonation). Speech abnormalities (e.g., atypical prosody) are one of the behaviors that are coded in the ADOS for verbal children, and they are particularly difficult for human observers to quantify.

Results:

To date, we have collected data from 51 subjects (14 module 1, 10 module 2, 25 module 3, 2 module 4; subjects' age range from 5 to 17 years, with a mean age of 9.3 years). A detailed description of the recruited subjects and data will be provided at the conference. We have designed an automatic voice activity detector, optimized for the acoustic conditions of the clinical space. We will provide a statistical analysis of pitch- and intensity-related speech cues extracted from the audio signal, which relate to the perception of prosody.

Conclusions:

Incorporating quantitative computational methods in the domain of autism research and practice could lead to a more consistent assessment framework across subjects and over time. Technology has the potential to help observational psychology research and practice by offering tools for analysis of important behavioral phenomena. This approach can play a critical role in autism research through the collection and automatic analysis of a large corpus of ADOS interactions. This work is supported by the National Science Foundation, Autism Speaks, and the Marino Autism Research Institute.

116.182 39 The USE of Eye-TRACKING TECHNOLOGY to ASSESS Pupillary Responses IN AUTISM Spectrum Disorder. C. J. Anderson*[1], J. Colombo[2] and N. Brady[2], (1), (2)*The University of Kansas*

Background:

The advent of eye-tracking technology has allowed investigators to provide a more detailed analysis of visual inspection of socially-relevant stimuli in persons with Autism Spectrum Disorder (ASD) (e.g., Anderson et al., 2006; Klin et al., 2002; Speer et al., 2007). Such data provide a more comprehensive and dynamic depiction of social attention in ASD than observational techniques.

An additional advantage of most eye-tracking technologies is the ability to simultaneously assess pupil size (an autonomic measure) within precise regions of interest. Given appropriate control of stimulus parameters (e.g., luminance) and individual patient factors (e.g., medication use), this technology has the ability to provide a powerful non-invasive tool to examine autonomic responses in children with ASD. Such measures can be taken at very early ages and are independent of cognitive or language ability.

Task-evoked (phasic) pupillary responses have long been used as a reflection of cognitive resources or attention allocated to a particular task (Beatty & Lucero-Wagoner, 2000). In addition, tonic (baseline) pupil size is often used in clinical settings to assess neurological functioning of the autonomic nervous system (ANS).

Objectives:

We will present data demonstrating the use of eye-tracking technology to measure pupil size in 2-5 year old children with ASD. Pupil size provides (a) an index of ANS neural functioning, (b) a biological marker that can be used in the early detection and screening of ASD, and (c) indicates the processing and selection of stimuli such as human faces or named vocabulary items.

Methods:

We have used eye-tracking technology to examine tonic pupil size in a baseline condition (Anderson & Colombo, 2009; Anderson & Colombo, under review) and phasic pupillary responses to static faces (Anderson et al., 2006) and dynamic social scenes (Anderson & Colombo, under review) in 2 – 5 year old children with ASD (compared to clinical and typical age-matched controls). Finally, pupillary responses to “known” and “unknown” receptive vocabulary targets are being investigated to evaluate their use as a tool in cognitive/language assessment.

Results:

We have found a significantly larger tonic pupil size and lower AA levels in ASD, and altered phasic pupillary responses to both static and dynamic social stimuli (Anderson et al., 2006; Anderson & Colombo, 2009; under review).

Conclusions:

Pupillometry and eye-tracking technology provide innovative findings about cognitive and autonomic function in ASD, and can provide added value to neurological and cognitive research programs. These measures show great promise in assessing candidate measures to improve assessment, diagnosis, and screening of ASD.

116.183 40 USING THERMAL Infrared Imaging to ASSESS Pathologically-Related THERMAL Dysfunction IN PATIENTS with Pervasive Developmental Disorders and MENTAL Retardation (PDD/MR): A Feasibility STUDY. C. L. Herry*, M. Rolland and A. Masse, *Neurodevelopmental Program, Riviere des Prairies Hospital*

Background: Physical examination of patients with pervasive developmental disorders and mental retardation (PDD/MR) is

important since pain and undiagnosed medical conditions may have a serious impact on disruptive behaviours. Studies suggest a higher prevalence of physical health problems in a population with mental retardation. Yet, simple physical examination of PDD/MR patients is often difficult, because of serious behavioural problems and communication impairments. Common diagnostic tests are equally challenging to perform without sedation. Infrared thermal imaging is a non-invasive, portable way to record the skin temperature distribution over time, which gives valuable information on thermal dysfunction associated with some common pathologies.

Objectives: To report on the initial feasibility of using thermal infrared imaging as a complimentary tool for the physician to identify pathological thermal dysfunction in non-verbal PDD/MR subjects.

Methods: 110 PDD/MR subjects (22 F, 88 M), ages 4-58 (mean 18.9), were acclimatized for 15 minutes at a room temperature of 24°C, unrestrained, clothing removed over the body regions to be imaged. The subjects' medication was not discontinued prior to the imaging session. Anxiety was minimized by the presence of parents or support workers and through the use of pictograms, toys, videos and small rewards. Infrared thermal videos of specific body regions were acquired with a FLIR SC640 camera mounted on a wheeled, adjustable tripod. Patients were invited to take specific posture by parents/support workers either verbally, using pictograms or gentle stimulation. The videos were displayed live to the subject.

Results: Strategies to put the patient at ease were successful in all but 10 imaging sessions i.e. at least one body region could be imaged satisfactorily. In failed cases, subsequent imaging sessions were usually successful, the subject being less apprehensive about the technique. Standard views of body regions were extracted from the acquired thermal videos. 74.2% of frames were good enough for further quantitative processing. Proper positioning of upper extremities was more difficult and the resulting thermal information was not always exploitable. A minimum of two imaging sessions is recommended. It ensures a stable thermal analysis and reduces the effects of environmental artefacts and uncontrollable factors. Abnormal thermal patterns were identified, although the clinical interpretation is complex due to physiological artefacts (e.g. self-mutilation) and medication. However, our preliminary work shows that important relevant information could be gained, which allowed the clinical staff to elaborate new hypotheses for physical, psycho-physical or behavioural observations.

Conclusions: Thermal infrared imaging is technically feasible (without constraint or medication) and can be a practical tool to assess thermal dysfunction in PDD/MR patients. The portability and non-invasive nature of the infrared camera certainly contribute to its success in imaging this typically difficult population. Future work will focus on the clinical interpretation of thermal sequences of PDD patients to establish the screening potential of IR thermal imaging for identifying pathology-related thermal dysfunction. We will also look at the impact of the treatment of potentially uncovered physical pathologies on the behaviours exhibited by the patients.

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116.001 41 Serotonin Axonal Pathways and Cortical Terminals In Autism; Evidence for Increased Fibers In Early Childhood and Dystrophic Fibers In Adolescence. E. C. Azmitia*[1], R. Xu[2], X. P. Hou[1], J. Wegiel[3] and P. Whitaker-Azmitia[4], (1)*New York University*, (2)*NYU*, (3)*New York State Institute for Basic Research in Developmental Disabilities*, (4)*State University of New York*

Background: Serotonin plasma levels are increased in many autistic patients and death in children is often attributed to respiratory distress, cardiac failure, seizures, and hyperthermia which are components of the lethal Serotonin Syndrome attributed to high levels of brain serotonin. In contrast, the associated symptoms shown by autism patients include aggression, hyper-sensensitivity, stereotypy, and self-induced aggression suggest a decrease serotonin system. Imaging studies in autistic patients support this notion. However, treatment with drugs which increase serotonin levels (e.g. SSRIs) produces a worsening of the symptoms.

Objectives: In this study we examined serotonin axons immunoreactive to 5-HT transporter (5-HTT) antibody in a number of postmortem brains from autistic and no known diagnosis (NKD, control) patients aged 2 to 34 years of age.

Methods: The postmortem brains were obtained from the Brain Bank for Disabilities and Aging in Staten Island, the Autism Tissue Program in Princeton New Jersey, and the NICHD Brain, and Tissue Bank for Developmental Disorders at University of Maryland, Baltimore. The brains were post-fixed in polyethylene glycol (PEG) so large sections could be cut that included temporal lobe cortices, hippocampus, and amygdala as well as underlying subcortical structures that included septum, hypothalamus, and striatum.

Results: Fine and thick straight 5-HTT positive fibers were found in forebrain pathways (e.g. medial forebrain bundle, stria terminalis and ansa lenticularis) from both autistic and NKD donors. Many highly branched 5-HTT immunoreactive varicose fine fibers were seen in target areas (e.g. globus pallidus, amygdala and temporal cortex). The number of serotonin axons was significantly increased in both pathways and terminal regions in cortex using morphometric analysis of the stained axons at all ages studied. Dystrophic serotonin axons were apparent in the brains of adolescent children with autism. Morphometric analysis showed a quadratic relationship between abnormal axons and age, with highest numbers appearing in adolescence. The highest level of dystrophic axons was seen in a young teenager who died with a diagnosis of the Serotonin Syndrome. We conclude that serotonin axons are increased in the brains of autistic patients beginning at the youngest age examined (2.8 years) and stay elevated throughout adolescence when the serotonin fibers begin to degenerate. Degenerating serotonin fibers have been previously observed in older patients with neurodegenerative diseases (Azmitia and Nixon, 2008).

Conclusions: The increased serotonin innervation is consistent with death associated with the serotonin syndrome. However, it is hard to understand why SSRIs should make "serotonin-deficient" symptoms worse that are normally effectively treated with SSRI. We propose high serotonin brain levels would result in a corresponding decrease in serotonin receptors, and result in "serotonin-deficient" symptoms. This situation would be exasperated by increasing serotonin, which would further drive the receptors down. An alternative treatment we propose is the use of atypical antipsychotics which have substantial 5-HT2A receptor antagonistic properties. We will discuss strategies for increasing serotonin receptors by use of an antagonist in brain (Abbas et al, 2007).

116.002 42 Three-Dimensional Reconstruction and Analysis of Laminar Microstructure In Young Autistic Males. R. Stoner* and E. Courchesne, *University of California, San Diego*

Background: A consistent pattern of aberrant neurobiology has yet to be uncovered in autism. Previous studies using postmortem tissue have yielded potential theories for the etiological origin and symptom diversity of the disorder but no conclusive evidence for a specific cytological defect. These studies are severely limited by the small number of young cases available and the intrinsic structural heterogeneity of cerebral cortex. With such limits in place, optimal analysis of the available tissue is critical. Advances in postmortem tissue labeling using in situ hybridization (ISH) now enable laminar-based analyses using multiple genes. This information, combined with advanced image processing algorithms, can generate rich descriptions of laminar organization and three-dimensional microstructure.

Objectives: To characterize laminar organization of young male autistic tissue using novel algorithms applied to ISH data. Further, we aim to visualize the laminar microstructure using volume reconstruction of registered ISH stacks.

Methods: Prefrontal cortical tissue was obtained from the NIHCD Brain and Tissue Bank for Developmental Disorders for 8 young typically-developing and autistic cases. The tissue was sectioned into ten sub-regions and sliced into a set of 30 slices, each 25μm thick. ISH was performed using 14 laminar-specific genes with nissl-stained slides for spatial reference. Visible light and expression images were captured for each slice at high resolution.

To calculate laminar distribution, ISH images were first aligned to their reference nissl. Image noise was removed using a HSV filter, a fixed-intensity threshold, and gap-fill step to produce a gap-free binary image. Bezier curves were fit to pial and gray-white contours to create the sampling domain. Intensity profiles were sampled following the curves to produce an aligned intensity array from which mean intensity profiles were obtained.

To generate the volume reconstructions of laminar architecture, filtered ISH images from the intensity calculation were processed using a particle filter to generate a point distribution. A two-dimensional Gaussian convolution was applied to generate a weighted density figure for each laminar marker. The sections were aligned and interleaved to create a single image volume. Volumes for multiple ISH markers were then rendered in a single environment to produce a complete three-dimensional reconstruction of the laminar microstructure.

Results: Using the intensity-based analysis, we were able to identify regions of aberrant organization in multiple layer-specific markers in several autistic cases. Further, we found spared regions of autistic cortex with normal laminar distributions. Finally, from volume reconstruction of regions identified to be aberrant, we were able to visualize a potential structural defect in the laminar microstructure in some autism cases that was not apparent in two-dimensional slice analyses.

Conclusions: Here we present a sophisticated method to characterize laminar disorganization using intensity and density-based algorithms. With this approach we show

differences in laminar-specific organization in several autistic cases compared to controls. Further, from the volume reconstructions we have identified a potential structural feature in some cases that can only been captured using a three-dimensional analysis. We will present this finding and discuss potential implications with respect to normal development and cortical migration defects.

116.003 43 Accumulation of Amyloid-Beta Peptide Species In Four Brain Structures In Children with Autism. J. Frackowiak*[1], B. Mazur-Kolecka[1], I. Kuchna[2], K. Nowicki[1], W. T. Brown[1] and J. Wegiel[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*New York State Institute for Basic Research in Developmental Disabilites*

Background: Secreted beta-amyloid precursor protein (APP) has been detected in elevated levels in the plasma of about 60% of autistic children. Particularly high plasma levels of APP were detected in children with severe autism and aggression. It has been hypothesized that increased APP processing in the alpha-secretase pathway takes place in autism, and that plasma levels of sAPP-α can be an early biomarker of at least a subgroup of children with autism. Our preliminary study of autopsy brains revealed amyloid-beta peptide (Aβ) in intracellular deposits in neurons of various brain structures. This study is focused on frontal and temporal lobes, and on cerebellum in which developmental alterations of cytoarchitectonics and size have been described in autism.

Objectives: To detect and characterize amyloid-β accumulation in brain cortex in the subjects with autism and in cerebellum in children with autism.

Methods: Formalin-fixed and frozen autopsy brain samples of individuals with autism (n=9, aged from 9 to 56 years) in which diagnosis was confirmed by ADI-R score, and controls (n=12, aged from 13 to 59 years) were used in the study. Aβ was detected by immunocytochemical staining in sections of formalin-fixed brains using mAbs 4G8 and 6E10 by the immunoperoxidase method. Aβ was detected by immunoblotting in samples of frozen frontal and temporal cortex, cerebellar cortex and dentate nucleus. Aβ: monomeric and bound in complexes was detected with antibodies specific for the Aβ species with C-terminal aa 40 and 42.

Results: Neurons in the frontal and temporal cortex, Purkinje cells and neurons in the dentate nucleus were immunopositive in all autistic cases. Similar immunoreactivity was observed in control brains, however, in majority of autistic subjects the reaction was stronger and present in more cells, including astrocytes. Intracellular Aβ was aminoterminally truncated, i.e. reactive with mAb 4G8 but not mAb 6E10. Biochemical characterization of frontal and temporal cortex samples revealed the Aβ40 and Aβ 42 species as monomers, dimers, and several distinct complexes/oligomers of the molecular sizes between 24 and 52 kD. Brain samples from autism contained significantly more of Aβ42 in the 30-34kD and 50-52 kD protein bands. Biochemical characterization of cerebellum revealed a pattern of Aβ40- and Aβ42-immunoreactive protein bands different than in cortex, indicating formation of distinct Aβ complexes. The levels of Aβ42 bound to the proteins of the molecular sizes between 30 and 34 kD were significantly higher in dentate nucleus in autism. Sequential centrifugation revealed that only a subset of Aβ42 complexes, of the molecular sizes between 17 and 34 kD, was accumulated within the large cellular deposits.

Conclusions: Brain neurons in cortex and cerebellar cortex and dentate nucleus in autism in the post-developmental period of life accumulate intracellular N-terminally truncated Aβ42. This may result from excessive processing of APP in the non-amyloidogenic pathway or defective degradation of N-terminally truncated Aβ42.

116.004 44 Defects of Cholinergic Neurons Development In Autism. K. Nowicki*[1], I. Kuchna[1], S. Y. Ma[1], J. Wegiel[1], H. Imaki[1], I. L. Cohen[1], E. London[1], M. J. Flory[2], W. T. Brown[1], T. Wisniewski[1] and J. Wegiel[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*NYS Institute for Basic Research in Developmental Disabilities*

Background:

Nucleus basalis of Meynert (NBM), consists of four major nuclei (Ch1–4) that send cholinergic, GABAergic and glutamatergic axons to the cortical mantle (Henny and Jones, Eur. J. Neurosc. 2008, 27, 654-670). Cholinergic drive to the forebrain plays a modulatory role in anxiety, arousal and attention, and is essential for many learning and memory tasks (Murray and Fibiger, Neuroscience 1985, 14, 1025-1032; Kilgard, Neuron 2003, 38, 678-680). Autism is associated with signs of developmental alterations of the cortex, including abnormal structure of minicolumns and curtailed neuron development (Casanova et al., Neurology, 2002, 58, 428-432). However, one may hypothesize that cortical functional alterations are combined effects of cortical developmental alterations and abnormal cholinergic modulation due to developmental defects of the NBM.

Objectives: The aim of this study is to test the hypothesis that development of cholinergic neurons of the NBM is modified in autistic subjects.

Methods: Unbiased morphometric methods were applied to characterize four nuclei of the NBM in 12 autistic (4-64 years old) and 12 control (4 to 64 years old) subjects. The fractionator method was used to determine the number of neurons, the Cavalieri method to estimate the volume of the NBM, and Nucleator method to determine the volume of neurons and neuronal nuclei (Microbrightfield, VT).

Results: General linear models (GLM), with age group (4-8 years vs. over 8-years of age) as a between-subject effect, and autistic status and the interaction of autistic status and age groups as within-subject effect, were used to examine the combined effects of age and autistic status on neuronal and nuclear volume. Autistic subjects had reduced neuronal volume ($F = 13.161$, $p = .005$); this was also a non-significant trend for younger subjects ($F = 3.942$, $p = .075$). A significant interaction of younger age and autistic status was observed ($F = 5.395$, $p = .043$), indicating that the association between autism and a reduced volume of neurons was most pronounced in the youngest subjects. Autistic subjects also had reduced nuclear volume ($F = 15.434$, $p = .003$). A significant interaction of younger age and autistic status was observed for nuclear volume as well ($F = 8.169$, $p = .017$), indicating that the association between autism and reduced nuclear volume was also most pronounced in the youngest subjects.

Conclusions: Reduced volume of neurons in the NBM of autistic subjects may reflect altered cholinergic innervation of the cortical mantle contributing to anxiety, arousal, deficit of attention, and learning difficulties.

116.005 45 Hypothalamic Neurons Developmental Delay In Autistic Subjects. S. Y. Ma*[1], I. Kuchna[1], K. Nowicki[1], J. Wegiel[1], H. Imaki[1], I. L. Cohen[1], E. London[1], M. J. Flory[2], W. T. Brown[1], T. Wisniewski[1] and J. Wegiel[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*NYS Institute for Basic Research in Developmental Disabilities*

Background:

It is hypothesized that genetic alterations in oxytocin and vasopressin neurotransmission may account for several features of autism. Oxytocin and vasopressin produced by hypothalamic neurons in the nucleus supraopticus (NSO) and nucleus paraventricularis (NPV) have unique effects on the normal expression of social behavior, attachment behaviors, formation and retention of social memory, communication, and rituals. In autistic subjects the level of oxytocin is reduced (Modahl et al 1998) but the level of C-terminal extended forms of oxytocin is increased which suggests a deficit in oxytocin production and modifications of oxytocin processing (Green et al 2001). Patients with autism spectrum disorders show a significant reduction in repetitive behaviors following oxytocin infusion (Hollander et al 2003).

Objectives:

The aim of this study was to test the hypothesis that development of neurons in the NSO and NPV is modified in autistic subjects and to characterize the type of structural changes by employing unbiased morphometric methods.

Methods:

Brain hemispheres of 13 autistic and 14 control subjects 4 to 64 years of age were fixed in 10% formalin, dehydrated, embedded in celloidin, cut into 200-um-thick serial sections and stained with cresyl violet. Due to incomplete preservation of hypothalamic nuclei the number of examined cases was reduced to 8 autistic (4 to 52 year old) and 10 control (4 to 32 year old) subjects. The fractionator method was used to determine the number of neurons, the Cavalieri method to estimate the volume of the NSO and NPV, and Nucleator method to determine the volume of neurons and neuronal nuclei (Microbrightfield, VT).

Results: The average volume of neuron and neuron nucleus volume in the NSO and NPV were compared in eight autistic and ten control subjects. Ages of autistic subjects ranged from 4 to 52 years (mean 20.2, SD 16.7) and of controls from 4 to 32 years (mean 15.5, SD 10.0). Stepwise regressions on autistic status, age, and their interaction showed neuronal size and nuclear size in the NSO to be significantly smaller in autistic subjects with age controlled. Mean neuronal size in autistic subjects was 3,813 μm^3 (SD 1,068 μm^3) vs. 4,895 μm^3 (SD 1,197 μm^3) in controls ($t = -2.70$, $p = .016$, controlled for age). Mean nuclear size in autistic subjects was 513 μm^3 (SD 164 μm^3) vs. 668 μm^3 (SD 177 μm^3) in controls ($t = -2.80$, $p = .014$, controlled for age). Similar pattern was found in the NPV.

Conclusions:

Detected altered trajectory of development of neurons producing oxytocin and vasopressin may contribute to biochemical and behavioral changes observed in autism.

116.006 46 Increased NMDAR1 Subunit mRNA Levels In Purkinje Cells In the Crus II Cerebellar Hemisphere Region In Autism: An In Situ Hybridization Study. A. P.

Piras*, A. C. Lanoue, J. J. Soghomonian and G. J. Blatt, *Boston University School of Medicine*

Background: Neurochemical studies on affected cell types and their associated receptors have consistently shown significant changes in the GABAergic system in the autism postmortem brain. In contrast, there is a paucity of information on the excitatory glutamatergic system in autism. An earlier study in the postmortem cerebellum reported a significant increase in the protein levels of the NMDAR1 gene in autism compared to controls and normal density of NMDA receptors in the cerebellar molecular and granular layers in the autism group (Purcell et al., 2001, Neurology 57:1618-1628). It is hypothesized that there may be an imbalance between the inhibitory GABAergic and excitatory glutamatergic systems in the autism brain, which provides a potential pathway(s) for the affected motor and/or cognitive deficits. The posterior lateral cerebellar hemisphere (Crus II) is an ideal substrate to investigate changes in glutamatergic receptor mRNA levels in autism due to a previously reported decrease in GAD 67 mRNA levels in Purkinje cells (PCs), as well as marked deficits in Purkinje cell number.

Objectives: To elucidate the state of NMDAR1 receptor subunit mRNA levels in Purkinje cells in the Crus II region in postmortem adult autism cases, compared to age- and post-mortem interval matched controls.

Methods: *In situ* hybridization histochemistry and autoradiography were used to examine the cellular distribution of NMDAR1 receptor subunit mRNA in the Crus II region and quantitative analysis of NMDAR1 expression was obtained by measuring silver grain density in 120 Purkinje cell somata for each case. Grain density corresponding to NMDAR1 mRNA labeling was expressed as a mean number of pixels per surface area using NIH Image J analysis software and two-tailed unpaired t-tests were applied to determine significance at a $P<0.05$ level.

Results: Based on the initial analysis of 6 autism and 6 control cases, significant increases in NMDAR1 mRNA levels were found in PCs in the autism group compared to controls. Quantification of the NMDAR1 labeling revealed a 21.9% signal increase in PCs in the autism group when compared with controls (11.6±1.05 pixels/surface area in the autism group compared to 9.06± 0.45 in the control group; $P=0.046$ two-tailed unpaired t-test). Note that additional cases are currently being quantified and will be added to this data set to total 12 cases per group.

Conclusions: Results from the data thus far support the hypothesis that there are changes in the glutamate system in the cerebellum in autism and may contribute, along with previously reported alterations in GABA biomarkers, to the core neural features of the disorder.

Acknowledgements: Human tissue was obtained from the Autism Tissue Program and The Autism Research Foundation via the Harvard Brain Tissue Resource Center, and from the NICHD Brain and Tissue Bank for Developmental Disorders at the University of Maryland, Baltimore.

116.007 47 The Olivo-Floccular Circuitry Developmental Defects In Autism. I. Kuchna*[1], H. Imaki[1], K. Nowicki[1], S. Y. Ma[1], J. Wegiel[1], I. L. Cohen[1], E. London[1], M. J. Flory[2], W. T. Brown[1], T. Wisniewski[1] and J. Wegiel[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*NYS Institute for Basic Research in Developmental Disabilities*

Background:

Individuals with autism demonstrate atypical gaze, deficit in facial perception, altered movement perception, impairments in smooth pursuit (Rosenhall et al 1988; Scharre and Creedon, 1992; Takarae et al 2004). Substantial number of Purkinje cells in the flocculus receives converging visual inputs from functionally distinct portions of the retina and subserve the neural mechanisms for oculomotor controls during slow eye movements. The flocculus provides the oculomotor system with eye position information during fixation and with velocity information during smooth pursuit and participates in the control of the oculomotor functions (Noda and Suzuki 1979, Zee et al 1981). Oculomotor neural integrator circuit requires interaction with oculomotor neurons of the inferior olive nuclei (Ito, 1984). Presence of olivary dysplasia in three of the five autistic subjects and ectopic neurons related to the olivary complex in two cases (Bailey et al 1998) indicate that oculomotor circuitry is prone to developmental defects.

Objectives:

The aim of this study is to detect and characterize defects of the olivo-floccular circuit that may contribute to altered oculomotor function.

Methods:

Brains of 13 autistic and 14 control subjects were examined. An expanded neuropathological protocol, based on examination of one CV stained section per mm, was applied to detect type, topography and severity of qualitative changes. To detect

quantitative changes, the volume of neurons and their nuclei were estimated by application of Nucleator (Mircobrightfield, VT).

Results:

The study of serial sections from one brain hemisphere including the cerebellum of 13 autistic subjects revealed multiregional dysregulation of brain development in 12 (92%) subjects. The presence of cerebellar flocculonodular dysplasia in six of 13 autistic subjects (46%), focal dysplasia in the vermis of one subject, heterotopia in one case and focal hypoplasia in one subject, reflect a high susceptibility of autistic subjects cerebellum (61% of subjects affected by one or more developmental change) and especially of the flocculus for developmental defects. The study revealed smaller by 19% volume of neurons in the inferior olive and reduced by 32% volume of Purkinje cells in children from 4 to 8 years of age.

Conclusions:

High prevalence of flocculonodular dysplasia and delayed neuronal growth of Purkinje cells and neurons in the inferior olive in children 4 to 8 years of age are the evidence of qualitative and quantitative changes in cerebellar and brainstem circuitry that may contribute to disturbed function of the oculomotor system in autism.

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116.079 48 The Educational Placement of Children with ASD In Middle Childhood: The Contribution of Child Attachment and Maternal Insightfulness. S. Dolev*[1], D. Oppenheim[2], N. Koren-Karie[2] and N. Yirmiya[3], (1)*Oranim Academic College of Education*, (2)*Haifa University*, (3)*Hebrew University Jerusalem*

Background: Decisions regarding the educational placement of children with ASDs are based on a number of factors, including children's' cognitive functioning, adaptive behavior, social abilities and presence of behavior problems. Children with higher levels of functioning in all domains tend to be placed in the general educational system (within "mainstreaming" and "inclusion" systems), whereas children who function at lower levels tend to be placed in special education schools. Previous work has emphasized the role of children's IQ as well as the age of entry into intervention programs as predictors of their educational placement (Harris & Handleman, 2000), but we are not aware of any study that examined the contribution of the quality of children's early relationships to their placement.

Objectives: The present study is the first to examine in a sample of children with ASD the role of children's attachment as well as maternal insightfulness (which involves maternal insight into the motives that underlie the child's behavior, a complex view of the child, an acceptance of the child's challenging behavior, and an openness to new information about the child) at the preschool age, as predictors of children's educational placement in middle childhood.

Methods: 41 boys diagnosed with Autism Disorder (AD) or Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) and their mothers participated in the study. Children's diagnosis and level of functioning was confirmed using the ADOS-G, the ADI-R, the Vinland and a standardized intellectual or developmental test.

Preschool age (ages 2.7 – 5.8 years): children's attachment to their mothers was assessed using the *Strange Situation Procedure* (Ainsworth et al., 1978), and mother's insightfulness was assessed using the *Insightfulness Assessment* (Koren-Karie & Oppenheim, 2001).

Middle-school age (ages 8.6 -11 years): children's educational placement was ranked as follows: 1 - special education school; 2 – special education class in a general school; and 3 – regular classroom in a general school.

Results: Children's early security of attachment as well as maternal insightfulness predicted higher educational placement ranking over and above the contribution of IQ, which made an independent contribution to children's future placement.

Conclusions: Although the quality of children's early relationships is not a contributing factor to the onset of ASDs, it appears to be associated with children's later educational placement, with more optimal early relationships associated with an educational placement closer to that of typically developing children. An important caveat is that it is possible that child factors which were not assessed in this study may have contributed to their future placement. This caveat notwithstanding, the findings suggest that both maternal insightfulness and child attachment should be included as a focus of early interventions.

116.080 49 Use of Services and Cost of Autism in Adulthood. M. Farley*[1], D. Bilder[2], H. Coon[2], W. M. McMahon[1] and R. Nelson[1], (1)*University of Utah*, (2)*University of Utah School of Medicine*

Background: Early adulthood may be among the most expensive periods of life for people with ASD, their caregivers, and society; yet, little is known about the range of services

used by adults with autism spectrum disorders (ASD) or the costs incurred. Published studies target subgroups of adults with ASD, use administrative data, or have small samples. This study addresses some limitations of previous research by collecting direct assessments from a moderately large sample of adults across the range of intellectual and functional abilities.

Objectives: Aims were: to estimate direct and indirect costs of ASD for a sample of adults across the spectrum of functional abilities, to assess the types of healthcare and adult support services used, and to explore what individual factors inhere the greatest financial burden to families and society.

Methods: Direct assessment data were collected from 70 adults with ASD and their caregivers. Data concern functional ability, residential status, daytime occupation, and co-occurring medical and psychiatric conditions. Caregivers completed an adapted version of the Client Service Receipt Inventory (CSRI; Beecham & Knapp, 2001), resulting in detailed data about specific services used, out-of-pocket expenditures, and indirect costs.

Results: Cost data specific to age, functional ability level, and co-occurring conditions will be presented. Results will be compared and contrasted to existing information about costs of ASD for subgroups and using different sources.

Conclusions: Information concerning costs of ASD in adulthood is necessary to balance resource allocation against maximizing opportunities for individuals with ASD. Results from this study suggest relative financial burdens related to specific characteristics that may aid in development and selection of interventions.

116.081 50 Should Medication for Children with Autism Spectrum Disorders Be Prescribed Using Measurable and Observable Data? Preliminary Findings From a Teacher Questionnaire. A. M. Krasno*[1], L. K. Koegel[1], H. Taras[2], R. L. Koegel[1] and W. Frea[3], (1)*University of California, Santa Barbara*, (2)*University of California, San Diego*, (3)*Autism Spectrum Therapies*

Background: The current prevalence of medication usage among children with autism spectrum disorders (ASD) is high and has greatly increased in recent years (Oswald & Sonenklar, 2007; Aman, Lam, & Van Bourgondien, 2005). It is typical in current practice for a psychiatrist to prescribe medication to a child with ASD based on a brief interaction with the child coupled with parent report of his/her behaviors. Medication often continues to be used for many years, with an increasing probability for additional medications to be prescribed, as the individual grows older (Ebensen, Greenberg, Seltzer, & Aman, 2008). How these prescribing practices extend to the classroom, and whether educators are aware of which medication a child is on, is unknown. Also, there is a lack of research about the extent to which teachers, who are working with the children for many hours daily, provide information to the prescribing doctor with regard to any effects the medication is having on the child during the school day.

Objectives: A first step in this process was to assess whether teachers were knowledgeable regarding medication their students with ASD were taking, and if so, what type of medication. We also assessed what information, if any, is coordinated with the prescribing doctor.

Methods: One hundred and four families receiving Pivotal Response Treatment services through the Koegel Autism Center at University of California, Santa Barbara and other agencies in Southern California were surveyed to determine if their children were taking medication. Eleven of these families surveyed had children who were taking a prescribed medication. After obtaining parent consent, the teachers of the eleven children were given a questionnaire regarding medication information about those particular students.

Results: Of the eleven teacher questionnaires, 54% knew the children were taking medication. Of those, 9% (one teacher) knew what type of medication and none were aware of the dosage. None of the teachers were coordinating with the prescribing doctor, and only two of the teachers were reporting back to the parents only about any side effects.

Conclusions: The data from this survey suggest that there is a lack of coordination between teachers and prescribing doctors regarding medication information as it relates to child behavior and performance for children with ASD. It is currently not required for schools to monitor the effects a medication may have an a student with a disability; however, we would argue that because medications may positively or negatively affect a child's behavior, it is important for teachers to know whether or not their students are on medication and for prescribing doctors to understand how the medications are effecting the child's performance and behavior. Future research will assess whether coordination of information across professionals for monitoring the improvement of the behavior of a child with an ASD is warranted. This coordination may be essential for monitoring the effectiveness of medication use and ensuring that the child receives optimal services.

116.082 51 The Effect of Childhood Autism on Parental Employment. Z. Cidav*[1], S. C. Marcus[2] and D. S.

Mandell[1], (1)*University of Pennsylvania School of Medicine*, (2)*University of Pennsylvania*

Background: The care of children with autism imposes direct care costs on families, as well as indirect costs resulting from loss of earnings due to increased caregiving responsibilities. Previous research on the cost of autism has been restricted primarily to studying medical costs incurred by the healthcare service system. A more comprehensive view of costs must include the financial impact on families and go beyond the costs of medical care. By examining parental employment consequences of childhood autism, this study will provide new insight on indirect costs to families. Having a child with autism imposes additional time and financial constraints for family members. Added time constraints would imply reduced employment, whereas additional financial constraints may lead to increased employment. The net effect on parental employment is an empirical question.

Objectives: to 1) estimate the effect of caring for a child with autism on parents' labor force participation and hours of market work; 2) examine how this estimated effect varies as a function of child's individual, family characteristics and community factors.

Methods: We will use the Medical Expenditure Panel Survey (MEPS) from the years 2002-2007. The MEPS is an annual survey that collects detailed information on healthcare use, costs, health insurance, health status, socio-economic, demographic and employment characteristics for nationally representative samples of U.S. households. We will identify children with autism using Medical Condition files that provide information on household-reported medical conditions. Using the parent identifier, we will match children with their parents. We will conduct the analysis separately for mothers and fathers. The main independent variable will be an indicator of whether the child has autism. State-of-the-art econometric techniques will be used to estimate the effect of childhood autism on mothers' and fathers' likelihoods of employment and hours of work.

Results: Analyses are ongoing. There were 47942 children living with their mothers, 147 of whom were diagnosed with autism. 62% of mothers of children with autism were employed, compared with 71% of mothers of other children. Average weekly work hours of mothers of children with autism were 34 (sd=12), compared with 35 (sd=11) for mothers of other children. There were 34937 children whose fathers were present in the household. Of these, 113 were diagnosed with autism. 91% of fathers of children with autism were employed, compared with 95% of other fathers. The average weekly work hours of fathers of children with autism were 46 (sd=11), compared with 44 (sd=10) for fathers of other children.

Conclusions: Our preliminary results suggest a negative effect of childhood autism on parental employment. To date, much of the discussion regarding the financial impact of autism has focused on system-level direct care costs. This results in a one-sided argument that favors insurance companies regarding the impact of different strategies for financing services for individuals with autism. This study will provide the most comprehensive estimate of a major source of family costs. This information is essential in designing healthcare and workplace policies that recognize the full impact of autism and appropriately target resources to alleviate its effects.

116.083 52 Living with Autism: Parents of Adults with Autism Who Live In a Residential Home Tell Their Life Narratives. E. Mishori*[1] and N. Yirmiya[2], (1)*The Hebrew university Jerusalem*, (2)*Hebrew University Jerusalem*

Background: Data is strikingly lacking regarding the coping process of parents of adults with autism (ASD). As the number of children with autism continues to increase, so will the number of adults with the condition and the lifelong challenges parents will be facing.

Objectives: We explore the coping process of parents to adults with autism as seen through personal narratives, retrospectively and future-oriented

Methods: The study involved 15 parents: nine mothers and five fathers. In-depth interviews were conducted with each one to extract qualitative data that could not otherwise be derived from experiments, questionnaires, or observations. The narratives were analyzed along two dimensions: a) Holistic vs. categorical, and b) Content vs. form. The analysis defined three broad categories. I: Temporal (perception of time, internally and externally). II: Coping styles (A. emotions, B. actions, C. cognition, D. attitudes and moral values.) III: Ecological (reciprocal influence between parents and social circles).

Results:

In general, results suggest that the basic and inherent attitude to life influenced the longitudinal coping process. The narratives revealed a uniformly painful experience which evolved and developed through a lifelong process as parents sought to find meaning in their situation.

Axis I: Most parents described seven "meaningful" periods: 'life before parenthood', 'baby comes to the world', 'time of anxiety',

'the diagnosis', 'early and late childhood' , 'present time', 'the future' Deepest concerns related to a future in which they won't be around to care for their children.

Axis II: Coping styles evolved and followed a predictable developmental process: reacting emotionally to the new situation; facing the child's special needs; regaining a sense of control through actions. These steps mirrored a cognitive evolution accompanied by change in their moral attitudes and re-defining the meaningfulness of their lives.

Axis III: Cultural and social constructs affected parental practice significantly. Mothers tended to accept the traditional role as the child's main caregiver, though many coped by engaging in private and public advocacy. Fathers also acted conventionally, but both parents showed the same interest and affection to the child. The mothers' narratives made use of more affectionate language and 'motherhood' played a big role. The fathers used more factual language giving much more space to their career and outer world.

The general societal attitude toward their child as 'the other' had a dominant effect on family and parental practices. The parents' ethnic origin and educational level were heterogenic and no significant differences were found based on socio-demographic data. The parents' narratives were highly reflective of Israeli societal influences.

Conclusions: Exploring parents' perspectives through their life narratives enables us to better understand complex developmental and social milestones in parents' lives. The experience of Israeli parents is likely similar to what parents in other countries and cultures encounter. This study highlights the need to identify and adopt appropriate interventions to present and future needs of families. This segment of the population must not be "lost in the shuffle" and must not be ignored in data collection involving autism-related studies.

116.084 53 Autism Screening In Under-Served Populations.

Y. M. Janvier*, J. Harris and G. Cable, *Children's Specialized Hospital*

Background: Although no evidence of racial or ethnic differences exist in the epidemiology or phenotype of autistic disorder (Bertrand et al., 2001), research suggests that both racial and income disparities are present in the early detection and treatment of autism. African-American and Latino children have been found to receive their first diagnosis at later ages than white children (Mandell, Listerud, Levy, and Pinto-Martin, 2002), and poor children have been found to receive a diagnosis later than non-poor children (Goin-Kochel, Mackintosh, & Myers, 2006; Mandell et al., 2002; Mandell, Novak, & Zubritsky, 2005). In addition, minority children have been found to be more likely than white children to be without health insurance coverage, to be without a usual source of care, and to report an inability to get needed medical care (Newacheck, Hung, & Wright, 2002).

Primary healthcare providers are unlikely to adopt mental health screening or early intervention methods already developed in child psychology or psychiatry, even though such knowledge may be critical to child mental health promotion and early intervention efforts (NIMH, 2001). This implies the need for targeted education among healthcare professionals regarding the diagnosis and treatment of autism and ASD within diverse populations, as well as among parents, caregivers, educators, and other community members who have regular contact with minority children to facilitate early recognition of in their children that might signal a developmental delay and a possible autism spectrum disorder. It also indicates the need for much greater accessibility to diagnostic services among poor and minority children.

Objectives: Screen at least 1,000 children for ASD in a community setting using the MCHAT or SCQ, in six cities in New Jersey with large, low income, minority populations. This will in turn facilitate access to appropriate services resulting in early entry into appropriate early intervention services for a large number of underserved children who traditionally would not have been identified until after they entered elementary school.

Methods: Health care providers in diverse settings within these cities were offered developmental screening training; culturally-sensitive autism education materials for use in community outreach were created; outreach was conducted to caregivers of children in these cities and other community members regarding normative child development, behavioral signs of possible developmental delay, and resources; community autism screening of children 18-60 months old within daycares/preschools was provided; and autism screening clinics in easily accessible locations throughout these cities will be established. In addition, children will be screened with the MCHAT or SCQ and children failing the MCHAT will complete the MCHAT interview. Children failing the MCHAT interview and SCQ will undergo further evaluation with the ESAC, Mullen visual reception component, and ADOS.

Results: Preliminary data based on screening with a homeless population in one underserved area indicates a higher failure rate on ASD screening than expected based on existing research. Necessary components of a successful screening

will be discussed along with challenges faced. Additional data will be discussed.

Conclusions: Our initial experiences suggest potential barriers to use of traditional parent report measures in this population.

116.085 54 Evaluation of the Factors Associated with at-Risk for Autism Designation During Developmental Screening, and Agreement Between at-Risk Designation and Subsequent Clinical Diagnosis In Young Children: A Retrospective, Observational Study. J. Harris*, Y. M. Janvier and G. Cable, *Children's Specialized Hospital*

Background: Autism is a life-long disability that is prevalent in as many as 1 in 90 children. Early-age screening, diagnosis, and service provision are critical to achieving optimal outcomes. Children's Specialized Hospital created a *Developmental Screening Clinic (DSC)* to improve early screening to identify developmental delays, autism and autism spectrum disorders, and to improve access to care, *inter alia*.

Objectives: This analysis focused on examining pre-specified factors for why a child is given an at risk/not at risk for autism designation during screening, and separately, the factors that explain agreement between the at risk/not at risk designation and subsequent clinical diagnosis of autism/no autism during the first two years of the DSC. The factors examined for both questions include: age and sex (male as referent category) of the child; the site at which the screening occurred (site A as referent), and; the year of screening.

Methods: The number of children screened, mean and median ages of children screened for the 2-year period, and percentage male/female were calculated. For the confirmatory analysis, the proportion at risk of autism and the proportion of cases for which there was agreement were both calculated. Logistic regression was employed to estimate the adjusted odds ratios of the factors associated with an at-risk designation and agreement with clinical diagnosis.

Results: 879 children ages 8 months to 79 months were screened for Autism/ASD. Mean and median ages for the children were 32.6 and 32 months, respectively, with 74.7% (657/879) being male. Just over 58% (513/879) of children were at risk of autism. Of the 556 children for whom a clinical diagnosis was available, 58.8% (327/556) were diagnosed with autism. Adjusting for age and sex, children screened at site B and C were 58% less likely (Odds Ratio [OR], 0.42) and 7% more likely (OR, 1.07), respectively, to be designated as at risk than children screened at site A (the referent site). In addition, children screened during year two were 85% (OR, 1.85) more likely to be designated as at risk of autism than children screened in the first year. Agreement model results indicated that after again adjusting for age and sex, children screened at site B and C were 38% less likely (OR, 0.62) and 51% less likely (OR, 0.49), respectively, to have agreement between the screening and final diagnosis than children screened at site A (the referent group). In addition, children screened during year two were 2.3 times more likely (OR, 2.3) to have agreement between the screening and final diagnosis than children screened in the first year of the DSC.

Conclusions: Our results suggest that spatial (by site) and temporal (across years) variation existed regarding the likelihood of at-risk for autism designation and agreement between this designation and agreement with the subsequent clinical diagnosis. The findings suggest that unmeasured factors resulted in a difference in the patient selection mechanism across sites and time, the quality of the screening/clinical evaluation processes, or both.

116.086 55 Characteristics of Children Referred for Evaluation of Autism Spectrum Disorders In a Community-Based Mental Health Setting. N. Stadnick*[1], N. Akshoomoff[2], K. Nguyen Williams[2], G. Cerda[2] and L. I. Brookman-Frazee[2], (1)*San Diego State University/University of California, San Diego Joint Doctoral Program in Clinical Psychology*, (2)*University of California, San Diego*

Background: The community mental health (CMH) system significantly contributes to providing care for children with ASD given their high rates of co-occurring psychiatric problems (e.g., anxiety, mood, attention, disruptive behaviors). This system may also contribute to identifying ASD, particularly for school-age, high functioning children who may be more diagnostically complex. Recent research (Brookman-Frazee et al., 2010; Joshi et al., 2010) indicates that a significant minority of children in these settings have ASD and are older with higher functioning diagnoses (Asperger's Disorder; PDD-NOS) and significant diagnostic comorbidity. Identification of children with ASD in CMH settings is difficult due to their clinical complexity, therapists' limited training in evidence-based screening and diagnostic practices, and the high proportion of youth from minority or non-English speaking families (Mandell et al., 2002). Limited research has examined the feasibility of identifying ASD using evidence-based diagnostic practices in CMH settings and the characteristics of children suspected of ASD.

Objectives: This study's aim was to examine the characteristics of children served in CMH settings who are referred for and receive evidence-based ASD assessment. This type of research is consistent with the goals of the 2010 Interagency Autism Coordinating Committee "Strategic Plan for

ASD Research" which emphasizes the need for research in ASD assessment and diagnosis with emphasis on community settings and school-age children and adolescents.

Methods: Data were extracted from CMH data (clinical evaluation reports). Eight CMH providers (psychologists; pre-doctoral psychology interns) were trained by a certified ADOS trainer. CMH providers referred children receiving CMH services (therapy or therapy/ medication management) who were suspected of an ASD based on clinician report and scores on screening measures. Trained providers administered the ADOS, gathered developmental history, and integrated information to determine diagnosis.

Results: Nineteen children were referred for ASD assessment. Children were an average of 12.05 years (SD = 3.41; range: 6-17 years) and 58% male. They were 47% Caucasian, 47% Latino/Hispanic, and 5% African American. Those referred had an average of two non-ASD diagnoses (range: 1-4) (anxiety, mood, disruptive behavior, and ADHD disorders were most common) and 58% had two or more comorbid diagnoses. Approximately 53% (n=10) fell within the ASD or Autism categories on the ADOS, and of this subset, 70% (n=7) were ultimately diagnosed with an ASD. Of those receiving an ASD diagnosis, 72% had at least two co-occurring non-ASD diagnoses, 71% received diagnoses of Asperger's Disorder or PDD-NOS, and most were Average to Low Average in cognitive functioning.

Conclusions: Children referred for ASD evaluation in this CMH setting were an average age of 12 years, diagnostically complex with the majority having at least two co-occurring disorders, and nearly half were Latino/Hispanic. Approximately 37% received a final diagnosis of ASD and these children were generally higher functioning (average cognitive functioning and diagnoses of Asperger's Disorder). The clinical and age characteristics of these children are consistent with research conducted in similar service settings. These data underscore the need for increased targeted ASD screening efforts, especially towards those who are higher functioning and have overlapping or comorbid problems.

116.087 56 Screening for Autism at 12 Months: Physician and Parent Perceptions. E. R. Crais*[1], B. P. Humphreys[2], C. McComish[3], L. R. Watson[1], G. T. Baranek[1], J. S. Reznick[4], R. Christian[3] and M. Earls[5], (1)*University of North Carolina at Chapel Hill*, (2)*University of New Hampshire*, (3)*University of North Carolina*, (4)*University of North Carolina - Chapel Hill*, (5)*Guildford Child Health*

Background: Early intervention (EI) improves developmental outcomes for young children with ASD (Dawson et al., 2010; Kasari, Freeman, & Paparella, & Jahromi, 2008), yet access to EI is contingent on screening. Fewer than 10% of primary care providers (PCPs) screen for ASD (Dosreis, Weiner, Johnson & Newschaffer, 2006) and yet the American Academy of Pediatrics (AAP) recommends screening all children for ASD twice before 24 months of age (Johnson & Myers, 2007). Understanding the views of PCPs and parents on early screening for ASD and what factors contribute to acceptance and use of screening tools might facilitate wider implementation of the AAP guidelines.

Objectives: To gain perspectives of PCPs and parents on screening for ASD in infants at 12 months of age. The results will inform a revision of the *First Year Inventory* (Baranek, Watson, Crais, & Reznick, 2003), a parent-report tool for identifying infants at-risk for ASD.

Methods: Eight focus groups with PCPs and three with parents were conducted around screening for ASD in infants. Participants were 60+ physicians/nurses across settings seeing infants in North Carolina, and 21 parents whose infants had just had a 12-month-old well-child checkup. A grounded theory approach was utilized to analyze focus group transcripts and team members gained consensus on 5 open and 30 axial codes using Atlas.Ti qualitative data analysis software.

Results: The five open codes focused on issues related to tool design, interpersonal interactions, procedures, context, and ethical/moral dilemmas. Some key issues are listed below:

- Tool design: PCPS wanted a tool that was: quick with possibly 5 questions and a two-tiered system (general & at-risk screens), Medicaid approved, electronically available, and culturally sensitive.
- Interactions: PCPs were concerned about possible cultural bias and their own limitations in understanding perspectives from families of other cultures.
- Between parents and PCPs: a lack of congruence in perceptions and culturally diverse views of development were highlighted.
- Procedures: who should complete the tool (parent and/or PCP) was important to both groups.
- PCPs also had questions about how do you know what to look for in infants, what is 'typical', and where's the evidence for early identification?

- Context: PCPs were apprehensive about the capacity of the EI system and the lack of follow-up from EI agencies once children were referred.

- Ethical/moral issues were raised by both groups such as the "risks" of over- or under-referral and the impact on families, the "stigma" of the term autism, and weighing the benefits and risks.

Conclusions: The results of this study can be used by researchers, primary care providers, and families to gain perspectives on PCPs' and parents' views on early screening practices. 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.

Funding: Ireland Foundation

116.088 57 State Differences and Comprehensive Treatment Model Characteristics Affecting the Receipt of Educational and Therapeutic Services for School-Aged Children with Autism Spectrum Disorder. D. Irvin*[1], B. Boyd[1], M. McBee[1], K. Hume[2] and S. Odom[3], (1)*University of North Carolina at Chapel Hill*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of North Carolina*

Background: Extant research suggests state of residence and comprehensive treatment model (CTM) characteristics affect access to and receipt of school-based services for children with autism spectrum disorder (ASD) (Thomas et al., 2007; Stahmer & Mandell, 2007). Speech language therapy (SLT), occupational therapy (OT) and applied behavior analysis (ABA) are types of services families of children with ASD often utilize. The purpose of this study was to examine factors affecting the receipt of both in-school and out-of-school services for school-aged children with ASD.

Objectives: To examine how the types and dosage of services children receive in private and school settings relate to (1) state of residence (i.e., North Carolina, Florida, Minnesota or Colorado); and (2) participation in a CTM (LEAP or TEACCH) or a "business-as-usual" (BAU) treatment approach.

Methods: Families of children with ASD (n=117), ages 3 to 5, enrolled in self-contained or integrated classrooms participated in the study. For state-to-state comparisons, the ADOS, Mullen Scales of Early Learning (MSEL) and an SES composite variable were included as covariates. Information on the type and dosage of service (i.e., # of minutes per session and # of hours per month) was gathered. Zero inflated negative binomial or poisson regression models were used, where appropriate, to examine the relationship between services used, state of residence, and CTM characteristics. These analyses are appropriate for count data that are overdispersed and/or contain an excess of zeros.

Results: In terms of state differences, families in Minnesota received a larger dose of in-school SLT than those who lived in North Carolina (p= .025) and Florida (p= .025). Colorado families received a larger dose of in-school OT than those in Florida (p= .000) and Minnesota (p= .000). Children with ASD received a smaller dose of private OT in Colorado (p= .010) than those in Florida. With regards to participation in a CTM, children in LEAP received a larger dose of in-school SLT than those in TEACCH (p= .003) and BAU (p= .048) classrooms. Children in BAU received a smaller dose of private SLT than children enrolled in LEAP (p= .050) and TEACCH (p= .038). LEAP children were less likely to receive private OT than those in BAU (p= .004) and TEACCH (p= .010), but when they did receive private OT, it was a larger dose than BAU children (p= .019). Finally, TEACCH children received a smaller dose of in-school OT than children in LEAP (p= .029) classrooms.

Conclusions: Factors outside of child or family characteristics can affect receipt of services for school-aged children with ASD. Based on this study, state of residence can affect the dosage of OT and SLT services used. Participation in a CTM or BAU also affected the dosage of in and out-of-school OT and SLT as well as the likelihood of using private OT services. Our findings appear to have implications for state-wide policy and practice.

116.089 58 Emergency Department Utilization by Adolescents and Adults with Autism Spectrum Disorders Living with Minimal Support, with Family and In Supported Group Homes. A. Tint*[1], S. Robinson[2], J. A. Weiss[1] and Y. Lunsky[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Individuals with Autism Spectrum Disorders (ASD) face multiple barriers to primary medical and mental health care, and frequently utilize emergency department (ED) services as a result (Krauss et al., 2003; Mandell, 2008). However, ED services do not adequately meet the care needs of this population, with impairments in social, communicative and behavioral abilities making ED visits particularly challenging (Bradley & Lofchy, 2005). Limited research exists on the detailed experiences of individuals with ASD in the ED, and no studies have compared the experiences of adolescents and adults with ASD from different residential settings.

Objectives: The present study aims to further examine the types and antecedents of ED visits in adolescents and adults with ASD, as well as differences in care received and discharge outcomes across three different living situations; with family, with minimal support, or in group homes.

Methods: As part of a larger project examining the crisis experience of individuals with Intellectual Disabilities in Ontario, Canada, the current study summarizes information collected from ED chart reviews on persons with ASD in minimal support settings, with family and in group homes. Forty-three individuals, 16-72 years of age (*M*=28.95, *SD*=12.26), had at least one ED visit and consented to have their ED documentation reviewed by a research team.

Results: Preliminary analyses indicate that there were 66 ED visits in total across the three residential groups. Individuals living in minimal support settings (*n* = 6) were 18-47 years of age (*M*=30.33, *SD*=10.65) and visited the ED a total of 11 times (2 medical and 9 psychiatric visits). Individuals living with family (*n* = 16) were 16-31 years of age (*M*=20.06, *SD*=3.80) and visited the ED a total of 20 times (1 medical and 19 psychiatric visits). Finally, those living in supported group homes (n=21) were 18-72 years of age (*M*=35.33, *SD*=13.03) and visited the ED a total of 35 times (11 medical and 24 psychiatric visits). In all three residential settings, aggression and self-injurious behaviors were the most commonly stated reasons for the ED visit. Further analysis will explore differences between residential contexts in the types of events leading up to the ED visit, and their associations to clinical and demographic characteristics, care received and discharge outcomes.

Conclusions: Consistent with related research, results indicate that individuals with ASD frequently use emergency psychiatric services due to aggressive and self-injurious behaviors. Results will be discussed in relation to potential risk factors, as well as implications for ED protocol and health service policies. Further insight into the ED experiences of individuals with ASD living in different residential settings will contribute to our understanding of crisis experiences of individuals across the spectrum.

116.090 59 Participation In Main Stream Schools – a Reality for Students with ASC?. M. Falkmer*[1] and T. S. Falkmer[2], (1)*Jonkoping University*, (2)*Curtin University*

Background: Existing research on inclusion for students with ASC is incoherent. Some studies report that students with ASC are well accepted by peers and teachers (1-3). Others that students with ASC are excluded from school activities (1, 4, 5). Students with ASC are at risk for dropping out of school, mainly not due to intellectual problems but to social alienation and lack of participation (6). Participation includes one aspect that can only be rated by the individual, i.e., the subjective feeling of having participated. Teachers tend to rate the participation of children with impairments as higher than the children themselves, indicating that they base their perceptions on observations, not on the child's experience(7). Hence, increased knowledge about children with ASC and their self rated participation in schools is necessary, in order to improve their school situation and further develop inclusive school

Objectives: The objectives were to examine if self-rated participation in school activities differs between students with ASC and their peers and, if so what may differentiates the groups? Another objective was to examine how reliable teachers' ratings of the ASC students' participation are, based on the students' own ratings.

Methods: As part of a larger study, a questionnaire was distributed to 22 students with ASC (mean age 10.9, 68% boys), attending mainstream schools and to 382 peers without ASC (mean age 10.9, 49% boys).

The study was approved by an ethical committee. The questionnaire comprised 46 questions on participation in school activities. It was distributed during lecture time to students and school staff (n=38) in 21 schools in Sweden. In the questionnaire to the staff, questions were rephrased asking them to rate their perceived level of participation of the child with ASC.

Results: The 46 questions were divided in to "Formal relations" (8 questions), "Quality of informal relations"(15), "Intra-personal aspects" (13) and "Quantity of informal relations" (10).

Compared with their peers, students with ASC rated their participation significantly ($p<.05$) lower on 38% of the questions in "Formal relations ", 40% in "Quantity of informal relations" and on 54% of the questions in "Intra-personal aspects". Students with ASC and their peers differed most in the category "Quality of informal relations" (73%).

An analysis of the agreements between the school staff's rating of participation of the student with ASC and the students' own rating will be presented and the consequences of agreements and disagreements will be discussed.

Conclusions: Students with ASC rate their participation in school activities lower compared with peers. Regarding "Informal relations", the difference between the groups is large. Since the category is about relations to friends, this finding

indicates an increased risk for social alienation in students with ASC and thus, interventions aiming to enhance social relations are of importance in mainstream schools.

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116.091 60 Developing the Japanese Version of the VABS-II (2): Examining the Validity by Confirmatory Factor Analyses. F. Someki*[1], M. Tsujii[2], I. Tani[3] and H. Ito[4], (1)*University of Minnesota*, (2)*Chukyo University*, (3)*Hamamatsu University School of Medicine*, (4)*Nagoya University*

Background:

Currently, there is no comprehensive adaptive behavior scale available in Japan to help making a decision on a necessary level of support for individuals with disabilities. The unavailability of adaptive behavior scales has led to an underestimation on needs in 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 scale in the US and other countries and is used not only for identifying individuals with cognitive disabilities, but also assessing needs of individuals with pervasive developmental disorder (PDD) and other developmental disabilities.

Objectives:

The original VABS-II consists of four primary factors that include 11 subdomains: Communication, Daily Living Skills, Motor Skills and Socialization domains, as well as the Adaptive Behavior composite (overall score of the others; Sparrow et al., 2005). Additionally, these primary factors (i.e., second tier) compose of the adaptive behavior as a secondary factor (i.e., top tier). The purpose of this study was to examine the validity of the Japanese VABS-II by confirmatry factor analyses.

Methods:

The participants were 1,219 normally developing children/individuals (614 males, 605 females) aged 0 to 87 years in 28 prefectures (out of 47) in Japan. The selection of the participants was modeled after the original VABS-II and matched to the demographics of Japan regarding age and male-to-female ratio. For those from 0 months to two years old, the data were collected for each month up to one-year-old (e.g., 1-month-old, 2-month old), and every other month up to two-year-old because they usually exhibit rapid developmental change. For data analyses, missing values were estimated by the full information maximum likelihood (FIML).

Results:

Confirmatory factor analyses by age exhibited sufficient factor loading for each primary factor, indicating that the original factor model fit the present data for all age groups. Each primary factor also exhibited sufficient factor loading for the secondary factor. When evaluating the best fit for a structural model using fit indices, four-factor model (three-factor for seven years and older because there was no Motor domain) showed the best fit for all the age groups but one (i.e., 7-12 years) rather than independent model (i.e., all the subdomains were independent from each other) or one factor model (i.e., all the subdomains belonged to a single factor).

Conclusions:

The validity of the Japanese version of the VABS-II appeared to have a sufficient validity supported by an adequate model fit.

116.092 61 Levels of ASD Recognition and Attitudes towards Treatments and Interventions In the Chinese General Population. X. Zhou*, J. Wang, W. Xia, C. Sun, X. Wang and L. Wu, *Harbin Medical University*

Background:

Autism is a common developmental disorder. However there is a paucity of research about people's knowledge about autism and attitudes towards treatments and interventions in the general population. Developmental disorders in children will be neglected and the early diagnosis and treatment for children with Autism will be delayed if there is a lack of the knowledge.

Objectives:

To (1) estimate the proportions of people in the community who could correctly identify autism spectrum disorders, (2) describe the attitudes towards various treatments for autism spectrum

disorders, and (3) identify factors associated with recognizing autism spectrum disorders in this population.

Methods:

Using cluster sampling method, parents and/or grandparents of children from 34 kindergartens in 6 districts in Harbin city (P.R.China) were enrolled in the study. We distributed 5515 questionnaires in potential participants. Among them, 4947 questionnaires were returned (89.7%). The questionnaires asked information about general knowledge about autism, ability to recognize autism and attitudes towards treatments and interventions. In this analysis, we estimated the proportions of participants who could correctly recognize autism, described the attitudes towards treatments and interventions, and identified factors associated with recognition.

Results:

We found that 57.9% of the participants could accurately identify the features of autism; 57.1% could accurately describe different levels of autism; 8.0% knew autism as a developmental disorder. Female knew more than male in the three aspects of autism. About 84.6% of the participants went to see health professionals as soon as their children were found with the abnormal behaviors. However, 55.3% of participants didn't know what settings they should go for the child's problems. In the questionnaire on the settings for autism treatment, 60.8% of parents thought treatment should be done in psychological clinic. Only 33.4% of parents knew the rehabilitation and education training were the best ways for treatment. Logistical results showed the mothers with high education had better knowledge about autism than fathers.

Conclusions:

The levels of recognition of autism are low in the general population. There is a significant room for improvement. Female participants have better knowledge about autism than males. Health education and promotion are needed to raise the autism awareness and facilitate early intervention in the general population.

116.093 62 Development of Children with Autism Spectrum Disorders In Special Education. R. Stoutjesdijk*, E. M. Scholte and H. Swaab, *Leiden University*

Background: Due to impairments specific for their disorder, children with ASD often have to rely on special educational services in either an inclusive or a segregated setting. The frequency of higher functioning children with ASD who use special educational support is increasing to date, and severe emotional and behavioral difficulties along with academic underachievement within this population are reported. To optimize educational services for these children, it is important to assess what developmental and academic progress is made within special educational settings, and whether there are differences in progress between children placed in inclusive versus segregated settings. In any case, studies concerning developmental gains in special education (across settings) of children with ASD in general are rare. Because of the limited knowledge about the development of children with ASD in special educational settings, decisions concerning educational placement and additional interventions can not be made on sufficient grounds.

Objectives: To determine if segregated and inclusive special educational settings offer higher functioning children with ASD a prospect of progressive behavioral and academic development.

Methods: Sixty-two higher functioning (IQ > 85) children with ASD (M_{age} = 9.6 years) were followed during one year of special education. In order to be included in the sample, children had to be formally diagnosed with ASD according to the DSM-IV criteria by a qualified clinician and also had to score in the clinical range on the subscale 'autistic traits' of the Social Emotional Questionnaire (SEQ). Within this sample, 38 children were placed in separated facilities for special education (Special School) and 24 children received special education in regular classrooms for most of the school day (Inclusive Education). Progress in children's functioning was evaluated by pre- and post-assessments. The Dutch version of the Teacher's Report Form (TRF) was used to obtain problem behavior assessed by the child's teacher. Academic performance on text reading accuracy, reading comprehension, math and spelling was measured by means of test methods used by the Dutch government to assess educational progress annually. GLM repeated measures were used to examine progress and group differences.

Results: Preliminary analyses show that within the total sample significant developmental progress within one year has been made concerning autistic symptoms, social problems, thought problems, attention problems, internalizing problems, and total problem behavior ($p < .05$). Between group differences on these variables were found for internalizing problems (Special School showed more progress than Inclusive Education), social problems, and total problem behavior (Inclusive Education showed more progress on these variables than Special School). Regarding academic performance significant progress

was made within the total sample for all subjects ($p < .01$). No significant differences between groups were found.

Conclusions: The findings show that within both educational settings improvement on a behavioral and academic level is achieved, but they also suggest that inclusive education offers a better environment for higher functioning children with ASD to improve their social functioning, whereas separated facilities are more capable of minimizing internalizing problem behavior. Implications of these findings concerning educational placement will be discussed and suggestions for further research will be presented.

116.094 63 Parent Reported Status and Expectations for Their Autistic Student Children: An Analysis of the 2007 National Household Education Survey. M. J. Carey*, *Self*

Background: National surveys provide a good source of information on autistic populations within the United States. The 2007 National Survey for Child Health was used to estimate autism prevalence (Kogan 2009), as well as to make comparisons of such family factors as the divorce rate (Freedman 2010). A similar survey, the National Household Education Surveys Program (NHES), is an opportunity to explore comparisons between parent-reported factors involving the lives and education of autistic and non-autistic students.

Objectives:

1. Compare educational placements and percieved educational abilities between children with (a) parent-reported autism spectrum disorders (ASD) and (b) children in the general population.

2. Explore parent expectations for the future of their ASD student.

Methods: Data used for this study were taken from the National Household Education Surveys Program (NHES 2007). NHES had 10,682 total respondents, representing students ages 3 to 20 years. 127 parents identified their child as having autism and an additional 37 identified their child as having pervasive developmental disorder. Parent responses for this group (164 total, or about 1 in 65) were compared to those of the parent responses within the general survey population.

Results: 75% of students with parent-reported ASD have an Individualized Education Plan. Parents reported that their ASD students are more likely to have repeated a grade (23% ASD vs. 9% without) or be home schooled (5.5% vs. 2.9%) or be in a program that does not assign letter grades (37% vs. 22%). ASD students were reported as less likely to be in private school (9.6% vs. 13.4%) and to have moved in order to attend a specific school (17.7% vs. 21.6%). Parents are generally satisfied with their child's school (82.2% rated somewhat or very satisfied), but less so than for non-autistic students (90.7%). Of those children who receive letter grades, the number of ASD students getting "mostly A's" or "mostly B's" is high (79.6%), but less than the general population (84.1%). Parents of students in middle school or above were asked about their future expectations. The fraction of ASD students whose parents' expectation were that their child would receive less than a high school diploma is much higher than for the general population (6.3% vs. 0.6%). However, by far the majority of parents expect their autistic student to receive a high school diploma, with most expecting at least some vocational school or college to follow. Most parents in the general population expect that their child would achieve a 4-year or graduate degree (72.7%). While the parental expectations for ASD students to obtain a bachelor or higher degree is much lower (28%), this is still a notable fraction of the autistic population.

Conclusions: Parents report that their ASD students lag behind the general student population in academic performance. Parent report high satisfaction with their schools, but at a lower level than the general population. Many parents of ASD students report high expectations for their ASD students. Services research should consider how to support individuals with ASD with a broad spectrum of abilities and expectations.

116.095 64 Cross-Cultural Comparisons of Social Expectations of Individuals with Autism. F. A. Boujarwah*[1], N. Nazneen[2], H. Hong[2], G. D. Abowd[2] and R. Arriaga[2], (1)*Georgia Institute of Technology, HSI*, (2)*Georgia Institute of Technology*

Background:

Culture can be defined as the way of life of a group of people – the behaviors, beliefs, values, and symbols that they accept. As such, differences in culture influence the way we perceive the social world. Our goal is to develop adaptive technologies for individuals with autism. However, we realize that the design of such treatment programs must be informed by data on the culture of the individual in question.

Objectives:

We have studied the ways that culture affects expectations regarding social and adaptive behaviors in individuals with

autism in four countries: Kuwait, Pakistan, Korea, and the United States. We hypothesize that social factors such as religion, socio-economic status, lifestyles and infrastructure, impact attitudes towards individuals with autism and mediate the expectations society has for them. Our goal is to understand how cultural differences impact the overall expectation for social behavior, and to provide a cultural lens onto the autism communities, so that we may help members of society understand ways they can support these individuals in a greater context.

Methods:

We conducted observations at schools and special needs centers, and semi-structured interviews with caregivers including parents, and teachers and therapists who work with young adults with autism. Participants were asked to answer a set of questions about the current interventions and therapies the child was receiving, and their goals for the development of the child's life skills and social skills. The data in each country was collected by a researcher who is native to the culture, and the transcripts and field notes are being analyzed, using affinity diagrams and open-coding, by the team to ensure cultural sensitivity in data collection and unbiased data analysis.

Results:

Preliminary findings indicate that cultural factors such as religion, education-level and the context in which that education was received, socio-economic status, and exposure to other cultures lead to differing attitudes towards individuals with autism and the expectations parents and teachers have for them. For example, whereas learning to live independently is strongly emphasized in the US and Korea, it did not emerge as a clear goal in our interviews with caregivers from Kuwait and Pakistan. This is a reflection of the strong religious values held in these societies. These values similarly were indicated as reasons why parents were complacent in ensuring their child reached their potential, citing the fact that the child's development "was in God's hands."

Conclusions:

We have gathered qualitative data suggesting that culture plays a pivotal role in framing expectations for social behavior, and what treatment goals are deemed socially acceptable and relevant for individuals with autism. Our preliminary findings underscore our intuitive sense that treatments aimed at improving social skills and adaptive functioning in individuals with autism must take into account the mores of the individual's society. In ongoing analyses, we will additionally focus on how public policies, such as regulations related to inclusive classrooms, have impacted social perceptions.

116.096 65 Expanding Medicaid Access for Children with ASD Through Home-and-Community-Based Waivers and the TEFRA Medicaid Eligibility Option: A National Study. R. M. Semansky*, *University of Pennsylvania School of Medicine*

Background: While the number of youth diagnosed with autism spectrum disorders (ASD) has grown dramatically, both commercial plans and public insurance programs have been slow to include the types of services that result in the greatest improvements for children with ASD. Commercial plans often limit the type and intensity of services available to youth with ASD or exclude ASD as a covered diagnosis altogether (Peele, Lave, & Kelleher, 2002). Standard state Medicaid plans also limit the types of available services (Ridgely & Maglione, 2006).

There are at least two ways that states can be flexible in the way that they use Medicaid dollars to improve access for youth with ASD. First, a state can apply for a federally-approved Medicaid waiver, which permits states to disregard or waive particular Medicaid requirements. For example, states could expand access by allowing youth in higher-income families to qualify for Medicaid; they also can add services that are not included in the state's regular Medicaid plan. Second, states can exercise the TEFRA Medicaid eligibility option, which allows youth in higher-income families to qualify for Medicaid and therefore access all services available under the state's regular Medicaid plan (R. M. Semansky & Koyanagi, 2004).

Studies estimate that as many as one third of children diagnosed with ASD in the US are served through the Medicaid system (Mandell et al., 2010; R. Semansky, Xie, & Mandell, Under review); however, little is known about the extent to which states expand access for youth with ASD through these Medicaid-specific policies.

Objectives: This study determined which states allow children to quality on the basis of their ASD diagnosis only for Medicaid home-and-community based waivers and the TEFRA eligibility option.

Methods: Trained research staff collected available rules, program descriptions and other relevant information on each state's Medicaid waivers and eligibility processes through searches of online databases. Brief telephone interviews were conducted with state Medicaid staff and protection and advocacy legal staff to confirm the characterization of each state's Medicaid program.

Results: By 2010, 10 states had implemented autism-specific Medicaid waivers. Though nearly all states have broadly-focused home-and-community based waivers for intellectual disabilities/development disabilities, only a small number permit children with ASD to qualify. Children diagnosed with Asperger's syndrome are often explicitly excluded from the waivers. The TEFRA Medicaid eligibility option has been adopted by one-third of states and a small but growing number of states allow children with autism diagnosis to qualify. Analyses regarding the specific eligibility requirements and covered services under these waivers is ongoing.

Conclusions: These findings indicate that more can be done to improve access to Medicaid coverage for youth with ASD. State officials, autism service providers, families of youth with ASD have opportunities to expand access to Medicaid-reimbursed services by advocating for the adoption of autism-specific HCBWs and the TEFRA Medicaid eligibility option in their state

116.097 66 A Snapshot of Autism In Qatar From the Eyes of Parents/Caregivers. O. M. Ghoneim*[1], N. Kheir[2], S. A. Hayder[2], M. S. Al Ismail[2], A. L. Sandridge[3], I. Shaffeeullah[4] and F. T. Al-Rawi[5], (1)*College of Pharmacy, Qatar University*, (2)*Qatar University*, (3)*Shafallah Centre for Children with Special Needs* , (4)*Shafallah Centre for Children with Special Needs*, (5)*Hamad Medical Corporation*

Background: Autism is a neurodevelopmental disorder characterized by delayed or disordered language, social impairment and repetitive or restricted behaviors. Autism imposes great burden on the family. Previous research conducted reported a number of psychosocial problems affecting caregivers of children with autism, ranging from stress, depression, anxiety, restrictions of roles and activities, strain in marital relationships and diminished physical health. To our knowledge, no previous research assessed the burden of parents/caregivers of autistic children in Qatar or the Gulf region. There is undoubtedly need to investigate how caring for children with autism interferes with the lives of the parents/caregivers on a daily routine base and to develop comprehensive care/support strategies in Qatar, not only targeting the individual(s) with autism, but also parents/caregivers who live in direct contact with autism throughout their life.

Objectives: To provide a snapshot of the status of Autism in Qatar from the eyes of parents and caregivers

Methods: Caregivers of an autistic child who was between the ages of 3-17 years old were recruited from two main developmental pediatric rehabilitation clinics in Qatar. Control group was represented by caregivers of a non-autistic child and who were visiting a family clinic for routine medical check-up. Demographic details were collected in a face-to-face interview setting using pre-tested forms. Information collected from both groups included the number of siblings, number of hours of sleep in a day, number of hours spent watching TV, time spent at home, absenteeism from school, and use of a nanny to care for the child. Information related to the caregiver included schooling level, profession, and other relevant information. In addition, caregivers of autistic children were asked whether they will encourage the child to marry or have children, how accepting they were of having an autistic child, and questions related to the specialized services provided by the health care system or that the caregiver wished to receive.

Results: Autistic children spent more time indoors, watching TV, or sleeping than children in the control group ($p \leq 0.05$). Around 40% of caregivers of autistic children said they would encourage their child to get married and become parent when s/he grows up. Half of the caregivers utilize special education classes and other facilities, and the remaining half has access problems. Around third of caregivers said that they attend special education classes to help them cope, but over 60% said they do not have access to such classes and they wanted to have such facility.

Conclusions: This study provides a snapshot of the status and burden of autism in caregivers of autistic children in Qatar. The fact that young children in the autistic group spent much more time indoors than children in the control group reflects a tendency among caregivers of autistic children to try to keep their children isolated from the outside world because of the perceived lack of social and community understanding of the nature of autism. While a number of caregivers of autistic children seem to utilize specialized services, like special education classes, others did express their needs of these services.

116.098 67 Parent-Reported Health Care Expenditure Associated with Autism Spectrum Disorders In Heilongjiang Province, P.R. China. L. Wu*[1], J. Wang[2], X. Zhou[2], W. Xia[2], C. Sun[2] and J. Wang[3], (1), (2)*Harbin Medical University*, (3)*University of Calgary*

Background:

Autism spectrum disorders (ASD) are a group of developmental disabilities characterized by pervasive deficits in socialization

and communication, as well as unusual behaviors or interests.Presently there are no medical therapies for autism. A number of studies have shown that early diagnosis and behavioral therapy may lead to improvements in social and language skills in ASD children.In China, There are limited public rehabilitative services for autism children and there is a lack of basic descriptive data about current costs of treatments for this population and the extent to which the costs account for the household income and expenditure.

Objectives:

To estimate the health expenses in the families with children suffered form autism spectrum disorder (ASD) and the percentages of health service costs for ASD children in relation to household income and expenditure

Methods:

This was a cross-sectional study. Parents with ASD children who were treated at the Children Development and Behavior Research Center (CDBRC), Harbin, P.R.China, were interviewed face-to-face (n = 290). Data on health service expenses for families with ASD children were collected. The outcome variables include annual costs for clinic visits, medicine therapies, behavioral therapies, transportation and accommodation, for ASD children and the percentages of the health-related costs in relation to household income and expenditure.

Results:

Compared to the 2007 provincial statistics, families with ASD children had a higher per-capita household expenditure from urban and from rural areas (60.8% and 74.7% respectively). The costs related to behavioral therapy accounted for the largest proportion of health expenses (54.3%) for ASD children. We also found that, in 19.9% of urban and 38.2% of rural families, health costs exceeded total annual household income. A majority of the families (89.3% of urban families and 88.1% of rural families) reported a higher proportion of health related costs in relation to overall household expenditure than provincial average.

Conclusions:

The economic burden is substantially higher for the family with ASD children compared with provincial average. This should be considered in developing the Chinese medical insurance system.

116.099 68 Occupational Therapy for People with Autism: Current Australian Practices and CPD Needs. S. Rodger*[1] and J. Ashburner[2], (1), (2)*Autism Queensland*

Background:

In 2007 the Australian Government injected $190 million over four years for autism-specific programs. In combination these two factors have led to the demand for occupational therapy (OT) services outstripping supply, and an influx of OTs working in the field with limited autism-specific experience.

Objectives:

This study, funded by the Occupational Therapists Board of Queensland, investigated OT practices, confidence and professional development needs in this field.

Methods:

Focus groups comprising OT clinicians, supervisors and academics were used to explore current issues in relation to autism-specific OT services and to inform the development of a survey, which was distributed to all registered Queensland OTs.

Results:

Sixty percent of 205 survey respondents described working in this field as more challenging than other fields. While 47% of respondents felt confident or somewhat confident in this area, 23% felt under-confident or somewhat under-confident. The most challenging aspects of the work related to the complexity of the disorder (55%), managing challenging behaviour (42%) and responding to the stress of others (34%). Priorities for professional development included learning about new developments in the field (78%), clinical reasoning (50%), sensory processing (50%), behaviour support (40%), social/communication (34%) and school-related issues (30%).

Conclusions:

This preliminary/exploratory study highlights the need for an OT specific comprehensive evidenced-informed autism-specific professional development program. A 3-day workshop and mentoring program are currently being developed to fulfil this need.

116.100 69 Identifying Barriers Faced by Parents When Accessing ASD Services: Analyses From the 2009 Pennsylvania Autism Needs Assessment. P. J. Doehring*, D. R. Langer, L. J. Lawer, E. Brusilovskiy, M. A. McCarthy, C. B. Zimmerman and D. S. Mandell,

Children's Hospital of Philadelphia, Center for Autism Research

Background:

The impact of Autism Spectrum Disorders (ASD) can include the schooling, physical and mental health, and community integration of the child with ASD, and the health and well-being of caretakers and other family members. The many services required to address these needs can, however, be difficult to access. The Pennsylvania Bureau of Autism Services commissioned a survey of individuals and families across the Commonwealth. One goal was to identify barriers to accessing services, to consider when seeking to improve the system of service delivery. While some of these barriers (e.g., cost, distance, lack of providers) and interactions with factors related to the family's background have already been explored in other studies, the breadth of the present study will help in advancing our understanding of these important issues.

Objectives:

1) Describe the most common barriers that individuals and families living with ASD encounter when seeking services; 2) Identify how these barriers vary across individuals of different ages and for families from different backgrounds and regions of the Commonwealth, and; 3) Explore how to communicate these results effectively to key stakeholders.

Methods:

Five versions of the survey were developed; 4 versions completed by parents and caretakers (of children not yet in elementary school, in elementary school, in middle/high school, or post high school), and one version completed by individuals with ASD responding for themselves. Each version shared a core set of questions, plus age-specific modules. Invitations to complete the survey were mailed to approximately 30,000 individuals or family members of a person with a Medicaid-reimbursed claim associated with an ASD diagnosis in Pennsylvania. Respondents completed the survey online or called to receive a paper version in English or Spanish. We focus on the responses of caretakers with respect to access to 4 key service categories: primary health care, dental care, specialty health and education services (e.g., Speech/Language Therapy, Occupational Therapy, Social Skills Training, Behavioral Support, Medical Management, etc), and family support services (e.g., Respite/Day/Afterschool care, Family/Sibling Counseling, Family/Sibling Support Groups, etc). Possible barriers assessed included lack of transportation, provider's refusal to see children with autism, scheduling issues, child's behavior problems, cost of services or lack of insurance coverage, and lack or shortage of providers.

Results:

Analyses are still in progress. Over 3500 parents or guardians of children and adults with ASDs responded to the survey. Analyses will consider the frequency of the barriers across the service categories listed above. Interactions between these barriers and a variety of child factors (e.g., age), and family factors (race/ethnicity, urban/rural, education, income, single/dual parent household, etc) will also be also considered. Results will include detailed maps illustrating specific, geographic-based service gaps and to aid in setting state and local priorities. Results will also include sample snapshots conveying the principle findings to parents and policymakers.

Conclusions:

This study will demonstrate strategies for gathering, analyzing, and presenting data to identify barriers in accessing services, to help shape efforts by citizens, professionals, and policymakers to develop targeted policies to improve service to individuals and families living with ASD.

116.101 70 The Influence of Workplace Factors on Evidence-Based Speech Pathology Practice for Children with Autism Spectrum Disorder. G. Cheung*[1], D. Trembath[2], J. Arciuli[1] and L. Togher[1], (1)*The University of Sydney*, (2)*Olga Tennison Autism Research Centre, La Trobe University*

Background: Evidence-based practice (EBP) is widely recognised as fundamental to the delivery of effective treatments to children with Autism Spectrum Disorder (ASD). Accordingly, a large body of research has examined the barriers health professionals face in their implementation of EBP with the view to addressing these barriers. However, research to date has focused on the barriers faced by health professionals at the individual level, and it is not known what affect workplace factors may have in terms of promoting or inhibiting EBP.

Objectives: The aim of this study was to identify and examine the impact of workplace factors on the implementation of EBP amongst speech pathologists who work with children with ASD. Specifically, we sought to (a) explore the views of speech pathologists who work with children with ASD about EBP; (b) identify and examine workplace factors which, in the participants' opinions, acted as barriers or enablers to their provision of evidence-based speech pathology services to children with ASD; and (c) determine whether or not speech

pathologists' responses to workplace factors differed based on the type of workplace or their years of experience.

Methods: A total of 105 speech pathologists from across Australia completed a customised anonymous online questionnaire regarding their views and experiences of implementing evidence-based speech pathology services to children with ASD.

Results: The results indicated that although the vast majority of speech pathologists agree that EBP is necessary, they experienced multiple barriers to their implementation of EBP including workplace culture and support, lack of time, cost of EBP, and the availability and accessibility of EBP resources. There was no difference between speech pathologists working in private clinics and those working in organisations in terms of their support for EBP, however those working in organisations expressed stronger agreement that the management of waiting lists was a barrier to EBP implementation. Similarly, support for EBP did not differ based on years of professional experience, but experienced speech pathologists expressed greater confidence in advocating for EBP in their workplaces than did their junior colleagues.

Conclusions: The findings suggest that barriers to speech pathologists implementing EBP occur at both the individual and workplace level. The findings also provide practical examples of barriers that workplace managers, speech pathologists, and other staff can work together to address in support of the delivery of evidence-based speech pathology services to children with ASD.

116.102 71 PARS-Short Version Screening System for Recognizing ASD Children's Early Support Needs on the Public Health Checkup Service for 3yeas Old Children In Japan.

S. Nakajima*[1], N. Mochizuki[2], I. Tani[1], F. Someki[1] and M. Tsujii[3], (1)*Hamamatsu University School of Medicine*, (2)*Hamamatsu University School of Medicine* , (3)*Chukyo University*

Background: Behavioral abnormalities in children with Asperger's disorder can be recognized before 2 years of age. Deficits in social responsiveness, communication,and play are present in those as young as age 6-12 months. At 36 months old, clinical signs become more overtas ever, and parents begin to concern about diagnostic possibility. And then, parents get ready to participate their child to group activity such as kindergarten or nursery school. Prior to enter kindergarten and so on, to have awareness of child's developmental character influencing adaptation or maladaptation was necessary. To recognize support needs of each child accurately at this point, we introduced screening programs for Autism Spectrum Disorders(ASD) including Higher Functionig-ASD among the community population of 36 month old toddlers, capitalizing on existing regular health checkups for 36-month-old children, which started in 1977 in Japan. Under Maternal and Child Health Act, local government were obligated to offer this checkup service to all mothers twice when child reached 18 month and 3 years of age.

Objectives: The purpose of this study was to examine the prevalence of screened positive as ASD comparing to previous studies, and to clarify the needs of screened children in Japan.

Methods: Participants consisted of 371 parents and their children who take the 3-yerars-old checkup by public health service from July to November in a city X, Aichi Prefecture, located in central Japan.Measure: Parvasive Developmental Disorders Autism Society Japan Rating Scale (PARS: Tani et al., 2009, 2010) short-version was used. This scale composed of 12items, which applay core domains of autism, socialisation, communication, and restricted receptive patterns of behavior. Public health nurses were trained to rate PARS short-version and hearing all mothers participating 3-years-oid health checkup service. Community sample was divided to positive or negative group of screening and compared to ASD children (N=31) and normally developing children (N=131).

Results: By One-Way ANOVA and multiple comparison analyses, the score of community sample composed of all participants (Mean=2.04 SD=2.80) was significantly higher than normal developing children (Mean=0.80 SD=1.73), but significantly lower than that of PDD children (Mean=10.20 SD=4.85) ($F>216.22$). Rate of positive children in our screening was 18.1%. The score of positive children was significantly lower than that of PDD children ($t>8.56$, $p<.01$). No significant difference was seen between negative-children from community sample and normal developing children.

Conclusions: The prevalence of screened (18.1%) was higher than ASD's or PDD morbidity known widely. This result was valid to minimize false negative in screening. It was considered that positive children screened by our PARS-SV system in community sample was composed of variety state in relation to developmental risk, in contrast PDD children already diagnosed. PARS-SV screening system for public health checkup service for 3 years equipped adequate validity about screening rate and comparison with clinical sample. Scores and contents about individuals were expected to share with public facilities in same city as support needs information.

116.103 72 The Japanese Version of the Modified Checklist for Autism In Toddlers (M-CHAT) Screening System for Recognizing ASD Children's Early Support Needs on the Public Health Checkup for 18 Months-Old-Children.

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Background: It is expected that Autism Spectrum Disorders(ASD) children have a lot of difficulties on their life. Therefore we need to detect autism-specific and lead them to support systems as early as possible(Robins & Dumont,2006). Because diagnostic criteria of ASD are based on clinical observations of children whom aged 3 to 4 years and older, it is not able to be applied to children who are under 3 years of age as in the Kamio's(2009) study. The delay of diagnosis of ASD will lead the delay of supports needed. Accordingly, it is essential to detect ASD at 18-24months of age. Recently, a growing body of literature indicates that children with ASD can be reliably diagnosed as young as age 2 on the basis of various social abnormalities (Kamio,2009). Although it is showed that the M-CHAT has been effective in early detection as a screening instrument(Inada & Kamio, 2010; Koyama, 2007), few studies targeted on the community in Japan.Thus, the purpose of this study was to examine the usefulness of M-CHAT as a screening instrument for early detection of ASD comparing to previous studies, and to clarify the needs of screened children in Japan.

Objectives: The present study aimed to examine the usefulness of M-CHAT as a screen instrument for ASD and to investigate the proportion of parents who have support needs in Japan.

Methods: Participants consisted of 421 parents and their children who take the 18months checkup by public health service in a city X, Aichi Prefecture, located in central Japan. Japanese version of M-CHAT (Inada & Kamio, 2006; Inada et al., 2010) was used. Parents of children completed M-CHAT at their home and brought to the checkup, then health nurses and clinical psychologists confirmed it.

Results: In this study, of the 421 caces,96 cases (22.8%) screened positive on the M-CHAT. In Kamio & Inada(2006), of the 1749 casec of 364 cases(20.8%) screened positive. The percentage of screened positive cases of this study was slightly higher than that of the other Japanese sample (Kamio & Inad ,2006). The reason was following. In this study, M-CHAT was confirmed not only by the public health nurses but also by the clinical psychologists. Namely, the clinical psychologists had more specialized knowledge of ASD than the public health nurses did, and the check of the M-CHAT was more strictly. Both Japanese studies showed that 18 months-old-children with support needs for ASD were about 20% .

Conclusions: In this study, of the 421 caces,96 cases (22.8%) screened positive on the M-CHAT, and it suggested that the M-CHAT could be useful instrument for detection of ASD children in the community.

116.104 73 Developing the Japanese Version of the VABS-II (1): Developmental Changes of the Normally Developing Sample.

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Background:

Currently, there is no comprehensive adaptive behavior scale available in Japan to help making a decision on a necessary level of support for individuals with disabilities. The unavailability of adaptive behavior scales has led to an underestimation on needs in 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 scale in the US and other countries and is used not only for identifying individuals with cognitive disabilities, but also assessing needs of individuals with pervasive developmental disorder (PDD) and other developmental disabilities.

Objectives:

The authors and colleagues started a standardizing process of the Japanese version of the VABS-II, and the purpose of the present study was to examine a developmental perspective of each subdomain.

Methods:

The participants were 1,219 normally developing children/individuals (614 males, 605 females) aged 0 to 87 years in 28 prefectures (out of 47) in Japan. The selection of the participants was modeled after the original VABS-II and matched to the demographics of Japan regarding age and male-to-female ratio. For those from 0 months to two years old, the data were collected for each month up to one-year-old (e.g., 1-month-old, 2-month old), and every other month up to two-

year-old because they usually exhibit rapid developmental change.

Results:

The scores on the VABS-II of normally developing individuals are expected to increase as they age. The results of two-way ANOVA (age × subdomains) showed that both the scores of overall adaptive functioning and the scores of each subdomain exhibited a smooth developmental increase, indicating the validity of this scale. Additionally, in the Motor area, which was measured only for those aged (a) zero-to-six-years and (b) over 50 years, there was a decrease on the scores of those who were over 50 years old. Lastly, there were no differences by gender in any subdomains.

Conclusions:

This scale was proven to be sensitive to developmental changes, and, moreover, it was sensitive to changes by aging as well. There was also no measurement bias by gender.

116.105 74 South Carolina Autism Treatment Network: Using Telepsychiatry to Increase Early Identification and Screening In Pediatric Practices. A. V. Hall*[1], R. K. Abramson[1], E. E. Wilkinson[1], A. Kinsman[2], D. P. Kelly[3] and H. H. Wright[1], (1)*University of South Carolina*, (2)*Greenville Hospital System*, (3)

Background: New data suggests that approximately 1 in 110 children have an ASD (MMWR, 58(SS10);1-20). Currently, there is no cure for ASDs. However, with early screening, identification, and intervention children with an ASD can progress developmentally and learn new skills. Thus, it is important to screen early and continuously survey for ASD. This ensures children are identified and receive access to services as early as possible to maximize the short and long term outcomes for these children. In South Carolina the individuals on the frontlines of early screening and surveillance are pediatricians. Unfortunately, much work remains in educating physicians to recognize and care for ASD patients.

Objectives: (1) Develop the South Carolina Autism Treatment Network (SCATN), a provider network of ASD consultants and pediatric practices in urban and rural areas willing to provide medical homes for underserved children with autism. (2) Increase early screening and surveillance for ASD. (3) Provide the pediatric practices support and consultation (assessment, diagnosis, behavioral and pharmacologic intervention, genetics) via telemedicine and continuing medical education.

Methods: The SCATN is a collaboration of ASD specialists from the USC School of Medicine and the Greenville Hospital System University Medical Center. SCATN contacted developmental pediatric practices to gauge their interest in the SCATN and to illicit names of other pediatric practices that might be interested. Initially there were 18 practices contacted and invited to join the network. Pediatricians in the SCATN are provided with (1) specialized training with an emphasis on early screening to help them provide medical homes before and after diagnosis; (2) computers with videoconferencing capability to talk to ASD consultants; (3) a monthly newsletter with clinical updates on evidence based screening and treatment of individuals with an ASD; (4) weekly videoconferencing for behavioral, psychopharmacologic, genetic or diagnostic consultations; and (5) access to the SCATN website.

Results: The SCATN enrolled 15 of the 18 pediatric practices contacted, totaling 53 pediatricians across South Carolina. Prior to joining the SCATN in September 2009, only 2 practices had ever used the MCHAT, though not consistently. Participation in the SCATN required each practice to submit monthly a log with the number of MCHATs completed at 18 and 24 months, the number of positive MCHATs, and the types of referrals made (80% compliance rate); and attend the 4 CME conferences. As of November 2010, 1027 18month MCHAT and 1099 24month MCHAT were completed (3% were a positive screen) and 197 referrals made. Videoconsulations have been provided weekly with the most popular being psychopharmacology. The website, part of the USC School of Medicine website, has been extensively visited by both the SCATN pediatricians and other interested parties.

Conclusions: The SCATN has worked to initiate early screening, referral and provision of medical homes for children with ASD. The SCATN has significantly increased screening for ASD but also increased the number of referrals for other pediatric services. Future focus includes expanding access to clinical community resources, reimbursement on the state level for video consultation and partnering with additional medical practices and state agencies.

116.106 75 Screening Based on Information Communication Technology for Detection of Autism Spectrum Disorders In Paediatric Outpatient Clinics of Primary Care of Castilla y León. R. Canal-Bedia*[1], V. Martin-Cilleros[2], L. Herraez[2], Z. Guisuraga[2], M. Herraez[2], J. Santos[2], P. Garcia-Primo[3] and M. Posada[4], (1), (2)*Universidad de Salamanca*, (3)*Instituto de Salud Carlos III*, (4)*Carlos III Health Institute*

Background:

Early detection of Autistic-Spectrum-Disorders (ASD) in toddlers has positive effects. Therefore paediatricians need to be provided with efficient tools but also need to improve their awareness on ASD early signs. Since 2005 a screening program of ASD has been operating in several paediatric outpatient clinics of Salamanca and Zamora. As a result we now have a validated Spanish version of the MCHAT questionnaire, also the possibility of identification of cases long before, 80% of paediatricians' participation, a good level of users' content, and more healthcare coordination. This previous screening system was based on a phone follow-up confirmation, which most of the times entailed delays to the confirmation and diagnosis. This system did not contribute to the improvement of the paediatricians' skills, showed difficulties to spread the program, and dragged out the uncertainty of many families.

Objectives:

To pilot an expandable screening program based on ICTs; to compare results with the traditional program; to implicate the healthcare personnel; to coordinate sanitary and social services; to reduce the delay timeslot, and to improve the users' satisfaction.

Methods:

Involving eight primary care units from the public health system; both programs (traditional screening and ICTs screening based) were compared using measures of delayed diagnosis, qualitative analysis based on focus groups, and questionnaires on level of content of paediatricians, nurses and families

Results:

Reduction of costs, less diagnostic delay and of confirmation-diagnosis time period; increase of the implication of the units; better awareness of early signs; good attitudes to participate on ICTs based screening; higher level of fulfilment of the users.

Conclusions:

ICTs screening based seems to be more efficient than traditional. It improves the willingness of healthcare personnel and their awareness of early ASD signs; it is accepted by users and could be extended to 100% of Castilla y León.

116.107 76 Unmet Healthcare Needs of Children with ASD and Their Families. J. E. Farmer*[1], M. J. Clark[1], W. A. Mayfield[1], A. R. Marvin[2] and J. K. Law[2], (1)*University of Missouri*, (2)*Kennedy Krieger Institute*

Background:

Recent research has shown that children with autism spectrum disorders (ASD) experience more difficulty accessing quality primary care services through the medical home than children with other chronic health conditions. However, unmet specialty care needs in this group are not well defined. Additional research is needed to identify gaps in care and strategies for improving access at both the state and national levels.

Objectives:

The objective of this project was to conduct a fine-grained study of the unmet health care and family support needs of a US sample of children with ASD using a national autism registry. A secondary objective was to examine unmet needs in a Midwest state in comparison with national trends.

Methods:

A 73-item *Access to Care Questionnaire* was designed for this study. Most questions were selected from the 2005/06 National Survey of Children with Special Health Care Needs (with author permission). The sample was drawn from families who were enrolled in the Interactive Autism Registry (IAN), a national, voluntary, online autism registry. A link to the questionnaire was emailed to 2,422 families, and the survey remained available for parents to complete for a 5 month period. There were 376 respondents in total (16% response rate), with 97 of these participants from the targeted Midwest state. Mean child age was 9.7 years (SD=3.9); 82% were male. Other IAN data on characteristics of the respondents were also used in data analyses (e.g., ASD diagnosis, Social Communication Questionnaire [SCQ] total score).

Results:

Unmet needs in the Midwest state did not differ from national data, so only national findings are described. On a global access item, approximately one-third of parents (31%) indicated that needed care was delayed or their child went without care in the past 12 months. In response to a list of specialized services, nearly two-thirds of respondents (65%) with a child who needed behavioral therapy were unable to access this service. Other frequently reported unmet child needs were for communication aids/devices (53%), occupational/physical therapy (46%), speech/language therapy (42%), and mental health services (41%). When asked about family support services, parents described unmet needs for respite care (70%), genetic counseling (69%), and family mental health services (63%). The main reasons for access

problems were cost and health plan barriers. Factors associated with unmet needs were minority status, lower family income, lower child functional status, poorer physical health, and a greater number of autism symptoms on the SCQ. Unmet needs did not differ by ASD diagnostic category.

Conclusions:

This study extends and refines the results of other research on access to care for those with ASD. A large percentage of children and families do not receive needed specialized services. Significant health disparities were noted for children with ASD from minority and low-income groups and for those with more complex and disabling conditions. These findings can be used to shape public policy and service delivery systems at both the state and national levels.

116.108 77 Provision of Transition Services for Children with Autism Spectrum Disorders. N. C. Cheak-Zamora*[1], J. E. Farmer[2], W. A. Mayfield[2], J. K. Law[3] and A. R. Marvin[3], (1), (2)*University of Missouri*, (3)*Kennedy Krieger Institute*

Background:

Approximately 500,000 children with special health care needs (CSCHN) make the transition from a pediatric to an adult provider each year (Reiss & Gibson, 2002). The need for transition services for this population puts a strain on the health care system, as well as the affected child and their families. Unfortunately, we know little about the accessibility or provision of health care transition services within the children with Autism Spectrum Disorder (ASD) population.

Objectives:

To determine how often children with ASD receive transition services and whether this rate fluctuates due to individual characteristics.

Methods:

An Access to Care Questionnaire was sent by electronic mail to 2,422 families of children that were enrolled in the Interactive Autism Network (IAN) registry. A total of 118 eligible participants (12-18 years of age) completed the survey. Adequate transition services were defined as having had at least one of three discussions about transition of care *and* one question regarding encouragement (see table). Chi-square and ANOVA were used to determine characteristics associated with of provision of adequate transition services and each component measure.

Results:

Fewer than 15% of children with ASD met requirements for receiving adequate transition services (both discussion and encouragement occurred). Analysis of discussion questions found 14.6% had a discussion about transitioning to an adult provider, 17.7% had a discussion about adult health care needs, and 19.5% had a discussion about health insurance continuation. Analysis of the encouragement question found 30.1% had discussions (usually or always) with a health care provider about responsibility.

Children with ASD who received adequate transition services was associated with having a mother with less than a bachelor's degree ($\chi^2(2)=6.96$, $p<.03$), \$250-\$500 in out-of-pocket expenses for child's health care ($\chi^2(5)=18.8$, $p<.002$), financial problems caused by child's health care ($\chi^2(1)=4.12$, $p<.04$), dual-parent household ($\chi^2(3)=13.55$, $p<.004$), increased number living in the household ($\chi^2(6)=15.83$, $p<.01$), and increasing age of the child ($F(1, 92)=3.76$, $p<.05$).

The table shows the statistically significant factors associated with the individual questions.

Question	Associated Characteristic	Chi-square/Anova Results
Discussion about adult provider	Diagnosis (Aspergers)	$\chi^2(6)=12.37$, $p<.05$
	Age of child	$F(2, 113)=5.09$, $p<.008$
	Presence of medical home	$\chi^2(2)=6.86$, $p<.03$)
Discussion about adult health care	Diagnosis (other)	$\chi^2(6)=13.04$, $p<.04$
	Age of child	$F(2, 112)=4.83$, $p<.01$
	Presence of medical home	$\chi^2(2)=6.68$, $p<.03$
	Increasing affect on ability	$\chi^2(6)=15.72$, $p<.01$
Discussion about health insurance	Diagnosis (Aspergers and Autism)	$\chi^2(6)=12.67$, $p<.04$
	Age of child	$F(2, 112)=5.38$, $p<.006$
	Higher medical	$F(2, 72)=3.31$, $p<.04$

	home score	
Encouragement about responsibility	Diagnosis (Aspergers)	$\chi^2(3)=7.49$, $p<.05$
	Age of child	$F(1, 102)=6.16$, $p<.01$
	Having no provider	$\chi^2(2)=7.05$, $p<.02$

Conclusions:

Very few children with ASD receive adequate transition services (15%). Individual and family characteristics, such as child's age and diagnosis are related to the provision of adequate transition services and the individual components of such. These finding can be used to educate providers and develop interventions to improve the provision of health care transition services for children with ASD.

116.109 78 Progress and Challenge of Community-Based Rehabilitation Programs In the Palestinian Territories. J. Odeh*[1], J. H. Awad[1], D. T. Isawi[1] and M. Elsabbagh[2], (1)*Palestinian Happy Child Center*, (2)*Centre for Brain and Cognitive Development, Birkbeck*

Background: Currently, 50.2% of the Palestinian population are children under the age of 18. Since 1990, community based rehabilitation programs have been part of a long-term strategy aimed at strengthening the rehabilitation sector as a whole in order to address the needs of disabled people. Research in the area of disabilities has focused on special education placement of mentally handicapped children (Khamis, 1993a,1997; Fasheh,1986) and efficacy of rehabilitation programs (Khamis,1993b). By contrast, little is known about availability and efficacy or services for developmental conditions such as autism.

Objectives: To survey and systematically evaluate community-based programs for developmental disorders, including autism available to the Palestinian population.

Methods: A systematic review was conducted of published and unpublished analyses by the Palestinian Authority Ministry of Health, various reviews, studies and research on disability and rehabilitation carried out in the area. Moreover, on site visits and interviews were conducted with service providers and major stakeholders, and with beneficiaries.

Results: Very little data is currently available on disability in Palestine. The most comprehensive data is from a 1996 Palestinian Central Bureau of Statistics health survey that found that 1.7% of children aged 0-14 have some form of disability. No data was available specifically on autism. There are also no comprehensive national programs for rehabilitation, but many successful small experiences, such as independent centers operate successfully. There is a clear lack of qualified professionals and paraprofessionals in the field of disability and rehabilitation except for a few specialized professionals in physiotherapy, speech therapy, occupational therapy and special education. There is lack of coordination between the three levels of rehabilitation on the National level. Notably, most Palestinian children with special needs have been cared for at homes rather than in institutional settings.

Conclusions: Community-based programs have a pronounced impact on individuals with disabilities and their families. These programs also have a positive impact on awareness, attitudes and practice towards individual people with disabilities in their local communities. There is a clear need for strengthening capacity of the community based program workers as a step towards the development of a national rehabilitation program. In the long term, we propose adopting a population 'needs' based approach for decision-making about resource distribution across different areas and priorities for future service development.

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116.110 79 Development and Evaluation of a Transition Intervention for Youth and Young Adults with ASD. L. Ghali*[1], D. B. Nicholas[2], M. Clarke[1], B. Beingessner[1] and W. Roberts[3], (1)*Sinneave Family Foundation*, (2)*University of Calgary*, (3)*University of Toronto*

Background:

Relatively little is known about the experience of transition from adolescence to adulthood among young persons with autism spectrum disorder (ASD). The literature suggests that the passage into adulthood, which involves leaving school and the cessation of many community and financial supports, often results in fewer, less coordinated and a more poorly defined range of services. Families, individuals and communities are frequently unclear about the trajectory of development into adulthood compared to the typically developing population, and unprepared for the developmental changes that take place in the teenage years (e.g., relationships and sexuality, emergence of mental health disorders, desire for increased autonomy and independence). Additionally, obtaining support services in the adult system (medical care, housing options, guardianship and trusteeship) is also significantly more challenging.

Objectives:

To identify service gaps and key issues related to transition in ASD; to implement and evaluate an evidence-informed intervention fostering an effective process of transition.

Methods:

Key transitional junctures, needs and gaps in adult services were examined in the literature, through case-based experiences and focus groups with clinicians and community service agencies. Further, ten semi-structured interviews were conducted with parents of adolescents (aged 12-19; 3 females, 7 males) with ASD. To ascertain developmental and transitional needs, the Diagnostic Interview for Social and Communication Disorders (DISCO) was implemented for each participant. The DISCO is designed to elicit a comprehensive picture of the whole child or adult by addressing developmental and behavioural history from infancy onwards

Following application of the DISCO, participants were offered an innovative 6 week curriculum (12 hours total) delivered as modular learning by key professionals addressing a number of identified need areas: Transition to Adulthood and Life Planning, Guardianship, Funding and System Issues, Healthy Relationships and Sexuality, Housing Options, Life Skills and Increasing Independence, Coping with Stress and Mental Health Disorders, Housing, and Vocational and Social Programs. The content of the modules reflected a review of evidence related to the transitional needs of youth and young adults. During and after the intervention, a process evaluation was completed.

Results:

The DISCO served in facilitating an understanding of the skills and impairments experienced by participants with ASD, and for highlighting areas where further support needs or interventions may be required to ensure successful transition to adulthood.

Participants identified the subsequent intervention as effective in addressing key informational needs pertaining to transition. They also described the benefit of connecting with others experiencing similar transitional challenges. They recommended ongoing peer mentoring strategies and the need for more programs and resources in pre-vocational and vocational training programs, housing supports and options for shared and supported living, employment opportunities in the community with specific ASD training for potential employers, and more opportunities for social and recreational experiences.

Conclusions:

Transitional support was found to be lacking. Based on outcomes, this intervention provided benefits to families and family feedback has important implications for clinical practice. Future work will examine the therapeutic value of the DISCO interview process for families and it utility in preparation for the transition to adulthood.

116.111 80 Validation of Parent Collected Observational Data In the Natural Environment. A. J. Findley*[1], R. Arriaga[2], D. M. Swartzwelder[1], N. Nazneen[2], G. D. Abowd[2] and N. A. Call[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta, & Emory School of Medicine*, (2)*Georgia Institute of Technology*

Background: Some individuals with autism engage in problem behaviors such as aggression or self-injury which may seriously impact their quality of life and that of their caregivers. Aside from threatening physical health, problem behaviors can restrict the range of choices available to individuals with respect to residence, employment, education, or social activities. As such, it is important to develop effective interventions that produce lasting decreases in problem behavior. Studies have demonstrated that treatments are most effective at reducing problem behavior when they are based on the results of a functional behavioral assessment (Horner & Carr, 1997; Vollmer & Smith, 1996). Directly observing the target behavior allows a clinician to indentify subtle relationships between environmental events and problem behavior. When in vivo observation or problem behavior is not feasible, some clinicians may ask caregivers to collect video footage of the problem behavior. Recent innovations in technology have lead to selective archiving video systems. Selective archiving continuously captures video using a temporal buffer that erases captured data as more is recorded. When a caregiver triggers the system, the relevant event is captured, as well as a preset interval prior to and following the moment indicated by the caregiver. However, it is currently unclear how well these caregiver implemented systems are utilized in real world situations.

Objectives: The purpose of the current study was to investigate the effectiveness of selective archiving systems in identifying relationships between environmental events and problem behavior when operated by a caregiver in the home. Specifically, the accuracy of caregiver collected video and missed occurrences of the target behavior were investigated.

Methods: Continuous Recording and Flagging Technology (CRAFT) was developed for this study so that caregivers could

signal when problem behavior occurred by placing a timestamp on continuously recorded footage. The timestamps were compared to the continuous footage to determine the accuracy of the data that would have been collected if a selective archiving system had been used. False positives were marked when a timestamp was placed on footage that did not indicate problem behavior in the previous window. False negatives were observed when problem behavior occurred in the absence of a timestamp. True positives were scored when the timestamps and trained observer data both indicated problem behavior occurred. Information was also collected in instances when the child was alone or out of the camera's view.

Results: Results indicate that caregivers do not collect accurate data. True positive accounted for only 16% (range, 0% to 50%) of the indicated instances of problem behavior. False positives and false negatives occurred 22% (range, 0% to 50%) and 8% (0% to 21%) respectively.

Conclusions: Selective archiving systems have recently found their way into the commercial marketplace (Caring Technologies, 2010) and are becoming more widely available. Data from the current study indicate that, when provided minimal training, caregivers do not use these systems optimally. Future investigations should explore ways to improve the effectiveness of selective archiving systems.

116.112 81 Efficacy of a Public School Intensive Parent Training Program for Difficult Behavior of Children with the Autisms. E. Delpizzo-Cheng*, *Newport-Mesa Unified School District*

Background:

Parent training for children with the autisms is considered an integral treatment component. Behavioral parent training is a behaviorally-based model evolved from the discipline of applied behavior analysis (ABA). It addresses socially relevant issues of parenting, such as management of difficult behavior and increasing prosocial abilities. Although children with autism spectrum disorders (ASD) are integrated within our public school systems, providing parent education within the system is challenging because of parent follow through, time, and cost. Thus, there is a lack of research on public school provision for parent training. This study explores the success of a manualized parent education program for families with ASD implemented within a public school system.

Objectives:

A *Behavioral Parent Education* program was developed to provide parents evidenced-based behavioral management strategies to use when their child demonstrates stressful, and upsetting behaviors. The goal of the study is to evaluate preliminary pre-course and post-course data on fidelity of implementation of strategies learned in a small group format and generalized to the home setting. A secondary goal of the program is to evaluate pre-course and post-course parental affect.

Methods:

This poster presents the results of five parent-child dyads whose children qualified for public school special education under the autistic classification. A modified ABA pre-course/post-course design is used where the first "A" phase is no-training baseline. The "B" phase is data collection following training, and the second "A", is data collection months following training. Additionally, affective change in parent-child dyads from precourse to postcourse is compared. Training followed a manualized program. Set in a small group format, training consisted of 12-hours, over 4-weeks. Home visits and, 50-minute on-campus clinics follow group training. Behavioral raters code video sessions on project-generated data sheets to examine training effects. All video was captured in the home. Overall interobserver agreement (IOA) is calculated at 85% (range = 76% to 90%).

Results:

Preliminary results suggest parents can apply basic strategies with fidelity. To date, 71 families completed the program. Results depict families that completed all aspects of the program, and provided permission for use of data. These data are reported on percentage of correct use of components for redirection, prompting, and differential reinforcement strategies. Moreover, a change in parent affect was observed. Affect data are reported on ratings of happiness, interest, stress and confidence. Social validity data indicate parents perceived the program as important and helpful. Data collection is ongoing.

Conclusions:

The study found support for the efficacy of an intensive parent education program for difficult behavior within a public school setting. In general, strategies taught and used by parents are correctly implemented. Parents improved in self-efficacy, defined as decreased stress and increased confidence. Moreover, parent's desire to 'work through' difficult behavior increases. Parent education presented in a public school system is promising for families of children with ASD with long term sustainability. Ongoing results of this work are utilized to

support parent training for families of children with ASD where treatment is provided in a public-funded agency.

116.113 82 Relationship Between Ethnic and Socioeconomic Classification and Parents' Perception of Autism Symptoms In Their Toddlers. S. Tek*[1], A. Faherty[1] and R. J. Landa[2], (1)*Kennedy Krieger Institute for Autism and Related Disorders*, (2)*Kennedy Krieger Institute*

Background: The literature shows that children of ethnic minority backgrounds receive a diagnosis of autism later than do Caucasian children (Mandell et al., 2002). Yet the barriers to early detection of autism have not been well defined. In this study, we examined issues related to barriers to early detection of autism by examining how parents from an ethnic minority background differed from American white Caucasian parents in perceptions of their toddlers' developmental characteristics just prior to their enrollment in an early intervention study.

Objectives: To compare pre-diagnosis perception of presenting symptoms of developmental delay between parents of toddlers from ethnic-minority vs. non-minority backgrounds who volunteered for an early intervention study.

Methods: 14 toddlers with autism (mean age = 27.98 months) and their caregivers from an ethnic minority background participated, which included minorities of African-American (N = 10), Hispanic (N = 1), and Asian (N = 3) descent. The non-minority group included 54 American Caucasian toddlers with autism (mean age = 27.08 months) and parents. Children were diagnosed with an autism spectrum disorder by expert clinical researchers. Parents in both groups were administered the MacArthur Communicative Development Inventories (CDI; Fenson et al., 1994), which is a parent checklist that assesses language and communication skills in infants and toddlers; and Communication and Symbolic Behavior Scales Caregiver Questionnaire (CSBS-CQ: Wetherby & Prizant, 2002), which is normed for children between 0-24 months of age, and provides information on sounds, words, gestures, and social-affective signaling, Children were also administered the Mullen Scales of Early Learning, (MSEL; Mullen, 1995) and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). Moreover, in order to control for the socioeconomic status (SES) of the participants, Hollingshead (1975) four-factor index of SES was calculated.

Results: The SES of participants was mostly upper (53% non-minority and 64.7% minority) and upper-middle class (43% non-minority, 11.8% minority). All participating families in lower SES classes were minorities (17.7%). Minority parents reported fewer words ($p < .001$), sounds ($p < .01$), and gestures ($p < .05$) on the CSBS-CQ; and fewer gestures ($p < .05$) and sentences ($p < .001$) on the CDI compared to non-minority parents. Low-SES and high-SES parents did not differ on any scale of the CSBS-CQ or the CDI (ps > .10). Minority children scored lower on the communication subscale of ADOS compared to non-minority children ($p < .05$); however, no differences were detected between groups on any scales of the MSEL (ps > .50).

Conclusions: This preliminary study indicates that the majority of parents who initiate contact with an academic institution's research program to determine whether their toddler might have autism are from upper to upper-middle class backgrounds, regardless of ethnic membership. This phenomenon has been reported by Maenner at al (2009). Moreover, ethnic minority parents may require more substantial communication delay in their toddler prior to seeking evaluation by autism experts. This was independent of SES. Whether this reflects a genuine clinical difference between groups or cultural differences in interpretation of autism symptoms needs to be further investigated.

116.114 83 Transition to Community by Adolescents with Asperger Syndrome. E. Giarelli*[1], J. Ruttenberg[2], A. Hanlon[1] and A. Segal[1], (1)*University of Pennsylvania*, (2)*The Center for Autism*

Background:

Transitioning out of formal secondary school into the community is a turning point in the life of an adolescent with Asperger Syndrome (AS). The purpose of this study is to develop a conceptual model and describe practical strategies that adolescents, parents, schools and employers can use to improve the transition to community among adolescents with AS.

Objectives:

1.Describe the beliefs, feelings, expectations, and behavioral strategies used by the adolescent/young adult with AS as he/she transitions to community.

2. Describe school and workplace obstacles to and facilitators of transitioning to community for the adolescent/young adult with AS.

3. Construct a conceptual model of the psychosocial phenomenon of transition to community illustrating the relationship among the following factors:a) adolescent's and parents' beliefs, feelings, expectations and behavioral strategies for transitioning; b) adolescent's perceived

behavioral problems; and d) intervening factors such as sex of the adolescent and autism associated features.

Methods:

This study mixed qualitative/quantitative methods to examine multiple perspectives on transition to community (TC) among adolescents with AS. TC is defined as the adolescent's completion of secondary school and entry into the larger social community, including college and the workplace. The conceptual model is *Symbolic Interactionism.* Adolescents, parents, educators and employers) are parties in the essential process that moves the adolescent from an insulated social environment to one that is open and interactive. The study was conducted in Philadelphia County. Forty participants were enrolled from four groups of stakeholders: 15 adolescents/young adults with AS, 15 parents of individuals with AS, 5 educators, and 5 employers. An adolescent/young adult was eligible if he or she meets all three criteria: in the last year of secondary school (high school) or newly graduated, diagnosed with AS, and between 18 and 22 years. A parent was eligible if he/she resided with the adolescent at enrollment. A teacher had to have taught a child with AS in Philadelphia County and an employer's business must be located in Philadelphia County. Participants were interviewed either in-person or by telephone. Parents and youths completed the *Achenbach Young Adult Behavioral Checklist (YABC)* or the *Achenbach YABC-Self Report*, respectively. Other measures were: *Transition to Community Index* and the *Autism Associated Features Checklist.* Participants received a $50 compensation for time.

Results:

Adolescents' ages ranged from 18 to 23, mean age 19.8 years (SD 1.6 yrs). The adolescents were; 80% male (n=12) and 93% Caucasian (n=14). Three adolescents were employed part-time for pay and three were enrolled part-time in college courses (3 in Community college, 1 in a private 4-year). The parent sample was comprised of mothers.>50% employed.

Emerging themes match the literature: fear of rejection/failure, subjects of teasing/abuse, poor self-image, loneliness, and dependency. New themes include: adapting using metaphors, life is a stage, success from anchoring, see me and know my reality.

Conclusions:

Final report will include a comparison of adolescent to parent reports of adolescents behaviors (YABC) matched to reports from parents, teachers and employers of obstacles and facilitators to successful transition, and recommendations for interventions.

116.115 84 Practitioner Feedback on An Evolving Classroom-Based Intervention for Preschoolers with Autism. K. P. Wilson*[1], J. Dykstra[1], L. R. Watson[1], B. Boyd[1], E. R. Crais[1], G. T. Baranek[1], T. W. Lenhardt[1] and S. Flagler[2], (1)*University of North Carolina at Chapel Hill*, (2)*Wake County Public School System*

Background: Research has established the lasting effects of early behavioral interventions targeting joint attention or symbolic play skills on later language skills of children with autism (Kasari et al., 2006, 2008). In line with these findings, our research team has collaborated with educational practitioners (i.e., teachers, teaching assistants, related service providers) and student clinicians in an iterative process of developing a classroom-based intervention program targeting early play and social communication skills in preschoolers with autism. This process, funded by a development grant from the Institute of Education Sciences, has spanned four years and four sequential phases of implementation. Feedback from practitioners and students has shaped the training, manual, coaching support, and materials that constitute the resulting Advancing Social-Communication and Play (ASAP) Intervention Program. This presentation will illustrate the valuable and informative experiences, preferences, and suggestions of participating practitioners and how they influenced the development of ASAP into a promising intervention program suited to public preschool classrooms serving children with autism.

Objectives: (a) To illustrate the real-life experiences of educational practitioners' in shaping, learning, and adopting a novel intervention program targeting pivotal skills of young students with autism (b) To describe the feedback provided in order to develop an intervention program suitable for public preschool classrooms serving students with autism.

Methods: Using a four-phase iterative process, the ASAP intervention was developed and refined through stages of increasingly complex implementation, with Phase 1 involving implementation of only one ASAP component (i.e., one-to-one intervention) and Phase 4 constituting full implementation of the refined ASAP intervention. Feedback from participating practitioners and students was collected following each phase through focus groups and semi-structured interviews. Feedback was categorized by question/probe (e.g., training, coaching, implementation, teams and administration) and themes were

derived from each phase's feedback through qualitative review of data and a grounded theory-based analytic approach.

Results: Themes that emerged from practitioner feedback across phases included the following: Desire for straightforward written information with high levels of organization; need for clear delineation of roles and expectations; positive impact of coaching relationship; time and staff constraints; lack of administrative support; positive impact on all students; difficulty of data collection; and interest in collaboration across schools. This presentation will make clear the myriad ways in which this feedback influenced and shaped the resulting ASAP intervention and its supporting materials, including substantial changes made to the manual, the training, and the coaching model.

Conclusions: The promise of ASAP as a public school-based intervention for preschoolers with autism is intrinsically linked to the feedback our research team received from community practitioners in the development process. In addition, the feedback provided to the ASAP research team has implications for other autism intervention efforts in public school settings.

116.116 85 Parents' Advice for Professionals Working with Children with Autism Spectrum Disorders and Their Families. B. E. Drouillard*[1], M. N. Gragg[1], R. T. Miceli[2], A. M. Mullins[1], A. J. Beneteau[1] and A. L. Tiede[1], (1)*University of Windsor*, (2)*St. Clair College*

Background: Although research on "best practices" in working with children with Autism Spectrum Disorders (ASD) and their families is burgeoning, few studies to date have investigated the recommendations of parents of children with ASD on how professionals can be most helpful to them. As parents often report relying heavily on professionals when first suspecting that their children may have ASD, effective professionals may be able to encourage earlier diagnoses, selection of evidence-based treatments, and other beneficial actions associated with more positive outcomes in children. Parents' perspectives on the benefits and drawbacks of various professional practices can enhance the responsible establishment of true "best practice" guidelines for working with children with ASD and their families.

Objectives: To outline advice for professionals offered by parents of children with ASD.

Methods: Participants were 19 parents (89% mothers) of children with ASD under age 6 years. Parents ranged in age from 18 to 54 years and had a mean age of 35 years. Parents' self-identified ethnic backgrounds included White (63%), Arab (10%), Chinese (10%), Metis (5%), South Asian (5%) and Multiracial (5%). Most parents (92%) had some college education or more and their family incomes ranged from under $25 000 (23%) to over $75 000 (35%), with a mean of $53 560 (Canadian). Their children (86% boys) ranged in age from 23 to 70 months. Participants completed demographic questionnaires and semi-structured interviews regarding their recommendations for professionals (e.g., "How can professionals best communicate treatment information to parents?") and their treatment selection for their children (e.g., "What were the main sources of information you used in selecting treatments for your child?"). Qualitative data were analyzed using thematic analysis and excerpts from parents' interviews were selected to illustrate the various themes that emerged.

Results: Preliminary results support the notion that parents often rely heavily on professionals' recommendations when making decisions regarding their children with ASD. Parents recommended that professionals inform parents as soon as the suspicion of ASD arises, that more focused ASD-related training be provided to paediatricians and family physicians, that professionals use lay terms when communicating with parents, and that professionals provide parents with written information on ASD and community resources prior to or immediately upon diagnosis. Parents also reported having more trust in professionals who were empathic, knowledgeable, approachable, and who worked collaboratively with them to help their children. Thematic analysis is ongoing for 7 participants.

Conclusions: The quality of parents' relationships with professionals appears to be of great importance when parents make assessment and treatment decisions regarding their children with ASD. In addition, the difficulty that this highly educated group of parents often experienced with understanding information from professionals indicates that this information should be communicated in more accessible formats. Greater educational opportunities for both parents of children with ASD and professionals from a variety of fields may also be beneficial.

116.117 86 Who Participates In Support Groups for Parents of Children with Autism Spectrum Disorders? the Role of Beliefs and Coping Style. T. Clifford* and P. Minnes, *Queen's University*

Background: Parents of children with autism spectrum disorders (ASD) report experiencing more stress and mental health problems than parents of both children with other intellectual disabilities and children without disabilities (e.g., Blacher & McIntyre, 2006; Eisenhower, Baker, & Blacher,

2005). Research has shown that participating in support groups is associated with less stress, less negative mood (Kerr & McIntosh, 2000; Preyde & Ardal, 2003) and more positive perceptions (Singer et al., 1999). Previous research with parents of children with autism spectrum disorders (ASD) has found that family demographic variables, clinical characteristics of the child, and having been referred by the diagnosing clinician predicted support group use (Mandell & Salzer, 2007). In other populations coping style, perceived controllability of the disorder, mood, social support, and beliefs and attitudes about support groups have been important predictors of use of support groups (Grande, Myers, & Sutton, 2006; Fontana, Fleischman, McCarton, Meltzer, & Ruff, 1988; Mickelson, 1997; Smith, Gabard, Dale, & Drucker, 1994).

Objectives: The aim of this study was to explore the factors contributing to the participation of parents of children with ASD in support groups. Determining how parents of children with ASD who access parent support groups (PSGs) differ from those who do not can facilitate the development of strategies to support all parents of children with ASD.

Methods: One hundred forty-nine parents of children with ASD completed a series of online questionnaires measuring their beliefs about support groups and ASD, coping styles, social support, mood, parenting stress, and their child's autistic symptoms and daily functioning. The parents were divided into three groups based on their use of support groups: never used support groups (n = 36), past support group use (n = 37), and current support group use (n =76).

Results: The groups significantly differed in their beliefs and attitudes about support groups and their use of adaptive coping strategies. Some parents who had never participated in PSGs reported that accessibility issues, such as the time, location, and lack of child care made it difficult to participate. Other parents who had participated in PSGs in the past did not find the groups to be as beneficial as parents who were currently participating in support groups. Those parents who participated in PSGs reported using more adaptive coping strategies than parents who were not currently participating in PSGs.

Conclusions: These findings suggest that a one-size-fits-all approach to supporting parents of children with ASD will not be most effective, rather focusing on the self-identified individual needs of the parent could lead to better support for parents and more efficient use of community resources. Further research on support groups for parents of children with ASD is warranted in order to learn more about the potential benefits of this support for parents, and the applicability of unique and innovative models of support, such as online groups.

116.118 87 SSC@IAN - A Model for Long-Term Follow-up. T. Zandi*[1], S. B. Johnson[1], J. K. Law[2], L. Green Snyder[3], L. C. White[4], D. Voccola[5], C. Anderson[2], C. W. Atwell[6] and P. A. Law[2], (1), (2)*Kennedy Krieger Institute*, (3)*University of Michigan*, (4)*Autism & Communication Disorders Center, University of Michigan*, (5)*Prometheus Research, LLC*, (6)*Simons Foundation*

Background: The Simons Simplex Collection (SSC), a project of the Simons Foundation Autism Research Initiative (SFARI), is establishing a repository of genetic and phenotypic information from nearly 3,000 simplex families. The Interactive Autism Network (IAN), an online research initiative with more than 30,000 participants, provides raw data and subject recruitment assistance to qualified researchers. Now, the SSC has partnered with IAN to coordinate future phases of the SSC project and to maximize its usefulness to the autism research community.

Objectives: SSC@IAN will provide a vehicle for long-term engagement of SSC families – originally recruited through 13 university-based sites – for a wide variety of longitudinal research efforts carried out both online and in clinic. New data from SSC families consenting to participate in SSC@IAN will be combined with their data collected through the original SSC protocol and made available to researchers via the Simons Foundation's online research database, SFARI Base. These efforts will provide the autism community with additional and expanding perspectives through which to explore the SSC population. This innovative collaboration will maximize the benefit the autism community derives from participating families' contributions, now and into the future.

Methods: The Simons Foundation and IAN have formed multiple working groups to facilitate the creation of SSC@IAN – an integration of two complex research networks. Challenges overcome include coordinating technology/software, communicating the SSC@IAN concept to SSC sites' staff, IRBs, and families, and formulating a longitudinal study plan. In the next stage, SSC Site Coordinators will reach out to SSC families, seeking their permission to share their contact information with IAN. Once permission is received, IAN will invite families to join SSC@IAN, and will register them via an online SSC@IAN consent approved by the Johns Hopkins Medical IRB. IAN will continue to work with SSC staff to securely use IAN and original SSC data for subject recruitment activities. Finally, each family's de-indentified IAN data will be sent to SFARI Base.

Results: Communication and training materials to help transition families into SSC@IAN have been developed, and IAN has built the online consent form that will make a family part of the special SSC registry and longitudinal study within IAN. Information technology infrastructure for project tracking and for data transfer to SFARI Base is in place. Families will begin to enroll in January 2011, and it is anticipated that all SSC families will have the ability to join the initiative by the end of 2011, maximizing the usefulness of SSC data and recruitment for the autism research community.

Conclusions: SSC@IAN represents a unique collaborative model that combines the advantages of a self-limited research project with an online longitudinal protocol and follow-up system. Both powerful and cost effective, this model for ASD research will have the breadth and depth necessary to address this incredibly heterogeneous and complex disorder into the future.

116.119 88 Access to Diagnosis and Care Among Latino Children with ASDs. K. Lopez*[1] and S. Magana[2], (1)*University of Michigan Autism and Communication Disorders Center*, (2)*University of Wisconsin-Madison*

Background: The striking increase in prevalence has lead to research, advocacy, and practice to improve early identification and treatment of children with ASDs. However, research has shown disproportionate diagnosis and care among children from racial/ethnic minority groups, and from lower levels of SES. At the provider level, the availability of services, cultural and linguistic competency, and biased care systems have further contributed to disparities. Although Latino children are the largest culturally distinct ethnic group of children in the U.S., there is a dearth of information about Latino children and families in ASD research. Identifying factors that limit access to diagnosis and care for Latino children with ASDs will greatly inform the research community and enhance the development of early identification and intervention programs for Latino children and their families.

Objectives: The aim of this study is to compare the timing of diagnosis, access to treatment and service utilization for non-Latino White and Latino children in Wisconsin and determine the role of maternal education in service use.

Methods: Forty-eight Latino caregivers and 59 non-Latino White caregivers were administered a questionnaire on their sociodemographic characteristics and experiences with their child's diagnosis, and service use. Families were recruited through service agencies and support groups. Children were between 3 and 21 years of age (μ=9.6; *SD*=4.5) at the time of the study. Latino mothers had significantly lower levels of education than non-Latino White mothers. T-tests and Chi-squares were conducted to identify differences between groups on service and access variables. Linear and logistic regressions were conducted to control for important variables and to test a mediation model.

Results: Latino children were diagnosed with ASD nearly a year later compared to non-Latino White children (μ =3.89, *SD*=1.51 and μ =2.99, *SD*=1.76 respectively). Fifty three percent of Latino children (53%) ever received early intervention services compared to 77.6% of non-Latino White children. The majority of non-Latino White children (81.4%) ever received intensive autism therapy compared to 41.7% of Latino children. Latino children received significantly fewer services overall than non-Latino White children. In addition to controlling for child's age and number of behavior problems, level of maternal education (which was significantly correlated with all outcome variables) was tested as a mediating variable between ethnicity and outcomes. Level of education mediated the relationship between being Latino and age-of-diagnosis and between being Latino and whether the child received birth to three services. However, non-Latino White children remained significantly more likely to receive intensive autism therapy and a greater number of services overall than Latino children, even taking into account level of maternal education.

Conclusions: Latino children were found to be diagnosed later and to have lower access to services and treatment compared with non-Latino White children. Lower education levels may account for some of these differences, however, not with all outcomes. Given the importance of early diagnosis and intervention these findings suggest strategies specific to the Latino population are necessary to improve early identification, service and treatment access. Research and clinical implications are discussed.

116.120 89 Classroom Climate, Program Fidelity, & Outcomes for Students with Autism. H. E. Dingfelder*[1], D. S. Mandell[2] and S. C. Marcus[3], (1)*University of Pennsylvania*, (2)*University of Pennsylvania School of Medicine*, (3)*University of Pennsylvania*

Background: Interventions for children with autism that have proven efficacious in laboratories generally have not been effectively implemented in schools. In general, findings regarding why interventions developed in the laboratory are not implemented successfully by community providers include insufficient training, skills, incentive, or motivation. A parallel body of research from children's community mental health settings indicates that even when individuals have the requisite

skills and motivation to implement the intervention, the organizational climate may not sufficiently support successful implementation. While this also is likely to be the case in the implementation of school-based interventions, there has been little study of the impact of school and classroom climate on intervention implementation. Challenges to implementation are apparent in AIMS, a randomized trial of the effectiveness of a proven-efficacious intervention for children in autism support classrooms in a large, urban school district. Early observations suggest that a key reason for teachers' variable program implementation is differences in their perceptions that use of the intervention is expected, supported, and rewarded by their colleagues. This perception is referred to as the organization's implementation climate. While a rich literature examines the role of implementation climate in business settings, there is little study of it in health and human services in general, and special education settings specifically.

Objectives: The aim of this study is to examine associations between the climate of autism support classrooms, program implementation, and student outcomes over time. We predict that a strong classroom climate for intervention implementation will lead to higher program fidelity and better student outcomes.

Methods: Measures of implementation climate were developed from the field of organizational psychology and covered four key domains: a) perceptions of program quality and ease of use; b) perceptions of training quality and accessibility; c) school support; and d) global perceptions of implementation climate. These measures were administered to teachers at the beginning and end of the academic year. Program fidelity was measured monthly throughout the year by coding videos of teachers implementing the program components. Student outcomes were measured by assessing IQ at the beginning and end of the academic year. Bivariate associations among climate, fidelity, and outcomes will be measured, as well as the direct effects of climate and fidelity on outcomes, controlling for other important covariates. We also will examine changes in climate and fidelity over the school year, and the association of those changes with each other and with outcomes.

Results: Analyses are ongoing. Early observations suggest great variability in implementation climate, program fidelity, and student outcomes. Preliminary results suggest independent contributions of implementation climate to both program fidelity and student outcomes.

Conclusions: Studying the relationships between classroom climate, intervention fidelity, and student outcomes is critical in advancing our understanding of the best ways to support the implementation of evidence-based interventions for children with autism in special education settings. By helping to identify malleable targets for intervention, the results of this study can be used to improve program effectiveness and sustainability in school settings, ultimately leading to better outcomes for children with autism.

116.121 90 Early Diagnosis of ASD In a Community Sample: Who Refers and Why?. L. H. Shulman*, K. Hottinger, R. M. Seijo and M. D. Valicenti-McDermott, *Albert Einstein College of Medicine*

Background: Early diagnosis of autism spectrum disorder (ASD) has become an important clinical and public health goal. Efforts to increase early identification have been directed at pediatricians (AAP) as well as parents (CDC, Autism Speaks). In community settings, how do very young children with ASD come to attention? Are they being referred by their doctors or their parents? For specific concerns regarding autism or for other reasons?

Objectives: To examine referral source and chief concern of young children diagnosed with ASD in a community early intervention setting and to assess the relationship between referral and clinical presentation/demographics.

Methods: Retrospective chart review of 101 children presenting by age 24 months (mo) to a University Affiliated early intervention program from 2003-2010 who received an ASD diagnosis based on multidisciplinary evaluation. Data included: age, demographics, year of referral and referral source, chief concern, autistic features (DSM-IV, Childhood Autism Rating Scale-CARS), and cognitive level. Statistical analysis included chi-square, t-test, and logistic regression.

Results: Mean age 20.2 mo; 75% male; 44% with cognitive standard score >70. 64% had Medicaid. 48% Hispanic, 22% white, 22% black. 38% of mothers were college educated. **Referral source:** 54% physician, 33% parent, 14% other agencies. **Chief concern:** language (40%), ASD (33%), general development (13%), language/behavior (9%), high risk follow-up (5%). Of those with ASD-specific concerns, 54% of referrals came from physicians, 25% parents, 21% others. Whites were more likely than both blacks and Hispanics to come with an ASD-specific concern (OR White 4.1 95% CI 1.1-15.1), an association that remained after adjusting for maternal education and Medicaid use.
Physician referrals were more likely to display poor eye contact (p=.05), lack of showing (88% vs 65% p=.01) and stereotypic interests (58% vs 30% p=.009). Parent referrals were more likely to display rigidity/adherence to routines (17.2% vs 4.7%

p=.04). Referral source and chief concern were not influenced by ASD severity, cognitive level, age, and year of referral.

Conclusions: Physician referral accounted for the majority of children with early ASD diagnosis. For most, referral was for general developmental concerns rather than specifically for ASD. Physician-referred children differed clinically from parent-referred. Demographic features impacted on the likelihood of an ASD-specific referral.

116.122 91 Implementing Evidence-Based Strategies In Community Mental Health Clinics: An Individualized Mental Health Intervention for School-Age Children with Autism Spectrum Disorders. L. I. Brookman-Frazee*, *University of California, San Diego*

Background: The community mental health (CMH) system plays an important role in caring for school-age children with ASD and a significant minority of children served in the CMH system have ASD. Unfortunately, CMH therapists are not trained to address the complex needs of children with ASD, particularly behavior problems, and both parents and therapists are highly frustrated with the quality of CMH care. *AIM HI (An Individualized Mental Health Intervention for Children with ASD)* was developed with input from community providers and parents to improve CMH services for children with ASD. AIM HI is a package of parent-mediated and child-focused evidence-based practice (EBP) strategies, based on the principles of applied behavior analysis, designed to reduce behavior problems in children with ASD ages 5 to 13 served in CMH clinics.

Objectives: To examine (1) the feasibility and acceptability of implementing the AIM HI in CMH clinics, (2) therapist fidelity, and (3) changes in child behaviors after receiving AIM HI.

Methods: Thirteen therapists/ family dyads from 3 CMH clinics participated in the study. Therapist participants represented multiple mental health disciplines: 39% MFT, 39% Psychology, and 23% Social Work. Children were 100% male and their ages ranged from 5 to 12 years (*M*=9.7; *SD*=2.2). Family race/ ethnicity included, 70% White, 15% Hispanic, and 15% Other/ Mixed. Child ASD diagnoses were 46% Asperger's Disorder, 39% PDD-NOS, and 15% Autistic Disorder. Sixty-nine percent had a non-ASD co-occurring psychiatric diagnosis (39% ADHD, 23% Anxiety Disorder, 15% Disruptive Behavior Disorder, 8% Mood Disorder). After initial training through an introductory workshop, therapists delivered AIM HI for approximately five months with participating families while receiving bi-weekly consultations with AIM HI developers.

Results: Feasibility of Implementing AIM HI in CMH Clinics: Attendance at AIM HI trainings was very high and all therapists indicated that they perceived the training and intervention as useful in their work with children with ASD. Further, parent participation was high (M = 93% of sessions were attended by parents; SD = 0.10; Range = 73-100%). Therapist Fidelity: 100% of therapists were observed to use the AIM HI intervention materials and follow the intervention protocol and deliver AIM HI with fidelity. Child Outcomes: Clinically significant improvements in child problem behaviors were observed (i.e., d=.56 on the Competing Behavior Total Scale of the Social Skills Improvement System Rating Scales (SSIS). The greatest changes were seen on the Hyperactivity (d=1.02) and Internalizing subscales (d=.52). Further, 85% of children were within the clinical range in Hyperactivity at baseline while only 31% were in the clinical range after 5 months of AIM HI treatment, supporting the clinical significance of the changes. Effect sizes observed in this study are significantly larger than those observed from historical comparison group from the same clinics.

Conclusions: Results from mixed quantitative and qualitative data suggest that the training and intervention model are feasible to implement in CMH settings and improvements in child behaviors are observed. This study provides preliminary support for the use of packages of EBPs strategies tailored for delivery in specific community service settings.

116.123 92 Multi-Media Social Skills Intervention for Adolescents. M. Murray*, A. Pearl and L. A. Smith, *Penn State Hershey*

Background: Despite increases in research examining the efficacy of social skills interventions for individuals with autism spectrum disorders (ASD), few studies have targeted adolescents (1). This is particularly problematic as adolescence is a time of significant social change with growing emphasis placed on peer relationships. The establishment of evidence based practice to improve the social abilities of adolescents with ASD is greatly needed.

Objectives: The Multi-Media Social Skills Project was developed to help teens with ASD develop better social conversation abilities, a critical social skill. The model utilized components of social skills interventions which have strong empirical support as established by previous work, namely group instruction and video modeling (1). Additionally, peer generalization experiences were paired with instruction.

Methods: Twenty-three adolescents with ASD and verbal IQ scores >80 (mean 108.09) were recruited for this study. All

were 13-18 years old (mean age 14.2) and 19 were male. Additionally, 24 typically developing adolescents were also recruited to provide the peer generalization experiences. Again all were 13-18 years old (mean age 14.96), 8 were male, and all were general education students. The subjects were grouped into cohorts of 6 and each cohort participated in the 12 week intervention. Each week's session lasted three hours with the first 90 minutes devoted to group instruction of new skills. Video modeling was the primary instructional modality. The remaining 90 minutes were spent participating in a digital photography class with typically developing peers; the participants and peers worked collaboratively on various photography projects over the 12 weeks. The participants were able to assess their own progress in social conversation skills when watching video samples of themselves at weeks 4, 8, and 12. Video tape samples of 5 minute unstructured conversations between each participant and a novel peer were obtained pre- and post-intervention as well as at 3 month follow-up. The video samples were coded for social behaviors and fluencies. Additionally, the participants and their parents completed various rating scales pre- and post-intervention including the Social Responsiveness Scale, the Srengths and Dfficulties Questionnaire, and the Loneliness Scale.

Results: Twenty-three participants completed the study. Preliminary results from cohort 1 support the efficacy of video modeling and peer generalization. The most significant changes were noted in verbal fluency, percent of eye contact, and number of verbal exchanges. The behavioral changes observed were not reflected in changes in the rating scale scores. Data analyses from all 4 cohorts will be presented.

Conclusions: Social skills deficits in adolescents with ASD can inhibit subsequent development. The need for developing evidence based practices to address these deficits is of critical importance. This model for improving social conversation abilities was based on components shown to have good empirical support in previous work with younger children. Implications for clinical practice based on full results of this study will be presented.

(1) Reichow, B, and Volkmar, FR. Social Skills Interventions for Individuals with Autism: Evaluation for Evidence-Based Practices within a Best Evidence Synthesis Framework. Journal of Autism and Developmental Disorders, 40(2):149-166.

116.124 93 A Web-Based Parenting Tutorial for Young Children with Autism: Improving Everyday Skills and Behaviors.

Z. Warren*[1], W. L. Stone[2], L. Wallace[1], A. Swanson[1], K. Robson[3] and K. A. Kobak[3], (1)*Vanderbilt University*, (2)*University of Washington*, (3)*Center for Psychological Consultation*

Background: There is a growing consensus that early intervention can significantly improve long-term outcomes for children with autism. Unfortunately, many children who are eligible for early intervention services do not receive them, due to a critical shortage of trained professionals in this area. Federally-mandated systems are often not equipped with adequate financial or human resources to provide individualized intervention services, and most states do not provide autism-specialized services. This situation creates a burden for parents, who are often placed in the position of identifying, locating, and paying privately for children's therapies or acting as primary interventionists themselves. One way to bridge the gap between the need for services and their availability is to teach parents how to incorporate effective intervention techniques in their daily interactions with their children. More effective interactions could improve short- and long-term outcomes, by increasing parenting efficacy and help remediate the core deficits associated with autism. While successful parent training programs have been developed, access to such programs is limited due to the lack of trained clinicians providing such services. One powerful way to increase accessibility to these programs is through interactive, multi-media, web-based technologies.

Objectives: To develop and evaluate the feasibility and efficacy of a web-based, multi-media, interactive tutorial ("Enhancing Interactions"), based on evidence-based practices and utilizing the web-based platform to maximize learning.

Methods: Participants were 23 parents with a child between 18 months and 6 years of age with an autism spectrum disorder. Mean age of parents was 33.7 (range 24-51). Participants were 22% African American, 74% Caucasian, and 4% other. Sixty-one percent received their child's diagnosis within the past 6 months. Pre- and post-test scores of parents' knowledge of the concepts presented in the tutorial were used to evaluate teaching effectiveness. User satisfaction was gauged with the System Usability Scale (SUS) (for technical aspects) and the User Satisfaction Questionnaire (for tutorial content). The tutorial contained modules describing the characteristics of autism, teaching strategies, and ways to improve children's communication.

Results: We found a significant increase in the mean number of correct items on the 24-item multiple-choice test of concepts, from 12.6 to 20.4, $t(23)=10.72, p<.001$. Seventy-nine percent scored 80% correct or better, compared to only 8% prior to

taking the tutorial. The mean score on the SUS was 85 (SD=17) (scale range is 0-100), corresponding to a score of "Excellent"; 52% had a mean score above 90. All participants found the tutorial user friendly, thought the technical features in the tutorial were well integrated, and 96% (all but one participant) thought it was easy to use, felt confident using the technical features, and would use a tutorial like this again. On the User Satisfaction Questionnaire all participants found the objectives of the tutorial to be well-organized, the concepts clearly presented and easy to understand, and reported that it increased their knowledge about communicating with their child, and they felt capable of applying these techniques with my child.

Conclusions: The tutorial appears effective in increasing parents' knowledge and was well accepted with high user satisfaction.

116.125 94 Grandparents of Children with ASD. C. Anderson*, C. A. Cohen, J. K. Law and P. A. Law, *Kennedy Krieger Institute*

Background: Raising a child with an ASD is demanding, both emotionally and financially, and high levels of parent distress are reported. Members of the extended family, particularly grandparents, are also affected, yet little is known about the extent of grandparents' participation in supporting families of children with ASD, or about the impact that having a grandchild with an ASD has on the grandparents themselves. Much of the scant literature that does exist on the topic focuses on grandparents' views of the child with ASD and of that child's impact on the parent rather than on the grandparent's own experience, contribution, or needs.

Objectives: The current study explores the impact of having a grandchild with an ASD on the grandparent, addressing both the level of grandparent involvement in the lives of children with ASD, and the effect of having a grandchild with an ASD on these grandparents in emotional, social, and financial terms.

Methods: Information was collected from grandparents of children with ASDs via an online survey. Only grandparents who lived within the United States or its territories were eligible to participate. The survey, which was created in consultation with the Grandparent Autism Network and other volunteer grandparents, was deployed on *Survey Monkey* and announced via the Interactive Autism Network (IAN) Community, AARP, and Autism Speaks. Grandparents could report on up to 3 separate grandchildren with an ASD.

Results: More than 2,500 grandparents completed the survey. Of these, 83% were grandmothers and 17% were grandfathers. Two-thirds were maternal grandparents, while one-third were paternal grandparents. Fifteen percent reported having more than one grandchild with ASD. Three percent reported that they also had a child who had been diagnosed with an ASD, while an additional 8% said they suspected one of their adult children should have received such a diagnosis, but had not. Many grandparents played a vital role in early recognition of their grandchild's ASD. Fully 30% said they were the first to notice a problem with their grandchild's development. (Many of those who felt concerned hesitated expressing this, which may indicate grandparents need support and resources in order to play a role as potential early identifiers of ASD.) An additional 49% said they encouraged and supported another person who was first to suspect the disorder. Many provided support to the grandchild's family, with 57% contributing financially to meet ASD-related needs. In addition, 34% provided child care and 18% provided transportation to school or appointments at least once a week. More than 7% had combined households with their grandchild's family, and 14% had moved closer, to help with ASD-related issues. In addition to expressing worry for their grandchildren, 85% experienced "a moderate" or "a great deal" of worry for their adult child (the parent).

Conclusions: Researchers, advocates, and policymakers seek a more in depth understanding of the effect of ASDs on families and society. This study provides a very large set of preliminary data on the impact of ASDs beyond the nuclear family.

116.126 95 Crisis Psychiatric Hospital Program and Its Outcome for Pediatric Patients with Autism Spectrum Disorders and Intellectual Disabilities: A Retrospective Study. R. L. Gabriels*[1], J. A. Agnew[1], C. Beresford[1], M. A. Morrow[2], J. Miller[2] and M. Z. Wamboldt[1], (1)*The Children's Hospital / The University of Colorado at Denver and Health Sciences Center*, (2)*The Children's Hospital*

Background: Individuals with autism spectrum disorders (ASD) and intellectual disabilities are at risk for higher rates of co-morbid psychiatric disorders. The presence of the developmental disability makes the assessment and treatment of severe behavior problems difficult and complex. The unique social, communication, and behavior problems associated with the ASD population also complicate their treatment in general psychiatric hospital settings. Unfamiliar personnel, procedures, and expectations can cause anxiety for this population and they lack the ability to verbally report physical or emotional experiences, skills often expected of children by medical and psychiatric personnel to complete successful diagnostic evaluations.

Objectives: The objectives of this retrospective study were to 1) compare previous inpatient psychiatric care management of pediatric patients diagnosed with an ASD and intellectual disabilities (ID) to patient care outcome data following the development of a specialized, short-term inpatient and intensive day treatment hospital-based psychiatric program (Neuropsychiatric Special Care; NSC) and 2) To describe the unique approach of this hospital-based crisis care program for ASD/ID children and its outcome.

Methods: The first pediatric patient group for this study consisted of 14 novel admissions to the hospital's general child and adolescent psychiatric unit prior to the start of the NSC program between October 2001 and October 2002. The second pediatric patient group for this study consisted of 110 novel patient admissions to the NSC specialized program from January 2009 to December 2009. All patients had co-morbid psychiatric and developmental diagnoses and some also had additional medical diagnoses. The specific structured approach of the NSC program was developed to decrease the diagnostic "noise" of the patients' developmental disability (e.g., communication problems) so that the psychiatric causes driving the current crisis for these patients can more accurately be assessed and addressed. The NSC structured approaches involve trained staff implementation of predictable routines, visual cues, and positive behavior management strategies.

Results: Prior to the NSC, inpatient length of stay averaged 58 days compared to an average of 13 days in the NSC program. Recidivism rates prior to the NSC program were 64% compared to recidivism rates of 14 % in the NSC program. The Aberrant Behavior Checklist-Community (ABC-C) completed by a consistent caregiver for a subset of patients (n = 44) in the NSC program both at admission and discharge revealed an average of 8.3 point decline on the Irritability subscale and a 7.9 point decline on the Hyperactivity subscale. In the NSC program during the time period of this study, the average length of day treatment stay was 12 days and 35 novel ASD diagnoses were made.

Conclusions: The development of the NSC program has resulted in a substantial increase in the number of children served and success in accurate patient diagnosis and brief hospital stays. Compared to previous psychiatric care of this special needs population, the NSC program has demonstrated significant drops in length of hospital stays and readmission rates. The NSC program has demonstrated declines in patients' irritability and hyperactivity behaviors from admission to discharge from the program.

116.127 96 Support Needs, Service Gaps and Perceived Solutions From the Perspectives of Young Persons with ASD and Their Family.

I. E. Drmic*[1], W. Roberts[2], D. B. Nicholas[3], B. Muskat[1], C. Roncadin[4], J. Levine[1], S. Mitchell[1], J. Lake[1], J. Mulligan[1], K. Gionfriddo[1], E. Ko[1], K. Johnson[5] and L. Zwaigenbaum[6], (1)*Hospital for Sick Children*, (2)*University of Toronto*, (3)*University of Calgary*, (4)*Peel Children's Centre*, (5)*Surrey Place Centre*, (6)*University of Alberta*

Background:

There is a dearth of literature examining the experiences, perspectives, care requirements and outcomes of individuals with ASD from a lifespan perspective. Accordingly, there is substantial need to hear the voices of individuals with ASD and their families in order to ultimately respond to these identified needs with targeted services.

Objectives:

This mixed method study, based on a case study design, examines the lived experience of young persons with ASD </=25 years of age, with a focus on their service needs, current access to services, and potential gaps between services needs and access.

Methods:

Using a comprehensive, mixed method approach, children/young adults with ASD and their parent(s) participated in the following data collection processes:

(1) Administration of child/youth assessment measures examining: autism symptoms, intelligence, language development, adaptive functioning, academic achievement, anxiety, attention, behavioral, social and emotional supports, motor skills, sensory-based symptoms, quality of life, and parent stress;

(2) Child and parent qualitative interviews illuminating experiences and perceived needs;

(3) Family assessment facilitation examining familial dynamics and contextual issues over time.

Results:

To date, 16 inter-disciplinary, holistic case studies have been completed representing a range of participant (with ASD) ages: 4 preschool, 6 school age, 5 adolescent, 1 young adult. Sample variation includes diversity in ASD functioning (e.g.,

language/communication and intelligence), SES, services received, and cultural background. Multi-method analysis approaches include statistical analysis and qualitative content analysis, within a mixed method concurrent triangulation design. Preliminary process and outcome findings are as follows:

Process Findings - Methodological complexities inherent in this comprehensive case study highlight clinical challenges associated with conducting holistic ASD assessments. Difficulties include the time and scheduling demands required for generating comprehensive multidisciplinary and integrated case formulation as well as reporting and supporting processes for families. To date, assessment-based case studies have yielded an emerging *balanced model* comprising a pragmatic 'tag team' approach in which intra-team processes and communication strategies have been developed. Preliminary findings highlight the urgent need for an evidence-informed model for *comprehensiveness yet efficiency* in the generation of case-based knowledge for comprehensive resource planning.

Outcome Findings - Young persons with ASD and their families are profoundly impacted by ASD in multiple sectors of their lives, and require a continuum of supports. Current needs are often not being met within current service delivery models. Findings identify a patchwork of services for families including public and private services, rendering the need for (i) increased services, (ii) continuity and navigational supports over child and adult development, (iii) family-centred models in which needs are holistically addressed, and (iv) ongoing opportunities for meaningful relationship formation between families and service providers.

Conclusions:

Findings highlight a range of multi-layered challenges facing individuals and families as they navigate the complex service delivery network. In varying degrees, parent participants express frustration and desperation as they independently seek services. Over time, they experience exhaustion, yet an increased aptitude and confidence in identifying needs and priorities. Overall, these findings critique existing models of service delivery, invite increased service access and coordination, and provide recommendations for targeting these needs with well-resourced and orchestrated services.

116.128 97 Documenting Service Use and Satisfaction Across Time In Families. N. Akshoomoff*[1], A. C. Stahmer[2] and G. Piccolini[2], (1)*University of California, San Diego*, (2)*Rady Children's Hospital, San Diego*

Background: The pervasive and complicated nature of ASD has led to service provision through a variety of service sectors that constitute what can often be described as fragmented system of care. The exact nature of an individual child's intervention program will depend upon a variety of clinical and non-clinical factors, including individual child and family characteristics, state and local policies, and intervention availability. Data is needed on the sequence of events that lead to service use patterns and changes in service use over time and a better understanding of the many factors that influence parent needs and service satisfaction.

Objectives: To examine the utility of a prospective approach for obtaining information about service use patterns, changes in service type and intensity over time, and the role of the parent in this process. As part of a pilot study of the long-term benefits of a parent training program, information about a prospective services survey approach was obtained and closely evaluated from a small group of families.

Methods: Four families who had a child with ASD (ages 2 to 4) participated in this 12-month study. The mother of each child was contacted on a monthly basis and the *Ongoing Services Survey* was completed over the phone. This survey was developed to obtain information about the amount and type of individual and educational intervention services received by children with ASD. For each service received, information about funding source, parental opinion of progress, and satisfaction with services was also obtained.

Results: All children in the study experienced a number of changes in service provision during the 12-month period. These included transitions from individual therapies to school-based programs, changes in providers, decreases in service provision due to changes in funding eligibility and consideration of individual child needs. The amount of time spent in individual intervention and educational programs ranged from 8 to 32 hours per week (mean=26 hours). The number of different individual services (outside of educational programming) ranged from 1 to 6 (mean=3.9). Parental opinion of child progress and satisfaction with service provision were generally positive and correlated but varied across services for each parent and fluctuated from month to month, particularly as services changed. Parental comments provided more detailed information about reasons for changes in services and the parental role in service advocacy.

Conclusions: This type of prospective monthly survey approach provides a means for obtaining accurate information about the variety of services obtained by young children with ASD and for

examining the role of the parent in service use. Monthly contacts with the parent, either over the phone or in person, is likely to be more convenient and reliable than requesting parents to maintain their own services log. Additional sources of information, such as from the service providers and funding sources may be helpful for learning more about factors impacting service provision and how these factors ultimately may affect child and family outcomes.

116.129 98 Family Empowerment, Acceptance, and Crisis In Families of Children with ASD. J. A. MacMullin*[1], J. A. Weiss[1] and Y. Lunsky[2], (1)*York University*, (2)*Centre for Addiction and Mental Health*

Background: Mothers of children with autism spectrum disorders (ASD) experience a wide range of acute and chronic stressors, heightening their risk for an experience of crisis. Understanding the processes that lead to stress, distress, and mental health problems in mothers of children with ASD is necessary if we are to mitigate the experience of crisis. Empowerment, defined as " …an intentional, ongoing process…through which people lacking an equal share of valued resources gain greater access to and control over those resources" (Cornell Empowerment Group, 1989, p. 2), is one variable that may affect the experience of crisis in families with ASD. Previous research indicates that empowerment contributes to better outcomes in families (e.g., Scheel & Rieckmann, 1998). Another variable that may mitigate an experience of crisis is psychological acceptance, which is related to decreases in parental stress, depression, and anxiety in families of children with intellectual disabilities (Lloyd & Hastings, 2008).

Objectives: The purpose of the present study is to examine the relationship between empowerment, psychological acceptance, and crisis in families of children with ASD. It is hypothesized that a change in empowerment and acceptance will be correlated with a change in the experience of crisis in families of children with ASD overtime.

Methods: As part of a large Canadian online survey of children with ASD, 145 mothers of children diagnosed with ASD aged 3-21 years old (115 boys and 30 girls; age *M*= 12.19, *SD*=4.44) completed the Family Empowerment Scale (Koren et al., 1992), which assesses the family's ability to handle day-to-day situations, and the Acceptance and Action Questionnaire-II (Bond et al., submitted), which measures acceptance of difficult thoughts and emotions. Mothers also completed a crisis measure, which asks mothers to rate their degree of current crisis on a 10-point scale (ranging from '0 – Not at all in crisis' to '10 – We are in crisis and it could not get any worse') (Weiss & Lunsky, in press). The measures were completed at two different time points with approximately one year in between. Child diagnoses included Asperger syndrome (32%), PDD-NOS (17%), Autism (49%), and other diagnoses (1%; 1% were missing).

Results: Preliminary analyses revealed that family empowerment and psychological acceptance are associated with crisis. Mothers who reported more family empowerment were less likely to be experiencing distress (r = -.31, p <.001). Mothers who reported more psychological acceptance were also less likely to be experiencing distress (r = -.40, p <.001). Regression analyses will be conducted to determine whether changes in empowerment and psychological acceptance are related to a change in crisis over time.

Conclusions: The importance of empowerment and psychological acceptance as targets for psychological interventions to alleviate crisis in families of children with ASD will be discussed.

116.130 99 Age-Related Differences In Treatment Utilization for Children with Autism Spectrum Disorders. S. S. Mire*[1], C. M. Brewton[2] and R. P. Goin-Kochel[2], (1)*University of Houston*, (2)*Baylor College of Medicine*

Background: The phenotypic presentation and needs of children with autism spectrum disorders (ASDs) are complex and diverse, contributing to the lack of a single course of treatment for ASD. Numerous treatment options have been proposed to address the needs of persons with ASD, and though multiple professionals may be involved, parents typically drive treatment, from choosing treatments to implementation. Parents choose particular treatments depending, in part, on their children's ASD symptomology (Goin-Kochel, Myers, & Mackintosh, 2007), sometimes pursuing treatments before formal diagnosis (Levy & Hyman, 2005). Yet parents often change the treatments they pursue as their children age. For example, parents of young children often use more simultaneous treatments than those with older children (Green et al., 2006). Special diets (e.g., gluten-free and/or casein-free) and behavioral/ educational treatments are more often pursued for younger age groups (Goin-Kochel et al., 2007). Psychopharmacological treatments are more common among older children (Aman, Lam, & Collier-Crespin, 2003; Goin-Kochel et al., 2007), although drug treatments are increasingly offered to younger and younger children (Olfson, Crystal, Huang, & Gerhard, 2010). Collectively, these results have focused on the treatments that *different* children are using at *different* ages, but little is known about the *patterns* of treatment use among the *same* children at different ages.

Objectives: To investigate age-related trends in types of treatments pursued by parents of children with ASD.

Methods: Participants will include children with ASD between the ages of 4 and 18 who are participating in the Simons Simplex Collection (SSC; https://sfari.org/simons-simplex-collection). Currently, 1,887 children have received ASD diagnoses via research-reliable administrations of the ADI-R and ADOS within the SSC. Data regarding types of treatment pursued by each family were collected through an extensive Treatment History Form, dating back to age 2 years, as well as a Medical History Interview. Categories of treatments include: speech therapy, occupational therapy, psychotropic medications (e.g., antipsychotics, ADD/ADHD medications), intensive behavioral therapies (e.g., ABA), biomedical treatments (e.g., chelation, special diets), and other treatments (e.g., social-skills training, picture exchange system). Descriptive data will be presented in multiple graphs to enable visual comparison of proportions of children receiving different treatment types at various ages (range = 2—18 years). Chi-square analyses will be conducted to investigate whether the difference in proportions of children receiving various treatments is statistically significant.

Results: We expect that differences in treatment-type utilization will emerge, both within treatment type and across age groups. For example, it is expected that speech-language services will be used by larger proportions of children at younger ages, while psychotropic medication will be used by larger proportions of children at older ages. Trends will be examined according to the ages at which parents *stop* using select treatment types and *start* using others.

Conclusions: Results of this study will facilitate understanding of *when* and *how long* parents implement different types of ASD treatments. In addition to potentially enhancing treatment planning, results of this study will also provide the foundation for future studies, such as investigating the influence of early treatment utilization on long-term phenotypic presentation.

116.131 100 Contrasting Language Environments of Four Children with Autism: Home and Preschool. E. Sliwkanich*[1], V. Smith[2] and S. Patterson[2], (1), (2)*University of Alberta*

Background: Enrolment in preschool programs has increased significantly in the past decade resulting in over half of preschool aged children attending a program (Stahmer & Carter, 2005). Children with autism spectrum disorder (ASD) are no exception to this increase especially with a growing number of studies citing the benefits of integrating children with ASD into the preschool classroom (e.g., Stahmer & Ingersoll, 2004). Providing children with a language rich experience is one of the characteristics of preschool programs that are more effective in producing long-lasting benefits for children with disabilities (Stahmer & Carter, 2005). Studies examining preschool classrooms suggest that children are exposed to moderate levels of meaningful, child-focused language and specialized training for staff is required in order to provide rich language environments (Turnbull, Anthony, Justice, & Bowles, 2009). However, in order to provide this specialized training for preschool staff that support children with ASD, we need to know more about the language opportunities that exist for these children in preschool settings and those that exist in the home. The purpose of the present study is to examine the language and interaction that children with ASD are exposed to throughout their day by utilizing a digital language processor (DLP).

Objectives: The main objectives of this study were to: (1) examine the frequency of language children with ASD are exposed to at preschool as compared to at home, and (2) determine whether the frequency of interactions these children engage in are similar between the home and preschool environments.

Methods: Four toddlers with ASD (age 37-40m) were recruited from a local agency. Language and interaction data was collected over three sessions. The DLP was utilized to capture audio data within each child's preschool and home settings. Computer software was then used to identify and contrast the three hours of data with the most child language in each setting, examining the frequency of: (a) the duration and frequency of adult language (AW) in the child's immediate environment were exposed to; (b) duration and frequency of child vocalizations (CV); (c) duration and frequency of adult-child communicative interactions (ACI).

Results: Each of the four children demonstrated differences in developmental age (DA 8-30m). Two of the four children experienced higher rates of adult language exposure at home (three times higher at home as compared to preschool), for the other two children AW exposure was roughly equivalent. Three of the four children engaged in more ACI at home (range 58-88 per hour contrasted to 18-38 per hour). One child vocalized

more at home, for the other three children total vocalizations were roughly equivalent.

Conclusions: It appears from this contrast of home and preschool language environments that some children with autism may experience more frequent exposure to language and interaction opportunities with adults at home than at preschool. While this data set is small and these results are preliminary, these data support the idea that preschool staff may benefit from specialized training to improve language-learning opportunities for children with ASD who attend preschool programs.

116.132 101 Examination of a Structured Swim Program on Social Interaction, Communication, and Stereotypical Behaviors In Children with Autism Spectrum Disorders (ASD). A. Cross* and M. Schneider, *Wilfrid Laurier University*

Background: Swimming is a lifetime activity that individuals can participate in alongside family and friends (Prupas et al., 2006). Research suggests children with autism spectrum disorders (ASD) enjoy swimming and respond in a typical manner to a hierarchy of swim skills (Killian et al., 1984;Yilmaz et al., 2004). Due to the therapeutic benefits, such as the warm temperature, buoyancy, and resistance of the water, children with ASD tend to thrive in the aquatic environment (Dulcy, 1992; Huettig & Darden-Melton, 2004). For instance, it has been suggested that swimming promotes social interaction (Pan, 2010) and decreases stereotypical behaviors (Yilmaz et al., 2004) in children with ASD. However, while past research confirms children with ASD benefit from the water, there are still many unanswered questions regarding the social, physical, and emotional benefits of aquatics on the characteristics of ASD.

Objectives: Using a phenomenological qualitative framework, the aim was to explore the influence of a structured swim program on social interaction, communication, stereotypical behaviors, and quality of life (QOL) of children with ASD, from the perspectives of the parents, teachers, and volunteers. For the purpose of this study, QOL was defined as the social, physical, and emotional well-being of the child.

Methods: A mixed-model "dominant-less dominant" design employing a qualitative framework with a quantitative component (Creswell, 1994) was chosen as the research design for this study. Recruitment took place at a school for children with developmental delays in South-Western Ontario. Recruited participants (n = 43) included: 15 children with expressive and receptive communication delays (including 6 children with ASD); 13 parents; 2 teachers; and 13 volunteers. All participants had various roles and degrees of involvement in the study. Each child participated in a 1-hour, structured swim class, once a week for 10-weeks. A certified swim instructor was responsible for teaching each swim session. Consistent with a phenomenological approach, in-depth interviews and open-ended questionnaires were the primary data collection strategies. Other data collection methods included: two quantitative scales, a background questionnaire, journal entries, evaluation forms, field notes, and member checks. The classroom teachers were responsible for completing all quantitative measures. The two quantitative scales included: four sections of the ABLLS-R (Partington, 2008) (i.e., social interaction, group interaction, requests, and spontaneous vocalizations); and The Children's Behavior Rating Form, which is a five-point likert scale modeled after Tony Attwood's (1998) Skills Rating Form.

Results: We are currently finishing data collection. Results will be completed by the conference.

Conclusions: As parents and professionals continue to strive to find interventions that are beneficial for children with ASD, this study will shed insight to a possible beneficial intervention, which will not only provide physical activity and foster a healthy lifestyle, but may also help with the symptoms of ASD. Furthermore, the knowledge gained from this study will be useful for autism intervention services, early intervention programs, teachers, parents, and therapy providers.

116.133 102 Increasing Executive Functioning Skills for College Students Diagnosed with Autism Spectrum Disorders. M. Boman*, *Kelly Autism Program at Western Kentucky University*

Background:

For many individuals diagnosed with Aspergers, attending college can be overwhelming due to their limited Executive Functioning skills. This research demonstrates how these skills were developed with 37 individuals diagnosed with ASD at the Kelly Autism Program so that they could live in the dormitory and be productive full-time students like their peers. Using Executive Function Theory and Social Information Processing, the program works toward productivity, independence, and employability for these individuals.

Many individuals with ASD are academically capable of attending college, but they struggle with the various Executive Functioning Skills necessary for their success. These skills include: inhibiting, shifting, controlling emotions, initiating, working memory, planning/organizing schedules, organizing materials, and monitoring. Often their academic skills are

adequate to pass the courses, but they struggle with attendance, handing in their assignments, time management, or communicating/working with their peers or professors. These simple tasks interfere with their success within the university setting.

Objectives:

To increase the success of students attending college while increasing their Executive Functioning skills so that they can complete their course work and live independently and become employable.

Methods:

Thirty seven college students, who were enrolled in full-time courses as well as living in the dormitory, participated in the Kelly Autism Program Circle of Support. These students received researched based support as well as meta-cognitive social skills training. Results of these experiences were measured using the Behavior Rating Inventory of Executive Functioning (BRIEF) as well as the Arc's Self-Determination Scale, which were administered each semester.

Results:

For most of the participants, a steady increase in their Executive Functioning skills was reported according the assessments. This was a reflection of the development of their independence as well as their success as a college student. Some participants and parents rated their Executive Functioning abilities outstanding the first semester as many were so elated that they were accepted into the university and the program. After receiving their first grades and the reality of what the university experience entailed, the scores appeared to be a more accurate evaluation of the participants' abilities. For some who were not successful in the program, the need to hide their disability (non acceptance of the ASD label) or parents who wanted to be actively involved in the college experience were identifying characteristics regarding the students' success.

Conclusions:

The research documents that with additional support, individuals with ASD can be successful in the university setting. With the estimated annual economic cost of autism at $35 billion (Ganz, 2006), more individuals with the diagnosis of ASD need to be successful as they pursue a postsecondary degree. For many of these students, additional support is necessary besides the typical academic support. The social and behavioral training needs to address the Executive Function skills necessary to carry through simple tasks which will be expected in the workforce. For this reason, these lessons must be taught and practiced so that the students can graduate with a degree as well as becoming productive, independent, and employable community members.

116.134 103 Psychological Well-Being In Fathers of Adolescents and Young Adults with Autism Spectrum Disorders, Down Syndrome, and Fragile X Syndrome.

S. L. Hartley*[1], M. M. Seltzer[2], L. Abbeduto[3] and L. Head[1], (1)*Waisman Center*, (2)*Waisman Center, University of Wisconsin-Madison*, (3)

Background: Despite decades of research on family adaptation in the context of having a child with a developmental disability, the psychological well-being of fathers remains poorly understood. There is considerable evidence that the challenges that mothers face and their psychological well-being varies by the child's diagnosis. The nature of autism spectrum disorders (ASD) has been shown to be particularly challenging both early on and during later parenting years; mothers of children and adults with an ASD report higher levels of stress (Herring et al., 2006) and increased depressive symptoms (Abbeduto et al., 2004; Dumas et al., 1991) as compared to mothers of children and adults with other disabilities. Little is known about whether the nature of ASD is also uniquely challenging for fathers.

Objectives: We compared the psychological well-being of fathers of adolescents and young adults with an ASD, Down syndrome (DS), and fragile X syndrome (FXS). We also identified factors that account for diagnostic-related variation in paternal psychological well-being.

Methods: One-way analyses of covariance were used to compare self-reported ratings of depressive symptoms, pessimism, and coping in fathers of adolescents and young adults with an ASD (n = 135), DS (n = 59), and FXS (n = 46), and (n = 135). Hierarchical linear regressions were used to examine the extent to which four factors (paternal age, child behavior problems, presence of additional children with a disability, and maternal depressive symptoms) contributed to diagnostic-related differences in paternal psychological well-being.

Results: Whereas 30.4% of fathers of adolescents and young adults with an ASD reported depressive symptoms warranting clinical attention, 15.9% of fathers of adolescents and young adults with FXS, and only 6.8% of fathers of adolescents and young adults with DS had a clinically significant level of depressive symptoms. Fathers of adolescents and young

adults with DS reported a lower level of pessimism than fathers of adolescents and young adults with an ASD or FXS. There were no diagnostic differences in paternal coping. The 'ASD disadvantage' in terms of heightened depressive symptoms as compared to both the DS and FXS groups was, at least in part, related to the child's heightened number of behavior problems, increased risk of having additional children with a disability, and increased maternal depressive symptoms.

Conclusions: Results confirm that fathers, like mothers, are affected by child-related stress and the nature of their son or daughter's disability. The influence of child-related stress on paternal well-being is not confined to the early parenting years, but is evident in the son or daughter's adolescence and young adulthood. Results can start to inform practitioners and health providers about the experiences of fathers, and suggest that fathers of adolescents and young adults with an ASD are particularly in need of services.

116.135 104 Autism Rapid Diagnosis Clinic: a New Model for Efficient Early Diagnosis and Referral. R. Choueiri*[1], S. Mangan[1] and E. Perrin[2], (1)*Floating Hospital for Children*, (2)

Background: Demand for early autism diagnostic evaluations continues to grow. Long waits for qualified clinical services delay access to crucial services in toddlers with Autism Spectrum Disorders (ASD).

Objectives: We describe here a new clinic model we have pioneered for children younger than 3 years

Methods: We reviewed the number of children seen between January 2009 and September 2010 in a new clinical model including gender, age, diagnosis, and average latency before appointment. We also looked at the rates of no shows and of follow-ups.

Results: The clinic is staffed by a neurodevelopmental pediatrician and a receptionist. Evaluations follow this protocol: a 90 minutes diagnostic visit that includes neurodevelopmental and medical history; review of a parental intake form and of Early Intervention evaluation; neurodevelopmental testing including ADOS and/or Mullen administration based on presenting concerns and behavioral observations; physical examination. Diagnosis and recommendations are discussed during the same session and families are provided with a letter to their Early Intervention Program or school system describing the diagnosis and recommended services. A full report describing the full visit follows afterwards. Other medical referrals are made as needed. When there is a diagnosis of ASD, the family is given extensive information about the disorder and contact information to access an autism resource specialist. All children are scheduled for a follow-up in 2-3 months. During the period January 2009 to September 2010, 91 children were evaluated; 59 (64.8%) were males and 32 (35.2%) were females. Five (5.5%) did not keep their appointment. Age ranged between 7 and 36 months with an average of 28 months. Duration of wait between parental referral and evaluation visit varied between 2 and 4 months with an average of 3 months. A diagnosis of ASD was provided in 55 (60.4%), Language Delay in 18 (19.8%), Developmental Delay in 16 (17.6%), Behavioral Disorder, NOS in 1 (1.1%) and At Risk in 1 (1.1%). Forty-Four (48.4%) came for at least 1 follow-up within 6 months and of these 4 (4.4%) changed diagnosis: 3 changed from developmental delay or language delay to PDD,NOS and one from PDD,NOS to language disorder.

Conclusions: The clinical protocol described was successful in providing quick and efficient diagnostic evaluations for children younger than 3 years with concerns suggesting an autism spectrum disorder or developmental delay.

116.136 105 New Questionnaire for Fathers of Children with Developmental Challenges: Supports and Challenges of Childrearing (SCC). A. R. Ly* and W. A. Goldberg, *University of California, Irvine*

Background: Previous studies about parents of children with developmental challenges (DCs) have primarily focused on mothers (Keller & Honig, 2004) leading to a relative lack of information about fathers. Although they share some perceptions about raising children with DCs (Knafl & Zoeller, 2000), factors related to stress in fathers do differ from mothers (Hastings, 2003). Studies that include fathers rely on measures intended for parents of typically developing children (e.g., Parental Stress Index (PSI; Abidin, 1995)), which may not address experiences of fathers of children with an autism spectrum disorder (ASD) or other DCs. The SCC was developed explicitly to apply to fathers raising atypically developing children and factors impinging upon their ability to be involved.

Objectives: To establish the reliability and validity of a new measure of fathers' perceptions of what supports and challenges their efforts to be involved in childrearing

Methods: Eighty-five fathers of children (78% male) with ASD and other DCs (74% ASD, 17% Down Syndrome, 9% other) completed an online survey. Children averaged 7.5 years (*SD* = 3.2). Fathers' average age was 44 years (*SD* = 8.5) and most were Caucasian (63%; 16.5% Hispanic; 10.6% Asian). A

sample SCC item is "It's easy to be involved with my child because I can handle the difficulties that come with my child's disabilities." Reliability was assessed via Cronbach's alpha. To address convergent and discriminant validity, fathers completed the PSI (Abidin, 1995), NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992), Parenting Commitment Scale (Greenberger & Goldberg, 1989), and the Social Communication Questionnaire (Rutter et al., 2001).

Results: The SCC demonstrated very good reliability (= .88) and construct validity by showing a high positive correlation with the PSI (r = .69, p < .001) and low correlations with the NEO-FFI ($r_{extraversion}$ = -.19, p = .08; $r_{openness}$ = .29, p < .001; $r_{conscientiousness}$ = -.17, p = .11; $r_{agreeableness}$ = -.22, p = .04; $r_{neuroticism}$ = .41, p < .001). Higher scores on the SCC (i.e., greater difficulty being involved) were related to more social communication severity (r = .39, p < .001) and less parenting commitment (r = -.41, p < .001). Despite the high correlation between them, the SCC and the PSI were not redundant as they demonstrated different magnitudes of association with study variables. Unlike the SCC, the PSI had a significant negative correlation with income and conscientiousness, and a significant positive correlation with extraversion. Although the SCC and PSI were both related to neuroticism, an r-to-z transformation revealed that the PSI correlation (r = .63) was greater (p = .05) than that of the SCC (r = .41).

Conclusions: The SCC represents a preliminary effort to create an easy-to-administer questionnaire of fathers' perceptions of supports and barriers to raising children with an ASD or other DCs. Results seem promising with analyses revealing that the SCC acts in theoretically expected ways, is reliable, and has construct validity. With further validation, the SCC could assist professionals aiming to create and deliver services to fathers with children with DCs.

116.137 106 An Investigation of Parental Perception of Their Child's Autism Spectrum Disorder Diagnostic Evaluation. A. Keefer*[1], L. Kalb[1], C. Foster[2] and A. M. L. wilms Floet[3], (1)*Kennedy Krieger Institute*, (2)*Kennedy Kreiger Institute*, (3)*kennedy krieger institute*

Background: A growing body of research suggests many parents are generally dissatisfied with their child's Autism Spectrum Disorder (ASD) diagnostic evaluation (Smith et al., 1994). This is not surprising given several studies have found that many parents view this process to be confusing, limited in benefit, and unsupportive of the family's emotional needs (Siklos & Kerns, 2007). Despite these troubling findings, a dearth of literature has examined what factors are associated with these poor outcomes or has provided recommendations aimed at improving parents' experience.

Objectives: This study measures parental perception of the diagnosticians' a) clarity in communicating diagnostic information and formulation, b) effectiveness in providing recommendations and plan for follow-up care, and c) effectiveness in creating a supportive and helpful relationship with parents during their child's ASD diagnostic evaluation.

Methods: Parental perception was measured using a 35-item, 5-point Likert-type questionnaire that was filled out after seeing the child's diagnostician. To assess the first and second objectives, 13 items from the *Mishel Uncertainty in Illness Scale* (Mishel, 1981), as well as four custom items, were included. Twelve items from two subscales (*Confident Collaboration* and *Dedicated Patient*) statistically derived from three measures of therapeutic alliance (Hatcher & Barends, 1996) were also included to assess the final study objective. In addition to parental measures, diagnosticians completed a 10-item questionnaire about their perception of the parents' diagnostic feedback experience. Descriptive statistics and ANOVA or t-test analyses were used to examine the study hypotheses. Presently, the sample size totaled 24 children (M = 7.14 years; 50% male and 62% Caucasian) / parents (M = 37.9 years; 96% biological mothers).

Results: Mean scores on the *Mishel* (M = 4.29, SD = .42)*, Confident Collaboration* (M = 4.47, SD = .38) *and Dedicated Patient* (M = 4.7, SD .37) subscales*,* and the custom items (M = 4.41, SD = .62) suggest parents were very satisfied with their diagnostic experience. However, there was no relationship between diagnostician rating of their perception of parents' experience and parental rating of the diagnostic experience (p > .05). The only demographic factor that was associated with parents' diagnostic experience was that parents seeking an initial evaluation reported greater confidence in the evaluative process (p < .05).

Conclusions: Results from the preliminary analysis indicate that patients report a high degree of satisfaction regarding diagnosticians' communication of diagnosis and follow-up plan, and the quality of their relationship with the diagnostician. Despite these positive findings, important caveats to the parental experience were identified. That is, parents seeking a second evaluation of ASD reported lower confidence regarding the evaluative process than parents seeking an initial opinion. This is concerning given that lower levels of confidence in the evaluation may hinder parents' acceptance of diagnosis and adherence to recommendations. In addition, the lack of

relationship between diagnosticians' and parents' perception of the evaluation suggests that diagnosticians may be ineffective in recognizing parental reaction to and understanding of diagnostic feedback. These data highlight the need for ameliorative strategies to address this gap .

116.138 107 Adaptation of the Psychosocial Assessment Tool for Families of Children with Autism Spectrum Disorders. K. K. Deidrick*[1] and J. E. Farmer[2], (1)*Thompson Center for Autism and Neurodevelopmental Disorders, University of Missouri-Columbia*, (2)*Thompson Center for Autism & Neurodevelopmental Disorders*

Background: Families of children with Autism Spectrum Disorders (ASD) are at increased risk for difficulties with psychosocial adjustment, but there is no established measure for identifying risk among these families.

Objectives: The Psychosocial Adjustment Tool (PAT 2.0) is a brief screening measure designed to stratify families on level of psychosocial risk at the time their child is diagnosed with cancer. The measure identifieds families at need for universal, targeted, and clinical levels of support, consistent with NIMH models for prevention. The objective of this study is to adapt the PAT 2.0 for use in families of children with ASD.

Methods: Parents of 31 children with an ASD completed the PAT 2.0 and Parenting Stress Index (PSI).

Results: Parents (77% mothers) of 31 children completed the PAT 2.0. 87% of children were male and 94% were Caucasian. Ages ranged from 2 years, 6 months to 14 years, 11 months (Mean=6 years, 11 months; SD=3 years). 97% of caregivers completed at least a high school education.

Conclusions:

Table 1

Descriptive Statistics

PAT 2.0 Scale	Scale Range	Mean	Standard Deviation	Range
Total	0-7	1.44	.583	.517-3.06
Structure and Resources	0-8	1.13	1.12	0-4
Family Problems	0-10	2.10	1.40	0-5
Social Support	0-4	.16	.374	0-1
Stress Reaction	0-3	.06	.250	0-1
Family Beliefs	0-4	1.10	1.012	0-3
Child Problems	0-14	9.19	2.738	4-14
Sibling Problems	0-14	1.26	1.843	0-7

Table 2

Pearson Correlation Matrix Among PAT Scales

	SRS	FPS	SSS	SRS	FBS	CPS
Total PAT	.491**	.660**	.657**	.169	.705**	.551**
Structure and Resources (SRS)	-	.461**	.268	-.150	.106	.111
Family Problems (FPS)	-	-	.479**	172	.205	.160
Social Support (SSS)	-	-	-	-.115	.310	.294
Stress Reaction (SRS)		.-	-	-	.238	-.165
Family Beliefs (FBS)	-	-	-	-	-	.258

Total PAT score was significantly correlated with the total score from the PSI (r=.599, p<.01). PAT scores were divided into quartiles. One-Way ANOVA indicated significant differences between quartiles in raw total PSI score ($F(3, 24)=5.770$, $p=.001$). Post-hoc analyses indicated significant differences only between quartiles 1 and 4 and 2 and 4. 87% of families endorsed PAT total scores of one standard deviation of the mean.

Discussion: Families of children with ASD's experience varying levels of psychosocial stress, which may increase risk for poor outcomes. On the PAT 2.0, a measure designed to identify at-risk families in a pediatric oncology population that was adapted for ASD, families reported few psychosocial difficulties, with the exception of child behavior problems. PAT subscale scores were significantly correlated with the total PAT score,

except for the stress reaction scale. This scale focused on trauma reactions, a construct that may not be meaningful in this population. In contrast to prior studies, which used this measure to divide families into three groups, a single cut-off was the most effective at identifying at risk families in this study. Further refinement of this measure for use in an ASD population with a larger sample size is warranted to increase its utility as a method for identifying families that are at risk.

116.139 108 The Impact of Teachers' Attitudes towards Evidence-Based Practices on Experienced Levels of Burnout: Do Comprehensive Treatment Models for Children with Autism Positively Effect Teachers, Too?.

C. S. Ghilain*[1], D. C. Coman[1], A. Gutierrez[1], K. Hume[2], B. Boyd[3], S. Odom[4] and M. Alessandri[1], (1)*University of Miami*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of North Carolina at Chapel Hill*, (4)*University of North Carolina*

Background: With reports of increasing rates of children diagnosed on the autism spectrum, many researchers are now focused on the services needed to provide for these individuals. Teachers are the primary treatment providers for most children with autism, but this unique student population requires specialized methods of intervention. The Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH) and Learning Experiences and Alternative Program for Preschoolers and their Parents (LEAP) are two comprehensive treatment models that provide teachers with manualized programs comprised of core components that reflect “best practices.” Exploring the impact of utilizing these structured models could give us insight into ways of reducing teachers’ feelings of burnout.

Objectives: This preliminary study investigated the impact of teachers’ general attitudes about EBPs (i.e., Openness) on aspects of teacher burnout (i.e., Emotional Exhaustion [EE], Depersonalization [DP], and Personal Accomplishment [PA]) across 3 widely utilized comprehensive preschool treatment programs used for children with ASD (TEACCH, LEAP & Business As Usual/Eclectic).

Methods: This study was conducted as part of a larger multi-site (CO, NC, MN, FL) preschool treatment comparison project. 49 teachers across 3 classroom types (16 TEACCH, 15 LEAP, and 18 Business as Usual/Eclectic) were asked to complete a demographic form, Evidence-Based Practice Attitude Scale (EBPAS) and Maslach Burnout Inventory-Educators Survey (MBI-ES).

Results: Regression analyses were conducted to evaluate the impact of teachers’ acceptance of EBPs on their feelings of burnout, controlling for their number of years teaching. Teachers in the TEACCH/LEAP group who expressed an openness to using EBPs were less emotionally exhausted, $F(2, 28) = 6.077$, $p=.006$, $\beta= -.527$, and had more feelings of personal accomplishment, $F(2,28) = 8.387$, $p=.001$, $\beta= -.493$. However, teachers openness to adopting EBPs did not significantly predict their levels of depersonalization, $F(2, 28) = 2.168$, $p= .133$, $\beta= -.355$. In addition, no significant associations were found between these measures in the Business as Usual group.

Conclusions: Preliminary analyses indicate teachers who were open to the use of EBPs in their classrooms had strong feelings of Personal Accomplishment and decreased feelings of Emotional Exhaustion. This was only the case for teachers who were following a theory-driven intervention framework (i.e, TEACCH, LEAP) as opposed to those teachers who were not following a manualized method of teaching.

116.140 109 Neurodiversity and the Internet: A Survey of Individuals with Autism, Family Members, and Others.

K. Gillespie-Lynch*[1], S. K. Kapp[2], D. S. Smith[3], P. M. Greenfield[3], J. Atkinson[3], A. Navab[2] and T. Hutman[4], (1), (2)*University of California, Los Angeles*, (3)*UCLA*, (4)*UCLA Center for Autism Research and Treatment*

Background: The neurodiversity movement, a civil rights moment started by individuals with autism, contests the pathologization of behavioral differences arising from neural differences (Harmon, 2004). Qualitative evidence suggests that the temporal asynchrony and text basis of Internet communication provides a medium wherein individuals with autism connect with one another and learn about neurodiversity (Bagatell, 2010; Blume, 1997). While online groups for individuals with autism often espouse neurodiversity-related viewpoints such as rejection of a cure, groups for family members of individuals with autism often conceptualize autism as an affliction (Brownlow, 2010). The current study is the first to quantitatively assess whether the Internet facilitates exposure to the neurodiversity movement and whether conceptions of neurodiversity-related topics differ between individuals with autism (ASD) and two groups of non-autistic participants: relatives of autistic people (Family), and people without autistic relatives (Unrelated).

Objectives:

1. Evaluate if the Internet facilitates communication for ASD.

2. Determine whether ASD learn about neurodiversity through the Internet more than non-autistic people do.

3. Examine whether ASD, Family, and Unrelated express different emotions about and ways of responding to autism.

Methods: 204 ASD, 60 Family, and 98 Unrelated participants were recruited to an Internet survey from autism advocacy and support groups, forums and discussion boards, social networking sites, schools, vocational rehabilitation centers, and Craigslist. The AQ (Baron-Cohen, 1998) was administered to all participants. Age, gender, and education were entered into all univariate analyses. Results significant at (p=.001) are reported. When no differences between the Family and Unrelated groups were observed, the combined group is described as non-autistic.

Results: Univariate tests indicated that ASD felt the textual basis of the Internet supported communication more than non-autistics did. ASD and Family found the time to think provided by the Internet more beneficial for communicating than Unrelated. ASD liked to use the Internet to meet people like them more than non-autistics. Non-autistics liked to use the Internet to stay close to friends and family more than ASD. Chi-square tests indicated ASD were more likely to be aware of neurodiversity than non-autistics. Of people aware of neurodiversity, ASD more frequently learned about it on the Internet than non-autistics. ASD felt more proud and content about being autistic than non-autistic people thought they would. Univariate tests indicated that non-autistic people thought people with autism should spend more time face to face and control unusual behaviors more than ASD felt they should. Non-autistic people thought the parents of people with autism should seek a cure, teach typical behaviors, and learn the cause of autism more than ASD felt they should.

Conclusions: The Internet supports communication for individuals with autism and is the medium through which they are most likely to learn about neurodiversity. ASD are more likely to espouse neurodiversity related viewpoints than non-autistics such as rejection of a cure, disinterest in the cause of autism, and positive emotions about autism. Family generally endorsed similar viewpoints to Unrelated individuals. Despite pronounced differences between individuals with autism and non-autistics in their conceptions about autism and neurodiversity, assessments of neurodiversity were far from uniform within groups.

116.141 110 Building a Knowledge Base to Support the Authoring of Social Skills Instructional Modules. F. A. Boujarwah*[1], J. G. Kim[2], M. O. Riedl[2], R. Arriaga[2] and G. D. Abowd[2], (1)*Georgia Institute of Technology, HSI*, (2)*Georgia Institute of Technology*

Background:

Difficulties with social skills are generally considered defining characteristics of HFA. Because deficits in socialization interfere with the educational experiences and quality of life of individuals with HFA, and because interventions must be highly individualized to be effective, we are interested in exploring the way technologies may play a role in assisting in the creation of customized social skills instructional modules.

Objectives:

Last year at IMFAR we presented Refl-ex, a computer-based system designed to allow the individual with autism to practice social problem solving skills by experiencing social situations and choosing appropriate responses to unexpected events. It is our goal to develop a system that will help non-experts (i.e. authors who have little or no knowledge of instructional strategies) author and share Refl-ex instructional modules. We call the authoring tool Refl-ex Authoring and Critiquing Tool (REACT).

Our first steps will be to build up the knowledge base of the authoring tool, by collecting information about individuals' cognitive scripts for every day tasks using crowd sourcing. A cognitive script is a standard event sequences we develop, which enables us to subconsciously know what to expect in particular situations. Crowd-sourcing is the process of delegating a particular task to a distributed group of people. Through this process, we will build a model that shows all the ways a situation can unfold, and possible obstacles that can arise.

Methods:

We have conducted a study in which we use crowd-sourcing strategies to elicit individuals' cognitive scripts for everyday events. Namely going to a restaurant and going to a movie. In addition, we asked participants what could go wrong at each step. The data collected is being analyzed to develop a model, which is a graph showing probabilistically how events follow each other; this model shows all the ways in which a restaurant experience can unfold. The introduction of an obstacle is salient to our pedagogical approach. For this reason our model will also enable REACT to provide the author with ideas for

obstacles and possible solutions to insert into the modules. This model will be used to build the knowledge base and provide suggestions.

Results:

The data collected from the cognitive scripts study has generated interesting results with respect to the regularity of the steps taken in a script describing an everyday task, despite the diversity in the language used. In addition, collecting large amounts of data makes it possible to create the graph of probabilities and provide diverse suggestions for language to describe a particular step.

Conclusions:

Crowd-sourcing techniques makes it possible to collect data that can be used to model knowledge in the world. In our study, we elicited participant's scripts for everyday tasks. This data has enabled us to create a model that can be used to aid authors in the creation of the instructional modules. By providing this information, and enabling collaboration between the author and the system, we believe it will be possible to create highly customized social skills instructional modules.

116.142 111 Fathers--the Forgotten Man: Psychological Experiences of Parents of Children with Autism. M. Elfert*[1] and P. Mirenda[2], (1), (2)*University of British Columbia*

Background: Child psychiatrist Leon Eisenberg wrote a paper in 1957 entitled "The Fathers of Autistic Children," in which he said, "The psychiatric literature is rife with studies of childhood disabilities in which detailed and particular attention is given to personality traits in the mother presumed relevant to the disorder in her child….Father has been the forgotten man" (p. 715). Although Eisenberg's seminal article was written more than 50 years ago, it still describes much of the research literature on parents of children with autism today. The majority of research on the experiences of "parents" of children with autism involves predominantly mothers—either exclusively or primarily—as participants.

Objectives: To analyze the literature examining psychological variables affecting the parents of children with autism with regard to the participants involved.

Methods: An exhaustive literature search was conducted to identify quantitative research studies that included measures of stress, coping, depression, anxiety, and/or social support as the primary variables of analysis. Inclusion criteria included publication in an English language peer-reviewed journal and participants who were the parents of children with autism, either exclusively or as a distinct group. Studies were categorized according to (1) the aforementioned psychological variable(s); and (2) the study participants who were involved.

Results: Out of 15 studies that investigated social support, 6 (40%) examined parents as a homogenous group (i.e., genders were not analyzed separately), 4 (27%) compared mothers to fathers, 5 (33%) examined mothers only, and none examined fathers only. Out of 21 studies investigating coping, 7 (33%) examined parents and mothers compared to fathers, 6 (29%) examined mothers only, and 1 (5%) examined fathers only. Out of 16 studies investigating depression, 2 (13%) examined parents, 9 (56%) compared mothers to fathers, 5 (31%) examined mothers only, and none examined fathers exclusively. Out of 8 studies investigating anxiety, 1 examined mothers only and the remaining 7 compared mothers to fathers. Finally, out of 36 studies investigating stress, 5 (14%) examined parents as a homogenous group, 17 (47%) compared mothers to fathers, 13 (36%) examined mothers only, and 1(3%) examined fathers only. Across all psychological variables, only one study dating back almost 20 years studied fathers' experiences exclusively (Rodrigue, Morgan, & Geffken, 1992).

Conclusions: There continues to be a dearth of research on fathers' experiences of parenting a child with autism. However, fathers have distinct psychological profiles from mothers (e.g., Ornstein Davis & Carter, 2008). Furthermore, fathers make distinct and direct contributions to both the spousal and parenting relationships (Hastings, 2003); thus, increased paternal participation in studies on parenting is both necessary and valuable. From an empirical perspective, studying fathers could provide important information about the unique experiences of this group and how they differ from (or are similar to) mothers. From a clinical perspective, research information on the "forgotten man" could be used to develop interventions that will support and assist fathers to be better parents and partners.

116.143 112 Group Parent Education for Toilet Training Children with Autism: Pilot Data. K. A. Kroeger*, *Cincinnati Children's Hospital Medical Center*

Background: Parents of incontinent children with developmental disabilities report higher personal stress and distress related to the toileting problems presented by their children than parents of toilet trained children (Macias, Roberts, Saylor, Fussell, 2006). Continence training not only increases quality of life factors for the child, but also increases the quality of life for the parents by reducing stress and subsequently for other family

members as corollary recipients of the distress. Data derived toilet training protocols have been widely developed and successfully implemented with children with autism (see Azrin & Foxx, 1971; Kroeger & Sorensen-Burnworth, 2009). However, these protocols are often delivered in external settings or if in home settings, with the intervention of clinical specialists (see Cicero & Pfadt, 2002; Kroeger & Sorensen, 2010; LeBlanc, et al., 2005). Despite the gains in toileting interventions, children with autism are still often delayed in toileting and parents continue to seek services to aid in continence interventions. It is important to determine if successful clinical procedures are able to be modified and delivered in group parent education trainings to create more access to needed intervention services.

Objectives: This pilot study aimed to investigate the effectiveness of using an empirically validated parent-delivered toilet training protocol in a parent training format delivered in a group education setting. That is, a protocol validated to be successful as an in-home training with professional support was modified to be delivered in a group education format for caregivers of children with autism.

Methods: Study participants included the caregivers of 18 children diagnosed with autism spectrum disorder who were incontinent. Caregivers were divided into two groups to establish a quasi-experimental multiple baseline across participants. A previously empirically validated toilet training protocol was modified to a group teaching presentation and delivered to study participants. Baseline data were collected prior to intervention description and intervention. Contact information to remote support during training was provided and follow-up group meeting sessions offered at one and two month post-education session intervals. Caregivers were contacted six months post participation in the group education training to determine efficacy of treatment received. Social validity data were also collected at that time.

Results: Results indicated that group delivered caregiver training may take longer to train children with autism spectrum disorders with more frequent residual post-training issues. More than half of the participants (67%) attempted training and nearly half (44%) of those who attempted successfully trained their children. Social validity appeared to be strong. Additional analyses investigating individual characteristics of the participant children are being conducted, along with qualitative analyses for those who deferred training (did not attempt to train), as well as comparisons of those who did and did not successfully train.

Conclusions: Commensurate with the established literature regarding toilet training for children with autism, parent implemented group training is effective in teaching continence. However, while effective, there appears to be areas needing continued focus including time to train, attempt to train and remediating residual training issues.

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116.008 113 Anatomical Connectivity-Based Analysis of Autism Using Diffusion Tensor Imaging. Z. Xue*[1], H. Li[1], T. M. Ellmore[2], B. Malmberg[2], R. E. Frye[2] and S. T. Wong[1], (1)*The Methodist Hospital Research Institute, Weill Cornell Medical College*, (2)*University of Texas Houston Health Science Center*

Background: Studies showed that Autism Spectrum Disorder (ASD) might result from abnormal connections among different anatomical regions rather than defects in specific brain area. Using Diffusion Tensor Imaging (DTI), inter-regional connectivity can be defined quantitatively by the white matter fiber tracts**.**

Objectives: To define inter-regional connectivity using DTI and compare them between high-functioning ASD and typically developing (TD) controls.

Methods: Ten high functioning autistics and 10 typically-developing (TD) matched subjects were studied.To define inter-regional connectivity, first, an elastic registration algorithm was recruited to align the JHU-DTI-MNI atlas onto each subject to automatically label the brain regions. Then, an improved tensor-based fast marching method was employed to simulate water diffusion dynamics to define the connectivity strengths among different regions. Specifically, the connectivity strength between two regions is defined by a combination of the fast marching results, “time map” and “velocity map”, which starts the diffusion simulation from one region and terminate to another. Faster diffusion between these two regions indicates denser, highly oriented fibers, or stronger connectivity between them. Finally, the connectivity strengths among 46 selected anatomical regions from the cortical surface were quantified, and statistics analysis was performed to study the connectivity strength of autistics by comparing with that of controls.

Results: Statistical analysis on the connectivity strength between each anatomical region pair showed that the regions with a large number of significantly different stronger connections in ASD compared with TD (p-value<0.05) include the left and right superior occipital gyri, supramarginal gyri, and

the left middle occipital gyrus, angular and pre-cuneus. Among the 67 significantly stronger connections (p-value<0.05), the smallest p-values were from the connections between cuneus (R) and middle occipital gyrus (R), pre-cuneus (L) and supramarginal gyrus (L), inferior frontal gyrus (L) and superior parietal lobule (L), inferior frontal gyrus (R) and superior parietal lobule (R) as well as superior parietal lobule (L) and supramarginal gyrus (L). On the other hand, the regions with a large number of significant stronger connections in TD compared to ASD include the left inferior temporal gyrus, inferior frontal gyrus, middle frontal gyrus, insular and lateral fronto-orbital gyrus. Among the 16 significantly different connections, the top lists are those between inferior temporal gyrus (L) and lateral fronto-orbital gyrus (L), inferior temporal gyrus (L) and middle fronto-orbital gyrus (L), inferior temporal gyrus (L) and precentral gyrus (L), inferior temporal gyrus (L) and insular, as well as inferior frontal gyrus (L) and supramarginal gyrus (L). After reordering the average connectivity matrix and permuting rows and columns so that highly connected regions are rearranged as neighboring index, three local clusters can be clearly seen from the connectivity matrix, and the majority of the above significantly different connections are within these clusters, indicating local stronger connectivity within left and right occipital, temporal, parietal lobes.

Conclusions: A novel inter-region connectivity quantification algorithm was proposed, and statistical analysis showed that high-functioning ASD have more local connectivity among brain regions as compared to TD, and significantly different connections were found in visual and multimodal integration regions.

116.009 114 Brain Activation Changes In Autism During Learning In a Spatial Working Memory Task. S. E. Schipul*[1], D. L. Williams[2] and M. A. Just[1], (1)*Center for Cognitive Brain Imaging, Carnegie Mellon University*, (2)*Duquesne University*

Background: Impaired learning in autism has been studied behaviorally in several tasks (e.g. Mostofsky et al., 2000; Plaisted et al., 1998). Although numerous studies have examined learning-related changes in brain activation in neurotypical individuals (see Kelly and Garavan, 2005 for a review), few have examined learning-related brain activation changes in autism. Two studies have shown that the decreases in activation with learning are smaller or non-existent in autism, compared to neurotypical participants (Müller et al., 2004; Schipul et al., under review). These findings suggest that fundamental brain mechanisms of learning may be deficient in individuals with autism.

Objectives: This fMRI study investigated whether there are learning-related brain activation atypicalities in individuals with autism over the course of learning the locations of objects.

Methods: 13 high-functioning adult individuals with autism and 13 age and IQ matched neurotypical individuals learned the locations of 10 objects around the perimeter of a circle. The experiment began with a pretest, consisting of one block each of Passive Viewing and Recall. In the Passive Viewing block, participants viewed the objects as they were exposed at their locations, one at a time, for 2500 ms each. The Recall block followed to behaviorally assess the participants' knowledge of the objects' locations. Following the pretest was the training session, which consisted of 6 Training blocks of a working memory recall task. In each Training block participants decided whether or not the location of the currently-presented object was adjacent to the object shown on the previous trial, a working memory demand that recruits frontal regions which often have atypical activation in autism. Following the training session was the posttest, which consisted of one Passive Viewing block and one Recall block. The entire run of the pretest, training, and posttest was repeated later in the scanning session with a new set of 10 different objects. Behavioral performance and brain activation were compared before and after learning within and between experimental sessions.

Results: Both groups showed significant decreases in activation across 6 blocks of Training in frontal, temporal, parietal, and occipital regions. However, between the pretest and posttest Passive Viewing blocks, the autism group showed a significantly smaller decrease in activation in frontal, temporal, and parietal regions relative to the neurotypical group. The behavioral data showed that both groups improved at the task as they learned and the performance was comparable between the two groups throughout the experiment.

Conclusions: The autism participants showed the typical learning-related decreases in brain activation across Training blocks, but failed to do so during Passive Viewing blocks. These findings suggest that the learning-related brain activation of individuals with autism may be typical during the acquisition of a skill, but atypical during passive visual encoding in the context of new knowledge.

116.010 115 The Costs and Benefits of a Larger Brain: The Relationship Between Head Circumference and Autism-Related Traits In Typically Developing Children 12-65 Months Old. J. C. Sullivan*, S. Baron-Cohen and A. Humphrey, *University of Cambridge*

Background: Differences in childhood head circumference (HC), especially in growth patterns and size, are one of the few consistent findings in the study of autism spectrum disorders. While individual variations in HC have robustly been found to correlate positively with measures of intelligence in typically developing children, little work has investigated the relationship between HC and autistic-like traits known to occur at sub-clinical levels in the general population.

Objectives: This study utilised typically developing children with no history of autism in the family to explore whether HC size relates to individual differences in two types of behaviours related to the autism phenotype, sensory processing dysfunction and restrictive/repetitive behaviours.

Methods: HC was measured either by a researcher or by a parent in 68 children aged 12-65 months and computed into z-scores after accounting for gender and age using the LMS method (Cole & Green, 1992). Sensory processing was assessed in the 30-65 month old children using the Short Sensory Profile (SSP; McIntosh, Miller, & Shyu, 1999; n=41), and repetitive behaviours in the 12-65 month old children by the Repetitive Behaviours Questionnaire (RBQ; Leekam et al., 2007; n=63). A measure of intelligence, the Mullen Scales of Early Learning (Mullen, 1995) was also administered to a subset (n=47) of these children.

Results: Correlation analysis revealed that larger HC was significantly associated with higher IQ scores (r=.403), greater total sensory processing problems (r=-.530) and total repetitive behaviours (r=.339), specifically on the insistence on sameness (IS) scale but not the repetitive and sensorimotor (RSM) scale. Controlling for IQ did not change the pattern of correlations between HC and autistic-like traits. Moreover the two questionnaires were strongly correlated with each other and IQ correlated negatively with the RSM scale of the RBQ (r=-.335) but not the IS scale.

Conclusions: These results are discussed with regards to the spectral nature of autistic-like traits in the general population and what this implies for autism, as well as a consideration of the implications for the study of normal brain development and intelligence.

116.011 116 False Beliefs and Intentions: Can the Brain Tell the Difference?. S. Carrington*[1] and A. J. Bailey[2], (1)*Cardiff University*, (2)*University of British Columbia*

Background: The results from neuroimaging studies of Theory of Mind (ToM) are heterogeneous, implicating numerous brain regions, including the medial prefrontal cortex, temporoparietal junction, and superior temporal regions. A recent review (Carrington & Bailey, 2009) concluded that although a clear confound, paradigmatic variation could not adequately account for the heterogeneity of these findings. Nevertheless, there was some evidence suggesting that false belief and deception might be associated with dissociable neural substrates. Reduced or spatially altered activity has been reported in several brain regions typically associated with ToM in individuals with ASD (e.g. Gilbert et al., 2009; Kana et al., 2009). To the best of our knowledge, however, within-subject comparison of activity evoked by different mental states has not been investigated in ASD.

Objectives: To determine whether the attribution of false beliefs (FB) and intentions (INT) was associated with dissociable patterns of brain activity in both typically developing (TD) individuals and individuals with an ASD.

Methods: Behavioural and fMRI data were acquired for 22 TD individuals and 20 individuals with ASD. ToM was explored using a comic strip paradigm based on the task developed by Sarfati et al. (1997). The original paradigm included three conditions, one involving mental states (INT) and two physical causality control conditions, one including characters (CP) and one with objects only (CO). Novel stimuli were developed for each of these conditions and an additional ToM condition: false belief (FB).

Results: Both groups were slowest and least accurate in the FB condition. The ASD group were consistently slower and less accurate than the TD group. In both groups, both INT and FB evoked significantly more activity than either CP or CO in a region of the posterior cingulate cortex and the ventral precuneus (PCC/precuneus). Moreover, CP did not evoke significantly more activity than CO in this region, suggesting that ToM-related activity was not attributable simply to the presence of people. FB evoked significantly more activity than any of the other conditions in the dorsomedial prefrontal cortex (dmPFC). Although similar patterns of activity were observed in both groups, there was a small cluster in the PCC/precuneus where the increase in activity evoked by INT compared with CP was significantly greater in the ASD group compared with TD ($p<0.005$, uncorrected for multiple comparisons). Furthermore, post hoc ROI analyses and comparison of each condition with baseline indicated less selective engagement of the dmPFC for FB in the ASD group.

Conclusions: Consistent with previous neuroimaging studies, ToM was associated with activity in the dmPFC and PCC/precuneus. The data extended previous knowledge by demonstrating that the PCC/precuneus appeared to be

engaged during ToM reasoning regardless of the mental state, while the dmPFC was more selectively engaged for the attribution of FB. Group differences were subtle, but suggested less specialisation of the dmPFC for FB in ASD. Furthermore, activity in the PCC/precuneus differentiated less between INT and CP in the TD group compared with ASD, perhaps suggesting more spontaneous mental state attribution evoked by the presence of people.

116.012 117 Low Sensory Reliability In Autism. I. Dinstein*[1], R. Malach[1], L. Lorenzi[2], D. J. Heeger[3] and M. Behrmann[2], (1)*Weizmann Institute of Science*, (2)*Carnegie Mellon University*, (3)*New York University*

Background: Several prominent theories of autism including the "enhanced perceptual functioning" (Mottron 2001), "weak central coherence" (Frith 1995), and "intense world" (Markram 2007) theories suggest that autism is characterized by sensory abnormalities, which are intimately related to the "core" social/cognitive symptoms of autism. Yet there is remarkably little examination of the integrity of sensory cortices in autism with which to support or refute these hypotheses. In the current study, we use functional neuroimaging to focus on a basic neural response characteristic – reliability. 'Reliability' here refers to the "within-subject" consistency of neural responses across multiple trials. Reduced sensory reliability may cause the world to be perceived as a confusing inconsistent environment and, thereby, be related to the manifestation of autistic behavioral symptoms.

Objectives: To compare the reliability of basic visual, auditory, and somatosensory neural responses across individuals with autism and age-, gender-, and IQ-matched typical adults. We hypothesized that decreased neural reliability may be evident in multiple sensory systems of individuals with autism.

Methods: We used functional magnetic resonance imaging (fMRI) to measure response reliability in a group of high functioning adult individuals with autism and matched typical controls. All subjects were presented with the same stimulus in multiple trials and the response variability was estimated across trials. The visual stimulus contained visual motion (coherently moving dots), the auditory stimulus contained pure tones, and the somatosensory stimulus contained air puffs to the hand. Subjects performed an unrelated orthogonal visual task (rapid letter detection) to control attention throughout all of the experiments.

Results: Individuals with autism exhibited equivalent response amplitudes, on average, to those of matched controls, in all three modalities yet showed significantly reduced response reliability (larger between trial variability). This result was evident to different extents in the three sensory modalities tested.

Conclusions: This is the first study to compare responses in three sensory modalities between individuals with autism and matched typical controls. The results show normal/equivalent response amplitudes, on average, in all sensory areas rather than hypersensitive responses as predicted by the "intense world" theory (Markram 2007). However, response reliability was reduced in all of the sensory areas examined, suggesting that individuals with autism may be perceiving an "inconsistent world". Individuals with autism exhibited abnormal neural responses at the earliest stages of sensory processing in response to "basic" stimuli, which have little social or cognitive value. This suggests that autism might be characterized by widespread neural abnormalities rather than selective abnormalities limited to cognitive, social, and/or emotional brain areas. Whether these abnormal neural characteristics of sensory cortices are related to the triad of behaviors that characterize autism, remains to be determined.

116.013 118 Neural Activation In Response to Sensory Stimuli In Adolescents and Children with and without ASD. S. A. Green*, D. Shirinyan, N. L. Colich, J. D. Rudie, M. Dapretto and S. Y. Bookheimer, *University of California, Los Angeles*

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 the 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). Theories about the neural basis of SOR include abnormal sensory gating in the thalamus (Hardan et al., 2008), and disruption of normal activation and processing by the limbic system, including the amygdala (Hitoglou et al., 2010; Waterhouse et al., 1996). However, the neural bases for SOR are still unknown, and as of yet no functional MRI (fMRI) studies of SOR have been conducted in children with ASD.

Objectives: The purpose of this study was to examine differences in brain response to mildly aversive sensory stimuli in children with ASD and TD children.

Methods: Participants were 11 children and adolescents with ASD and 11 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. After the fMRI scan, participants were asked to rate on a scale from 1-10 how much each trial type bothered them and how much they wanted each trial type to stop. Participants' mothers rated their symptoms of SOR with the Sensory Profile (Dunn, 1999) and Sensory Over-Responsivity Inventory (Schoen et al., 2008).

Results: The ASD group was rated as having significantly higher symptoms of SOR than the TD group. During the fMRI task, both groups showed significant activity in visual and auditory cortices. However, during the visual task, the ASD group showed significantly more activation in the lateral geniculate nucleus of the thalamus and downstream primary and secondary visual cortex. During the auditory task, the ASD group showed significantly more activation in the amygdala and auditory cortex.

Conclusions: Findings suggest that children with ASD exhibit hyperactivation of the thalamus and amygdala while processing mildly aversive sensory stimuli. A lack of inhibition and/or habituation of these areas may lead to hyperactivity of the sensory cortical areas and may thus be more likely to lead to a sense of overstimulation These findings support theories that SOR is related to abnormal thalamus and amygdala activity and that there may be a bottom up abnormality in primary sensory modulation.

116.014 119 Reward System Response to Highly Salient Social Rewards In Autism. D. Shirinyan*[1], J. Hopkins[2], J. D. Rudie[3], M. Dapretto[4] and S. Y. Bookheimer[4], (1)*UCLA, Center for Autism Research and Treatment*, (2)*UCLA Center for Autism Research and Treatment*, (3)*UCLA*, (4)*University of California, Los Angeles*

Background: The social motivation hypothesis (Dawson et al., 1998b, 2005; Schultz, 2005) of autism spectrum disorders (ASD) holds that social stimuli are not experienced as rewarding for children who later develop an ASD, and that this lack of reward leads to reduced social and affinitive behaviors and interests later in life. Recent neuroimaging work (Scott-Van Zeeland et al., 2010; Schmitz et al., 2008) has begun to focus on neural response to rewards in the canonical reward system which includes the ventral striatum (VS), subcallosal, anterior cingulate (ACC), and orbitofrontal (OfC) cortex. Thus far, only one study (Scott-Van Zeeland et al., 2010) has tested the neurophysiological extension of the social motivation hypothesis finding hypoactivation of VS and thus supporting the social motivation hypothesis.

Objectives: While VS hypoactivation to social rewards has been observed in adolescents with ASD, we aim to test whether the reward system in ASD is unresponsive to social rewards or whether the neural response to social rewards in ASD is circumscribed to highly salient social rewards.

Methods: We conducted an fMRI study with 21 (4 female) ASD and 19 (3 female) typically-developing (TD) participants who were equivalent on age, IQ, and head motion, using highly salient social rewards in the context of a modified Weather Prediction Task (WPT: Knowlton et al., 1994). The task is a probabilistic learning paradigm where participants were presented abstract images and asked to respond as to whether a given picture is in group 1 or group 2. Pictures of the child's primary caregiver, were used as the highly salient social stimuli. Pictures of the mother were taken immediately before the fMRI study and incorporated into the program. A smiling picture of the mother was shown after correct responses, and a "sad" or "disappointed" picture of the mother was shown after incorrect responses.

Results: The TD group demonstrated greater VS and amygdala activation to the highly salient social rewards minus rest (fixation cross) compared to the ASD group while the ASD group demonstrated greater activation of subcallosal cortex and ACC than the TD group for this same contrast.

Conclusions: These findings indicate that rather than being unresponsive to social rewards, when the social rewards are highly salient, children with ASD show what may be a compensatory pattern of activity in nodes of the reward system outside of the VS. The areas shown to be hypoactive in ASD are consistent with those reported by Scott-Van Zeeland et al (2010) in response to low salience social rewards vs. penalty (sad face). Similarly, the areas showing hyperactivation in ASD are areas where Scott-Van Zeeland et al reported significant within group activation in the ASD group for social rewards vs. penalty. The present findings indicate that children with ASD *do* activate some nodes of the reward system; however, the pattern of activation is different than that observed in TD children and may represent neural compensation in regions activated for even low salience social rewards.

116.015 120 Social and Non-Social Memory In Autism: Delineating the Role of the Hippocampus and Amygdala. R. S. Brezis*[1], D. Pham[2], O. L. T. Wong[2] and J. Piggot[3], (1)*University of Chicago*, (2)*UCLA*, (3)*University of California, Los Angeles*

Background: Studies of memory abilities in ASD have consistently shown a discrepancy between difficulties in

episodic memory for personally experienced events, relative to a preserved semantic memory for facts (Boucher and Bowler, 2008). How may we explain these findings? Are autobiographical memory deficits simply the extreme of a graded scale of information-processing deficits (Happe and Frith, 2006; Minshew and Williams, 2007), or do they present a qualitatively independent impairment in the social domain (Baron-Cohen et al., 2000, Hobson et al., 2006)? Further, on the neurobiological level, can they be traced to structural differences in the hippocampus or amygdala (Salmond et al., 2005), which are associated with memory in typically developing individuals? Previous studies of memory abilities in autism have generally compared simple semantic recall with complex episodic recall (Crane and Goddard, 2008; Losh and Capps, 2003; Klein et al., 1999), thus precluding the possibility of directly testing each alternative hypothesis. The present study aims to disentangle the underlying components of episodic and semantic memory, extending previous studies through carefully controlled behavioral measures, and through voxel-based morphometry of the hippocampus and amygdala.

Objectives: (1) To disentangle the relative importance of information-processing deficits from self- and social-processing deficits in ASD using episodic and semantic memory tasks matched for level of complexity. (2) To determine whether deficits in memory in autism can be traced to abnormalities in the hippocampus or 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). Sub-tests from the NEPSY-II were used to obtain standardized measures of social and non-social semantic memory and organizational ability. The experimental tasks included a Levels-of-Processing task (based on Toichi et al., 2002) and a narrative recall task (based on Crane and Goddard, 2008) comparing memory for self, mother and favorite fictional character. 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: The TD group performed overall higher than the ASD group in all memory conditions ($p=0.009$); with post-hoc tests revealing a significant difference in semantic memory ($p=0.001$), memory for self ($p=0.013$), and memory for mother ($p=0.015$). Further, memory for self was found to be positively correlated with a test for organizational ability ($r=0.353$; $p=0.003$), yet did not correlate with a test for social memory ($r=0.208$; $p=0.087$)
Further analyses are underway to determine the relation between these behavioral results and anatomical regions of interest.

Conclusions: These preliminary results suggest that the pattern of memory abilities in autism may be driven by a broad deficit in information-processing, rather than a specific deficit in social information-processing. Further analyses will determine the relation between these behavioral memory patterns and brain structure.

116.016 121 Brain Mechanisms for Processing Social Approach: Relationships to Autistic Traits. M. B. Farmer*[1], M. Shiffrar[2], K. A. Pelphrey[1] and M. D. Kaiser[1], (1)*Yale University*, (2)*Rutgers University*

Background: Disrupted social perception and cognition is a core feature of autism spectrum disorder (ASD). Social interactions begin with the approach of one person towards another; biological motion (eye, face or whole body motion) typically conveys this intent for social engagement. Researchers have documented ASD-related disruption in the brain mechanisms for perceiving the intent for social engagement (vis-à-vis direct vs. averted gaze). However, the perception of approaching versus passing full body biological motion has never been directly studied. Further, while brain mechanisms for biological motion perception have been implicated in ASD (Kaiser et al., 2010, *PNAS*), no study to date has used functional magnetic resonance imaging (fMRI) to specifically examine the relationship between autism and the perception of approaching versus passing human motion.

Objectives: We sought to characterize the brain mechanisms for processing approaching versus passing biological motion in typically developing adults and to examine the relationship between autistic traits and such mechanisms. This study also serves to develop a task to investigate this neural circuitry in individuals with autism.

Methods: During an fMRI scan, 19 typically developing adults (mean age = 23.80 ± 2.85) viewed masked point-light displays of an emotional human figure either approaching (walking towards) or passing (walking left-to-right or right-to-left). Participants viewed each stimulus (3 second duration) in a pseudo-random order and then reported (2 second query) with Y/N button-press whether they detected a walker in a masking cloud of dots. There were 18 stimuli, each shown twice over the

course of the experiment. Participants also completed the Autism-Spectrum Quotient (AQ).

Results: At the behavioral level, participants exhibited equivalent detection (accuracy and reaction time) of approaching and passing walkers. However, an RFX GLM (q = .001, k = 40) identified brain regions that were differentially responsive to approaching versus passing walkers. We examined the relationship between AQ scores and beta values in each of the regions identified in the above contrast. AQ scores (ranging from 3-20) negatively correlated with the response to approaching walkers in the right temporoparietal junction (r = -.474, *p* = .020) and the left cerebellar tonsil (r = -4.14, *p* = .039).

Conclusions: We conducted an fMRI study that identified brain regions for processing approaching and passing human locomotion and further discovered that autistic traits predict brain response to socially engaging stimuli in two brain regions. These regions, the left cerebellar tonsil (Sokolov et al., 2010, *Cerebral Cortex*) and the right temporoparietal junction (Saxe, 2006, *Current Opinion in Neurobiology*) play a key role in action observation and other social cognition tasks relating to social engagement. This study illustrates a tight coupling of autistic traits and disrupted mechanisms for fundamental aspects of social cognition (i.e., the critical detection of intent for social engagement). Future studies will examine such mechanisms in children with autism.

116.017 122 Neural Network Associated with Social Cognition and Communication In Adults with ASD: A Structural MRI Connectivity Study. E. Anagnostou*[1], E. G. Duerden[2], K. A. R. Doyle-Thomas[1], M. J. Taylor[3], L. V. Soorya[4], A. T. Wang[4] and J. Fan[4], (1)*Holland Bloorview Kids Rehabilitation Hospital*, (2)*The Hospital for Sick Children*, (3)*Hospital for Sick Children*, (4)*Mount Sinai School of Medicine*

Background:

Social interaction impairments in adults with autism spectrum disorder (ASD) include difficulties with recognizing emotions, mentalizing, social conversation, and atypical verbal and nonverbal communicative emotional gestures. Previous neuroimaging studies with individuals with ASD have found either abnormal functional or structural changes in the social brain network (orbitofrontal cortices [OFC], fusiform gyri, posterior superior temporal sulci [pSTS], amygdalae, temporo-parietal junction, cingulate gyri and anterior temporal cortices) and the mirror neuron system (inferior frontal gyri, fusiform gyri, inferior occipitotemporal gyri); however, no study has examined their cortical structural anatomical connectivities in relation to impaired social cognition and communication.

Objectives:

To determine the relation between brain structures in the social brain and mirror neuron networks with social cognition and communication deficits, by measuring cortical thickness and performing structural connectivity analysis on anatomical MRIs, and ASD symptomatology.

Methods:

Cortical thickness measurements were made on the anatomical MRIs of 19 adults (age=26.8 ± 5.7 years; 16 males) diagnosed with ASD by a trained neurologist and met criteria specified by the Autism Diagnostic Observation Schedule-Generic (ADOS-G) and the Autism Diagnostic Interview Revised (ADI-R). We examined the association between cortical morphology and autism symptom severity in social and communication domains as determined by the ADOS. Data were analyzed using a general linear model controlling for the effects of age and sex, and regional differences in cortical thickness were examined using a cluster analysis, correcting for multiple comparisons according to random field theory with a $p<0.05$.

Results:

A directed search in the left OFC revealed a significant inverse correlation (p=0.01) with thickness in this region and scores for the social and communication domains of the ADOS. We then explored the structural connectivity associated with the left OFC to identify a network of brain areas related with social cognition and communication in ASD. Based on a whole brain search, significant positive correlations were seen in the left parahippocampal gyrus (p=0.02) and the right mid-cingulate gyrus (p=0.001). Non-significant negative structural correlations were seen in the right posterior superior temporal gyrus and the lateral temporo-occipital gyrus.

Conclusions:

Our results indicate that varying levels of social cognition and communication impairments in adults with ASD rely on differing cortical networks. Less severe deficits in social cognition and communication were associated with greater thickness in limbic and paralimbic brain regions while more severe impairments showed an inconsistent pattern of regional connectivity more associated with temporal lobe structures.

116.018 123 Object-Based Attention Modulation to Social and Nonsocial Stimuli In Children with Autism Spectrum

Disorders. J. A. Eilbott*, D. Z. Bolling, S. M. Lee, K. A. Pelphrey and B. C. Vander Wyk, *Yale University*

Background: Autism spectrum disorders (ASD) are characterized by a triad of deficits, one of which is profound social impairment. Debate continues as to whether these social deficits arise from a specific inability to process social stimuli or a more general deficiency in complex information processing. A recent functional MRI (fMRI) study in our lab suggests the former; when compared to typically developing (TD) individuals, those with ASD showed reduced brain activation in response to social stimuli (faces), yet preserved activation to nonsocial stimuli (houses). Past fMRI studies, including one by Bird and colleagues (2006), provide further evidence of preserved nonsocial processing in adults with ASD. These past studies predominately used simple tasks manipulating spatial attention in adult participants. Few, if any, have examined the neural basis of preserved nonsocial object processing in children with ASD, or directly tested in children how attention differentially modulates brain activity in regions exhibiting category specific function.

Objectives: Using fMRI we aim to investigate whether activation of the brain regions associated with faces and houses (social and nonsocial stimuli) in typical adults is modulated by implicit object-based attention in children with and without ASD.

Methods: Adapting a study of object-based attention in adults from Kanwisher and colleagues (1999), subjects view an image of a face transparently superimposed over an image of a house. In alternating blocks, one image oscillates while the other remains static. Subjects are tasked with monitoring motion for a change in oscillation direction, without specific instruction to attend to which image is moving. Differential processing of face and house images can then be assessed by measuring BOLD signal from each participant's fusiform face area (FFA) and parahippocampal place area (PPA), respectively. Individual differences in symptom severity and social responsiveness are being assessed in participants to corroborate brain data.

Results: Based on previous studies of object based attention in typical adults, we expect that in typically developing children object-based attention, even when implicitly directed, will modulate activity in the FFA during face processing and in the PPA during house processing. In children with an ASD, we expect typical modulation of PPA and reduced modulation of FFA. We also anticipate that the degree of modulation in the FFA will vary as a function of autism symptom severity in ASD and as a function of social responsiveness regardless of group membership. To date, preliminary results from three participants (2 TD, 1 ASD) are consistent with these predictions.

Conclusions: The processes of perception and attention parse the world into discrete meaningful units. Here we argue that impairments in ASD arise, at least in part, from deficits in these processes specifically for social stimuli. By charting the patterns of neural activation to social and non-social stimuli in children with and without ASD, we can begin to better understand the nature of the unique constellation of deficits that we observe in ASD and begin to understand the basis of the observed heterogeneity in the disorder.

116.019 124 Patterns of Brain Activation Among Children with ASD When Observing Joint Vs. Parallel Play. J. Letzen*, R. T. Schultz, E. T. Hunyadi, M. Riley, J. M. Taylor and J. D. Herrington, *Children's Hospital of Philadelphia*

Background:

Deficits in social information processing are well established in Autism Spectrum Disorders (ASD). A substantial literature now exists linking these deficits in ASD to activation abnormalities in specific brain areas such as superior temporal sulcus (STS) and ventromedial prefrontal cortex (vmPFC). However, this literature is based on paradigms that are often quite distinct from real-world social perception – e.g., still-photos of faces and people, cartoons, or anthromorphized shapes. Very few ASD studies have tested the performance of the "social brain" during the perception of naturalistic social stimuli.

Objectives:

The present study examined differences in brain activity between children with ASD and a typically developing control group (TDC) while viewing naturalistic movies of children playing during two different conditions: joint play or parallel play.

Methods:

FMRI data were collected from ASD (n=11; 9 male) and TDC (n=17; 6 male) participants as they watched video clips of joint and parallel play. Additional data collection is ongoing in order to balance groups by gender, and to match on IQ. The only instruction given to participants was to attend to the movies. Following the paradigm, participants completed a recognition task to assess their attention to the stimuli. FMRI data analyses included traditional GLM-based procedures as well as

techniques for measuring spatio-temporal patterns of coordinated activity (independent components analysis).

Results:

Mixed-effects analysis showed decreased activation ($p<.05$, cluster corrected) of social brain areas in ASD (including STS and vmPFC) during the perception of joint versus parallel play. Connectivity analyses also revealed important group differences in the interactions between brain structures. Both groups were more than 95% accurate on the post-scan recognition task, with no group differences.

Conclusions:

The present data are among the first to establish differences in social brain function among individuals with ASD during the perception of naturalistic social interactions. In addition to more closely replicating real-word interactions, dynamic social stimuli appear to be well suited to eliciting sustained, system-wide differences in brain connectivity that may be absent from studies relying on static or anthromorphized stimuli. These results suggest that individuals with ASD might not appreciate differences in the manipulation of social interactions (joint vs. parallel play) used in this study.

116.020 125 Self-Other Correspondence In Joint Attention and Autism. J. H. G. Williams*, M. McWhirr and G. D. Waiter, *University of Aberdeen*

Background:

It has been argued that impairment in self-other correspondence may constitute core impairment in autism that applies to joint attention (JA) possibly through impaired function of mirror neurons. Deficits in JA are strong diagnostic indicators of autism. An important feature of JA is that 2 or more people maintain an awareness that they have a common focus of attention. This may depend upon self-other correspondence processes that serve to relate perceived action to enacted gaze-direction. We recently developed an fMRI paradigm to explore the neural correlates of correspondence between self and other for gaze direction and hypothesized that they would be affected by autism.

Objectives: To compare participants with and without autism in an fMRI study of joint attention.

Methods:

Stimuli consisted of video clips whereby a dot moved randomly between 4 corners of the screen. Participants were instructed to follow the target dot by looking at it as it moved. In the centre of the screen, was either a person's head or an arrow. In 3 conditions, the person was seen to a) look at the dot as it moved (congruous condition), b) make similar movements but direct attention to a different corner of the screen (incongruous condition), or stay still (baseline). In 3 further conditions, the head was replaced by a symbolic stimulus in the form of an arrow (for incongruous and incongruous conditions) or a bar (for baseline). 13 adolescent participants with normal IQ and autism, and 13 age and IQ matched controls were participants.

Results:

Clusters in medial frontal cortex and the intra-parietal cortex resulted from a group difference in an interaction between cue-type and congruity. Both clusters were driven by greater activity in the incongruous compared to the congruous condition for faces, contrasted with the opposite for arrows. Therefore, intraparietal and medial frontal cortex were engaged by the arrow in an opposite way to the face, being active according to whether the direction of the arrow matched, or the direction of the face mismatched the direction of action being executed by the observer. This interaction only occurred for controls and the autism group showed no effect of condition at these locations. No group differences for the arrow vs face contrast meant these results cannot be explained as differences in attention to faces.

Conclusions:

The parietal brain area that was more active in the control but not the autism group is particularly concerned with providing control in the presence of competing demands for visual attention. The area of medial frontal cortex that was more active in the control but not the autism group is associated with mental state attribution. The presence or absence of correspondence between action-direction executed by the self and perceived action-direction had marked influence on activity in these areas, suggesting that detection or monitoring of self-other correspondence is very relevant to mental state attribution and control of visual attention. This absence of this in people with autism supports the hypothesis that a deficit in self-other correspondence underlies problems with both social cognition and executive function.

116.021 126 Self-Other Differentiation In Cortical Midline Structures Is Atypical In Children and Adolescents with High-Functioning ASD. J. H. Pfeifer*[1], J. S. Merchant[1], N. L. Colich[2], J. D. Rudie[2] and M. Dapretto[2], (1)*University of Oregon*, (2)*University of California, Los Angeles*

Background: Autism Spectrum Disorder (ASD) is being increasingly characterized not only by aberrant patterns of interaction with others, but atypical development of the self. Research suggests children with ASD show impairments in autobiographical memory and significantly less rich social self-concepts that incorporate less social-comparative or interpersonal contextual information. Recent social neuroscience studies have documented differences in brain functioning that may underlie these atypical self-appraisals in ASD. Self-evaluative processing is commonly associated with activity in cortical midline structures (CMS), including medial prefrontal cortex (mPFC) and medial posterior parietal cortex (mPPC), in neurotypical (NT) children, adolescents, and adults. However, in adults with ASD there appears to be a lack of differentiation between self and other in mPFC (Lombardo et al., 2010). It is as yet unknown how the neural foundations of self-evaluative processing differ between NT and ASD groups earlier in development, but such information is critical to understanding and ultimately intervening to ameliorate the consequences of atypical self-development in ASD.

Objectives: Explore self-other differentiation in CMS displayed by children and adolescents (NT vs. ASD) across two domains (social vs. academic competence).

Methods: Participants were 18 youth with high-functioning ASD aged 8.8-17.8 (1 female, diagnoses confirmed via ADI-R/ADOS-G) and 18 age-, gender-, and IQ-matched NT controls. During fMRI, participants reported whether phrases describing social or academic attributes and abilities described themselves or a familiar, fictional young character (i.e., Harry Potter), in counterbalanced order. Data were preprocessed and analyzed using FSL, SPM, and MarsBaR, including: i) brain extraction, realignment, coregistration, normalization, and spatial smoothing, ii) constructing first-level (fixed effects) and second-level (random-effects) models, and iii) interrogating regions of interest.

Results: Replicating previous fMRI studies, NT youth demonstrated greater engagement of CMS when making self-evalutions vs. other-evaluations. However, youth with ASD did not show a comparable effect. Direct comparisons between groups showed that, relative to youth with ASD, NT youth exhibited significantly more anterior rostral and ventral mPFC activity, as well as more activity in dorsal anterior cingulate cortex (during self>other). Meanwhile, relative to NT youth, youth with ASD demonstrated significantly more activity in dorsal PFC (both medial and lateral aspects) during the opposite contrast (other>self), as well as more activity in bilateral anterior insula. However, when comparing self-evaluations in the social and academic domain directly, both NT youth and youth with ASD engaged mPFC relatively more during the former than the latter.

Conclusions: The results of this initial study exploring the neural correlates of self/other appraisals in youth with ASD suggest that similar to adults with ASD, they do not engage mPFC more during self-evaluations than other-evaluations. Failure to preferentially engage mPFC during self-evaluations in youth with ASD may indicate a lack of self-other differentiation, already hypothesized to be one factor contributing to atypical self-development. However, youth with ASD may show a more normative response when the task encourages them to make self-evaluations in the social than academic domain. This identifies potential targets for interventions to enrich self/other perception in youth with ASD.

116.022 127 Serotonergic Modulation of Go/No-Go Executive Function Task In People with Asperger: An fMRI and Acute Tryptophan Depletion Study. E. Daly*[1], Q. Deeley[2], C. Ecker[2], N. Gillian[1], D. Spain[3], K. Rubia[4], C. M. Murphy[5], P. Johnston[6] and D. G. Murphy[2], (1)*Institute of Psychiatry, Kings College London*, (2)*Institute of Psychiatry, King's College London*, (3)*south london and maudsley nhs foundation trust*, (4)*King's College London, Institute of Psychiatry,*, (5)*King's College London, Institute of Psychiatry*, (6)*King's College London*

Background: One of the triad of impairments characterising Autistic Spectrum Disorder (ASD) is stereotyped, repetitive and obsessional behaviours. It is proposed that these symptoms may be related to executive functions difficulties including inhibitory control set shifting. Compared to a control group, people with ASD showed increased brain activation when performing a go/no-go test, a motor inhibition task during a functional Magnetic Resonance (fMRI) experiment. Impulsiveness is known to be mediated by the neurotransmitter serotonin (5-HT), and the 5-HT system is abnormal in ASD. The serotonergic system in the brain can be manipulated with the technique of Acute Tryptophan Depletion. (ATD).

Objectives: To study the modulatory role of 5-HT on stereotyped and repetitive behaviours in ASD. The hypothesis is that modulation of the serotonergic neurotransmitter system by acute tryptophan depletion would differentially affect brain activity when performing a go/no-go motor inhibition task by people with ASD and controls.

Methods: We studied 14 high-functioning right handed adult male volunteers clinically diagnosed by ICD-10 as having

Asperger's Syndrome and 14 healthy age, gender, handedness and IQ matched controls. 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 go/no-go motor inhibition task. 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: On the sham day blood tryptophan values were increased and on the ATD day reduced for both groups. There was no effect on the performance of the go/no-go task based on drink. There were inteactions of 5-HT status and group in right middle temporal lobe and left hippocampus.

Conclusions: People with Asperger show effects of serotonergic manipulation in the brain regions involved with performing a motorinhibition task and these effects differ from the results in a well-matched control group.

116.023 128 The Effect of Object Goals and Visibility on the Mirror Neuron System In Autism and Typical Development. J. J. Pokorny*[1], N. V. Hatt[2], C. Colombi[3], G. Vivanti[1], S. J. Rogers[4] and S. Rivera[2], (1)*The M.I.N.D. Institute, University of California at Davis Medical Center*, (2)*University of California, Davis*, (3)*University of Michigan*, (4)*UC Davis M.I.N.D. Institute*

Background:

The mirror neuron system (MNS) consists of interconnected brain regions, namely the inferior frontal gyrus (IFG) and the inferior parietal lobe (IPL). First discovered in monkeys, the MNS contains neurons that respond similarly when an individual observes an action, such as reaching for a cup, or executes the same action. One difference between the monkey and human MNS is that the monkey MNS only responds when an object is present as the goal of the action, while the human MNS will respond to meaningless or pantomimed gestures that do not have objects present. It has been hypothesized that this system underlies the ability to understand the actions of others, including their goals and intentions. These are skills that individuals with autism often have demonstrated difficulty, leading to the broken mirror theory of autism (Williams et al., 2001). However, it appears that some skills that rely on the MNS are not compromised in ASD. For instance, the ability to imitate actions performed on objects (transitive actions) is less affected than the ability to imitate gestures without objects (intransitive actions), such as opening and closing the hand (Rogers et al., 1996), suggesting there may not be a global MNS impairment in ASD.

Objectives:

The goal was to examine the MNS in ASD and typical development using fMRI as related to the understanding of transitive and intransitive actions.

Methods: Functional neuroimaging was obtained from age and gender matched children (aged 8-17 years) who were either typically developing or diagnosed with ASD. Participants passively viewed 5-second videos of transitive and intransitive hand actions (adapted from Umiltà et al., 2001; Colombi et al., 2009) while functional images were acquired. For half of the stimuli, the end of the hand movement was occluded by a screen to assess the effect of visibility during observation.

Results: Our results indicate that both TD and ASD participants demonstrate neural activation of the MNS, in the IFG and IPL, although to a lesser extent in the ASD group. The TD group shows an expected effect of transitivity, in that the MNS responds more to transitive than intransitive actions. In contrast, the ASD group only demonstrates a transitivity effect in the IPL. IFG activity was notably absent during transitive actions in the ASD group. Consistent with Umiltà's results is that in the TD group, occluding the end of the action did not significantly affect the IFG response.

Conclusions:

The fMRI results in the TD group are consistent with previous findings of the MNS in monkeys, as well as what has been seen in TD adults (Umiltà et al., 2001; Rizzolatti & Craighero, 2004). While the MNS responds in the ASD group, differences were observed, particularly with regards to IFG activation during transitive actions on objects. These findings suggest that children with autism do not exhibit a MNS deficit in the IPL, which may be consistent with behavioral data showing more typical imitation responses in children with ASD when executing transitive actions than when executing intransitive actions (Rogers et al., 1996).

116.024 129 The Mirror Neuron System In Siblings of Children with An Autism Spectrum Disorder : An EEG Study. L.

Ruysschaert*, P. Warreyn, J. R. Wiersema and H. Roeyers, *Ghent University*

Background: The genetic liability for autism spectrum disorder (ASD) is expressed not only as the complete syndrome of autism, but also in milder similar characteristics that have been referred to as the 'broader autism phenotype' (BAP). This concept is indicative of the presence of subclinical features that look like characteristics of ASD and which occur more often in first-degree relatives of persons with ASD (Rogers, 2009). Investigating the characteristics of the BAP in relatives of individuals with ASD may provide information concerning the genes underlying this phenotype. In the interest of documenting early manifestations of ASD and its BAP, several researchers investigated siblings of children with ASD.

The discovery of mirror neurons in the macaque brain (Di Pellegrino et al., 1992) and the evidence of a mirror neuron system (MNS) in humans (Keysers & Fadiga, 2008) influenced the interest in the neurobiological processes of ASD. Mirror neuron functioning has been theoretically related to action understanding (Rizzolatti & Craighero, 2004) and various social–communicative functions such as imitation, theory of mind, language and empathy, which are difficulties seen in ASD. However, the findings concerning the role of the MNS in ASD seem controversial and research into the ontogeny of the MNS is inconclusive. Exploring the relationship between mirror neuron functioning and social-communicative functions in ASD may benefit from investigating siblings of children with an ASD.

Objectives: In the interest of systematically documenting early manifestations of ASD and of testing specific hypotheses regarding the ontogeny of the MNS, we conducted an EEG study of high-risk infants, all of whom have an older sibling diagnosed with ASD. Mu suppression is considered to be a good indicator of activity in the MNS (Muthukumaraswamy et al., 2004).

This study had 3 important objectives. First, we have investigated mu wave activity with EEG-recordings during different conditions (age 18 - 30 months). Second, we investigated the relationship between mirror neuron activity and quality of imitation. Finally, we have retested the infants 2,5 years later between the age of 4 and 5 years to investigate the evolution and/or stability of the MNS.

Methods: The experiment consisted of 4 experimental conditions (with 5 different objects) during which brain activity was measured with 64 active electrodes. The infants observed a moving object (object observation condition) and an experimenter performing hand movements (hand movement condition). Subsequently, infants observed (action observation condition) and imitated (action imitation condition) a goal-directed action with each object. Mu wave activity (6-9 Hz) was analysed.

Results: Concerning the first objective, the preliminary results showed no significant difference between mu suppression in the sibling group in comparison with the typical developing control group during all three conditions (age 18 – 30 months). Full results and conclusions concerning objective 2 and 3 will be presented at the IMFAR meeting.

Conclusions: To our knowledge, the present study is one of the first to investigate mirror neuron activity in young infants at high risk for ASD and may have important implications for further research aimed at understanding neuropsychological processes in ASD.

116.025 130 Title: Brain Responses to Fearful Faces Differentiate Childhood Disintegrative Disorder From Other Autism Spectrum Disorders. A. Westphal*[1], A. C. Voos[2], M. D. Kaiser[3], B. C. Vander Wyk[2], N. B. Pitskel[4], F. R. Volkmar[2] and K. A. Pelphrey[2], (1)*Yale Child Study Center*, (2)*Yale University*, (3)*Yale University* , (4)*University of Pittsburgh School of Medicine*

Background: Childhood disintegrative disorder (CDD) is defined by normal development for at least two years of life, followed by regression of social and language development, and the onset of repetitive behavior patterns. During the period of acute regression, behavioral dysregulation occurs characterized by severe anxiety that may reflect disruption in amygdala function. Once the regression is complete, however, CDD is clinically similar to Autism Spectrum Disorder (ASD) with Intellectual Disability. Research on CDD is scarce due to its association with low intellectual and adaptive function and its rare occurrence. This disorder is particularly interesting given that the natural history suggests an acquired disorder rather than a developmental process of the kind thought to underlie other ASDs. Thus, examining the brain mechanisms of CDD may inform our understanding of ASD. This is the first neuroimaging study of children with CDD.

Objectives: We used functional magnetic resonance imaging to capture brain responses to fearful faces and houses in children with CDD relative to children with ASD (both with and without ID) and typically developing (TD) children. The passive-viewing task was designed to drive the amygdala, fusiform, and superior temporal sulcus (in response to fearful faces) and the parahippocampal gyri (in response to houses). On the basis of

the fact that CDD is marked by an anxiety prodrome, we hypothesized that children with CDD would exhibit distinct amygdala activity in response to fearful faces relative to children with ASD. On the basis of the similarity in ultimate presentation, we hypothesized that the CDD and ASD groups would exhibit similar hypoactivation to faces in the right fusiform gyrus and superior temporal sulcus. We predicted that all groups would exhibit equivalent response to houses in the parahippocampal gyri.

Methods: The CDD (n=3) and ASD with ID (*n* = 4) groups both had severe to profound intellectual disability. The ASD without ID (*n* = 13) and TD groups (*n* = 11) were matched on IQ. Participants viewed gray-scale images of 30 fearful faces from the NimStim Face Stimulus Set and 30 houses in two series of ten alternating blocks, each lasting 12 seconds, for a total of 320 seconds. Face and house stimuli were matched on luminosity, resolution, size, and contrast.

Results: We examined neural response to faces versus house in each of the anatomically defined regions described above. We observed amygdala response to fearful faces > houses in the TD children. However both the CDD and the ASD groups did not appear to exhibit differential activation to faces vs. houses. We observed robust right superior temporal sulcus and fusiform gyrus activity to faces > houses in both the typically developing children and those with CDD, but not in the other ASD groups.. Equal levels of houses > faces activity was observed in all groups in the parahippocampal gyri.

Conclusions: CDDs appear to be distinguishable from TD on the basis of amygdala activity, and from other ASDs on the basis of right superior temporal sulcus and fusiform gyrus activity when viewing alternating blocks of fearful faces and houses.

116.026 131 When Is a Face a Boat?: An fMRI Study In Category Perception In ASD. R. I. Pillai*[1], E. S. MacDonnell[2], H. Seib[2], K. A. Pelphrey[2] and B. C. Vander Wyk[2], (1), (2)*Yale University*

Background:

Many studies in the adult brain have shown distinct neural regions responding to visual stimuli such as faces, houses, letters, numbers, and objects. Deficits in face processing, both behaviorally and neutrally, have been observed in individuals with an autism spectrum disorder (ASD). However, there has been comparatively little research on the brain activity evoked by the other stimulus categories.

Objectives:

Using fMRI, we aim to establish comprehensive maps of visual perception using a broad range of visual stimuli within a single experiment.

Methods:

Adults (n=23 adults), children with an ASD (n=22) and their unaffected siblings (n=27) were scanned during a passive viewing experiment consisting of visually presented black and white faces, houses, objects (vehicles in this case), letters, and numbers—unaffected siblings and adults were used as control groups. Regions of interest were constructed using pairwise contrasts and groups were compared on the extent of activation, and the magnitude and location of the peak of activation within each region.

Results:

When compared to adult controls, all groups of children had less localized and more diffuse activations in response to all categories. Unaffected siblings appeared to have the most differential activation in every category. Children with ASD had some differential activation also; the highest activations were found when viewing houses. There was little differential activation between either faces and objects or houses and objects. Areas that were consistent across groups and between adults and children with ASD tended to be areas corresponding to more general spatial skills, such as the posterior cingulate cortex. Neither child group showed any differentiation between numbers and letters.

Conclusions:

While there was some overlap between adult and child areas, many of the localized areas were different, perhaps indicating a shift in some visual processing systems. Relative to their unaffected siblings, children with an ASD showed the least impairment in processing houses, though even this seems to activate areas of general spatial orientation, such as the posterior cingulate cortex, as opposed to areas of visual perception, such as the parahippocampal place area. In addition, the lack of differentiation between categories suggests that there is a serious deficit in category formation in general. Studies such as these can help shed light on the developmental theories of ASD—the neurobiological causes of these deficits (such as lack of pruning) remain to be seen.

116.027 132 fMRI of Implicit Phonological Processing In Autism. L. B. Wilson*, J. R. Tregellas, E. Slason, B. E.

Pasko, S. Hepburn and D. C. Rojas, *University of Colorado Denver, Anschutz Medical Campus*

Background: Deficits involving phonology, the sound system of language, are seen in a large subset of children with autism. To date, however, no neuroimaging studies have investigated phonological processing in autism.

Objectives: The purpose of the present study was to use functional magnetic resonance imaging (fMRI) to investigate the neurobiological substrates of phonological processing in individuals with autism.

Methods: Seven adults with DSM-IV ASD and eighteen controls performed a phonological priming task while undergoing fMRI. The task consisted of four prime-target conditions including homophones (e.g., PAUSE-paws), pseudohomophones (e.g., JURM-germ), unrelated (e.g., ARCH-gash), and word-nonword (e.g., FRAIL-clute) stimuli. Primes were presented below perceptual threshold at 30ms in order to investigate the initial, automatic stages of visual word recognition. Subjects performed a lexical decision task (i.e., is it a word or nonword?) on all lowercase targets. Functional images were acquired using a GE 3T whole-body magnet with a gradient-echo T2* Blood Oxygenation Level Dependent (BOLD) contrast technique. Data were realigned to the first volume, normalized to standard space, smoothed with an 8mm FWHM kernel, and evaluated using the GLM in random effects whole-brain and region-of interest analyses in SPM8.

Results: Individuals with autism exhibited similar hemodynamic response suppression to controls for phonological priming across homophone and pseudohomophone conditions in regions associated with phonological processing including the left supramarginal gyrus and superior temporal gyrus. However, individuals with autism exhibited increased hemodynamic response relative to controls for pseudohomophone compared to homophone priming in a number of cortical regions including the left supramarginal gyrus, precentral gyrus, postcentral gyrus, and supplementary motor cortex.

Conclusions: Individuals with autism exhibited enhanced hemodynamic responses for pseudohomophone relative to homophone priming in cortical regions associated with subvocal articulatory demands as well as regions associated with phonological processing. While preliminary due to the small sample size, these findings provide evidence for the neuroanatomical basis of the phonological deficits seen in autism.

116.028 133 "Resting Brain" In Autism: Functional Deactivation and Connectivity of the Default Mode Network. D. L. Murdaugh*, M. R. Pennick and R. K. Kana, *University of Alabama at Birmingham*

Background: The default mode network (DMN) is a collection of brain areas consistently deactivated during task performance (Raichle et al., 2001). Several components of the DMN make up the Task Negative Network (TNN) which has been implicated in self-referential processing; and studies have shown reduced task-related deactivation of this network in autism, suggesting social impairments (Kennedy et al., 2006; Kennedy & Courchesne, 2008). These results are further supported by recent evidence of association between default mode brain function and processing information within social contexts (Schilbach et al., 2008).

Objectives: The primary aim of this fMRI study was to investigate deactivation and functional connectivity of the DMN in autism during resting baseline, and to examine the effect of prior task (social cognitive or linguistic) on this response.

Methods: Thirteen high-functioning adults with autism and fourteen typical control participants took part in three fMRI studies (two language tasks: word and sentence comprehension, and a Theory-of-Mind (ToM) task). Each of the studies had separate blocks of fixation baseline, in which participants were asked to relax and think about nothing. The data from these separate fMRI studies (task blocks and fixation blocks) were collated to examine deactivation and functional connectivity using previously established methods (Fair et al., 2007). Data were acquired from a Siemens 3.0T Allegra head-only scanner and analyzed using SPM8.

Results: 1) Within-subject analyses revealed that controls exhibited stronger deactivation in key regions of the DMN (ventromedial prefrontal, anterior cingulate, posterior cingulate cortices) during task-related performance. Participants with autism, however, failed to show significant deactivation in any DMN regions; 2) Between-group analyses, using a 2x2 ANOVA design, revealed that individuals with autism showed lesser deactivation in TNN areas (e.g., left medial prefrontal cortex); 3) When the tasks were separated to examine fixation blocks following social cognitive or linguistic tasks, using a Group (Autism, Control) x Tasks (Fixation, Language, ToM) ANOVA, fixation blocks following the language task revealed no group difference. However, fixation blocks occurring during the ToM task showed less deactivation in autism than in controls in several DMN regions; and 4) A functional connectivity analysis revealed decreased connectivity within the TNN for individuals

with autism, specifically between dorsomedial prefrontal cortex and angular gyrus.

Conclusions: The overall lack of deactivation in DMN in autism has implications for self-reflection processes, suggesting that DMN may be a compelling framework for understanding the *social brain* in autism. Our study examined resting blocks from fMRI tasks, providing a unique dataset for investigating the effect preceding task may have on rest and DMN deactivation. While language tasks did not show deactivation differences between the two groups, the ToM task elicited lack of deactivation in autism. This difference may attest to the difficulty individuals with autism have in modulating the recruitment of DMN regions depending on task; the deactivation becomes less when the task involves self-other reflections. Our findings suggest more in-depth examination of the DMN in autism to better understand not only the resting brain, but also its relationship to social cognition in autism.

116.029 134 Microstructural White Matter Properties In Autism Spectrum Conditions: Correlations with Empathy. A. N. Ruigrok*[1], H. Howells[2], M. V. Lombardo[1], S. A. Sadek[1], G. Pasco[1], F. dell'Acqua[2], M. C. Lai[3], M. Catani[2], D. G. Murphy[4], U. K. MRC AIMS Consortium[5] and S. Baron-Cohen[1], (1)*University of Cambridge*, (2)*King's College London*, (3)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (4)*Institute of Psychiatry, King's College London*, (5)*Institute of Psychiatry, King's College London; University of Cambridge; University of Oxford*

Background: Individuals with autism spectrum conditions (ASC) have difficulties with identifying (complex) emotional facial expressions and mentalizing. Several studies using fMRI found decreased activation in areas of the "social brain" in mentalizing and emotion recognition tasks (Baron-Cohen et al., 1999; Deeley et al., 2007). Two white matter fiber tracts, the inferior longitudinal fasciculus (ILF) and the inferior fronto-occipital fasciculus (IFOF) have been found to be involved in face perception by a lesion study (Philippi, Mehta, Grabowski, Adolphs & Rudrauf, 2009) and were associated with age-related changes in face perception (Thomas et al., 2008): reduced structural connectivity of these tracts was correlated with performance on emotion recognition (Philippi et al., 2009) and a face discrimination task (Thomas et al., 2008). Previous diffusion tensor imaging (DTI) studies have revealed reduced fractional anisotropy (FA), and increased mean diffusivity (MD), radial diffusivity (RD), and number of streamlines in the ILF and IFOF of individuals with ASC (Pugliese et al., 2009; Bloemen et al., 2010; Shukla, Keehn & Muller, 2010). Building on these prior findings, the present study will investigate if there is a relation between microstructural properties in these tracts and performance on two empathy measures: the "Reading the Mind in the Eyes" Test (Eyes) and with the Empathy Quotient (EQ).

Objectives: To investigate (1) whether there are any differences in microstructural properties of the IFOF and ILF between adult males with ASC and age and IQ-matched typical control subjects, and (2) if any structural differences found (e.g. in mean FA, MD, RD, and/or number of streamlines) correlate with EQ scores and/or performance on the Eyes Test. It is hypothesized that individuals with ASC will perform worse on the Eyes test and have lower scores on the EQ than the typical controls. Furthermore, it is predicted that reduced connectivity is correlated with performance on the Eyes and EQ.

Methods: Data from 30 males with a clinical diagnosis of ASC and 30 typical developed males who participated in a multi-center study and met the cut-off criteria of autism from the Autism Diagnostic Interview-Revised (ADI-R) were analyzed. Data preprocessing (e.g. eddy current correction with rotation of the b matrix, diffusion tensor estimation using a nonlinear least-squares algorithm and whole brain tractography using Euler Integration) was executed using ExploreDTI (Leemans, Jeurissen, Sijbers & Jones, 2009). Dissections of the ILF and IFOF were performed according to guidelines given by Catani & Thiebaut de Schotten (2008) using TrackVis (Ruopeng Wang & Wedeen, J. Van, TrackVis.org, Martinos Center for Biomedical Imaging, Massachusetts General Hospital). Furthermore, all participants completed the EQ and Eyes test.

Results: The groups were matched on age (between 18 and 45 years) and IQ. Group differences were found on EQ (t=8.2, p<.001) and Eyes (t=3.8, p<.001) measures. Tractography and correlational results will be presented on the poster.

Conclusions: The results are discussed in relation to previous reported abnormalities in structural connectivity of individuals with ASC and how this may relate to reduced performance on empathy tasks.

116.030 135 Relationship Between Handedness and Language Lateralization In Autism. A. Froehlich*[1], J. S. Anderson[1], N. Lange[2], B. A. Zielinski[1], M. B. DuBray[1], J. A. Nielsen[1], A. Cariello[1], J. R. Cooperrider[1], E. D. Bigler[3], A. L. Alexander[4], P. T. Fletcher[1] and J. E. Lainhart[1], (1)*University of Utah*, (2)*Harvard University*, (3)*Brigham Young University*, (4)*University of Wisconsin*

Background: Most neuroimaging studies investigating language in autism group-match participants with autism and typically developing controls on qualitative handedness of right or left. Evidence suggests, however, that the relationship between handedness and language lateralization may be quite different in autism versus in typical development. Lack of similar relationship between handedness and language lateralization in autism and control groups could affect the results of studies that simply control for handedness.

Objectives: The primary objective of the study was to examine the relationship between language lateralization and handedness in autism in comparison to typical development.

Methods: Forty-six males with autism and thirty-six typically developing control males, ages 9 to 42 years, were presented with an auditory language task during fMRI. The task required participants to think of a word in response to recorded, spoken phrases, such as “the water that falls from the sky” or “the funny man at the circus”. Signal during rest periods was subtracted from that occurring in response to the sentence stimuli. A language lateralization index (LI) was calculated for Broca’s and Wernicke’s areas for each participant using the formula LI = (Left – Right) / (Left + Right), where Left and Right represent the total number of active voxels within the respective hemisphere. Handedness index scores, which range between 100 (completely right-handed) and -100 (completely left-handed) were obtained using the Edinburgh Handedness Inventory. Data from only right-handed individuals was analyzed; the number of left-handed individuals was too few to be examined.

Results: A smaller proportion of the right-handed participants with autism had leftward language lateralization index scores (75.6%) compared to typically developing controls (94.4%; p = 0.0115). The difference in the autism group appeared to be primarily driven by less left-lateralization in Broca’s area and to a lesser extent by Wernicke’s area. When the interaction between lateralization in Broca’s and Wernicke’s areas was examined, there was less left-lateralization concordance in the autism group; more autism participants had discordant lateralization (e.g, L>R Broca's with R>L Wernicke's) and rightward lateralization in both Broca’s and Wernicke’s areas.

Conclusions: The differing relationship between language lateralization and handedness in autism and typical development has implications for genetic and neurobiological studies of autism. The different relationship could also affect the results of neuroimaging studies that attempt to control for group differences in language lateralization by using handedness as a surrogate. The effects of other covariates on the outcomes of interest in these studies could be masked without accounting for this previously unknown relationship.

116.031 136 Aberrant Interregional Correlations of Cortical Thickness In Autism Spectrum Disorders. G. Wallace*[1], S. J. Gotts[2], N. A. Dankner[3], B. L. Robustelli[2], L. Kenworthy[4], J. Giedd[5] and A. Martin[3], (1), (2)*NIMH/NIH*, (3)*NIMH*, (4)*Children's National Medical Center*, (5)*NIH*

Background: Prior neuroimaging studies assessing either white matter integrity or blood oxygenation suggest that aberrant neural connectivity is characteristic of Autism Spectrum Disorders (ASD). Recent work indicates that hubs or networks can be derived using interregional correlations of cortical thickness among typically developing individuals. No study to date has investigated whether these interregional correlations of cortical thickness are atypical in ASD.

Objectives: Examine patterns of interregional cortical thickness correlations in 41 high functioning males with ASD as compared to a group of 40 typically developing (TD) males matched on age, IQ, and handedness.

Methods: T1-weighted 3T MPRAGE MRI scans were acquired from 41 males with an ASD (diagnoses based on DSM-IV criteria and scores from the Autism Diagnostic Inventory and/or Autism Diagnostic Observation Schedule) and from 40 TD males (screened for the presence of learning, developmental, psychiatric, neurological disorders) matched group-wise on age, IQ, and handedness. Cortical reconstruction and volumetric segmentation were performed with the FreeSurfer image analysis suite. Once cortical models were completed, the cerebral cortex was parcellated into 33 regions per hemisphere based on gyral and sulcal structure. Average cortical thickness was computed for these 66 individual gyral regions. Patterns of covariation in thickness among the gyral regions were obtained using Multi-dimensional scaling and K-Means clustering. K-Means clusters were determined solely on the basis of the TD ROI-ROI correlation matrices.

Results: Four clusters were derived from the analyses: Cluster 1 (C1)=cingulate cortex, Cluster 2 (C2)=lateral and inferior temporal cortex, Cluster 3 (C3)=medial temporal cortex, Cluster 4 (C4)=the remainder of the cortex. Though global patterns of cortical thickness correlation were largely similar between groups, several significantly discrepant (p<.05 after Bonferroni correction) interregional correlations were found. The ASD group had significantly greater correlations between C1 & C1, C1 & C2, and C1 & C3 than the TD group. In contrast, the TD

group had significantly greater correlations between C1 & C4, C2 & C4, C3 & C4, and C4 & C4 than the ASD group.

Conclusions: Consistent with prior findings of atypical connectivity in ASD, the present study demonstrates that ASD is associated with aberrant interregional correlations of cortical thickness. The pattern of findings is striking in that (1) less differentiation of interregional relationships characterized the ASD group, (2) cingulate cortex is more strongly associated with the rest of the cortex in ASD than in TD individuals, and (3) group differences in correlations were not localized to regions previously associated with accelerated cortical thinning in this identical sample of ASD individuals (Wallace et al., 2010). Of note, a large longitudinal study of typical development shows that the thickness of cingulate cortex follows an independent trajectory than the rest of the cortex during adolescence/young adulthood (Shaw et al., 2008). The failure of cingulate cortex to decouple from the rest of the cortex in ASD during this age range may be the result of synaptogenesis gone awry. Examining these relationships during different developmental periods and longitudinally will help to pinpoint the ontogeny of group differences.

116.032 137 Brain Mechanisms for Emotion Regulation In Children and Adolescents with Autism. N. B. Pitskel*[1], D. Z. Bolling[2], M. D. Kaiser[2], M. J. Crowley[1] and K. A. Pelphrey[2], (1)*Child Study Center, Yale University*, (2)*Yale University*

Background: Emotional volatility is common among individuals with autism spectrum disorder (ASD), detrimentally impacting the quality of life for those affected and their families. For many higher-functioning children with ASD, maladaptive emotional responses (e.g., behavioral outbursts associated with changes in routines or violation of expectations) are often the first concerns noted by parents or caregivers. Despite the importance of this area, the behavioral and neural underpinnings of emotion dysregulation in ASD remain poorly understood.

Objectives: We sought to examine activity associated with cognitive reappraisal of negative reactions to disgusting images in children and adolescents with and without ASD.

Methods: During functional magnetic resonance imaging (fMRI) children viewed child-appropriate disgust-inducing ("gross") pictures or neutral pictures. They were instructed to simply attend ("look"), increase ("more gross"), or decrease ("less gross") their emotional reaction to the disgust-inducing pictures. Strategies were provided (e.g., pretend it's right in front of you; pretend it's fake) to facilitate performance, and pre-task training was employed to ensure task understanding. The children rated their level of disgust on a 1-5 visual analogue scale after each trial. Two IQ- and age-matched groups were studied: typically developing children (TD, *n* = 15, mean age = 13.03, range = 9-18 years); and children with autism spectrum disorder (ASD, *n* = 16, mean age = 13.82 years, range = 9-17 years). Our hypotheses centered on regions involved in: (1) the experience of disgust (revealed in the contrast between passively viewing gross (i.e., "look gross" condition) versus neutral images), (2) the regulation of emotion (revealed in the contrast between decrease disgust (i.e., "decrease gross") versus "look gross"), and (3) those regions being regulated (revealed in the contrast between "decrease gross" versus "look gross").

Results: Ratings of disgust increased for looking at gross relative to neutral pictures equally across the two groups. Moreover, ratings of disgust significantly increased and decreased as expected by regulation condition equivalently across the two groups. Children with and without ASD exhibited robust gross > neutral activity in the right insula, right amygdala, and bilateral fusiform gyri. When instructed to "decrease", these same regions exhibited decreased activity in TD children, but decreased to a significantly lesser degree in children with ASD. A correlation analysis identified a region of the medial prefrontal cortex in TD children but not children with ASD that exhibited a significant negative correlation with activation in both the right insula and left amygdala, suggesting that this region may serve as a regulator of activity in regions linked to the perception and experience of disgust.

Conclusions: Whereas children with and without ASD exhibited similar behavioral profiles indicating successful cognitive reappraisal of negative emotion in response to disgusting images, fMRI revealed different patterns of brain activity in the two groups associated with this regulation. In particular, children with ASD failed to engage the medial prefrontal cortex in the process of emotion regulation.

116.033 138 Absence of Age-Related Cortical Thinning In Autism Spanning Into Adulthood. N. Mateljevic*, R. J. Jou, F. R. Volkmar and K. A. Pelphrey, *Yale University*

Background: While there is substantial data suggesting that brain development of children with autism proceeds abnormally, there is less data charting its development through adulthood. For example, the most replicable structural MRI finding in children with autism is megencephaly which is presumably driven by rapid overgrowth of brain tissue in early childhood. This is followed an abrupt cessation while growth continues in typically developing individuals. What is unclear is

how this abnormal developmental trajectory continues through adulthood. Two recent studies have addressed this issue by examining the relationship between age and cortical thickness in children, adolescents, and adults with autism. The first study (N=127, age range=10-60 years) reported cortical thickness to be negatively correlated with age in controls but not in autism. The second study (N=81, age range=12-24 years) reported accelerated age-related cortical thinning in autism. Thus, further research is needed to reconcile these findings.

Objectives: The purpose of this preliminary investigation was to chart the relationship between age and cortical thickness in a sample of individuals with autism with ages spanning into adulthood. It is hypothesized that age will correlate negatively with cortical thickness in typically developing individuals. In contrast, it is hypothesized that age-related cortical thinning would be absent in individuals with autism.

Methods: Participants included 18 adolescent and adult males with autism (mean age=22.8 ±6.9 years, range=16.1-37.8 years) and 14 gender- and age-matched controls (mean age=25.9 ±7.6 years, age range=17.9-42.4 years). High-resolution, T1-weighted images were acquired using a 3-Tesla MRI scanner. All images were assessed for excessive motion artifact by an experienced rater. Structural MRI data was processed and analyzed using the FreeSurfer image analysis suite (http://surfer.nmr.mgh.harvard.edu). FreeSurfer consists of automated tools for reconstruction of the brain from structural MRI data, facilitating the quantification of cortical thickness using a spatially-unbiased analysis. Group-wise comparison of cortical thickness data was conducted using the QDEC (Query, Design, Estimate, Contrast) application included in the FreeSurfer image analysis suite. QDEC fits general linear model at each surface vertex where the discrete variable consisted of group membership and age as the continuous variable. Images were generated displaying areas where the thickness-age correlation significantly differed between groups ($p<0.01$, two-tailed).

Results: There were numerous areas in both left and right hemispheres where the age-thickness correlation significantly differed between groups. For the vast majority of these areas, this correlation was negative in the control group, but zero or positive in the autism group. For the left hemisphere, these cortical areas included: prefrontal, cingulate, superior temporal, superior parietal, and paracentral. For the right hemisphere, these cortical areas included: prefrontal, cingulate, superior temporal, middle temporal, inferior parietal, and lateral occipital. Many of these areas involve cortical structures known to underlie social cognition.

Conclusions: Contrary to typically developing individuals where there is age-related cortical thinning, individuals with autism display an increase or no change in cortical thickness with age. These preliminary results support the presence of an abnormal neurodevelopmental trajectory that extends into adulthood, affecting the neural structures involved in social cognition.

116.034 139 MRI Analysis of Gyral Window In Normal Brain Development and Its Implications for Studies In Autism. B. A. Dombroski*, A. E. Switala, A. S. El-Baz and M. F. Casanova, *University of Louisville*

Background: Autism spectrum disorder (ASD) is a pervasive developmental disorder (PDD) that is clinically and qualitatively diagnosed as having impairment in social interaction, communication and repetitive behavior. There is no known cause or cure for ASD. Limited sample size, narrow age range, lack of resources and an inability to duplicate findings of individual studies has made it difficult to assess brain development in autistic individuals as compared to typical or control individuals.

Objectives: To measure the gyrification of cerebral cortex in MRI scans using normalized gyral window depth measurements.

Methods: Using Release 4.0 of the NIH Pediatric MRI Data Repository for normative developmental studies, we measured gyrification by identifying the normalized gyral window depth of 410 typically-developing children ages 4.8 to 22.3 (215 males and 195 females). Of these, 150 (82 males and 68 females) provided MRI data at three visits; 163 (83 males and 80 females) provided MRI data at two visits; and 97 (50 males and 47 females) provided only one MRI scan. Gyral white matter was segmented by lobe using the parameters established by the NIH. A Euclidean distance map (EDM) of gyral white matter was constructed using MatLab in a total of 873 MRI scans from the 410 subjects collectively. 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.

Results: Gyral window measurements indicated that gyrification increased with age in both males and females in the frontal, temporal and parietal lobes and that gyrification decreased with age in both males and females in the occipital lobe. There was no significant age difference between male and female groups overall ($F_{1,867} = 0.0002$; $p = 0.99$) or per-visit ($F_{2,867} = 2.18$; $p = 0.86$). There was significant dependence of gyral window upon

age ($F_{1,6544}$ = 115, p < 0.0001), lobe ($F_{3,6544}$ = 229, p < 0.0001), hemisphere ($F_{1,6544}$ = 5.23, p = 0.022), age*sex ($F_{1,6544}$ = 13.8, p = 0.0002), age*lobe ($F_{3,6544}$ = 120, p = 0.0001), and age*hemisphere ($F_{1,6544}$ = 4.41, p = 0.036).

Conclusions: GI is a morphometric index that varies according to age, hemisphere and lobe examined. Its dependence on lobe and hemispheric side suggests its usefulness in studies of cerebral dominance. The results help explain why gyral window measurements have provided for statistically significant distinctions between the brains of autistic and controls individuals.

116.035 140 Amygdala Dysfunction In Children and Adolescents with Fragile X Syndrome. S. Y. Kim*[1], J. Burris[1], F. C. Bassal[1], F. Tassone[2] and S. Rivera[1], (1)*University of California, Davis*, (2)*University of California Davis School of Medicine*

Background: Mutations of the fragile X mental retardation 1 (FMR1) gene are the genetic cause of fragile X syndrome (FXS), the most common inherited form of mental retardation. Hypermethylation of the FMR1 promoter region, along with CGG repeat expansion, results in deficiency or absence of the FMR1 protein (FMRP), ultimately causing cognitive and behavioral impairments. Patients with partial methylation or patients with a mixture of full and premutation cells may have some FMRP expression, resulting in a less severe phenotype (i.e. FX mosaicism). Although the mutation of the FMR1 gene is not a direct cause of autistic spectrum disorder (ASD), FXS is the most common known genetic cause of autism. In fact, prevalence of ASD in FXS is relatively high (about 15-33%), and the two disorders share similar behavioral and social deficits, such as high social anxiety, withdrawal, and gaze aversion. In the current study, we used functional magnetic resonance imaging (fMRI) to examine amygdala dysfunction in children and adolescents with FXS, as they passively evaluated social-emotional stimuli.

Objectives: Using emotion face stimuli (*NimStim Face Stimulus Set*, Tottenham et al., 2002), we investigated neuroanatomical and functional aspects of amygdala dysfunction in children and adolescents on the FX spectrum, including females with FXS and males and females with FX mosaicism. In particular, we examined whether the emotional deficits associated with amygdala function is sensitive to FMRP level in children with FXS.

Methods: Sixteen children and adolescents on the FX spectrum and 16 neurotypical (NT) age-matched controls participated in an fMRI task in which they passively viewed grayscale fearful and happy faces, as well as scrambled versions of calm faces. Structural MRI scans were also obtained in the same session. The functional data were analyzed using SPM5 and the volume of amygdala was manually traced for each participant.

Results: The structural analysis revealed no significant difference in the size of amygdala between the two groups. In the functional analysis, however, significant differences in amygdala activation were observed between NT and FX groups. Specifically, the NT group revealed well-established, fear-specific effects of amygdala activation (i.e., greater activation to fearful faces than to scrambled or happy faces) while fear-specific effects in amygdala activation were significantly reduced in the FX group, suggesting deficits in amygdala function in the FX group. Furthermore, a multiple regression analysis performed on data from girls with full mutation or mosaicism, using activation ratio (AR) as a regressor, showed a positive relationship between AR and fear-specific amygdala activation.

Conclusions: The difference in amygdala activation to the fear-related stimuli between the FX spectrum and the NT group suggests abnormal amygdala function in fragile X. Furthermore, the regression result with AR implies a dosage response of FMR1 gene expression on the fear-specific function of the amygdala in FXS.

116.036 141 Anterior and Posterior Cortical Folding In Autism. G. Fung*[1], C. Cheung[2], M. E. King[1], L. Ling[1], V. Cheung[3], K. S. Tai[4], P. Leung[5], S. F. Hung[6], T. P. Ho[1], C. C. Lee[6], C. P. Tang[6], S. E. Chua[7] and G. M. McAlonan[1], (1)*University of Hong Kong*, (2)*The University of Hong Kong*, (3)*Polytechnic University*, (4)*Hospital Authority*, (5)*Chinese University of Hong Kong*, (6)*Kwai Chung Hospital*, (7)*State Key Laboratory for Brain and Cognitive Sciences*

Background:

Cortical gyrification is a useful summary marker of cortical folding. The gyrification index (GI) is calculated as the external cortical circumference divided by the total cortical contour. Preliminary evidence suggests an increase in folding in frontal regions of the brain in children with autism (Hardan et al., 2004), implying aberrant development of frontal regions. However, it is unknown whether folding differences involve the whole brain and whether they are specific to autism or a more general consequence of neurodevelopmental disorder.

Objectives:

The present study aimed to examine both anterior and posterior brain GI in a sizeable number of intellectually able children with autism (ASD) and typically developing controls. In addition, we included a neurodevelopmental control group of children with attention-deficit-hyperactivity disorder (ADHD) to assess whether differences are indeed specific to autism.

Methods:

The study was approved by the University of Hong Kong/ Hospital Authority Research Ethics Committee. Informed consent was obtained from participants' parents prior to MRI scanning. T1 images were acquired from 6 – 16 year old children with ASD (n=34), ADHD (n=19), and typically developing controls (n=65). There were no differences in age and verbal IQ. The GI was measured using a conventional manual tracing technique (Jou et. al., 2010). One coronal slice anterior and one posterior to the corpus callosum were selected for measurement. Both hemispheres were divided into superior and inferior portions. The outer and total contours were traced for each quadrant.

Results:

Contrary to prior study, we observed significantly lower mean GI in the left anterior and right anterior-inferior frontal regions in ASD compared to both controls and children with ADHD. Despite lower GI in the left anterior-inferior region in the ASD (mean GI=2.07) when compared to controls (mean GI=2.14), correlation analysis revealed a significant positive correlation of GI with age in the ASD group but not in the control groups. Further exploration indicated that children with autism younger than 12.5years have lower frontal GI than controls while those older than 12.5 years have higher GI than controls. No significant differences emerged in the posterior brain across all three groups.

Conclusions:

These findings provide preliminary evidence for age-related differences in the cortical folding pattern in children with ASD. The childhood group in the study by Harden et al 2004 was older than ours and this may explain our opposite findings. The trajectory of cortical development therefore appears quite distinct in autism making issues of age-matching in studies of autism critical to address. These findings, which appear relatively restricted to frontal regions and specific to ASD, may provide clues to timing and aetiology of pathogenic mechanisms in autism.

116.037 142 Reduced Acetylcholinesterase Activity In the Fusiform Gyrus In Adults with Autism Spectrum Disorders. K. Nakamura*[1], K. Suzuki[1], G. Sugihara[1], Y. Ouchi[1], M. Tsujii[2], Y. Iwata[1], K. Matsumoto[1], K. Takebayashi[1], T. Wakuda[1], Y. Yoshihara[1], S. Suda[1], M. Kikuchi[3], N. Takei[1], T. Sugiyama[1] and N. Mori[1], (1)*Hamamatsu University School of Medicine*, (2)*Chukyo University*, (3)*Graduate School of Medical Science, Kanazawa University*

Background: Both neuropsychological and functional MRI studies have shown deficiencies in face perception in subjects with autism spectrum disorders (ASD). The fusiform gyrus has been regarded as the key structure in face perception. The cholinergic system is known to regulate the function of the visual pathway, including the fusiform gyrus.

Objectives: To determine whether the central acetylcholinesterase (AChE) activity, a marker for the cholinergic system, is altered in ASD, and the alteration in the AChE activity, if any, is correlated with their social functioning.

Methods: Twenty adult subjects with ASD (14 male and 6 female; age range 18-33 years; mean [SD] IQ, 91.6 [4.3]) and 20 age-, sex-, and IQ-matched healthy comparison subjects were recruited from the community. Using positron emission tomography and a radiotracer *N*-[^{11}C]methyl-4-piperidyl acetate ([^{11}C]MP4A), regional cerebrocortical AChE activities were estimated by reference tissue-based linear least-squares analysis and were expressed in terms of the rate constant k_3. Current and childhood autistic symptoms in the adult subjects with ASD were assessed by the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), respectively. Voxel-based analyses as well as region-of-interest (ROI)-based methods were used for between-subject analysis and within-subject correlation analysis with respect to clinical variables.

Results: Both voxel- and ROI-based analyses revealed significantly lower [^{11}C]MP4A k_3 values in the bilateral fusiform gyri in subjects with ASD than in those of controls ($P < .05$, corrected). The fusiform k_3 values in subjects with ASD were negatively correlated with their social disabilities as assessed by ADOS as well as ADI-R.

Conclusions: The results suggest that a deficit in cholinergic innervations of the fusiform gyrus, which can be observed in adults with ASD, may be related with not only current but also childhood impairment of social functioning.

116.038 143 Subcortical Contributions to Effective and Anatomical Connectivity In Brain Networks Supporting

Imitation. A. Jack*, Z. A. Englander and J. P. Morris, *University of Virginia*

Background: To fully understand the neural basis of both typical and atypical social cognition, it is necessary to investigate not just the activity of individual brain regions, but also the ways in which these sites coordinate their function. However, despite the fact that the cerebellum is increasingly recognized as playing an important role in a variety of affective and cognitive functions, its contributions to system processes are rarely considered outside of investigations of motor behavior. Given that cerebellar abnormalities are frequently reported in studies of the brains of individuals with ASD, a better understanding of the way in which this structure supports typical performance of important social behaviors, like imitation (which is often impaired in ASD), may also provide insight into the potential developmental consequences of cerebellar deficits.

Objectives: Our aims in this project were to 1) characterize functional specialization for imitation in typically developing (TD) adults in a statistically rigorous fashion, and 2) examine task-specific effective connectivity for imitation among key cortical and subcortical regions.

Methods: Using functional magnetic resonance imaging (fMRI), we investigated effective connectivity of brain networks supporting imitation in a sample of 15 TD adults. While in the scanner, participants engaged in a simple imitation paradigm with three conditions: Observe trials, in which participants passively viewed a human actor executing a sequence of four finger presses on a keypad; Imitate trials, in which participants imitated the actor's finger presses on a keyboard; and Execute trials, in which participants also executed finger presses but did so based on visuospatial cues in the absence of the actor's hand. Internal localizer analyses conducted on the functional data identified regions displaying functional specificity for imitation. Subsequently, we used these sites as seed regions in psychophysiological interaction (PPI) analyses, which are a data-driven means of assessing task-specific effective connectivity.

Results: Consistent with previous literature, we found parietal (SPL, IPL), premotor, and posterior STS (pSTS) activity associated with imitation, as well as IFG and anterior intraparietal sulcus (aIPS) activity possibly associated with mirroring processes. However, we also found task-sensitive changes in the degree of correlation between activity in the pSTS and bilateral regions of cerebellar lobule VII, such that the hemodynamic response in these regions was more highly correlated during imitation than during control conditions. A similar interaction existed between the right SPL and left lobule VII, as well as between the right pSTS and left IPL.

Conclusions: We found regions of the neocerebellum to display task-specific increases in connectivity with brain sites important for biological motion perception (the pSTS), spatial attention regulation (the SPL), and visual control of action (the SPL) during participants' engagement in imitative behavior, suggesting that neocerebellar activity may help to facilitate nonmotor aspects of imitation in TD individuals. These findings in a TD population, when coupled with the histological, molecular, and functional cerebellar abnormalities observed in ASD, indicate that the neocerebellum should receive greater future attention in studies of social behavior and brain connectivity in ASD.

116.039 144 Caudate Volume In Preschool Age Children with Autism. S. Subramanian*, A. Lee, C. W. Nordahl, M. D. Shen, T. J. Simon, S. J. Rogers, S. Ozonoff and D. G. Amaral, *UC Davis M.I.N.D. Institute*

Background: Previous investigations into the neuropathology of autism have suggested that the caudate nucleus is enlarged in older children and adolescents with autism. Moreover, associations between caudate volume and repetitive behavior have also been reported. However, few studies have examined the caudate in very young children with autism.

Objectives: To evaluate whether abnormal enlargement of the caudate nucleus is present in very young children with autism spectrum disorders (ASD) relative to age-matched typically developing (TD) controls. We also investigated the relationship between repetitive behavior and caudate volume.

Methods: High-resolution structural MRIs were acquired during natural nocturnal sleep. Caudate volume was measured in 88 participants (58 ASD, 30 TD) between 2.1 - 4.6 years of age. Autism diagnoses were conducted by trained, experienced psychologists using the ADOS and ADI-R. Severity of repetitive behavior deficits was measured using the Repetitive Behavior Scale (RBS), a parent-report questionnaire. Two researchers, blinded with respect to diagnosis, manually traced the right and left caudate using Analyze 10.0 software after achieving an inter-rater reliability of .94 ICC.

Results: There was no significant overall group difference in the caudate volume between children with autism and age-matched TD controls. Preliminary analyses within the autism group show there was a significant difference in right and left caudate volume between children who had early onset autism compared to those with regression ($p=0.03$). Right and left caudate volumes were 7% smaller in children with early onset

autism (n = 28) compared to those with regression (n = 27). Children with early onset autism also had more severe RBS scores compared to children with regression (p=0.03). This is consistent with a trend suggesting that smaller caudate volume is related to more severe repetitive behavior in all children with ASD (r = -.23, p = .13).

Conclusions: Abnormal caudate enlargement is not present in very young children with autism. However, autism is an extremely heterogeneous disorder, and preliminary data suggest that caudate volume may be associated with onset status of autism. Interestingly, these data suggest that smaller caudate volumes were associated with more severe repetitive behavior symptoms in very young children. Additional studies with larger sample sizes and longitudinal analyses will be necessary to understand the role of the caudate in the neuropathology of autism.

116.040 145 Functional Connectivity of Attention Networks In Children and Adolescents with ASD: A Resting State fcMRI Study. K. M. Leyden*[1], P. Shih[1], J. K. Oram[1], J. Spradling[1], B. Keehn[2] and R. A. Müller[1], (1)*Brain Development Imaging Laboratory, San Diego State University*, (2)*San Diego State University / University of California, San Diego*

Background:

Individuals with Autism Spectrum Disorder (ASD) experience early and pervasive deficits of attention. Previous research has detected three functionally separate attention networks, each of which is responsible for a separate set of cognitive processes that facilitate attention: the alerting, orienting, and executive control networks. Functional connectivity magnetic resonance imaging (fcMRI) detects the degree of correlation between brain regions of the blood oxygen level dependent (BOLD) response and is considered to be an indicator of brain network organization. Developmental studies of functional connectivity have suggested a dual process model of functional development, involving functional segregation at a local level, and functional integration through long-distance connections. The analysis of functional connectivity during resting state identifies spontaneous low-frequency BOLD signal fluctuations in brain voxels, therefore allowing the identification of correlated regions of neural activity across brain regions that serve similar functions.

Objectives:

To examine the functional connectivity of the alerting, orienting, and executive control networks of attention using resting state data in individuals with ASD.

Methods:

Functional images were acquired on a 3T GE scanner for 12 high-functioning children and adolescents with ASD and 13 age-, gender-, and IQ-matched TD individuals. Participants were scanned at rest for a period of six-minutes. Data were preprocessed using AFNI. We applied a low-pass filter to isolate intrinsic low-frequency BOLD fluctuations and included the six motion parameters as nuisance regressors. ROIs were selected using the fMRI activation results from Fan et al. (2005) for the alerting, orienting, and executive control networks. The average time series was extracted from the set of ROIs for each network and correlated with the whole-brain.

Results:

Within-group connectivity maps were relatively consistent with the activation maps reported by Fan et al, (2005) for the alerting and executive networks. On between-group comparison, the alerting network showed reduced connectivity in bilateral anterior cingulate cortex in the ASD compared to TD group. Reduced connectivity was also seen in the left fusiform gyrus, right superior frontal gyrus, and thalamus. Between-group comparison of the executive network showed reduced connectivity in the anterior cingulate cortex in the ASD group.

Conclusions:

Our findings may suggest reduced connectivity for two attention networks, alerting and executive, in ASD. A consistent site of reduced connectivity for both networks was the anterior cingulate gyrus, which has been found to be anatomically and functionally affected in ASD in previous studies. Resting state data are generally considered to be unaffected by confounds of task performance in fcMRI studies. However, as in other resting studies of ASD, it cannot be ruled out that atypical and individually variable response to a task-free scanning condition may have affected the findings.

116.041 146 Detailed Spatiotemporal Profiles of Somatosensory Information Processing In Autism Spectrum Disorders as Revealed by MEG. S. Kato*[1], A. Nakamura[2], K. Yoshiyama[2], K. Ono[2], T. Kato[2], K. Ito[2], N. Iwata[3] and T. Sugiyama[4], (1)*Aichi Children's Health and Medical Center*, (2)*National Center for Geriatrics and Gerontology*, (3)*Fujita Health University School of Medicine*, (4)*Hamamatsu University School of Medicine*

Background: Besides the characteristic triads of autism spectrum disorders (ASD), sensory abnormalities are also frequently observed symptoms. Several neurobehavioral studies have reported that many individuals with ASD have abnormal skin sensation such as hypo- or hyper-sensitivity to touch, pain and temperature (O'Neill, M., et al.,1997; Tomchek, SD.,et al.,2007). However, detailed pathophysiological mechanisms for such sensory abnormalities are still not well understood.

Objectives: The present study is aimed to disclose the detailed spatiotemporal profiles of the somatosensory information processing in ASD using magnetoencephalography (MEG). Specifically, we focused on the following 3 components of somatosensory evoked fields (SEFs); 1) the primary response which reflects the initial response of the somatosensory cortex, 2) mismatch response (MMR) which is known to represent the automatic discrimination processes (Näätänen, R., et al., 1978), and 3) a component related to selective attention.

Methods: The participants are 8 male high-functioning ASD (aged 21 to 27) and 8 male typically developing (TD) individuals (aged 23 to 29 yrs). There were no differences in IQ between the two groups. None of the participants had subjective skin sensation abnormalities. Written informed consent was obtained from all of the participants prior to the experiment. An air-puff-derived tactile stimulator (Nakamura, A., et al., 1998), which provides a light, superficial pressure stimulus to the skin surface, was used for the stimulation. Using an oddball paradigm, the right index finger and middle finger were randomly stimulated with probabilities of 80% (standard) and 20% (deviant), respectively. The experiment consisted of following two blocks; a) ignore condition (subjects were instructed to watch a silent movie and ignore the tactile stimuli) and b) attend condition (instructed to count the number of the deviant stimuli mentally). SEFs to these stimuli were recorded using a 74-channel MEG system (4D Neuroimaging, San Diego). Source estimations were done by calculating current source density (CSD) maps using the L2 minimum-norm technique. After the spatial normalization of the individual CSD maps, statistical tests were performed using the statistical parametric mapping (SPM). Finally, time courses of the electrical activity around the somatosensory cortex were visualized by region of interest (ROI) analysis.

Results: 1) All of the subjects elicited clear primary responses in the latencies around 40ms. There were no differences between ASD and TD. 2) MMRs were clearly elicited in both groups in the latencies around 80ms. However, ASD showed prolonged MMN activity which persisted until 170ms, while TD showed no MMN activity in the latencies after 140ms. 3) The effects of selective attention were also different between the two groups. TD showed significant activation in the left intraparietal sulcus during the attend condition compared with the ignore condition in the latencies around 80ms. However, ASD did not show such attention effects.

Conclusions: The results indicate that the somatosensory information processing in ASD, even without any subjective symptoms, is different from that in TD. The prolonged MMRs suggest that ASD individuals are hyperactive to a deviant stimulus which is different from stored memory trace. Further, ASD appears to have impairments in controlling selective attention.

116.042 147 Neural Signatures Predict Autism Diagnosis. M. D. Kaiser*, J. A. Eilbott, R. H. Bennett, D. R. Sugrue and K. A. Pelphrey, *Yale University*

Background: Using functional magnetic resonance imaging (fMRI) to assess brain activity during the visual perception of biological motion in 4- to 17-year-old children with autism (ASD), their unaffected siblings, and typically developing (TD) children, we recently discovered three types of "neural signatures of autism" including state, trait, and compensatory markers (Kaiser et al., 2010, *PNAS*). The state regions represent areas of dysfunction unique to the children with ASD. The identification of the state markers presents the possibility of predicting an autism diagnosis based on activity to biological motion in specific brain regions.

Objectives: The current study sought to predict group membership in a new set of children with and without autism using the state markers from our prior study.

Methods: Eleven children with ASD (mean age = 11.8±3.06 years) and 16 TD children (mean age = 11.58±2.65 years) participated in the study. Diagnosis of ASD was confirmed with ADOS, ADI-R and expert clinical judgment. Children viewed point-light displays of coherent or scrambled biological motion. Data collection is ongoing.

Results: We replicated our prior finding of hypoactivation in a set of brain regions involved in the perception of biological motion in children with ASD relative to TD children. We conducted a discriminant function analysis using activity within the previously identified state regions to identify a linear function of regional beta weights that maximally separated children with ASD from TD children. Six brain regions (right and left fusiform gyrus, right posterior superior temporal sulcus, right amygdala, left ventrolateral prefrontal cortex, and ventomedial prefontal cortex) were entered simultaneously.

Three-fourths of the children with or without autism were correctly classified as having or not having autism. This analysis provided best-estimate probabilities of group membership for each participant based on the optimal weightings for the state regions. We then evaluated the receiver operating characteristics (ROC) of this probability value for the state regions of activity. The “gold-standard” for our ROC analyses was the diagnostic criteria used to define the ASD group (i.e. the ADOS, ADI-R, and expert clinical evaluation). This analysis revealed an area under the curve (AUC) value of .73 (95% confidence interval = .54 - .92) for the regions of state activity with an associated asymptotic significance level of .043. This AUC value of for the regions of state activity indicates that there is a .73 probability that the group differences in the imaging data from this set of brain regions allows correct identification of a person as having ASD. A probability score from the discriminant function analysis of .50 is associated with a sensitivity of .82 and specificity of .63 for ASD.

Conclusions: We previously identified disruption in brain regions involved in social perception in ASD. Here we replicated these results in a new sample and then utilized the previously identified regions reflecting the state of having autism to successfully predict diagnosis in a new group of children with and without ASD. Our results illustrate the predictive power of fMRI as a diagnostic tool.

120.006 147A Altered Myelination of the Corpus Callosum In Autism. M. Gozzi*, A. Hanley, M. Stockman, B. Wade, R. Lenroot, S. J. Spence, A. Thurm, S. Swedo and J. Giedd, *National Institute of Mental Health*

Background: Existing literature indicates that autism may be associated with atypical functional connectivity. It has been suggested that abnormalities in white matter myelination may contribute to this connectivity dysfunction; yet there is lack of data specifically examining myelination of the corpus callosum (the major interhemispheric white matter tract) in autism. Magnetic transfer imaging (MTI) is an MRI technique that detects the exchange of magnetization between protons bound to large, poorly mobile macromolecules (such as myelin) and mobile protons in free water. The most common MTI measure is the magnetization transfer ratio (MTR), which provides quantitative information about the presence of myelin in the brain.

Objectives: In this study, MTI was used to investigate corpus callosum myelination in children with autism compared to typically developing children. Children with autism with and without a history of regression were analyzed separately to determine whether differences in myelination may support these as distinct subtypes. While MTI has been successfully applied in disorders affecting myelin such as multiple sclerosis, no studies are currently available using this technique in autism.

Methods: Subjects included 23 children with regressive autism (17 males, 6 females; mean age=4.1, sd=1.2), 23 children with non-regressive autism (17 males, 6 females; mean age=4.1, sd=1.4), and 23 typically developing children (17 males, 6 females; mean age=4.0, sd=1.6). Gender and age did not differ between groups. Experienced clinicians confirmed the diagnoses using the ADI-R and ADOS. Autistic subjects were sedated for scanning; controls were scanned without sedation. All subjects were scanned using a 1.5 Tesla scanner. The corpus callosum was manually traced on each subject's anatomical MRI by an experienced rater. The magnetization transfer images were then co-registered with the anatomical images. Within the corpus callosum, MTR values were calculated and plotted as a histogram. Each subject’s histogram was analyzed in terms of the MTR peak location (most frequent value) and MTR peak height (the number of voxels having the most frequent value, a measure of uniformity). Group comparisons of MTR parameters were performed using analysis of variance (ANOVA) and post-hoc tests.

Results: Peak height was significantly different between groups (regressive autism: mean=.097, sd=.011; non-regressive autism: mean=.097, sd=.008; controls: mean=.087, sd=.012; p=.004). LSD post hoc comparisons revealed that peak height was significantly higher in the children with regressive (p=.003) and non-regressive (p=.005) autism relative to the typically developing children; peak height did not differ between regressive and non-regressive groups. Peak location was not significantly different between groups (regressive autism: mean=26.04, sd=2.36; non-regressive autism: mean=25.87, sd=2.01; controls: mean=24.83, sd=1.8; p=.11).

Conclusions: This is the first study investigating the myelination of the corpus callosum in autism using MTI. Compared to typically developing children, autistic children showed increased MTR peak height, providing evidence of altered myelination in the corpus callosum. The lack of significant differences between children with regressive and non-regressive autism does not support these as distinct subtypes of autism. Our findings of atypical white matter development are consistent with the theory of abnormal connectivity in autism and may provide additional clues to the neuropathology of autism.

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116.043 148 A Distinct Face-Processing Style In the Broad Autism Phenotype Revealed with fMRI. G. Yucel*[1], M. C. Parlier[1], R. Adolphs[2], A. Belger[1] and J. Piven[1], (1)*University of North Carolina, Chapel Hill (UNC-CH)*, (2)*California Institute of Technology*

Background: The genetic liability for autism is expressed in first-degree relatives who do not meet diagnostic criteria for an autism spectrum disorder, but show milder characteristics resembling autism. This so-called Broad Autism Phenotype (BAP) exhibits many of the patterns of abnormal social cognition observed in autism, only milder.

Objectives: The aim of this study was to investigate the neural substrates of face processing in parents who have a child with autism using functional magnetic resonance imaging (fMRI), with a particular focus on the fusiform gyrus (FG) and amygdala (AMG), two structures known to exhibit abnormal activation to faces in autism. We further examined the association between fMRI activation and the presence of specific deficits in social-emotional processing domains by classifying the BAP parents as having “aloof personality” (BAP+), or “non-aloof personality” (BAP-).

Methods: BAP- (N = 19) and BAP+ (N=13) were defined on the basis of their scores from extensive interviews. A healthy control group consisted of parents of neurotypical children (N=14). Imaging was done on a GE 3T MRI scanner (TR: 2000 ms; TE: 27ms; FOV: 256; image matrix: 64 × 64; Flip angle 60; Voxel size: 4 ×4 × 3.8 mm; 34 axial slices). Subjects viewed alternating blocks of a face-matching and object-matching task, and responded with a button press. Data were analyzed with a focus on specific regions of interest in FSL.

Results: Analysis of the main effect of face and object stimuli revealed that faces evoked activation in fusiform gyrus (FG) and amygdala (AMG) for all groups. However, the BAP group (BAP+ and BAP- pooled) showed significantly greater activation in FG during face and object matching compared to the control parents. Moreover, FG and AMG showed greater responses during face matching in the BAP+ compared to the BAP- groups.

Conclusions: The pattern of face processing seen in parents of autistic children differed from that seen in parents of neurotypical children. Moreover, amongst the parents of autistic children, those with aloof phenotype (BAP+) showed differences from those who were not aloof (BAP-). In each case, the differences resembled those between people with autism and neurotypical individuals. These findings provide insights into the neural circuitry underlying the genetic liability for autism and suggest a neural signature for a forme fruste of this condition.

116.044 149 Granger causality reveals abnormal network structure in the right hemisphere in children with high-functioning autism. M. H. Wu*[1], B. Malmberg[1], T. M. Ellmore[1], H. Li[2], Z. Xue[2], S. T. Wong[2] and R. E. Frye[1], (1)*University of Texas Houston Health Science Center*, (2)*The Methodist Hospital Research Institute, Weill Cornell Medical College*

Background: Recent neuroimaging studies have suggested that children with autism spectrum disorder (ASD) have abnormal functional connectivity as compared to typically developing (TD) controls, but few have investigated whether the hierarchical structure is different between these two groups. Recently we have used granger causality to demonstrate differences in hierarchical structure within the phonological language network during the period just before presentation of a visual phonological stimulus in dyslexic v typical readers and demonstrated how variations within the hierarchical structure are associated with higher function in the dyslexic group.

Objectives: To investigate differences in functional network structure between ASD and TD children using our established paradigm.

Methods: Ten children with high-functioning ASD and 10 TD controls matched on age and gender performed several visual and auditory phonological tasks during a magnetoencephalography scan. Structural MRI scans and neuropsychological assessments were also obtained for each subject. Sources were localized on the cortical surface using the minimum norm estimate (MNE) method. Data from 500ms prior to the onset of the stimuli were extracted from six cortical regions [right and left inferior frontal area (IFA), temporoparietal area (TPA) and visual word form area (VWFA)] and filtered into gamma, beta, alpha, delta and theta frequency bands. The five sources from each cortical area with the highest activity were selected for analysis. Granger causality was calculated using Dynamic Autoregressive Neuromagnetic Causal Imaging (DANCI). An analysis of variance conducted on the connectivity values for each region was used to determine significant differences. Alpha was corrected to 0.001 to account for multiple analyses. Data from six ASD and five TD participants were available for this analysis.

Results: Differences in connectivity were seen in both the left and right hemisphere but changes in the hierarchical network structure were only found in the right hemisphere.

Analysis for the left VWFA demonstrated an ASD by brain area interaction for the gamma frequency range. This resulted from greater connectivity between the left VWFA and TPA for the ASD participants as compared to the TD participants but not other regions. Analysis of the right TPA demonstrated an ASD by brain area by connectivity direction interaction for the beta range and delta frequency band. This was driven by significant differences in connectivity direction between the right TPA and IFA for the ASD and TD groups. In addition, Analysis of the right IFA demonstrated an ASD by brain area by connectivity direction interaction for the alpha frequency band. This was also driven by significant differences in connectivity direction between the right TPA and IFA for the ASD and TD groups.

Conclusions: Although preliminary**,** the results implicate that the hierarchical structure of the right hemisphere is different between ASD and TD participants, particularly with regards to the functional organization of the pathways between the right IFA and right TPA. This may point to deficient top-down control of the TPA from the IFA. Analysis of further participants and additional paradigms will help clarify these differences as will inclusion of performance measures as cofactors in our analysis.

116.046 151 White Matter Integrity and Non-verbal Intelligence in Autism. T. M. Ellmore*[1], H. Li[2], Z. Xue[2], B. Malmberg[1], S. T. Wong[2] and R. E. Frye[1], (1)*University of Texas Houston Health Science Center*, (2)*The Methodist Hospital Research Institute, Weill Cornell Medical College*

Background: A growing number of neuroimaging studies report differences in white matter integrity between children with autism spectrum disorder (ASD) and typically developing (TD) controls. Findings from several of these studies show differences in white matter integrity across widespread areas of the brain, suggesting that ASD is a disorder related to connectivity. However, far less is understood about how aberrant connectivity relates to neuropsychological assessments of intelligence, which often differ between ASD and TD subjects.

Objectives: We sought quantify how a standardized measure of non-verbal intelligence – the computerized test of non-verbal intelligence (CTONI) - relates to differences in white matter integrity between children with high-functioning ASD and TD controls.

Methods: Ten children with high-functioning ASD and 10 TD controls matched on the basis of age (mean 10.7 vs. 11.4) and gender (9 males) were scanned at 3T (Philips Intera). Neuropsychological assessments were obtained in each subject, which included the CTONI. A high-resolution T1-weighted anatomical MRI and a 32-direction diffusion-weighted sequence were acquired. A standard tract-based spatial statistics (TBSS) analysis was performed with contrasts testing for voxel-wise differences in fractional anisotropy (FA) between ASD and TD controls, and differences in the correlation of the CTONI intelligence quotient between ASD and TD groups in areas showing significant ($p<0.01$, Threshold-Free Cluster Enhancement) FA differences.

Results: CTONI IQ differed significantly between groups (85.3 vs. 108.4, $p=0.003$). Using TBSS, we found two areas where FA was significantly higher in TD vs. ASD, which includes white matter terminations near the medial aspect of the superior frontal gyrus in the right hemisphere and the superior temporal gyrus of the left hemisphere. We also found areas where FA was significantly higher in ASD vs. TD, including white matter terminating near medial and lateral middle frontal gyrus and interior frontal gyrus (*p. orbitalis*) of the right hemisphere, and white matter terminating near the middle occipital gyrus, cuneus, thalamus, and inferior frontal gyrus (*p. orbitalis*) of the left hemisphere. In the network of areas that showed FA differences between the groups, we tested for a significant difference between the groups in the correlations between FA and CTONI scores. We found significant differences between correlations of FA and CTONI sources near terminations of white matter that included the left hemisphere of the middle occipital gyrus, thalamus, and inferior frontal gyrus. In these regions, children with ASD showed a greater positive relationship between FA and CTONI scores compared with TD controls.

Conclusions: Although preliminary**,** these results implicate a thalamo-cortical white matter network, possibly including the inferior fronto-occipital fasciculus of the left hemisphere, as a possible neural substrate underlying differences in non-verbal intelligence in children with high-functioning ASD. This anatomical network may mediate the transfer of visual information from occipital areas directly to frontal cortex for further processing. Children with high-functioning ASD may rely more on this network, to the detriment of performance, than TD children for carrying out the cognitive operations necessary to complete some neuropsychological tests. Ongoing studies will test this hypothesis in the context of more specific behavioral measures.

116.047 152 Abnormalities In Neuronal Gamma-Band Synchronization and M100 Latency Delays In First-Degree Relatives of Children with Autism Spectrum Disorders (ASD). K. L. McFadden*, D. C. Rojas and S. Hepburn, *University of Colorado Denver, Anschutz Medical Campus*

Background: Current diagnoses and treatment of Autism Spectrum Disorders (ASD) are based entirely on behavioral observations, so identification of biomarkers and endophenotypes in ASD would provide substantial benefits to diagnostic subtyping, preclinical development of therapeutics, treatment monitoring and genetics. An endophenotype would be seen at higher rates in those with ASD than unaffected family members or the general population, but also more frequently in unaffected family members than in the general population. Synchronized neuronal activity in the gamma band (30-80 Hz) has been found to be abnormal in both children and adults with ASD during presentation of auditory tone stimuli (Wilson et al., 2007; Rojas et al., 2008). These abnormalities have also been observed in unaffected parents of children with ASD (pASD), suggesting the gamma-band response may be a useful ASD endophenotype. However, the gamma-band response to language in ASD has not been investigated as an endophenotype marker, and would be of specific interest for this population given the language and communication impairments commonly seen in ASD.

Objectives: The current study aims to investigate differences in gamma-band responses to language between a group of adults who have a child with ASD and a healthy adult control group, using magnetoencephalography (MEG). In addition, since children with ASD have shown latency delays in the M100 response (an early evoked field component of the MEG waveform) (Roberts et al., 2010), M100 latency will be assessed.

Methods: Parents of a child with ASD (N = 17) and a group of adult control participants (N = 23) listened to 90 abstract English nouns presented binaurally during MEG recording. Dipole fits were used to construct virtual electrodes from which to conduct time-frequency transformation, and averaged evoked (i.e., phase-locked) waveform data between 30-100 ms post-stimulus was analyzed to capture evoked transient gamma-band activity. In addition, phase-locking factor (PLF), a direct measure of phase-locking to stimulus, was calculated. M100 peak latency was measured from the time of stimulus onset. Independent samples t-tests were used to assess group differences in mean transient evoked power, PLF, and M100 latency.

Results: The pASD group showed an increased mean PLF (p = .012) and increased M100 peak latency (p = .005) compared to controls. No group differences were found for transient evoked gamma-band activity, p > .05.

Conclusions: Previous studies showed decreased PLF in pASD during tone presentation (Rojas et al., 2008), but it seems this gamma-band abnormality is distinct for language stimuli, as the current study found pASD to have an increased PLF compared to controls. Additionally, pASD showed an M100 latency delay compared to controls, which has been found previously in children with ASD (Roberts et al., 2010), but has not previously been investigated in first-degree relatives of individuals with ASD. These results suggest M100 latency and gamma-band responses to language stimuli are heritable, and are potential ASD endophenotypes.

116.048 153 Total Cerebral Volume Is Associated with Onset Status In Preschool Age Children with Autism. C. W. Nordahl*[1], A. Lee[1], M. D. Shen[1], T. J. Simon[1], S. J. Rogers[1], S. Ozonoff[2] and D. G. Amaral[1], (1)*UC Davis M.I.N.D. Institute*, (2)*UC Davis*

Background: Autism is a heterogeneous disorder, and multiple behavioral and biological phenotypes likely exist. One well-characterized behavioral phenotype is onset status. While some children with autism exhibit symptoms very early in life, others experience a regression or loss of previously acquired skills. There is currently very little known about the neural substrates associated with these two different behavioral trajectories in autism.

Objectives: We examined the relationship between total brain volume and onset status in a large sample of 2-4 year old children with autism spectrum disorder (ASD) (n = 48, early onset, n = 58, regression) and a comparison group of age-matched typically developing children (TD) (n = 55).

Methods: Diagnoses and autism severity were based on ADOS and ADI-R scores and clinical judgment by trained, experienced psychologists. Developmental quotients (DQ), verbal quotients (VQ) and nonverbal quotients (NVQ) were based on the Mullen Scales. Onset status was categorized based on parent reports from related ADI-R questions. Total cerebral volume was compared between autism onset groups as well as relative to age-matched typically developing controls. Autism severity and DQ were also evaluated in relation to brain volume and onset status.

Results: Children who exhibited regression had significantly larger total brain volumes than children with early onset autism (p = .004). Total brain volume in the early onset ASD group did

not differ from the TD group, whereas total brain volume was significantly larger in the children with regression. Moreover, children with regression had significantly lower VQ ($p = .03$) and higher (i.e. more severe) ADOS social and communication scores ($p = .02$). Total brain enlargement remained significant even after controlling for these variables. There were no significant correlations between total brain volume and VQ or ADOS scores.

Conclusions: Total brain enlargement has been reported in children with autism under the age of five. However, behavioral associations with abnormal brain enlargement have not been fully explored. Our findings suggest that abnormal brain enlargement in autism is associated with a parent-reported regressive pattern of onset and more severe symptoms involving both developmental impairment and ASD severity.

116.049 154 Action Perception In Children with and without Autism Specturm Disorders. B. C. Vander Wyk*[1], R. I. Pillai[1], H. Seib[1], E. S. MacDonnell[1] and K. A. Pelphrey[2], (1)*Yale University*, (2)*Yale University Child Study Center*

Background:

Individuals with autism spectrum disorders (ASD) exhibit deficits in using gaze spontaneously to understand and predict other people's mental states and behaviors. Neuroscientists have begun to identify key brain regions involved in this aspect of social perception in typically developing adults (i.e., "the social brain"), and work has commenced on identifying dysfunction in ASD.

Objectives:

We tested the hypothesis that the brain circuitry involved in perceiving the intentions underlying other people's actions develops abnormally in children with autism. We conducted a cross-sectional study of children with and without autism using a joint attention paradigm, while measuring activity using fMRI and concurrently tracking eye gaze inside and outside the scanner.

Methods:

Adapting a previously used joint-attention paradigm, participants viewed videos of an actress expressing either a positive or negative emotion towards one of two cups and subsequently grasping one of them. If the actress grasped the cup that has either received positive regard or had not received negative regard, the action was Congruent (i.e. the action would be expected based upon the previous expression); otherwise, the action was Incongruent. The experiment used an event-related design with participants viewing 16 trials of each condition (Positive/Congruent, Positive/Incongruent, Negative/Congruent, and Negative/Incongruent). Eye gaze was monitored using a custom-built eye tracking system inside the scanner and outside the magnet using a Tobii-T60. In both cases, visual stimuli are being partitioned into areas of interest (AOIs) corresponding the actress's face and the targets of reach.

Results:

We plan to compare activation within regions of the posterior superior temporal sulcus (STS) to the Incongruent and Congruent trials. For the neuroimaging component of this study, we expect that the STS region and other brain regions previously shown to be engaged by joint attention paradigms will respond more strongly and exhibit greater functional connectivity for incongruent compared to congruent reaching conditions in typically developing children. In contrast, we predict that children with ASD will not exhibit this increased activity and functional connectivity. Since sensitivity to emotional expression is a skill that develops over childhood and supports social competence, we predict that both age and skill will correlate with the magnitude of this effect. Preliminary fMRI evidence from typically developing children (n= 32) and children with an ASD (n=5) is consistent with these hypotheses.

Conclusions:

Increased activation in regions processing joint attention is hypothesized to reflect the need to update representations based on the observation of actions that are inconsistent with expectations, a basic constituent of higher order social cognition. The lack of such activation in ASD may reflect a failure to link the actress' actions to the expectations set up by the actress' direction of gaze and positive or negative affectation. Higher-level social cognition deficits often noted in ASD, such as theory of mind, might actually result from disruption of a more basic ability, such as responses to bids for joint attention or responses to mutual versus averted gaze. Thus, these complex deficits might be culminations rather than starting points.

116.050 155 Age-Related Brain Changes Associated with Social Impairments In Children, Adolescents and Adults with Autism Spectrum Disorders. K. A. Doyle-Thomas*[1], E. G. Duerden[2], M. J. Taylor[3], L. V. Soorya[4], A. T. Wang[4], J. Fan[4] and E. Anagnostou[5], (1)*Holland Bloorview Kids Rehabilitation Hospital*, (2)*The Hospital for Sick Children; Autism Research Unit*, (3)*Hospital for*

Sick Children, (4)*Mount Sinai School of Medicine*, (5)*Bloorview Research Institute, University of Toronto*

Background: Brain regions involved in perceiving and recognizing affect show structural abnormalities in adults with autism spectrum disorders (ASD) and are related to impaired social cognition. It remains unclear whether these structural atypicalities change with age or are associated with ASD symptomatology.

Objectives: We assessed the relation between the severity of social deficits and brain morphometry in cohort of individuals with ASD that spanned a large age range.

Methods: 28 children, adolescents and adults between the ages of 7 and 39 (mean age=22 ±8 years; 22 males) who carried a clinical diagnosis of ASD, according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV), were enrolled in this study. Their diagnoses were then confirmed using the Autism Diagnostic Observational Schedule - Generic (ADOS-G) and the Autism Diagnostic Interview - Revised (ADI-R). High-resolution anatomical Magnetic Resonance Imaging (MRI) scans were obtained for each participant. Cortical thickness measurements were made on the anatomical MRIs using an automated pipeline. The cortical thickness data were analyzed using a general linear model controlling for sex. We performed a directed search in limbic areas (rostral and dorsal anterior cingulate cortices, medial prefrontal cortices, orbitofrontal cortices), and brain areas implicated in social cognition (inferior frontal gyri, superior temporal gyri, fusiform gyri) correcting for multiple comparisons using the False Discovery Rate (q=0.05). Scores for the social domain of the ADI algorithm were correlated with the thickness with the ROIs.

Results: Greater impairment on the social domain of the ADI was significantly correlated with increased cortical thickness in the rostral ACC, even when the variance associated with age was removed from the model. A significant interaction was found between the age of the participants and the social scores on the ADI and thickness in the left orbitofrontal cortex, suggesting that the relation between cortical thickness in this region and impaired social cognition varies with age. Younger participants with greater social cognition impairments showed decreased thickness in the orbitofrontal cortex relative to adults.

Conclusions: Atypical ACC morphology is associated with impaired social cognition in children, adolescents and adults with ASD; however this abnormality was not related to age and may be a result of abnormal development in this region. Interaction effects between age and social cognition were seen in the orbitofrontal cortex, a region involved in social functioning and reward. Previous work has theorized that socialization deficits may be due to disruptions in connections between the orbitofrontal cortex and the amygdala. Given the strong age-related changes in the orbitofrontal cortex seen in the current study, future work should examine fronto-amygdalar connections across the life-span in ASD.

116.051 156 An Event-Related Potential Study of Familiar Face Processing In Autism Spectrum Conditions. O. Churches*[1], S. Baron-Cohen[2] and H. Ring[1], (1)*University of Cambridge*, (2)*Autism Research Centre, University of Cambridge*

Background:

Clinical reports and behavioural studies of face perception in autism spectrum conditions suggest that the recognition of familiar faces is impaired. However, there have been inconsistent findings from functional brain imaging studies of familiar face perception in autism spectrum conditions. The N250 event-related potential component is a negative going wave maximal over occipito-parietal areas which peaks between 230 and 320 milliseconds after the presentation of a stimulus. Previous studies in the typical population have found that the N250 is larger to familiar faces than unfamiliar faces. Hence, this component is a means for investigating the processing of face familiarity in autism spectrum conditions.

Objectives:

The current study aimed to investigate the acquisition of new face representations in autism spectrum conditions. Specifically, it was hypothesised that people with autism spectrum conditions would show a decreased N250 to a previously unfamiliar target face that was repeated and so became familiar during the course of the experiment. Thus, this paradigm differed from previous ERP and fMRI studies of face familiarity in autism spectrum conditions by directing the attention of participants toward the relevant face.

Methods:

A sample of 15 adults with autism spectrum conditions and 15 age and intelligence quotient matched typical controls were shown a single, previously unfamiliar face and asked to remember it. This face was then inserted as the target into a randomised odd-ball sequence with seven non-target faces. During the odd-ball sequence, each face was repeated 100 times and participants were asked to indicate with a button

press whether each face was the target or one of the non-target faces.

Results:

The autism spectrum conditions and typical control groups were comparable in their behavioural performance for identifying the target and non-target faces. Consistent with the N250 literature in the typical population, the N250 was larger for the target face than the non-target faces across both participant groups. And, consistent with the hypothesis for this experiment, there was an interaction between participant group and face type for the N250 in which the autism spectrum conditions group showed a smaller N250 component to the target face than the typical control group but a similar N250 to the non-target faces.

Conclusions:

The reduced N250 for the target face in the autism spectrum conditions group suggests that the development of face familiarity, indexed by the N250, is impaired in autism spectrum conditions. This is consistent with clinical accounts and behavioural studies that have found impaired recognition of familiar faces in autism spectrum conditions. That a decreased N250 was found in this study but not in previous studies of face familiarity in autism spectrum conditions may be because this paradigm deliberately directed the attention of participants toward the relevant face. This suggests that the impairments in familiar face processing found in autism spectrum conditions may be due to decreased attentional modulation of individual face representations.

116.052 157 Attentional Capture In ASD: A Combined fMRI-EEG Study. B. Keehn*[1], P. Shih[2], A. Nair[1], A. Khan[2], M. Westerfield[3], A. J. Lincoln[4], J. Townsend[3] and R. A. Müller[2], (1)*San Diego State University / University of California, San Diego*, (2)*Brain Development Imaging Laboratory, San Diego State University*, (3)*University of California, San Diego*, (4)*Alliant International University;Center for Autism Research, Evaluation and Service*

Background: Previous descriptions of attentional modulation in autism spectrum disorder (ASD) are paradoxical; individuals with ASD are described as over-focused, yet susceptible to distraction. The coordination of goal-directed and stimulus-driven attentional processes is vital for the selection of behaviorally-relevant information. Contingent attentional capture, as when a task-irrelevant stimulus sharing a task-relevant feature captures attention, is one such example of this top-down/bottom-up interaction.

Objectives: To evaluate the neural basis of top-down and bottom-up attentional modulation during contingent attentional capture in children and adolescents with ASD.

Methods: Participants were nine children and adolescents with ASD and 16 age- and IQ-matched typically developing (TD) children and adolescents. The study consisted of separate functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) / eye-tracking sessions of a rapid serial visual presentation experiment. Stimuli included three streams of numbers (0–9). Each trial lasted 480ms and consisted of four iterations of simultaneously varying numbers (120ms per iteration). The central stream was composed of numbers of various colors. Digits presented in the peripheral streams were gray in most trials; colored peripheral distractors appeared infrequently in either the left or right peripheral streams and were either the same color as the target (red) or a non-target color that did not appear in the center stream (green). Participants were required to respond via button press to the identity of targets (red numbers) appearing only in the central stream (left button ≤ 4; right button ≥ 5). On target present trials, a red number occurred in the center stream on the third iteration with or without the appearance of target- and non-target-colored peripheral distractors. For target absent trials, no red number appeared in the center stream with the appearance of either target- or non-target-colored peripheral distractors. Participants completed four 6-minute runs for the fMRI session and sixteen 3-minute blocks for the EEG/eye-tracking session.

Results: No group difference in error rates to target present trials was found; both groups had increased error rates to target present trials with target-colored as compared to non-target-colored distractors. To isolate attentional capture from target- and response-related activation, only target absent trials were examined for fMRI data. There were no group differences in activation to non-target-colored distractors. For target-colored distractor trials, individuals with ASD exhibited greater activation of dorsal frontal-parietal regions; TD individuals exhibited greater activation of anterior cingulate cortex (ACC). Correlational analyses revealed that reduced activation of ACC was related to greater social impairment in ASD. Analysis of EEG and eye-tracking data is ongoing.

Conclusions: In both groups, to-be-ignored distractors were more likely to capture attention when sharing a task-relevant feature. Activation to target-colored distractors was increased in the ASD group within the network responsible for endogenous control of visual attention, whereas it was atypically reduced in ACC, a region associated with task-control. Correlation of this

latter finding with social impairment may suggest a crucial role of ACC dysfunction in ASD, consistent with some previous findings.

116.053 158 Atypical Brain Response to Simultaneous Touch and Sound In Children with Sensory Processing Differences: A Multisensory Integration Functional Imaging Study. E. J. Marco*[1], L. Hinkley[1], S. S. Hill[2], A. Bernard[1], A. M. Findlay[1], P. Mukherjee[1] and S. Nagarajan[1], (1), (2)*UCSF*

Background: Atypical auditory and tactile response behaviors are ubiquitous in autism spectrum disorders (ASD). These behaviors are thought to reflect early unimodal and multimodal processing differences that may underlie the core ASD deficits in social skills, communication and restricted interests/behaviors. In fact, over 30 years of evoked potential research suggests cortical differences in the processing of sound, sight, and touch for children with ASD. A recent ASD study by Russo et. al (2010) suggests delayed multisensory integration. We have previously reported decreased functional brain connectivity as well as decreased early auditory cortex evoked response amplitudes in children with sensory processing differences (SPD). However, multisensory integration of auditory and tactile information has not previously been explored in this population. Children with SPD, who do not meet ASD criteria, provide a unique opportunity for probing the neural underpinnings of abnormal sensory processing behaviors and can help to understanding atypical sensory behaviors, measure treatment response, and shape more functional neural pathways in susceptible individuals

Objectives: Our goal is to investigate whether children with SPD show neural differences in multisensory integration. We used magnetoencephalographic imaging (MEG-I), a technique that examines changes in cortical activity on a millisecond level, to create maps of cortical activation for children with SPD and matched controls during unimodal and bimodal auditory and tactile stimulation We hypothesized that children with SPD would exhibit reduced activation in the oscillatory frequencies thought to underlie long-range cortical communication (gamma band) in multimodal regions.

Methods: Brain responses to simultaneous monaurally tone (-45dB) and finger tap (17PSI) were recorded for the SPD group (n=10, mean age=10.6 years) and the HC group (n=10, mean age=10.0 years) using a 275-channel whole-head biomagnetometer system at a sampling rate of 1200Hz. Epochs of 900ms (400ms pre-stimulus) were collected and filtered 2-40Hz. For evoked field analysis, MEG sensor data was averaged for each subject and the latency and amplitude(root mean squared; RMS) of the M110, M164, and M190 peaks at the left supramarginal gyrus were compared using a mixed effects model. MEG data was also reconstructed in the time-frequency domain using an adaptive spatial filtering technique, which allowed us to observe induced (non phase-locked) responses, measured as change in the modulation of oscillatory activity. We investigated high gamma (65-115Hz) and ultra-high gamma (115-150Hz) frequency bins. Time-frequency reconstructions were spatially normalized and entered into a group analysis using statistical non-parametric mapping.

Results: The SP group showed trends toward reduced M110 amplitudes with increased later activity at M190 within the left supramarginal gyrus, a region previously identified as underconnected in the SPD group (p=.06). Decreased high-frequency oscillations were also identified in the SPD group over medial posterior parietal cortex (p=0.01).

Conclusions: This study suggests that children with SDP, like children with ASD, have measurable and reduced early MSI of simple auditory and tactile stimuli. The time frequency analysis made possible by MEG-I will direct our ongoing investigation of how brain regions differ in their processing of sensory information both in time as well as in oscillatory frequency.

116.054 159 Atypical Hemispheric Asymmetry of the Corticospinal Tract In Autism Spectrum Disorder. J. M. Treiber*[1], D. K. Shukla[1], B. Keehn[2] and R. A. Muller[1], (1)*San Diego State University*, (2)*San Diego State University / University of California, San Diego*

Background:

Most previous diffusion tensor imaging (DTI) studies in ASD have focused on corticocortical tracts (such as corpus callosum), whereas less is known about subcortical tracts supporting sensorimotor functions. We examined the corticospinal tract, which contains motor axons connecting cerebral cortex and spinal cord and is crucial for voluntary motor control. Any corticospinal abnormalities may therefore be related to motor impairments observed in previous studies.

Objectives:

To examine the white matter integrity and hemispheric asymmetry of the corticospinal tract in children and adolescents with ASD, using probabilistic white matter fiber tracking.

Methods:

DTI data from 11 children with ASD and 12 typically developing (TD) children were acquired on a 3T MRI scanner, using single-shot diffusion-weighted EPI pulse sequence with two degrees of diffusion weighting (b=0 and 1000 s/mm^2, 61 non-linear directions, 1.875x1.875 mm^2 in-plane resolution, 2 mm slice thickness). ASD and TD participants were matched for gender, age, verbal and nonverbal IQ, and handedness. Geometric distortions due to local magnetic field inhomogeneities were corrected using field maps. Diffusion tensor tractography was performed using a probabilistic tracking approach from two regions-of-interest (ROIs) placed in the primary motor cortex and the cerebral peduncle to derive the corticospinal tracts. Bayesian estimation of diffusion parameters using Markov Chain Monte Carlo sampling techniques and trilinear interpolation of the probability density functions were employed to determine the streamline between the given ROIs. Mean diffusivity (MD), and radial diffusivity of the corticospinal tracts were calculated. Asymmetry of corticospinal tract was determined for each index using the formula [2*(R-L)/(R+L)]*100.

Results:

A marginally significant increase of mean diffusivity (MD) for corticospinal tract in the right hemisphere was found in the ASD group compared to the TD group (TD: MD = .95 +/- .04*10^{-3}; ASD: MD .98 +/- .05*10^{-3} TD mm^2/s, p=.07). There was an atypical rightward shift for MD (F=5.70, p=.04) and radial diffusivity (F=5.05, p=.02) in the ASD group.

Conclusions:

Using probabilistic white matter tractography, we were able to delineate the corticospinal tracts linking primary motor cortex and cerebral peduncles. The results suggest an atypical corticospinal tract asymmetry in ASD, with greater impairment in the right hemisphere. Corticospinal tracts play an important role in motor and somatosensory functions. Our findings may relate to sensorimotor impairment and atypical hemispheric dominance in ASD.

116.055 160 Atypical Language Lateralization Mediated by Development of the Corpus Callosum. L. B. Hinkley*, E. J. Marco, J. Gold, A. M. Findlay, M. Wakahiro, A. J. Barkovich, P. Mukherjee, S. Nagarajan and E. Sherr, *University of California, San Francisco*

Background:

While over 90% of typical individuals have language lateralized to the left hemisphere, individuals with autism are reported to show a higher rate of right hemisphere language lateralization. In autism, atypical development of the corpus callosum (a large white matter structure that serves to transfer information between the left and right hemispheres) has been reported and the role of the corpus callosum in language lateralization remains unclear. Intriguingly, clinical language impairments reported in autistic individuals are observed in individuals with callosal abnormalities, including agenesis of the corpus callosum (AgCC).

Objectives:

Here, we quantify language lateralization in patients with AgCC and matched healthy controls using magnetoencephalography (MEG) during a verb generation task. This task has been shown to produce patterns of left hemisphere dominant activation in typical individuals. Both hemispheric dominance as well as temporal and oscillatory differences were assessed and compared between groups.

Methods:

27 participants with AgCC and 20 IQ and age-matched healthy control (HC) subjects enrolled in this study. Of the 27 AgCC participants, 10 have complete agenesis of the corpus callosum (cAgCC) and 17 have partial agenesis of the corpus callosum (pAgCC). MEG data were collected using a 275-channel whole-head biomagnetometer (MISL) at a sampling rate of 1200Hz. At the beginning of every trial, a single noun was presented at a comfortable volume through earphones every four seconds (100 trials). Subjects were instructed to think of a verb or “action word” associated with the noun and to speak into a megaphone attached to a microphone at the foot of the bed. Data were analyzed in the time-frequency domain using an adaptive spatial filtering technique implemented in Nutmeg (nutmeg.berkeley.edu). Changes in beta oscillatory power (12-30Hz) were used to compute an index of language lateralization (laterality index; LI). Tomographic reconstructions were spatially normalized and entered into a second-level group analysis using SnPM and multiple comparisons corrections were performed using a Family-Wise Error rate (FWE).

Results:

While we found the expected leftward language lateralization in 90% of our healthy controls (mean LI=0.6), only 20% (mean LI=-0.06) of individuals with complete AgCC showed left hemisphere language dominance. The partial AgCC group demonstrated an intermediate left lateralization at 47% (mean LI=0.08). Further investigation reveals that individuals with AgCC have greater activation of the right middle frontal gyrus

(MFG; p<0.05, FWE corrected) that occurs in the beta frequency. This increase in neural activity occurs immediately prior to the vocal response (750ms post-stimulus, -450ms pre-response).

Conclusions:

Language deficits are a core feature of autism spectrum disorders and may be a result of atypical hemispheric specialization. The cause of this disruption may be related to abnormal interhemispheric communication mediated by the corpus callosum. This report shows a direct relationship between the preservation of the corpus callosum and language lateralization. With the overlap in communication deficits seen in both autism and AgCC, identification of this level of neural specification can facilitate the development of targeted treatment interventions that focus on remediating language impairments.

116.056 161 Atypical Neural Networks for Social Orienting In Autism Spectrum Disorders. D. J. Greene*[1], N. L. Colich[2], E. Zaidel[3], M. Iacoboni[3], S. Y. Bookheimer[2] and M. Dapretto[2], (1)*Washington University in St. Louis*, (2)*University of California, Los Angeles*, (3)*UCLA*

Background: Autism spectrum disorders (ASD) are characterized by significant social impairments, including deficits in orienting attention following social cues. Behavioral studies investigating social orienting in ASD, however, have yielded mixed results, as the use of naturalistic paradigms typically reveals clear deficits whereas computerized laboratory experiments often report normative behavior.

Objectives: The present study seeks to examine the neural mechanisms underlying social orienting in ASD in order to provide new insight into the social attention impairments that characterize this disorder.

Methods: Using functional magnetic resonance imaging (fMRI), we examined the neural correlates of social orienting in children and adolescents with ASD and in a matched sample of typically developing (TD) controls while they performed a spatial cueing paradigm with social (eye gaze) and nonsocial (arrow) cues. Cues were either directional (indicating left or right) or neutral (indicating no direction), and directional cues were uninformative of the upcoming target location in order to engage automatic processes by minimizing expectations.

Results: Behavioral results demonstrated intact orienting effects for social and nonsocial cues, with no differences between groups. The imaging results, however, revealed clear group differences in brain activity. When attention was directed by social cues compared to nonsocial cues, the TD group showed increased activity in frontoparietal attention networks, visual processing regions, and the striatum, whereas the ASD group only showed increased activity in the superior parietal lobule. Significant group x cue type interactions confirmed greater responsivity in task-relevant networks for social cues than nonsocial cues in TD as compared to ASD, despite similar behavioral performance.

Conclusions: These results indicate that, in the autistic brain, social cues are not assigned the same privileged status as they are in the typically developing brain. These findings provide the first empirical evidence that the neural circuitry involved in social orienting is disrupted in ASD and highlight that normative behavioral performance in a laboratory setting may reflect compensatory mechanisms rather than intact social attention.

116.057 162 Atypical Premotor, Parietal, and Cerebellar Functioning Underlies Sensorimotor Impairment In Autism. M. W. Mosconi*, S. A. Coombes, A. M. D'Cruz, L. Schmitt, S. Shrestha, D. E. Vaillancourt and J. A. Sweeney, *University of Illinois at Chicago*

Background: The brain system abnormalities underlying sensorimotor deficits in autism are not well established.

Objectives: Investigate brain alterations underlying visuomotor control impairments in autism.

Methods: Using fMRI, we studied 16 individuals with autism and 17 age-matched healthy control individuals performing a sustained precision grip force task. All subjects were right-handed. Subjects gripped a transducer while viewing a white force bar that moved upwards with increased force toward a fixed target bar. They were instructed to maintain a constant force level so that the white force bar remained at the level of the target bar set to 15% of each individual's maximum force contraction. The gain of the feedback, defined as the vertical distance the force bar moved per Newton of force applied to the transducer, was compared in low and high conditions each presented during 26 sec trials. When gain was low, the white bar moved a smaller distance for every Newton of force applied compared to when gain was high. Subjects also performed trials in which no visual feedback was given.

Results: Subjects with autism and controls did not differ in their mean force level. The error of sustained force was greater for subjects with autism relative to controls, P=.01, indicating a difficulty using sensorimotor feedback to sustain a constant force output. When the gain setting was low, and thus visual feedback less precise, and when no visual feedback was provided, subjects with autism showed increased force error

compared to controls, *P's*<.05. During the low gain condition, subjects with autism showed reduced activation in left motor and premotor cortices, bilateral superior parietal lobule, and bilateral anterior (lobules III/IV) and posterior cerebellum (lobules V/VI), and increased activation in right MT/V5 and left posterior cerebellum (Crus I). During the high gain condition, subjects with autism showed reduced activation in left middle frontal gyrus, right inferior parietal lobule and bilateral V3, and increased activation relative to controls in bilateral supplementary motor area (SMA), left motor cortex, right MT/V5, bilateral putamen and posterior cerebellum (Crus II). During the no visual feedback condition, subjects with autism showed reduced activation within bilateral dorsolateral prefrontal cortex, medial frontal gyrus, and ipsilateral cerebellar lobules V/VI.

Conclusions: Individuals with autism showed greater isometric force error, suggesting impaired utilization of visual feedback to guide motor performance. These impairments implicate dysfunction within lateral cerebellar circuitry that typically modulates the accuracy of motor performance by transforming sensory inputs about performance error into corrective afferent motor commands. This system is not able to guide accurate motor performance in autism when the precision of visual input is attenuated. Increased activity within the SMA, putamen and posterior cerebellum in the context of intact performance during a condition of increased sensory feedback indicates that subjects with autism may recruit alternate brain systems typically involved in complex motor planning. These findings provide evidence that cerebellar dysfunctions and their interaction with neorcortical systems may underlie dyspraxia in autism, and that even intact sensorimotor performance in autism may involve atypical recruitment of compensatory brain systems.

116.058 163 Autism Symptom Severity Modulates Responsivity In the Mirror Neuron System: A Replication and Extension of Prior Research Findings. M. Dapretto*[1], N. L. Colich[1], L. M. Hernandez[2], J. D. Rudie[1], S. Y. Bookheimer[1] and M. Iacoboni[3], (1)*University of California, Los Angeles*, (2)*Brain Mapping Center, University of California, Los Angeles*, (3)*UCLA*

Background: A large number of studies – relying on a variety of neuroimaging tools and paradigms – have reported abnormalities in the so-called mirror neuron system (MNS) in individuals with autism. However, a few studies have failed to find significant group differences. These negative findings have been heralded as evidence against the hypothesis that MNS dysfunction may contribute to core deficits in autism.

Objectives: The present study had two main aims. First, we aimed to replicate our prior findings of MNS dysfunction in a considerably larger and independent sample of children and adolescents with ASD. Second, we aimed to further examine how responsivity within the MNS might vary as a function of symptom severity in order to assess how relatively minor differences in sample characteristics may affect study results when comparing individuals with ASD to neurotypical controls.

Methods: While undergoing two fMRI scans, a total of 40 children and adolescents with ASD and 14 typically-developing (TD) control subjects (matched by age, IQ and head motion) passively observed or imitated faces displaying different emotions (angry, fearful, happy, sad, and neutral). As in our prior study (Dapretto et al., 2006), we used a jittered event-related design, where faces were presented every 3 sec (with each face being displayed for 2 sec) according to an optimized random sequence. The order of the two scans was counterbalanced within and between groups. All participants in the larger ASD sample (ASD_ALL) had an autism diagnosis based on the ADI and best clinical judgment; on the ADOS, 14 participants met criteria for full autism (ADOS_AUT), 18 participants only met criteria for ASD (ADOS_ASD), and 8 participants did not meet criteria for either (ADI_ONLY).

Results: When comparing the largest ASD sample (ASD_ALL) to TD controls, we replicated our previous findings showing significantly greater activity in the frontal component of the MNS in the TD group for both the Imitate and Observe conditions. The results held when comparing the most severely affected group (ADOS_AUT) to TD controls; however, when comparing the less affected group (ADOS_ASD and ADI_ONLY) to TD participants, significant between-group differences were observed only for the Imitate condition and at less stringent statistical thresholds. Consistent with our previous findings, a significant negative correlation was also observed between frontal MNS activity and individual scores on the Social and Communication Subscale of the ADOS such that the most impaired individuals showed the least amount of MNS activity.

Conclusions: These results add to a large body of work indicating hyporesponsivity in the MNS in individuals with autism. Importantly, these findings may help explain some of the discrepant results in the literature showing that relatively small differences in symptom severity (as indexed by the ADOS) may determine whether significant group differences are observed. Overall, these findings highlight the need to carefully consider symptom severity as well as sample

heterogeneity within and between studies, particularly when making sense of conflicting results.

116.059 164 Brain Activation During Inferential and Theory of Mind Processing In Children with Autism. D. L. Williams*[1], E. J. Carter[2], J. F. Lehman[2] and N. J. J. Minshew[3], (1)*Duquesne University*, (2)*Carnegie Mellon University*, (3)*University of Pittsburgh*

Background: Individuals with autism have a deficit in Theory of Mind (ToM) processing manifested both behaviorally and in brain activation. Adults with autism were reported to indiscriminately engage the right hemisphere ToM network during discourse processing that required inferencing about physical, emotional, and mental states, irrespective of the demand for ToM processing (Mason et al., *Neuropsychologia,* 2008).

Objectives: This functional magnetic resonance imaging (fMRI) study used a paradigm that required inferential processing in physical and social conditions with children with autism to examine whether the inefficient use of the ToM network occurs earlier in the developmental process. Because children with autism may have more difficulty with reading than typically developing (TD) children, the paradigm used visual scenarios.

Methods: Twelve children with autism (ages 8 to 16 years, mean = 13.08; FSIQ range 87-135, mean 112.08) and 13 TD children (ages 7 to 15 years, mean = 11.23; FSIQ range 97-128, mean = 114.92) participated in this event-related fMRI study. The two groups were matched on age, gender, VIQ, PIQ, and FSIQ. Participants simultaneously viewed two pictures labeled as the first and second of a sequence for 6s. Then, they read the question "What comes next?" for 2s. Two more pictures were displayed for 4s while the participants selected which image logically completed the sequence. Ten trials required knowledge about basic physical properties (e.g., that a falling egg would crack). The other ten trials required social knowledge, particularly an understanding of other people's intentions and mental states (e.g., a boy would cry after a girl knocks over his block tower). Brain activation was analyzed during the viewing of the first two pictures, when inferential processing was thought to occur.

Results: In the Social-Physical comparison within each group, both the autism and the TD group had brain activity in bilateral posterior superior temporal sulcus (pSTS) and right middle temporal gyrus ($p<.001$). In addition, the autism group had bilateral activation in inferior frontal gyrus and medial frontal gyrus. In the reverse Physical-Social comparison, both groups had frontal and parietal activation; however, this activation was bilateral in the TD group but left-lateralized in the autism group. In the between-group comparison for Social-Physical, the autism group had greater bilateral inferior frontal gyrus activity than the TD group ($p<.005$). In the group comparison for Social-Fixation, the autism group had reliably less activation than the TD group in right pSTS ($p<.005$). Both groups performed the tasks without difficulty (Physical means: autism 93%, TD 95%; Social means: autism 91%, TD 94%).

Conclusions: Both groups differentially used ToM areas during the Social condition. The more extensive brain activity pattern of the autism group during inferencing about Social scenarios, as indicated by the recruitment of frontal language and medial frontal areas, suggests that they required more support from reasoning and language systems to perform the ToM tasks.

116.060 165 Corpus Callosum Volume In Autism and Its Extended Phenotype. L. R. Chura*, R. J. Holt, S. Baron-Cohen and M. D. Spencer, *Autism Research Centre, University of Cambridge*

Background: Several lines of research have converged to suggest the corpus callosum (CC) may be central to understanding the pathophysiology of autism spectrum condition (ASC). 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) and one of the most replicated findings in autism research has been decreases in CC size (Hardan et al., 2000). Discrepancies remain, however, as to which subregions of the CC are affected in autism (Brambilla et al., 2003) paving the way for further research in this area.

Objectives: To investigate possible differences in corpus callosum size and asymmetry.

Methods: High-resolution structural magnetic resonance images (MRI) of the brain have been obtained on adolescent subjects with ASC (n=40), their unaffected siblings (n=40), and unrelated typically developing controls (n=40).

Results: Structural neuroimaging data will be presented from the three groups and will include midsaggital and parasaggital corpus callosum size measurements. The CC has been partitioned into the seven functional subregions according to the Witelson method (Witelson, 1989).

Conclusions: This work seeks to extend previous research from our group employing the same partition methodology wherein fetal testosterone was found to be a primary

mechanism for asymmetric callosal size and the isthmus emerged as a subregion of particular interest (Chura et al., 2010). Differences in CC subregion size and symmetry may have implications for understanding lateralization of the brain, task performance, and relevant cognitive deficits associated with ASC. Moreover, to date siblings of individuals on the autistic spectrum have been the subject of very little neuroimaging research, and this study aims to shed light on the extended phenotype of ASC.

116.061 166 Differences In Global and Local Level Information Processing In Autism: An fMRI Investigation. M. Gadgil*[1], E. Peterson[2], J. R. Tregellas[1], S. Hepburn[1] and D. C. Rojas[1], (1)*University of Colorado Denver, Anschutz Medical Campus*, (2)*University of Northern Colorado*

Background:

The theory of weak central coherence (WCC) proposes that people with autism have compromised perception of global, holistic information, whereas people without autism generally show a strong bias for holistic perception[1]. As a consequence, people with autism may be relatively good at tasks where attention to local detail is advantageous. This theory may explain why people with autism have difficulty with tasks involving global perception, including recognition of faces and understanding words in context, while at the same time exhibiting relatively enhanced or preserved performance of tasks that involve local detail processing such as the Block Design and Embedded Figures tasks[3]. There is little functional neuroimaging evidence, however, that persons with autism subjects have impaired global processing. Previous fMRI studies have focused on local detail processing but not global processing differences in autism.[2,3,4]

Objectives:

Our main objective was to conduct an fMRI study of both global and local attention in persons with autism.

Methods:

Seventeen adults with autism spectrum disorders (Autistic Disorder and Asperger's Syndrome) and 16 healthy control subjects participated in an fMRI experiment. Subjects were studied using a 3T whole body magnet while performing a target detection task using hierarchical abstract shapes. Attention was focused on either global shape or local shape target detection in a blocked fashion. fMRI data were analyzed using SPM8.

Results:

Results were corrected for multiple comparison using alphasim height and extent thresholds and random field theory. The pattern of activation for both groups and both attention conditions (local and global) was similar and included activation of attention and cognitive control networks (bilateral parietal BA7, frontal operculum, dorsolateral prefrontal cortex and pre-supplemental motor area/cingulate gyrus), as well as ventral visual stream regions including the lateral occipital cortex. In both attention conditions, the autism group exhibited significantly greater activation of the right lateral occipital visual region than controls. Relative to controls, the autism group showed greater activation of medial prefrontal cortex than controls in the global condition compared to the local condition and greater activation than controls in right prefrontal cortex for local compared to global attention.

Conclusions:

These findings may suggest greater difficulty in maintenance of attentional set and cognitive control as well as greater early visual processing of both global and local information in autism.

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116.062 167 Disrupted Brain Mechanisms for Processing Affectionate Touch In Children with ASD. I. Gordon*[1], M. D. Kaiser[2], R. Bennett[1], A. C. Voos[1] and K. A. Pelphrey[1], (1)*Yale University*, (2)*Yale University*

Background: Recent discoveries of the neural mechanisms underlying social dysfunction in Autism Spectrum Disorders (ASD) have highlighted visual social perception (e.g., faces, biological motion, and social scenes). Despite the critical role of proximity seeking and touch hedonics in social development,

and known associated deficits in ASD, the neural basis of touch processing in ASD has not been investigated. A prime candidate for examination is a system of slow-conducting unmyelinated C-tactile (CT) afferent fibers that exist only in hairy skin and respond preferentially to light and pleasant touch. This type of touch is particularly reminiscent of the evolutionary conserved system of "affectionate touch" amongst bonded individuals (such as mother and infant or romantic partners). An elegant series of functional magnetic resonance imaging (fMRI) studies has illustrated that somatosensory and insular cortical regions are activated by affectionate touch. The insular activation is particularly interesting given its involvement in social-emotional processing. The available evidence strongly suggests that the CT system is involved in processing the caress-like, skin-to-skin contact, a key part of the bio-behavioral processes of the mammalian affiliative system.

Objectives: We sought to examine brain responses to affectionate touch in children with ASD using fMRI. We hypothesized that children with ASD would exhibit decreased responses to affective touch in the insula but not the somatosensory cortex compared to age- and IQ-matched typically developing (TD) children.

Methods: Samples of children with and without ASD (matched on age and IQ), ranging from 4-17 years of age, participated in the study. Participants received continuous brushing to the palm or forearm in a block design procedure. There were 2 runs of each condition (forearm, palm) which included 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 watercolor brush administered by a trained experimenter.

Results: Both groups rated the brush strokes as pleasant. Supporting our initial hypothesis regarding the CT afferent system, both groups exhibited activation in the somatosensory cortex during arm touch (relative to baseline). However, several brain regions revealed distinct responses to affective touch in the two experimental groups. In TD children, the bilateral posterior, and middle, insular cortex were robustly engaged whereas this activation was left lateralized and significantly weaker in the children with ASD. Further, TD children revealed unique activation in several additional regions including the medial prefrontal cortex, right posterior superior temporal sulcus, and ventral striatum. Children with ASD revealed amygdala activation that was not present in the TD children.

Conclusions: Children with ASD do not process affectionate touch with the same brain mechanisms utilized by their TD peers. While somatosensory activation in both groups indicates that children with ASD feel the touch, the social brain is not engaged during slow soft touch which is associated with activation of the CT afferent system. These results suggest the disruption of social perception in ASD extends beyond the visual domain. This work has implications for derailed social engagement in ASD and provides potential target for early intervention.

116.063 168 Dissociating Individuals with Asperger SYNDROME FROM High Functioning AUTISM USING A Probabilistic Pattern Recognition Approach. C. Ecker*[1], A. Marquand[2], M. C. Lai[3], M. V. Lombardo[4], P. Johnston[5], B. Chakrabarti[6], E. Daly[7], C. M. Murphy[8], M. Aims[9], S. Baron-Cohen[4] and D. G. Murphy[5], (1)*Institute of Psychiatry*, (2), (3)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (4)*Autism Research Centre, University of Cambridge*, (5)*Institute of Psychiatry, King's College London*, (6)*University of Reading*, (7)*King's College London, Institute of Psychiatry,*, (8)*King's College London, Institute of Psychiatry*, (9)*Institute of Psychiatry, London; University of Oxford; University of Cambridge, United Kingdom*

Background: Autism is a spectrum condition (ASC) with multiple causes, co-morbid conditions, and a wide range in type and severity of symptoms expressed. Traditionally, ASC can be further subdivided by some into individuals with Asperger syndrome (AS), who have normal language milestones, and individuals with high-functioning autism (HFA), who have a history of delayed language development. Behavioral evidence suggests that by adulthood these groups are largely indistinguishable at the phenotypic level. However, the extent to which these groups differ at the level of brain anatomy is largely unknown.

Objectives: To test if individuals with AS and HFA can be distinguished on the basis of grey matter neuroanatomy using a probabilistic pattern recognition approach.

Methods: Structural MRI data was collected on 38 well-characterized male adults with an ADI-R confirmed diagnosis of ASC (mean age = 25 yrs, mean FSIQ = 105), which included 23 individuals with AS (i.e. phrase speech acquired prior to 36 months) and 15 individuals diagnosed with HFA (i.e. history of delayed language acquisition). Both subgroups were matched for age and FSIQ. For each participant, a set of 5 morphological parameters including both volumetric and geometric features were obtained at each spatial location on the cortical surface (i.e. vertex) was obtained using FreeSurfer

software. This set of measures was then used to (1) discriminate between individuals with AS and HFA using a probabilistic pattern recognition (PR) approach, and to (2) find a spatially distributed pattern of regions with maximal discriminative power.

Results: Overall, the PR approach achieved above-chance separation between Asperger's and HFA group and was able to classify individuals at an overall accuracy of 68.1% ($p < 0.04$) and a true/false positive rate of (TP/FP) 72.0/64.2 % respectively. Discrimination of the Asperger's subgroup was driven by a combination of volumetric and geometric features and revealed spatially distributed patterns of regions with maximal discriminative weights.

Conclusions: This study provides preliminary evidence for the hypothesis early language acquisition serves as a marker for distinct brain phenotypes within the autism spectrum, and that individuals with AS may be dissociated from individuals with HFA on the basis of spatially distributed patterns of grey matter abnormalities.

116.064 169 Do Autism Spectrum Disorders and Obsessive Compulsive Disorders Share a Neuroanatomical Phenotype?. K. Yu*[1], E. Pun[1], P. Wong[1], S. E. Chua[2], C. Cheung[1] and G. M. McAlonan[3], (1)*The University of Hong Kong*, (2)*State Key Laboratory for Brain and Cognitive Sciences*, (3)*University of Hong Kong*

Background:

Children with autism spectrum disorder (ASD) who have high scores in the repetitive behaviours domain of the ADI-R are more likely to have parents, especially fathers with Obsessive Compulsive Disorder (OCD) (Hollander et al., 2003) and those with high levels of 'insistence on sameness' have parents with clinically significant scores on the Yale-Brown Obsessive Compulsive Scale (Abramson et al., 2005). This suggests familiarity of obsessive compulsive/repetitive behaviours. Fronto-striatal volume differences relative to unaffected controls are associated with both OCD and autism spectrum indicating that similar genetic mechanisms may act upon this circuitry to drive these traits.

Objectives:

To examine this issue we conducted a preliminary anatomical likelihood meta-analytic estimation (ALE, Turkeltaub et al. 2002) of the extent to which OCD and ASD have overlapping neuroanatomical phenotypes.

Methods:

We used 'dual-disorder' ALE approach (Yu, Cheung et al., 2010) in which co-ordinates from voxel-based MRI studies of grey matter volume in 15 studies of ASD and 16 studies of OCD could be entered jointly into the analysis. This allowed a preliminary map of common and distinct regional volume differences in ASD and OCD to be generated. More detailed analysis controlling for confounds including age, gender and medication is in progress.

Results:

Relative to typically developing controls, grey matter volumes in bilateral caudate, frontal gyrus, thalamus, and right precuneus were increased in both OCD and ASD, whereas grey matter was decreased in both conditions in left paracentral lobe and precentral gyrus, and right precuneous and superior frontal gyrus.

Conclusions:

Our preliminary results point to a shared neuroanatomical phenotype in OCD and ASD. This raises the possibility that similar aetiological mechanisms may drive common behavioural and neurobiological traits associated with these conditions. Thus what is inherited in ASD and OCD may not be the specific condition, but a neurodevelopmental vulnerability. These results also imply that advances made in unraveling causal factors and treatment approaches in either condition may have useful application to both.

116.065 170 Dr. Temple Grandin: A Neuroimaging Case Study. J. R. Cooperrider*[1], T. Grandin[2], E. D. Bigler[1], J. S. Anderson[1], N. Lange[3], A. L. Alexander[4], M. B. DuBray[1], A. Froehlich[1], B. A. Zielinski[1] and J. E. Lainhart[1], (1)*University of Utah*, (2)*Colorado State University*, (3)*Harvard University*, (4)*University of Wisconsin*

Background: Dr. Temple Grandin is the most renowned woman with autism in the world. She has generously provided science with many insights into the mind of individuals with autism and has been an inspiration to many, given her enormous success in the face of many challenges. Because of the uniqueness of her mind and her exceptional abilities, it seems scientifically prudent to examine her brain to better understand how brain structure and function are related to outstanding ability and disability within the same brain.

Objectives: The objective of this study is to begin to elucidate the neuroanatomical and functional basis of Dr. Grandin's cognitive strengths and weaknesses.

Methods: 3-Tesla anatomical, diffusion tensor, and functional MR imaging was performed on Dr. Grandin and compared to three female age-matched controls (Dr. Grandin age 61.3 years; controls mean age 62.3 years, range 59.1 to 67.9 years). MP-RAGE, T2-weighted anatomical, 12-direction DTI, and functional MRI (visual language, auditory language, resting state, and music) data were collected on all participants. Measures of total and regional brain volumes, cortical thickness, white matter microstructure, and functional (BOLD) differences were analyzed.

Results: Compared to the controls, Dr. Grandin had increased (greater than 2 standard deviations above control means) intracranial volume, and volumes of the left lateral ventricle, left hemisphere white matter, right amygdala, left cingulate, and entorhinal cortex. Her left lateral ventricle was 57% larger than her right. Cortical thickness was increased (greater than 2 standard deviations above the control mean) in entorhinal cortex. Fractional anisotropy was decreased in the white matter of her left posterior/superior temporal and inferior parietal regions. In contrast to controls, fMRI activation was significantly increased ($q<0.05$, FDR) in her bilateral parietal cortices during the visual language task. Activation was also significantly increased ($q<0.05$, FDR) in the medial prefrontal cortex, mPFC (especially in the pregenual right anterior cingulate), while she listened to her favorite song, Led Zeppelin's *Stairway to Heaven*, compared to her resting state brain activity.

Conclusions: These fascinating findings suggest that differences found in white matter microstructure in her parietal lobe, especially at its junction with the temporal lobe, might account for the difficulties in working memory that Dr. Grandin reports. Increased activation in the mPFC suggests that she might be experiencing more self-reflection while listening to her favorite song than while resting. Past research has implicated the mPFC in self-reflective cognition. Her increased intracranial volume is consistent with the 20% rate of macrocephaly in autism. Dr. Grandin and the control participants will undergo neuropsychological testing that will provide further neuroscientific insights into her cognitive functioning and suggest new interventions to help improve the lives of more globally impaired children and adults with autism.

116.066 171 Emotion Attribution to Self and Other In Children and Adolescents with and without Autism: An fMRI Study. F. Hoffmann*[1], K. A. Pelphrey[1], R. I. Pillai[1], H. Seib[1], E. S. MacDonnell[1] and B. C. vander Wyk[2], (1)*Yale University*, (2)*Yale Child Study Center*

Background:

The medial prefrontal cortex (mPFC) appears to be preferentially tuned for self-relevant information. In typical children and adolescents the mPFC seems to be even more engaged during self-referential processing compared to adults (Pfeifer et al., 2007). Recent studies indicate that in autism the mPFC seems not to distinguish between self-relevant or other-relevant information, which is associated with symptom severity (Lombardo et al.,2010, Kennedy & Courchesne, 2008). In autism, it remains largely unknown how self- and other-referential processing networks change over development and how these networks are implicated in adaptive social functioning, empathy and self-referential cognition.

Objectives:

Using fMRI, we are measuring mPFC activity during affective judgments in children with autism, while accounting for individual differences in adaptive social functioning, empathy and self-referential cognition.

Methods:

Children with autism (n=4, collection ongoing) and matched controls (n = 25), were instructed to perform an emotion attribution task, in which a series of emotional pictures were presented. The children were required to make judgments under three conditions. In the Self condition, they evaluated whether the picture made them feel good or bad. In the Other condition, they evaluated whether the person or people in the picture felt good or bad. In the Location condition, they evaluated whether the picture was taken inside or outside. The Social Responsiveness Scale (SRS), the Empathy Quotient (EQ), the Interpersonal Reactivity Index (IRI), the Toronto Alexithymia Scale (TAS-20) and a Self-Referenced Memory Task were used to investigate social functioning, empathy and self-referential cognition. Eye-tracking was used to monitor looking patterns.

Results:

Two independently defined regions of interest in the mPFC (one defined by functional connectivity to a precuneus seed, the other based on an Activation Likelihood Estimation computation) were used for further quantitative tests. In typical controls, both regions exhibited the pattern of Self > Other > Location. Activation in these areas increased with age, while increasing activation was associated with less social impairment. The data collection and analysis of the matched group of children with autism is ongoing. We hypothesize that in children with autism the mPFC will show no significant difference in modulation to the Self condition compared to the

Other condition consistent with previous findings in adult samples.

Conclusions:

The findings of this cross-sectional study suggest an increasing self-selectivity in the mPFC during typical development in respect to affective judgements. This increased self-selectivity seems to be socially adaptive in children and adolescents and might represent an increase in self-awareness. Conversely, in autism hypothesized reduced self-selectivity in the mPFC in respect to affective judgements could represent a lack of self-awareness associated with abnormal social functioning and deficits in empathy and self-referential cognition. In addition heightened self-referential processing might seem socially adaptive especially at particular points in development (i.e. adolescence), while it could act at the same time as a vulnerability factor for psychiatric disorders such as depression and anxiety disorders. The identification of specific neural correlates in the mPFC of behavioural symptoms in autism could help elucidate the mechanisms of this heterogeneous disorder.

116.067 172 Frontal White Matter Tract Impairment In Autism Spectrum Disorders: A Diffusion Tensor Imaging Study Using Tract Based Spatial Statistics. S. H. Ameis*[1], J. Fan[2], C. Rockel[3], A. Voineskos[4], N. Lobaugh[5], L. V. Soorya[2], A. T. Wang[2], E. Hollander[6] and E. Anagnostou[7], (1)*The Hospital for Sick Children, University of Toronto*, (2)*Mount Sinai School of Medicine*, (3)*The Hospital for Sick Children*, (4)*Centre for Addiction and Mental Health, University of Toronto*, (5)*Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, University of Toronto*, (6)*Montefiore Medical Center University Hospital, Albert Einstein College of Medicine*, (7)*Bloorview Research Institute, University of Toronto*

Background:

White matter overgrowth early in the course of illness may cause widespread developmental impairment of white matter tracts and functional underconnectivity, in autism spectrum disorders (ASD).

Diffusion tensor imaging (DTI) can infer properties of white matter micro-structure *in vivo*. Currently, DTI data informing the nature of white matter disturbance in ASD, is limited.

Objectives:

To examine for the presence of widespread white matter disturbance in children and adolescents with ASD compared to controls, using DTI.

Methods:

DTI scans were acquired for 19 children and adolescents with ASD (full scale IQ ≥ 70; 7-18 years; mean 12.3 ± 3) and 16 age and IQ matched controls (7-18 years; mean 12.5 ± 3) on a 3T Siemens Allegra head-dedicated MRI system.

Whole brain DTI values for fractional anisotropy, mean diffusivity, radial, and axial diffusivity values were extracted and age by group interaction effects examined.

Voxel-wise comparisons were performed using tract-based spatial statistics (TBSS) in: (i) ASD children and adolescents, and (ii) ASD children only (age ≤12), versus controls.

Results:

Significant age by group interaction effects for whole-brain DTI indices in our total sample, were driven by differences among ASD and control children.

TBSS analysis of children and adolescents revealed no between-group differences for DTI indices. However, widespread increases in mean and radial diffusivity found in ASD children, prominently affected frontal white matter regions.

Follow-up analyses revealed particular impairment in white matter tracts linking frontal with parietal and temporal lobes, in ASD.

Conclusions:

Our findings point to prominent disruption of frontal white matter in children with ASD. Unexpected, were widespread increases in radial diffusivity, a potential index of abnormal myelination.

116.068 173 Functional Brain Imaging of Aberrant Social Motivation In Children with Autism Spectrum Disorders. G. Kohls*[1], S. Faja[2], J. M. Taylor[1], E. N. Madva[1], S. J. Cayless[1] and R. T. Schultz[1], (1)*Children's Hospital of Philadelphia*, (2)*University of Washington*

Background: We and others have hypothesised that the failure to develop better social perceptual and social cognitive skills in children with autism spectrum disorders (ASD) could at least partly be due to a suboptimal reward-based motivation to seek social experiences and learn social information. Decreased social motivation might be due to dysfunction in neural systems implicated in reward processing such as ventral striatum

(including nucleus accumbens/NAcc) or orbitofrontal cortex (OFC). Despite the influence of this "social motivation deficit theory" in the field, very few tests of it using brain imaging have been conducted.

Objectives: This study's central scientific aim is to develop a better understanding of the neural circuitry of reward based social motivation in children with ASD, and to characterize the relationships between brain activity in motivation circuitry and social behavior.

Methods: We conducted a functional magnetic resonance imaging (fMRI) study to investigate the effects of social reward on brain areas associated with reward 'wanting' (NAcc) and reward 'liking' (OFC) in 20 children with ASD relative to 20 age, gender, and IQ matched typically developing children (TDC). We apply a modified motivation paradigm that has been tested and validated in the normative literature (Spreckelmeyer, Krach, Kohls et al., 2009). To optimize the ecological validity of our social motivation task, we created and validated a new stimulus set by replacing still photos with short video clips of actors showing social approval. In addition, our modified paradigm includes a tracking algorithm of subject task performance. This is important as it permits adjustment of task difficulty in real time and, thus, individualized reward delivery. FMRI data are collected on a 3T scanner and analyzed with FSL.

Results: Data collection is ongoing; we plan to have preliminary analyses on 10 participants with ASD and 10 TDCs. Analyses will focus on the hypothesis that participants with ASD will show reduced neural activations in the NAcc in response to social reward anticipation, reflecting reduced reward 'wanting'. Moreover, we predict that the diminished neural responsivity in the NAcc to social reward 'wanting' will be significantly correlated with the degree of social deficits among individuals with ASD.

Conclusions: An increased understanding of the biological mechanisms causing social deficits in ASD can be used to develop therapeutic (e.g., brain-based pharmacological) interventions and treatment procedures where, for instance, medications support social learning. If social motivation deficits are indeed a fundamental cause of a cascade of events that support the development of ASD, then interventions that increase social motivation could help individuals with ASD and their families.

116.069 174 Functional Connectivity Across Cerebral Hemispheres Is Decreased In Autism. D. Neumann*, L. K. Paul, J. M. Tyszka, R. Adolphs and D. P. Kennedy, *California Institute of Technology*

Background: Long-range white matter connections are thought to be reduced in the brains of people with autism, contributing to the behavioral and cognitive phenotype of this developmental disorder. The clearest evidence for this underconnectivity hypothesis comes from structural, diffusion, and functional magnetic resonance studies of the corpus callosum in autism. A recent study found evidence that corresponding voxels of cortex in the left and right hemispheres showed reduced functional coupling during resting-state neuroimaging, consistent with reduced connectivity mediated via the corpus callosum (Anderson et al., 2010).

Objectives: Here we corroborate this finding and extend it to an examination of interhemispheric coherence between all regions of cortex, at the whole-brain level. We compare all homotopic and heterotopic coherence values to a large normative sample of neurotypical subjects (Biswal et al., 2010).

Methods: Two independent groups of high-functioning adults with autism (N=11 and 19) and their matched neurotypical controls (N=12 and 20; each paired group imaged on a different scanner with different parameters) were contrasted and compared to reference data from 700 individuals. Diagnosis of an ASD was made following administration of the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview - Revised (ADI-R), together with clinical interview. Resting-state blood oxygenation level-dependent (BOLD) coherence was computed between all pairwise cortical regions, which were defined in each individual brain using the automated surface-based segmentation provided by FreeSurfer (Fischl et al., 2004). The coherence values were computed by multitaper analysis using the Chronux toolbox (Mitra and Bokil, 2008), providing a frequency- and phase-dependent measure of the strength of coupling between pairs of cortical regions.

Results: We found significantly reduced coherence in both autism groups compared to their respective controls, and compared to the normal reference set. This abnormality was evident across most homotopic regions, and robust to frequency band. By contrast, heterotopic coherence did not differ notably between groups. Homotopic coherence was also

reduced when the analysis was performed between corresponding voxels in both hemispheres, instead of an analysis based on segmented cortical regions.

Conclusions: These findings provide additional evidence for long-distance underconnectivity in autism, and point to a specific functional deficit resulting from abnormal callosal connectivity.

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116.070 175 Functional Connectivity of the Ventromedial Prefrontal Cortex In Children with Autism Spectrum Disorders. B. Deen*[1] and K. A. Pelphrey[2], (1)*MIT*, (2)*Yale University*

Background: Several lines of research have implicated abnormal neural connectivity as a possible etiological mechanism in Autism Spectrum Disorders (ASD). Prior studies have found various alterations in functional connectivity, as assessed by resting-state fMRI, in individuals with ASDs. For instance, several studies have noted abnormalities in functional connectivity of the default mode network, potentially involved self-referential cognition and theory of mind. However, few studies have investigated functional connectivity in children with autism, to begin to address the developmental relevance of these alterations.

Objectives: To assess large-scale cortical functional connectivity in children with and without autism, using resting-state fMRI.

Methods: Resting-state fMRI data was collected in 25 typically developing (TD) children (age 8-17), 25 children with ASDs, and 50 typical adults. Maps of functional connectivity were computed in each group, using a range of seeds defined functionally using a portion of the adult dataset. Seeds included regions of the default mode, fronto-parietal attention, cingulo-insular control, and other networks. These maps were compared between TD and ASD groups.

Results: Overal, long-range cortical functional connections were largely similar in the TD and ASD groups, with few differences found. However, we do find a striking difference in the functional connectivity of the ventromedial prefrontal cortex (vmPFC), particularly with other regions of the ventral default mode network subnetwork, such as parahippocampal and retrosplenial cortices.

Conclusions: In contrast with prior reports of global underconnectivity in individuals with ASD, cortical functional connectivity appears to be largely intact in children with ASD. However, there is a marked reduction of connectivity of vmPFC, particularly with regions of the default mode network. This may relate to prior findings of vmPFC-lesion-like behavioral abnormalities in ASD, and fMRI results indicating altered response properties of vmPFC.

116.071 176 History of Mental Illness Does Not Predict Gamma Band Deficits In First-Degree Relatives of Children with Autism. D. C. Rojas*, L. B. Wilson, P. Teale, E. Kronberg, K. Youngpeter and S. Hepburn, *University of Colorado Denver, Anschutz Medical Campus*

Background:

Gamma band oscillatory activity, as measured using EEG and magnetoencephalography (MEG), has been associated with intrinsic GABA and glutamate activity in animal and computational models of the neocortex and is thought to play an important role in perceptual binding and central coherence. We have previously published data demonstrating that auditory steady-state response (ASSR) gamma activity is abnormal in people with autism. We have also recently established that transient gamma-band response deficits are seen in adult first-degree relatives, suggesting the utility of some of the findings as endophenotypes. As first-degree relatives of persons with ASD have an increased prevalence of various Axis I mental illnesses, this factor should be considered as an alternative explanation for the observed gamma-band deficits.

Objectives:

The purpose of this study was to extend the ASSR gamma-band findings to 1st degree relatives of persons with ASD and to examine the potential impact of history of mental illness on gamma-band deficits.

Methods:

We examined MEG recorded ASSR in 21 parents of children with autism spectrum disorders (pASD) and 18 adult control subjects (CON). History of mental illness was assessed using the Structured Clinical Interview for DSM-IV (SCID); 8 persons in the HC group had a personal history of Axis I mental illness and 11 of the pASD group had such history (primarily mood and anxiety disorders). MEG data were acquired using a 248-channel neuromagnetometer system. Responses to repeated, 32, 40 and 48 Hz amplitude modulated white noise (100% depth, 500 ms duration, 50 dB HL) were examined in the time-frequency domain from source space projected auditory "virtual electrodes" for the left and right hemispheres. Measures of gamma-band phase-locking factor, normalized phase-locked power and normalized total power were derived for each subject and hemisphere.

Results:

Evoked power was significantly higher at 40 and 48 Hz modulation rates than for the 32 Hz rate across all subjects. The pASD subjects had significantly lower phase-locking factor and phase-locked power across all modulation frequencies compared to the HC group, while normalized total power was not different between groups. Evoked, or phase-locked power was highly correlated with the phase-locking factor, as expected. There was no significant effect of history of mental illness noted for any MEG dependent measure.

Conclusions:

The preservation of total gamma-band power suggests a shift of power from phase-locked to non-phase-locked in the pASD group, consistent with prior results for ASD and pASD. Both the phase-locking factor and the normalized phase-locked power differences were greater in the left than in the right hemisphere. While ASSR gamma-band power may be significantly higher to 40+ Hz modulation rates, the phase-locking deficit appeared consistent across the range of frequencies employed in this study. History of mental illness, at least with respect to anxiety and mood disorders, does not appear to be related to the gamma-band findings. This study, together with previous results for the transient gamma-band response in first-degree relatives, highlights the potential of gamma-band deficits as a potential new ASD endophenotype.

116.072 177 Incidental MRI Findings In Infants at Risk for Autism. M. D. Shen*[1], C. W. Nordahl[1], S. E. Liston[1], M. DiNino[1], S. L. Wootton-Gorges[2], G. S. Young[1], S. Ozonoff[3] and D. G. Amaral[1], (1)*UC Davis M.I.N.D. Institute*, (2)*University of California, Davis Medical Center and U.C. Davis Children's Hospital*, (3)*UC Davis*

Background: Infants with an older sibling with autism have a higher recurrence rate of developing the disorder than infants without familial autism. These high-risk infants are also more likely to have other developmental delays than low-risk infants without a family history of autism. Despite the growing use of MRI to study the brain development of infants at risk for autism, it is unclear whether high-risk infants exhibit clinically significant incidental MRI findings and whether the presence of neurological anomalies is associated with developmental delays.

Objectives: To evaluate the rate of incidental MRI findings in infants at risk for autism and its association with developmental delays.

Methods: High-resolution, T1-weighted structural MRI scans (voxel size=1 cubic mm) were acquired during natural sleep on 40 infants (n=28 high-risk, 12 low-risk) at either 6 or 9 months of age. A board-certified pediatric neuroradiologist, blind to subject risk status, evaluated the scans for incidental findings (i.e. unexpected, asymptomatic brain abnormalities). Motor and language function of each infant was assessed using the Mullen Scales of Early Learning (standardized mean for each scale=50, sd=10, scores<40 are considered delayed).

Results: We found a high incidence (41%) of high-risk infants with "benign extraaxial fluid" at 6 months. Benign extraaxial fluid (BEAF) is characterized by an excess of cerebrospinal fluid in the subarachnoid space, which may be associated with head growth in the absence of corresponding brain growth. The high-risk infants with extraaxial fluid had significantly lower Mullen scores at 6 months on fine motor, gross motor, and receptive language scales, relative to high-risk infants without extraaxial fluid [fine motor: BEAF M=38.6(sd=11.0), non-BEAF M=46.1(6.5), p<.05; gross motor: BEAF M=37.3(12.9), non-BEAF=45.7(10.3), p<.10; receptive language: BEAF M=37.7(9.7), non-BEAF M=44.2(8.6), p<.10]. 57% of high-risk infants with BEAF were delayed in all three fine motor, gross motor, and receptive language scales, compared to 11% of infants without BEAF.

Conclusions: Infants at risk for autism have a high incidence of "benign extraaxial fluid" at 6 months of age, as indicated by a pediatric neuroradiologist. Motor and language delays found in high-risk infants with extraaxial fluid call into question the "benign" nature of this finding. This raises the potential of clinical MRI findings to serve as an early indication of general developmental delay in infants at risk for autism, although it is

yet unclear how general delays will relate to autism symptoms in later development. In addition, since extraaxial fluid occupies space that would otherwise contain cerebral cortex, head circumference may be an inaccurate proxy of brain volume in infants with this incidental finding. If this finding is confirmed in a larger cohort of subjects, it should be considered when interpreting previous studies that used head circumference to report early brain overgrowth in autism.

116.073 178 Is He Being Bad?: Brain Activation During Social Judgment In Children with Autism. E. J. Carter*[1], D. L. Williams[2], J. F. Lehman[1] and N. J. J. Minshew[3], (1)*Carnegie Mellon University*, (2)*Duquesne University*, (3)*University of Pittsburgh*

Background:

Individuals with autism often have difficulty making social judgments and often violate social rules (Baron-Cohen et al., 1999, *JADD*). Behavioral reports have indicated that children and adolescents with autism have lower accuracy in identifying and explaining inappropriate social behavior, suggesting that they use different reasoning in social interactions (e.g., Loveland et al., 2001, *JADD,* Nah & Poon, 2010, *Autism*). However, potential differences in the neural processes underlying this phenomenon have not yet been examined using fMRI and an age-appropriate task.

Objectives:

To compare the fMRI brain activity of children with and without autism in response to social versus physical judgments about similar images.

Methods:

Twelve children with autism (age: 8-16 years, mean = 13.1; FSIQ range = 87-135; mean = 112.1) and thirteen group-matched TD children (7-15 years, mean = 11.5; FSIQ: 97-131, mean = 116.6) participated in this IRB approved fMRI study. In 16 trials, participants had to indicate in which picture a blond-haired boy was being bad (Social condition). In another 16 trials, they had to determine which picture was outside (Physical condition). Trials were organized into eight blocks, four of Social choices and four of Physical Choices. For each of 32 trials, participants viewed two images simultaneously for 4s. The images were adaptations of Goofus and Gallant cartoons from *Highlights* magazine. Both images contained Goofus, and the children were asked to attend to him, "the blond-haired boy." Then, the pictures remained up for another 4s while a symbol (either a sun or a universal sign for no) appeared below the images, indicating which question the child was supposed to answer. Icons of right and left hands each holding a computer mouse also appeared to prompt a response.

Results:

In the TD children, the Social-Physical comparison resulted in activity in Broca's area, medial frontal cortex, and bilateral posterior superior temporal sulcus (pSTS) ($p<.001$). The reverse Physical-Social comparison elicited bilateral superior temporal gyrus (STG) activity ($p<.001$). Children with autism showed bilateral pSTS activity in the Social-Physical comparison and bilateral STG activity in the Physical-Social comparison ($p<.001$). When the two groups were compared directly, the control group showed greater Broca's area and medial frontal activity than the autism group for the Social-Physical comparison and greater right middle frontal gyrus and right inferior temporal gyrus activity in the Physical-Social comparison ($p<.005$). Both groups performed similarly on task accuracy ($p<.05$).

Conclusions:

The TD children drew upon Broca's area (a language region) and medial frontal cortex (a social region; e.g., Amodio & Frith, 2006) along with bilateral pSTS to make social judgments. In contrast, the children with autism did not show increased activity in Broca's area and medial frontal cortex when making social judgments. Their pattern of activation suggests reliance predominantly on posterior STS cortices alone and reduced involvement of anterior language and social cortices. This pattern may indicate reliance on visual rather than language and cognitive processes for social judgments.

116.074 179 Meta-Analysis of Neuroanatomical Overlap In Autism Spectrum Disorders and Bipolar Disorder. C. Wong*[1], K. Yu[1], S. E. Chua[2], C. Cheung[1] and G. M. McAlonan[2], (1)*The University of Hong Kong*, (2)*State Key Laboratory for Brain and Cognitive Sciences*

Background: Recently perspectives on neurodevelopmental conditions such as autism spectrum (ASD) have broadened. There is a growing appreciation that what is 'inherited' in psychotic disorders such as schizophrenia and bipolar disorder and ASD is not diagnosis specific but rather a neurodevelopmental vulnerability which modifies post-natal brain maturation (Cheung, Yu et al., 2010; van Os and Kapur 2009). Consistent with this, higher rates of bipolar disorder are found in families of individuals with ASD (DeLong 2004). Limbic-striato-thalamic brain regions involved in control of mood and cognition are affected in each condition, but this has not been studied systematically.

Objectives: To conduct a preliminary anatomical likelihood meta-analytic estimation (ALE, Turkeltaub et al. 2002) ASD and bipolar disorder to establish the extent to which these conditions share a neuroanatomical substrate.

Methods: We adopted a modified 'dual-disorder' ALE technique (Yu, Cheung et al., 2010) to accommodate co-ordinates derived from 15 voxel-based MRI studies of ASD and 19 studies of bipolar disorder in a single analysis. This generated a map of common and distinct regional volume differences in ASD and bipolar disorder.

Results: Grey matter volumes in bilateral cingulate, left superior, medial, and inferior frontal gyrus, left thalamus were decreased in both bipolar disorder and ASD. Volumes in left caudate, parahippocampal gyrus, middle temporal gyrus, and right precentral and parietal lobe were increased in both conditions. Further detailed analysis to accommodate any potential confounds of age, gender and medication in now underway.

Conclusions: Our preliminary findings substantiate a sizeable overlap in brain regions affected by both conditions. This may indeed reflect similar neurodevelopmental pressure acting across conditions which is not disorder specific. We suggest further exploration of shared causal factors across a spectrum of neurodevelopmental disorders should be encouraged with an eye to applying advances made in one condition to other related disorders.

116.075 180 Mirror Neuron Dysfunction In High Functioning Autism. T. J. Perkins*[1], J. A. Manjiviona[2], K. Saunders[3], J. A. McGillivray[1], R. Bittar[4], A. Connelly[5] and M. A. Stokes[1], (1)*Deakin University*, (2)*Private practice*, (3)*Private practicioner*, (4)*Precision neurosurgery*, (5)*Brain Research Institute*

Background:

Deficits in the mirror neuron system (neurons which respond to executed *and* observed actions) have been linked to HFA. It is believed mirror neurons may contribute to the difficulty autistic subjects have understanding other actions and intentions. 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 functional MRI (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 undergoing fMRI. The first and second tasks utilized 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 neurotypicals.

Methods:

Subjects with a confirmed diagnosis of HFA were compared to TD (*N*=10 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 a 3 Tesla MRI scanner where they observed the four different mirror neuron tasks. Following data collection, a blood-oxygen-level-dependent (BOLD) analysis was performed to compare fMRI activity between HFAs and neurotypicals 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 controls. Of particular interest, mirror neuron activity seems to be particularly reduced for communicative and directive actions.

116.076 181 Multivariate MEG Pattern Classifiers for Language Impairment In Autism. W. A. Parker*[1], M.

Ingalhalikar[1], R. Verma[1] and T. P. L. Roberts[2], (1)*University of Pennsylvania, Section for Biomedical Image Analysis*, (2)*Children's Hospital of Philadelphia, Lurie Family Foundations MEG Imaging Center*

Background: Language impairment (LI) is an important behavioral component of Autism Spectrum Disorders (ASD). Two measures of auditory processing revealed by magnetoencephalography (MEG) that may relate to LI in ASD are M100 and mismatch field (MMF) latencies. Roberts et al. (2010) demonstrated that the latency of the M100 in the superior temporal gyrus was increased in children with autism and could be used to distinguish between autistic and typically developing (TD) subjects. This measurement, however, could not distinguish between language-impaired (LI+) and non-language-impaired (LI-) subjects. The MMF latency, a measure of how quickly the brain detects changes among sounds or phonemes, is lengthened in ASD and may also be a measure of LI (Roberts et al., 2008). While these univariate measures characterize some aspect of LI/ASD, we hypothesize that their appropriate combination will improve the group distinction.

Objectives: Using multivariate machine-learning pattern classifiers created by combining the two MEG latency measures, we evaluate whether this combination can distinguish between ASD/LI+, ASD/LI- and TD populations better than univariate classifiers, by learning patterns of disease variability, incorporating age effects and generating an abnormality score that can aid diagnosis of an unseen subject.

Methods: We measured MMF and M100 latencies in the superior temporal gyrus in 41 children with ASD (13 LI+, 28 LI-, defined according to clinical/neuropsychological assessment) and 21 TD controls using MEG. In our data (as in several other studies: Gage et al., 2003b; Oram Cardy et al., 2008) M100 correlated significantly with age ($R=-.5129$, $p=2.0\times10^{-5}$), with no significant difference in this correlation between groups. Hence, M100 measurements were age-corrected by linear regression. Using MMF and age-corrected M100 as input features, we created a non-linear two-way support vector machine (SVM) classifier of ASD and TD populations and a three-way classifier between the ASD/LI+, ASD/LI- and TD groups, cross-validated with a leave-one-out paradigm. For each classifier, we obtained an average classification accuracy by testing on each left out subject using the constructed classifier. For the three-way classifiers, the sensitivity for LI+ was recorded as the percentage of LI+ individuals that were correctly classified.

Results: The two-way ASD-TD classifier using MMF and M100 yielded a cross-validated classification accuracy of 83.87% (52/62) with sensitivity of 87.8% (36/41) and specificity of 71.4% (15/21) compared to univariate MMF classifier (accuracy 80.65% (50/62); sensitivity 90.24% (37/41); specificity 61.9% (13/21)) and M100 classifier (accuracy 75.81% (47/62); sensitivity of 95.12% (39/41); specificity 38.1% (8/21)). The three-way multivariate classifier yielded a cross-validated accuracy of 66.13% (41/62), significantly higher than the chance rate of 33% ($p<0.001$). The sensitivity towards LI+ was 38.46% (5/13). The classifier using only M100 yielded an overall accuracy of 59.68% (37/62), but sensitivity towards LI+ was inferior (7.69%, 1/13; $p=0.06$), with similar values for a 3-way univariate MMF classifier.

Conclusions: This work presents multivariate MEG-based classifiers that provide better group separation between ASD and TD populations compared to univariate M100 and MMF classifiers. Further, the three-way multivariate classifiers (despite small sample sizes) were able to better elucidate the heterogeneity of ASD, distinguishing degrees of LI.

116.077 182 Network Model of Face Processing In Autism Based on Diffusion Tensor Tracking (DTT) and Behavioral Data. T. E. Conturo*[1], D. L. Williams[2], C. D. Smith[3], A. R. McMichael[1], K. W. Chua[4], S. C. Green[4], M. S. Strauss[4] and N. J. J. Minshew[4], (1)*Washington University School of Medicine*, (2)*Duquesne University*, (3)*University of Kentucky*, (4)*University of Pittsburgh*

Background: Recognition of faces/face emotions is commonly impaired in autism. Using DTT, we identified previously-unknown hippocampo-fusiform (HF) and amygdalo-fusiform (AF) face processing pathways (Smith et.al., 2009, JMRI). We found reduced minimum-diffusivity (D-min, intrinsic across-fiber diffusivity; Smith et.al., 2009) in right HF and right AF in autism, which correlated with decreased ability to recognize faces and their emotional content on neuropsychological tests (NPTs) (Conturo et.al., 2008, JINS; Conturo et.al., IMFAR2010). Such D-min reductions and DTT-NPT relationships suggest a new mechanism of autism -- small diameter axons that cause slowed neural transmission. This biologic mechanism is also consistent with: small cell bodies in hippocampus (Bauman et.al., 2005) and minicolumns (Casanova et.al., 2002); reduced fMRI correlations (Just et.al., 2004; Kleinhans et.al., 2008); lengthened reaction times (Townsend et.al., 1996); slowed electrophysiology (McPartland et.al., 2004); and symptom abatement with fever (Curran et.al., 2007).

Objectives: To confirm DTT-NPT relationships and devise a network model of slowed pathway transmission causing decreased ability to recognize faces/face emotions.

Methods: DTT data acquired in adolescent/adults with high-functioning autism meeting ADOS/ADI criteria were compared to additional NPT data acquired using sensitive custom tests of face-gender (Wilkinson et.al., IMFAR2009) and face-emotion (Rump et.al., 2009) recognition. A network model was developed accordingly.

Results: The gender/emotion NPTs showed a strong associated between lower performance and lower pathway D-min for both right HF/AF pathways (e.g., r=0.589; AF vs. face-gender NPT). These results confirm that the D-min reduction in autism-vs-controls in (Conturo, et al., 2008) is functionally significant, with the unusual reversal of the expected DTT-NPT relation supporting the small-diameter mechanism. The behavioral effects can be explained by a network model. Face visual-feature information first enters primary visual cortex (V1), then passes through the ventral-stream processing stages to arrive at fusiform face area. We posit a parallel passage of face information from V1 to amygdala [via the amygdalo-calcarine pathway in (Lori et.al., 2002)] to fusiform (via AF pathway). This parallel path is analogous to the putative "short-cut" of Rudrauf et.al. (2008) where visual information takes a short-cut to fusiform. In our model, emotional modulation of face perception occurs by visual information passing from V1 to amygdala and then to fusiform, arriving in fusiform at the same time (or earlier) that feature information arrives via ventral stream. If the AF were slowed by small-diameter axons (as in autism), emotion information would arrive at fusiform too late to modulate the featural information arriving from ventral stream, as that information would have already exited to other brain areas. A similar path involves hippocampus for memory modulation.

Conclusions: The association between decreased D-min in right HF/AF, and decreased recognition of faces/face emotions in autism, can be explained by small-diameter axons and slowed transmission in right HF/AF, combined with a network model whereby slowed transmission causes memory/emotional information to arrive at fusiform too late to modulate face information arriving via ventral stream.

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116.078 183 Reduced Cortical Response to Adjacent Finger Stimulation: Evidence for Local Underconnectivity In the Autistic Brain?. B. R. Sheth*[1], M. A. Coskun[1], K. A. Loveland[2], D. A. Pearson[3] and A. C. Papanicolaou[4], (1)*University of Houston*, (2)*University of Texas Medical School, Houston*, (3)*University of Texas Medical School at Houston*, (4)*Univ. of Texas Medical School, Houston*

Background:

Putative structural and physiological differences in autistic versus typical brains must eventually manifest at the level of neural circuitry. Therefore, probing for differences in connectivity is a natural starting point for determining the neural phenotype. In this regard, proposals of local over-connectivity and long-range under-connectivity in the autistic brain are attractive candidates. Autism is a developmental disorder; therefore, abnormalities in the circuitry of autistic brains are likely to be pervasive and include regions involved in sensory processing. One such region is the somatosensory cortex. Afferents from adjacent fingers project via segregated neuronal clusters in the sub-cortical pathway and reach cortex, where the first neural interaction between them occurs. The cortical region to which the thalamic afferents corresponding to a given finger project is its hot spot, and the early part of its response to the stimulation of an adjacent finger assays the strength of local excitatory intracortical connectivity.

Objectives:

Local overconnectivity predicts that the tactile stimulation of a finger would yield a stronger response in the cortical hot spot corresponding to its adjacent finger in autism versus control. We tested this prediction with magnetoencephalography (MEG).

Methods:

(i) We recorded neural responses to the passive tactile stimulation of the thumb (D1) and index finger (D2) of the dominant hand of young adult participants (13 high-functioning persons with autism spectrum disorder or ASDs and 17 typically developing persons or TDs, matched for gender and age) while they remained awake in an eyes-closed supine posture in a 248-sensor MEG scanner.

(ii) For each participant, we computed the evoked response in source space using a mathematical tool called singular value decomposition (SVD). This method creates a virtual sensor that approximates the response of the cortical hot spot corresponding to a particular finger. In this manner, two hot spots, one each for D1 and D2, were obtained.

(iii) Somatosensory evoked potentials (SEPs) in the hot spot to the tactile stimulations of D1 and D2 were computed. For M50 (short-latency SEP, mediated mainly by feedforward sub-cortical pathways) and M100 (mid-latency SEP, mediated by

cortical feedback) SEP components separately, responses of the neighboring/primary hot spots were measured and optimal least-squares slopes computed. The slopes of the two groups were then compared.

Results:

M50: No between-group differences were found in the ratios of D2/D1 hot spot responses to D1 stimulation or D1/D2 hot spot responses to D2 stimulation.

M100: There were clear between-group differences. *D1 stimulation*: The slope of the D2 hot spot's response to the D1 hot spot's response to D1 stimulation was significantly smaller in the ASD group compared with the TD group (P=0.003). *D2 hot spot*: The results were similar. The slope of the D1 to the D2 hot spots' responses to D2 stimulation was again, significantly smaller in the ASD group (P=0.015).

Conclusions:

The findings indicate a weaker degree of local cortical interaction in the somatosensory cortex of the person with autism compared to the person without. Local underconnectivity in the autistic brain is consistent with our results.

Invited Educational Symposium Program
117 Translation of Intervention Research to Practice
Moderator: S. Odom *University of North Carolina*

The behavioral intervention literature focusing on individuals with Autism Spectrum Disorders (ASD) is among the most active in the social and clinical sciences. Yet, a gap exists between scientific knowledge about efficacy of intervention practices and their use by practitioners who work with individuals with ASD. A set of procedures have been established to systematically identify intervention practices that have strong scientific support. Similarly, rigorous tools and procedures are being established for assessing quality in intervention settings, determining implementation of practices, establishing support for implementation through coaching, and documenting student outcomes. In this symposium, presenters will describe methodology and outcomes related to each of these areas. In the first paper the authors will examine two methodologies for reviewing the research literature, identifying evidence-based practices, and summarizing practices identified. In the second paper, an assessment instrument for determining quality in program environments for students with ASD, from age 3 – 22 will be presented and data on reliability and validity will be described. In the third paper, the author will describe a methodology for operationalizing individual goals for individuals with ASD, called Goal Attainment Scaling, and illustrate the ways it has been used in their research on coaching and implementation. In the fourth paper, a systems approach developed by the National Professional Development Center on ASD for supporting the implementation of evidence-based intervention practices will be presented, and outcomes (at the program practice and child level) will be described.

117.001 Identification of evidence-based intervention practices for student with ASD. S. Wilczynski*, *National Autism Center*

117.002 Assessment of Quality in Programs for Students with ASD. C. Ann*, *University of North Carolina at Chapel Hill*

117.003 Assessing performance on individualized goals for students with ASD. L. A. Ruble*, *University of Kentucky*

117.004 A systems approach to supporting use of evidence-based practices for students with ASD. . S. J. Rogers*, *UC Davis MIND Institute*

118 Epidemiology: ASD Prevalence, Trends, and Adults with ASD
Moderator: M. Yeargin-Allsopp *CDC*

118.001 Varation In the Prevalence of the Pervasive Developmental Disorders by DIAGNOSTIC Criteria. C. E. Rice*[1], L. D. Wiggins[2], L. A. Carpenter[3], L. A. Schieve[1], R. T. Fitzgerald[4], A. Pedersen y Arbona[5] and L. C. Lee[6], (1)*National Center on Birth Defects and Developmental Disabilities*, (2)*Centers for Disease Control and Prevention*, (3)*Medical University of South Carolina*, (4)*Washington University School of Medicine*, (5)*University of Arizona - Tucson*, (6)*Johns Hopkins Bloomberg School of Public Health*

Background: The criteria used by professionals to diagnose autism and related disorders are defined by the Diagnostic and Statistical Manual (DSM) of the American Psychiatric Association (APA). Autism was initially defined in the DSM as a form of childhood schizophrenia. In 1980 (DSM-III), autism was listed under the category of "Pervasive Developmental Disorder" which included the more stringently-defined "infantile autism" and the more broad "childhood onset pervasive developmental disorder." The PDD criteria were revised again for the DSM-IIIR in 1987, and again, with the DSM-IV in 1994 with a text revision (TR) in 2000. The update in 1994 included the addition of Asperger's disorder. Over the same time period,

prevalence estimates changed from about 1/2000 to about 1/100 today. There has been significant debate regarding the extent to which DSM criteria changes have affected ASD prevalence estimates.

Objectives: To evaluate how the identification of children with an ASD varies by DSM version used.

Methods: The Autism and Developmental Disabilities Monitoring (ADDM) Network has identified the prevalence and described the population characteristics of children with ASDs in multiple areas of the United States. ADDM Network clinician reviewers use a coding guide based on the DSM-IVTR criteria for autistic disorder and PDD (including Asperger's). The coding is applied to developmental and behavioral information abstracted from existing records of developmental evaluations for children who may or may not have been diagnosed with an ASD by a community professional. For this analysis, DSM-III, IIIR, and IVTR criteria for autism and PDD were applied to the same developmental and behavioral information abstracted from existing records.

Results: A total of 5,007 eight-year-old children were suspected of having an ASD in the year 2006 from areas of the US with a population of 280,423 eight-year-old children. Of these, 2,054 met DSM-IVTR criteria for autism and 2,641 for overall ASD/PDD. When using DSM-IIIR criteria, 1,892 met criteria for autism and 2,223 for PDD. For DSM-III, 1,921 met criteria for autism and 2,232 for overall PDD. Autism prevalence estimates per 1,000 children (95% confidence intervals) for DSM-IVTR, DSM-IIIR, and DSM-III are as follows: 7.3 (7.0-7.6); 6.7 (6.4-7.1); and 6.9 (6.5-7.2), with overall PDD prevalence estimates: 9.4 (9.1-9.8); 7.9 (7.6-8.3); and 8.0 (7.6-8.3). There was no difference in overall PDD prevalence between DSM-III and IIIR criteria ($p=.45$), but PDD prevalence was 17.50% lower ($p<.001$) using DSM-III criteria and 18.98% lower ($p<.0001$) using DSM-IIIR criteria compared to DSM-IVTR.

Conclusions: Given that ASDs are behaviorally-defined disorders, the diagnostic criteria impact the number of children identified with the condition(s) as seen when the different criteria are applied to the same population of children. These results indicate that a portion of the increase in identified ASD prevalence over time may be attributed to differences in community identification based on the criteria used to characterize the symptom constellation that makes up the PDDs.

118.002 Heterogeneity In Longitudinal Trajectories of Children with Autism. C. Fountain* and P. S. Bearman, *Columbia University*

Background: Although autism is typically diagnosed in early childhood, it is a lifelong disorder from which only a minority recover. Currently, little is known about the long-term symptom trajectories of children diagnosed with autism. A few studies have followed the long-term outcomes of persons with autism over the life course, but these studies, in general, have utilized small or non-representative samples or infrequent follow-ups. Further, the few extant studies tend to analyze average or typical outcomes with little attention to the heterogeneity of outcomes.

Objectives: In this paper, we identify and describe the common patterns of symptom expression over time among children with autism from ages two to fourteen. These trajectories are induced from the data, using an innovative statistical strategy, rather than imposed based on diagnostic or other categories. We establish their frequencies in a large population of children with autism and then explore the correlates – including birth cohort, age of diagnosis, maternal characteristics, and risk factors – for group membership.

Methods: We begin with a population-level data set of the birth certificate records of all children with autism born in California in 1992-2000 and enrolled with the Department of Developmental Services (DDS). We extract the annual evaluation items from the CDER and construct longitudinal trajectories for social interaction and communication indices for 4,376 children from diagnosis until they are up to 14 years old. Using group-based latent trajectory modeling, we identify and describe sub-groups within the data of similar developmental trajectories along both dimensions. We then estimate a series of binomial and multinomial logistic regression models on the trajectory assignments uncovered by the trajectory models.

Results: The final models split the social and communication trajectories into six typical patterns. Most children develop substantially over time, but the extent of this development is heterogeneous; some children improve much more than others. The period of most rapid development occurs before age 6, and several of the trajectories subsequently flatten. A group of "Bloomers", children who develop especially rapidly, was identified. These children begin with low scores, comparable to the lowest-functioning trajectories, and quickly improve, ending with scores comparable to the two highest-functioning trajectories. Regression results show that the Bloomer group is relatively socioeconomically advantaged with white mothers of average or better education, and they are

unlikely to be born on Medi-Cal. They are also geographically concentrated in such a way that is not entirely explained by regional center catchment areas.

Conclusions: There is significant heterogeneity in longitudinal autism outcomes, suggesting phenotypic and etiological heterogeneity. Children born on Medi-Cal and to non-white mothers or to mothers with less education are less likely to experience rapid, upward mobility on their symptom trajectories. This suggests that even in an environment like California, where children with autism diagnoses are provided with state-funded developmental services, there is substantial heterogeneity in outcomes associated with parental resources. Without additional targeted resources, some children with autism may never realize their full potentials.

118.003 More Documented Diagnoses of Autism Likely Responsible for Increased Identification of the Autism Spectrum Disorders. L. D. Wiggins*, O. Devine, J. Baio, C. E. Rice, K. Van Naarden Braun and M. Yeargin-Allsopp, *Centers for Disease Control and Prevention*

Background:

The number of children with an Autism Spectrum Disorder (ASD) has increased substantially over the last few decades, which has lead to the hypothesis that increased ASD identification is due to the recognition of more children with typically milder ASDs. Yet no study has examined changes in the proportional distribution of children in differing diagnostic subgroups (e.g., Autistic Disorder versus other ASD) identified from a variety of providers within the community.

Objectives:

Our goals were to examine 1) whether children identified by a population-based surveillance system were receiving more diagnoses of an ASD and fewer notes of ASD characteristics without a confirmatory diagnosis over time and 2) changes in the proportional distribution of diagnostic subgroups and how these changes differed based on the presence or absence of intellectual disability (ID).

Methods:

Participants were 1,497 children who met the Centers for Disease Control and Prevention (CDC) ASD surveillance definition in Atlanta, GA in surveillance years (SYs) 2000, 2002, 2004, and 2006. Children were placed in one of five groups based on ASD diagnostic specificity identified by a community professional and stratified by ID: 1) a 299.0 billing code or diagnosis of Autistic Disorder, 2) a 299.8 billing code or diagnosis of ASD without a diagnosis of Autistic Disorder, 3) autism eligibility at a public school without a noted clinical diagnosis, 4) a documented suspicion of an ASD without a clinical diagnosis or autism eligibility at a public school, and 5) none of the above. Changes in the distribution of these diagnostic groups were evaluated using Bayesian multinomial logistic regression.

Results:

The relative risk of being diagnosed with Autistic Disorder increased substantially from 2000 to 2002 (RR=1.7) and then stabilized in 2004 (RR=1.7) and 2006 (RR=1.8) for children with and without an ID (Table 1). There were no substantial changes in the proportion of children diagnosed with other ASD or children who received school services for an ASD who did not have a diagnosis of Autistic Disorder. Fewer children identified by the surveillance system were classified as having no ASD diagnosis or school services or suspicion of an ASD noted in service records; suggesting the proportion of children in this group was decreasing while the proportion of children with a noted Autistic Disorder was increasing over time.

Conclusions:

We found substantial changes in documented diagnoses of Autistic Disorder, which could be due to growing awareness of ASD symptoms and less reluctance to diagnose autism when enough behavioral symptoms are noted. The major shift in providing more diagnoses of Autistic Disorder occurred after the introduction of the *DSM-IV* in 1994 (i.e., SY 2002). Our findings do not support the conclusion that expanded diagnostic criteria has a major impact on the increased use of ASD diagnoses by community professionals since there were no changes in the proportion of children diagnosed with an ASD. However, autism is being diagnosed more now than in the past; which highlights the need for more services for children with ASD and continued support for their families.

118.004 Epidemiology, Screening and Diagnosis of ASD In Adulthood. T. S. Brugha*[1], J. Bankart[1] and S. McManus[2], (1)*University of Leicester*, (2)*NATCEN*

Background: Recent prevalence surveys of autism in childhood suggest higher rates than older surveys. But there is no published information on the epidemiology of autism in adults. If the prevalence of autism is increasing, rates in older adults would be expected to be lower than among younger adults. Survey methods in children can be carried out with the assistance of parents and teachers acting as informants of child behavior. This option is not available in community

surveys of adults. Adult surveys therefore require an approach that is adapted from survey methods successfully employed for studying the epidemiology of other mental and behavioral disorders such as anxiety, depression and psychosis. These methods rely on self report measures and in selected respondents at increased risk of the disorder the use of diagnostic assessments.

Objectives: To conduct an epidemiological study of autism amongst adults living in England, UK

Methods: A stratified multi-phase random sample was used in the third national survey of psychiatric morbidity in adults in England in 2007. A 20 item subset of the Autism Quotient, a 50 item self completion questionnaire, was used to screen for adults at higher risk of ASD. A second phase involved detailed assessments with the Autism Diagnostic Observation Schedule Module 4 (ADOS-4). There were 7,461 screening interviews and 618 diagnostic assessments. The ADOS-4 was also cross validated with clinical case vignettes and ADI-R and DISCO assessments conducted in a third survey phase. Respondents also provided socio- demographic and service use information. Survey data were weighted to take account of study design and non-response so that the results were representative of the household population of England.

Results: The overall prevalence of ASD in adults was estimated to be 9.8 per 1000. Prevalence was not related to the respondents' age. Rates were higher in males, those without educational qualifications, and in those living in rented social housing. There was no evidence of increased use of services for mental health problems whereas adults with other forms of mental disorder were making greater use of treatments and services. None of the cases identified in the survey had taken part in an autism diagnostic assessment or were known to have an ASD.

Conclusions: Conducting epidemiological research on ASD in adults irrespective of whether or not in contact with clinical services is feasible. The prevalence of ASD in adults appears similar to that found in the most recent general population surveys of children. The lack of an association with age implies there has been no increase in the prevalence of ASD over time, that its causes are temporally constant and not due to a novel environmental toxic factor, and that apparent increases in prevalence in child surveys are attributable to improvements in awareness, recognition and in case finding. Use of mental health services seems less than for other mental disorders, which suggests that adults with autism are noy known to services, possibly because of under recognition and non availability of diagnostic services.

118.005 Outcomes and Needs In Mid-Later Adulthood. P. Howlin*, *Institute of Psychiatry, King's College London*

Background: There have been a number of recent studies on trajectories of development from child to adulthood in individuals with autism (eg Farley et al., 2009; Taylor & Seltzer, 2010).These have generally indicated a decrease in severity of autistic symptomatology over time. Improvement also tends to be greater in individuals who are not intellectually impaired. However there is also clear evidence that access to adequate support networks decreases once individuals leave full time education, and this is particularly the case for those whose IQ lies within the normal range. Moreover, mental health problems tend to increase with age.

Follow-up periods in these studies have ranged from around 10 to 20 years, with the mean age of participants being late 20's to early 30's. There have been no longer term follow-up investigations exploring outcomes and needs involving older individuals with ASD

Objectives: To examine outcomes and changes in functioning over time in a cohort of individuals first diagnosed in early childhood and followed up over a period of 35-40 years.

Methods: ***Participants***: 47 individuals (40 males, 7 females) initially assessed in childhood (mean age 6 years) as having autism and a performance IQ ≥70. Diagnosis was reconfirmed by the ADI at an average age of 29 years when data on cognitive and social outcomes were also collected (Howlin et al., 2004). The current follow-up was conducted at a mean age of 44 years (range 29 to 64 years). ***Measures:*** IQ and language data, and information on social functioning and mental health were collected from participants using standardised interviews and questionnaires. Informants (mainly parents) provided data on current levels of autistic symptomatology, social outcomes and difficulties, and mental health problems. ***Analysis:*** Change over time was analysed using analysis of variance and regression techniques to explore the impact of child variables on adult outcome

Results: For most individuals, IQ remained relatively stable during the adult years but some showed a significant decline in IQ from child to adulthood. Autism severity scores decreased with time. However, around two thirds of the cohort were not in paid employment, did not live independently and had never had close friendships. In contrast, rates of mental health problems were relatively low compared to earlier reports. For those living

alone, social support was limited and many individuals remained dependent on their elderly parents for continuing support. In this group childhood IQ was not a strong predictor of adult outcome. Data analysis is ongoing to explore other predictors of outcome

Conclusions: In this clinical cohort, first seen as children in the 1960's and 1970's, outcome in mid-late adulthood was generally poor, with few individuals living independently or being fully socially integrated. Those who had achieved a higher degree of independence as adults had access to little support other than that provided by parents. The implications of these findings for services for older individuals with autism will be adressed

118.006 Increasing Socioeconomic Disparity In the Prevalence of Autism Spectrum Disorder In Wisconsin. M. S. Durkin*[1], M. J. Maenner[1] and C. L. Arneson[2], (1)*University of Wisconsin-Madison*, (2)

Background: Although developmental disabilities as a whole are most prevalent in children of low socioeconomic status (SES), recent epidemiologic studies in the United States suggest this may not be true for autism spectrum disorder (ASD) and that the prevalence of ASD appears to increase with increasing SES. A study in Wisconsin based on surveillance data from the year 2002, for example, found ASD prevalence to increase in a stepwise manner from a low of 2.5 (95% confidence interval 1.6, 4.0) per 1,000 children in the lowest SES quintile to a high of 6.8 (95% confidence interval 5.1, 8.9) in the highest SES quintile.

Objectives: To replicate the Wisconsin 2002 study using comparable data for the year 2006 and evaluate the hypothesis that the SES disparity in ASD prevalence would be reduced in 2006. Support for this hypothesis might suggest that awareness and identification of ASD among children of low SES have improved over time.

Methods: A cross-sectional study was implemented with data from the Wisconsin Surveillance of Autism and Other Developmental Disabilities System, a multiple source surveillance system that incorporates data from health care and developmental disabilities service providers to determine the number of 8-year-old children with ASD in southeastern Wisconsin. In 2006, there were 257 children with ASD among a population of 34,058 8-year-old children residing in the surveillance area. Area-level census SES indicators were used to compute ASD prevalence by SES quintiles of the population.

Results: The prevalence of ASD in this population in 2006 was 7.6 per 1,000 children, a 46% increase relative to 2002. In addition, as in 2002, the prevalence increased stepwise with increasing SES, from a low of 2.4 (95% confidence interval 1.5, 3.8) per 1,000 children in the lowest SES quintile to a high of 11.5 (95% confidence interval 9.3, 14.2) in the highest SES quintile. However, because the increase in prevalence between 2002 and 2006 occurred differentially in the higher SES quintiles, the SES disparity in ASD prevalence also increased between the two study years. The prevalence ratios for the highest versus lowest SES quintiles increased from 2.7 (95% confidence interval 1.6, 4.5) in 2002 to 4.8 (95% confidence interval 2.9, 7.9) in 2006.

Conclusions: The SES gradient in ASD prevalence in Wisconsin has become steeper rather than diminished during a time period of increasing overall prevalence of ASD. 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.

118.007 Risk Factors for Autism Among California Births 1992-2002: a within-Family Framework. K. Cheslack-Postava* and P. S. Bearman, *Columbia University*

Background: Male sex and increased parental ages are widely established risk factors for autism. Associations between autism and pregnancy-related factors such as maternal parity and birth complications have also been reported, and indicate that sub-optimal prenatal environment may play a role in risk for the disorder. Variation in risk over subsequent pregnancies may implicate biological factors or environmental exposures that vary from one pregnancy to the next, and could help inform the search for modifiable risk factors for autism. However, the weight of evidence for these associations stem from study designs drawing comparisons between rather than within families, while the processes of interest are of relevance within women or families.

Objectives: To examine associations between sociodemographic and perinatal factors and autism while controlling for potential confounding by family-level characteristics, by conducting within-family analyses.

Methods: We identified sets of full singleton siblings from among all births in California between 1992 and 2002. Cases of autism were identified using California's Department of Developmental Services client files. The association between autism and birth order and other covariates within families was

investigated using conditional logistic and multi-level random effects models.

Results: Second and later born children were at increased risk of autism relative to their first-born siblings. The association between birth order and autism diagnosis was time dependent, such that the increased risk occurred when interval between pregnancies was short (OR and 95% CI for second versus first born siblings= 2.15 (1.87, 2.47) for a 6 month versus 0.99 (0.87, 1.13) for a 24 month pregnancy interval, based on conditional logistic models). The first multi-level analysis to address this question, the results also suggest that increasing parental age plays a significant role in influencing risk between, rather than within, families; and that being male is associated with a higher manitude of association within families than between.

Conclusions: Confounding by family-level factors influences both the magnitude and direction of observed associations for risk factors for autism, which may be relevant to causal inference about the mechanisms behind these associations. Epidemiologic studies of risk factors for autism should include within-family comparisons when feasible.

118.008 Autism Spectrum Disorders & Comorbid Disorders: Findings From New Jersey Autism Study. J. Shenouda*[1], P. Khandge[2], H. Patel[2], N. Scotto-Rosato[3], S. Howell[3] and W. Zahorodny[1], (1)*New Jersey Medical School*, (2)*UMDNJ*, (3)*NJ State Health Department*

Background: Children with Autism Spectrum Disorder (ASD) often display behaviors that are not related to the core features of ASD; however, some of these behaviors are often consistent with other disorders, and some of these children may be affected by other co-occurring disorders. Population-based studies are needed to appreciate the occurrence and expression of ASD and comorbid disorders and their effects on each other.

Objectives: This study investigated the number, proportion and demographic distribution of children with ASD with a comorbid disorder. The study also investigated the association between the presence of comorbid disorders and the average age of ASD diagnosis.

Methods: Data were collected as part of the New Jersey Autism Study (NJAS), 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 previous diagnosis were analyzed. The socioeconomic status (SES) of ASD cases was represented by the District Factor Group (DFG) ranking, a community-level index. A number of mean difference tests were performed to gauge whether the presence and type of comorbid diagnosis; SES, and other demographic factors were significantly associated with the age of ASD diagnosis.

Results: 533, 8 year old, children were identified with ASD from a population of over 30,000 children. 248 children with ASD (46.5%) had one or more comorbid disorders. The most frequently diagnosed comorbid disorder was ADHD, accounting for 208 ASD children (39%). 85 children with ASD (15.9%) had other psychiatric disorders, including mood disorders, oppositional defiant disorder, and anxiety disorders. 41 ASD children (7.7%) had other medical disorders including genetic disorders, epilepsy/seizure disorders, hearing and/or visual impairments, and cerebral palsy. Overall, the distribution of comorbid disorders and average age of ASD diagnosis did not significantly vary by race, gender, or SES. However, it was found that ASD children without a comorbid disorder were identified earlier with ASD (50.6 months) than ASD children with any comorbid disorder present, (55.8 months) ($t=2.24$, $p<.05$). We also found that ASD children with ADHD were identified with ASD at a later age (57.7 months) compared to ASD children without ADHD (50.2 months) ($t=3.15$, $p<.001$).

Conclusions: There has been an overwhelming increase in ASD prevalence over the past decade. Many studies support early identification of ASD and timely intervention. Based on the results of this study, it was observed that many children with ASD are also afflicted with other disorders, and the presence of a comorbid disorder, specifically ADHD, is associated with delayed identification of ASD. This suggests that the presence of a comorbid disorder may mask the presentation of ASD, leading to a delayed identification of ASD as well as a delayed intervention to ASD.

Clinical Phenotype Program

119 Sex Differences and Females with Autism Spectrum Disorders

Moderator: C. Lord *University of Michigan*

119.001 Sex Differences In the Early Screening of Autism Spectrum Disorders. 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. Research also demonstrates sex differences in these disorders throughout development. Because differences may exist very early on, the predictive value of current early screening tools may vary based on sex.

Objectives: To examine whether the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 1999) identifies males and females with ASDs at similar rates and whether specific items better predict ASD diagnosis in males and females.

Methods: The sample included 7895 males and 7556 females (mean age=20.62 months, *SD*=3.09) 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 completed the M-CHAT Follow-up Interview (FUI). Those who screened positive on the FUI completed an ASD evaluation.

Results: Of those who completed the M-CHAT (*n*=15,451), 10% (*n*=788) of males and 7.5% (*n*=564) of females screened positive. Of all of those who screened positive on the M-CHAT (*n*=1,352), 58% were male. Of those who completed the FUI (*n*=1,078), 17% (*n*=104) of males and 9.9% (*n*=46) of females continued to screen positive. Of those who screened positive on the FUI (*n*=150), 69.3% were male. Of the children who completed a diagnostic evaluation (*n*=140), 53.8% (*n*=56) of males and 36.1% (*n*=13) of females were diagnosed with an ASD. Of all of those with an ASD (*n*=69), 81.2% were male. Females were more likely than males to be false positives on the FUI, (χ^2 (1)=9.64, *p*=.002), and evaluation (χ^2 (3)=16.10, *p*=.001) stages. Therefore, positive predictive value (PPV) for M-CHAT was three times greater for males than females on M-CHAT alone (.071 and .023, respectively). PPV for M-CHAT + Follow-up Interview was nearly double for males than females (.538 and .283, respectively). A discriminate function analysis yielded seven items in boys and eight items in girls that best predicted ASD. Six of the items were the same for males and females, but two items (point to request and imitation) were better predictors in females and one item (response to name) was a better predictor of diagnosis in males.

Conclusions: Based on the population rates, we expected 80% of screen positives to be male. Rather, only 58.3% of screen positive cases were male. Males comprised 69.3% of those positive on the FUI, and of the children diagnosed with ASD, the sex ratio was as expected based on epidemiological reports (81.2% male). These rates indicated that PPV is approximately threefold greater for males than females when only the paper-and-pencil M-CHAT is administered, and nearly twofold greater for males than females for M-CHAT + FUI, suggesting that screen positives results in males are more likely to predict an ASD diagnosis. Largely overlapping but distinct subsets of items best predict an ASD diagnosis in males and females; this may be useful for the development of sex-specific algorithms of the M-CHAT. Future research will further investigate the predictive power of individual items and subsets of items in males and females.

119.002 Sex Differences In the Identification and Diagnosis of Autism, Asperger's Syndrome and PDDNOS.

S. Begeer*[1], D. S. Mandell[2], B. Wijnker-Holmes[3], F. Stekelenburg[4] and H. M. Koot[1], (1)*VU University*, (2)*University of Pennsylvania School of Medicine*, (3)*Dutch Autism Association (NVA)* , (4)*Dutch Autism Association (NVA)*

Background:

Autism Spectrum Disorders (ASD) have a male predominance ranging from 4:1 among individuals with autistic disorder to 9:1 among individuals with Asperger's disorder. It has been suggested that diagnostic biases are involved in the skewed sex ratio, which may leave females with ASD undiagnosed.

Objectives:

To examine whether there are sex differences in the timing of the identification of specific diagnostic categories of Autism, Asperger's syndrome or PDD-NOS.

Methods:

Survey data were collected in the Netherlands from 2275 individuals with ASD. Timing and procedure of diagnosis were compared for males and females with autism, Asperger's syndrome and PDDNOS.

Results:

Among participants < 18 years of age, females with Asperger's syndrome were identified later than males, despite parents' report of first concern at similar ages. No delays in identification were found for individuals with ASD and PDD-NOS, or among participants ≥18 years of age.

Conclusions:

Among children and adolescents with Asperger's syndrome, females are diagnosed later than males, which can result in

increased family stress and critical delays in treatment initiation. Strategies for changing clinician behaviour to improve recognition of ASD in females are needed.

119.003 Females with Autism Spectrum Disorder: An Analysis of the Simons Simplex Collection. M. Huerta*[1], S. L. Bishop[2], K. Gotham[3], V. Hus[1], S. Lund[1], A. Buja[4] and C. Lord[1], (1)*University of Michigan*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*University of Michigan Autism and Communication Disorders Center*, (4)*The Wharton School University of Pennsylvania*

Background:

The existing literature has long reported that females with autism spectrum disorders (ASD) may be more cognitively impaired than males with ASD (Lord, Schopler, & Revicki, 1982; Tsai, Stewart, & August, 1981). More recent work on children with ASD has revealed sex differences in specific cognitive and behavioral domains (Carter, 2007) and has suggested that this variation may be moderated by VIQ (Skuse et al., 2009). Work that has taken NVIQ into account has identified specific dimorphic patterns in comorbid and autism-specific symptoms such that females demonstrate fewer restricted and repetitive behavior (RRBs) but more communication deficits and greater anxiety and depressive symptoms than males (Hartley & Sikora, 2009: Lord et al., 1982). Further work is needed to better understand sex differences in ASD.

Objectives:

This study will examine the female autism phenotype with a specific focus on the moderating role of IQ.

Methods:

The sample for the current study was drawn from the Simons Simplex Collection and consists of1632 males and 255 females with ASD. Children, ages 48 to 216 months, completed a battery of cognitive and diagnostic measures that included the Autism Diagnostic Observation Schedule (ADOS) and parents completed the Autism Diagnostic Interview-Revised (ADI-R), the Vineland Adaptive Behavior Scales-2nd Edition (Vineland-II), and other measures of functioning such as the Aberrant Behavior Checklist (ABC).

Results:

Preliminary results support previous findings: females with ASD obtained a significantly lower mean FSIQ than males. In addition, scores on adaptive behavior were significantly lower for females. Additional analyses will examine differences in social and communication impairments and other behavioral symptoms while taking into account level of functioning.

Conclusions:

This sample contains one of the largest groups of females with ASD ever studied. Thus, the results from this study will greatly add to our existing knowledge of ASD sex differences and the female phenotype.

119.004 Is Being Female Protective Against Autism Spectrum Disorders? Oxytocin and Vasopressin Levels In Children and Adolescents. M. Miller*[1], K. Bales[2], S. Taylor[3], J. H. Yoon[4], M. Minzenberg[4], C. S. Carter[4] and M. Solomon[5], (1)*UC Berkeley*, (2)*UC Davis*, (3)*UC Davis School of Medicine Clinical and Translational Science Center*, (4)*UC Davis Imaging Research Center*, (5)*Department of Psychiatry, MIND Institute, Imaging Research Center*

Background: Male predominance of autism spectrum disorders (ASD) is estimated at 4 to 1. One theory for this higher male prevalence is that the female neuroendocrine system confers “protection” against autistic traits (Carter, 2007). According to this view, processes mediated by oxytocin (OT), and the lack of reliance on arginine vasopressin (AVP), make being female protective against autistic-like behavior. No previous studies have investigated sex differences in blood plasma OT and AVP levels in individuals with ASD.

Objectives: Primary aims included examining blood plasma levels of OT and AVP in girls and boys with ASD and typical development, and relating OT and AVP levels to autism and internalizing symptom measures. We hypothesized that: (1) neuropeptide levels would be significantly higher in typically developing individuals and would increase with age; (2) higher OT levels would be related to less social and repetitive behavior pathology and lower anxiety and depression; and (3) higher AVP levels would show the inverse of relationships in (2).

Methods: Plasma OT and AVP levels and standardized measures of autism and internalizing symptoms were obtained from 72 children ages 8-18: 39 with high-functioning ASD (18 girls, 21 boys) and 33 typically developing children (15 girls, 18 boys). OT and AVP levels were log-transformed and modeled as a function of time of blood draw, age, gender, and diagnosis. Spearman’s Rho was used to assess correlations between OT and VP levels and symptom measures.

Results: There were significant main effects of gender on OT levels (p = .04; girls higher, Cohen's d = .47) and time of blood draw on AVP levels (p = .01), and marginally significant effects of diagnosis on OT (p = .09; ASD higher, Cohen's d = .43) and gender on AVP (p = .08; boys higher, Cohen's d = .44). There were no effects of age. Controlling for time of blood draw and age, OT values were positively associated with anxiety levels in girls and pragmatic language ability in boys and girls. OT and AVP levels were *positively* associated with restricted and repetitive behaviors in girls with ASD, while AVP levels were *negatively* associated with these behaviors in boys with ASD.

Conclusions: Results are consistent with the animal literature suggesting higher OT levels in females and higher AVP levels in males. However, our findings are inconsistent with several studies that have found lower OT in individuals with ASD, with trends in the opposite direction. The present results are suggestive of common and distinct roles of OT and AVP in boys and girls. Larger samples further exploring potential sex and diagnostic differences in OT and AVP are warranted.

119.005 Mass-Univariate and Pattern Classification Analysis on Structural MRI In Children with Autism Spectrum Disorders: a Focus on Females. S. Calderoni*[1], A. Retico[2], L. Biagi[3], R. Tancredi[4], F. Muratori[5] and M. Tosetti[6], (1)*Magnetic Resonance Laboratory, Division of Child Neurology and Psychiatry University of Pisa; Stella Maris Scientific Institute*, (2)*National Institute of Nuclear Physics, Division of Pisa, Italy*, (3)*Magnetic Resonance Laboratory, Division of Child Neurology and Psychiatry University of Pisa; Stella Maris Scientific Institute* , (4)*University of Pisa – Stella Maris Scientific Institute*, (5)*University of Pisa - Stella Maris Scientific Institute*, (6)*Magnetic Resonance Laboratory, Division of Child Neurology and Psychiatry University of Pisa; Stella Maris Scientific Institute, Pisa, Italy,*

Background: The several but inconclusive studies on structural MRI in children with autism spectrum disorders (ASD) have mainly focused on samples entirely or prevailingly consisting of males. Sex differences in brain structure are observable since infancy and therefore caution is required in transferring to females the results obtained for males. The neuroanatomical phenotype of female children with ASD represents indeed a neglected area of research.

Objectives: The purpose of this study is to investigate anatomical brain structures in a sample entirely composed of ASD female children, using *mass-univariate and pattern classification approaches.*

Methods: Thirty-eight ASD females (ASDf) between 25 and 88 months (2-7 years of age; mean=53 months; SD=18) were compared to 38 female control children (19 idiopathic developmentally delayed, 19 typically developing) between 22 and 89 months (mean=53 months; SD=19) selected to carefully match by age and non-verbal IQ (NVIQ). Regional grey matter (GM) volumes were compared between the two groups using voxel-based morphometry (VBM) with the Diffeomorphic Anatomical Registration using Exponentiated Lie algebra (DARTEL) procedure.

Results:

The subjects in the ASDf group showed significantly more GM in the superior frontal gyrus (SFG; MNI coordinates: -19 44 23), compared with the age and IQ matched controls. A pattern classification approach has also been implemented to discriminate between ASDf and control subjects. The GM segments obtained in the VBM-DARTEL preprocessing have been classified with a support vector machine (SVM). The recursive feature elimination (SVM-RFE) approach allows for the identification of the most discriminating voxels in the GM segments. This information is shown in the discrimination maps obtained for different threshold values on the area under the receiver operating characteristic curve (AUC), which is implemented as a figure of merit to estimate the classifier performance.

The regional cortical volume alteration revealed in the SVM-RFE map obtained with the most exiguous set of voxels (0.01% of the total GM voxels) with high discrimination power (AUC within the 2% of relative difference from AUC_{max}=0.80) is extremely consistent with the significant area in the superior frontal gyrus identified by the VBM analysis. Furthermore, the SVM-RFE map obtained with the most discriminating set of voxels (the 0.08% of the total GM voxels) corresponding to AUC_{max}, reveals a more complex circuitry of increased cortical volume in ASDf, involving bilaterally the superior frontal gyrus (MNI coordinates: -26 44 20; 26 50 10) and the right temporo-parietal junction (TPJ; MNI coordinates: 45 -55 26).

Conclusions: These results suggest that structural anomalies of the brain cortical development are present in ASDf children and that these alterations in the SFG and TPJ might have a crucial role in the pathophysiology of ASD in female children.

119.006 Sex Differences In Behavior In Adults with High Functioning Autism Spectrum Conditions. M. C. Lai*[1], M. V. Lombardo[2], G. Pasco[3], A. Ruigrok[1], S. J. Wheelwright[2], S. A. Sadek[4], B. Chakrabarti[5] and S. Baron-Cohen[2], (1)*Autism Research Centre, Department*

of Psychiatry, University of Cambridge, (2)*Autism Research Centre, University of Cambridge*, (3)*Institute of Education*, (4)*University of Cambridge*, (5)*University of Reading*

Background: It is uncertain if there are phenotypic sex differences in autism spectrum conditions (ASC). Understanding behavioral sex differences (and similarities) in ASC is important not only for clinical assessment and sub-grouping, but also has implications for theories of psychological sex differences and of autism.

Objectives: To investigate sex differences and similarities, at both behavioral and cognitive levels, in age- and IQ-matched adults with ASC with above-average IQ.

Methods: Eighty-three (45 males and 38 females) adults with clinical diagnoses of ASC (high-functioning autism or Asperger syndrome) were recruited for behavioral assessment. Sixty-two of them (33 males and 29 females) who met the Autism Diagnostic Interview-Revised (ADI-R) cutoff for autism were subsequently analyzed. All participants were assessed using the ADI-R, Autism Diagnostic Observation Schedule (ADOS), Autism Spectrum Quotient (AQ), Empathy Quotient (EQ), Systemizing Quotient (SQ), Reading the Mind in the Eyes Test (Eyes), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), and Obsessive-Compulsive Inventory-Revised (OCI-R).

Results: Male and female adults with ASC showed comparable severity of childhood autistic symptoms on the ADI-R on the three core dimensions. However, females with ASC showed significantly more lifetime sensory symptoms (p = 0.034), as assessed by three sensory-related items on the ADI-R. Moreover, females showed significantly fewer current autistic socio-communicative characteristics (p = 0.001), as assessed by the module 4 of ADOS. ASC females with developmental language delay showed lower performance IQ than those without (p < 0.001), but this was not evident for males. However, both sexes with ASC reported similar levels of autistic traits on the AQ, EQ and SQ, and co-occurring symptoms (anxiety, depression and obsessive-compulsive traits) on the BAI, BDI, and OCI-R, and performed comparably on an advanced mentalizing (Eyes) task.

Conclusions: The present study profiles both phenotypic sex differences and similarities in adults with ASC. This underscores the importance of investigating the developmental history in assessing women with ASC, whose autistic nature can sometimes be masked by their apparently typical social-communication when interacting with people. Sensory issues and correlation between language delay and intellectual ability are more prominent in females than males, which may be informative for sub-grouping of ASC. The absence of some sexually dimorphic cognitive features (e.g. autistic traits and empathizing-systemizing profiles) in ASC compared to typical controls may also be etiologically relevant. Both sex differences and similarities in the behavioral presentation of ASC should be taken into consideration in future research and in clinical settings.

4th Oral Brain Imaging in ASD temporary Program
120 Early Functional and Structural Development and Age-Related Changes In ASD
Moderator: K. Pierce *University of California, San Diego*

120.001 Failure of STS Activation May Underlie Early Emerging Social Orienting Defects In Autism. K. Pierce*[1], L. T. Eyler[1], S. Solso[2], K. Campbell[1] and E. Courchesne[1], (1)*University of California, San Diego*, (2)*University of California,San Diego*

Background: Unusual social responding, such as a failure to respond to name, is a red flag for autism in infants and toddlers, but the neural systems that underlie this deficit are unknown. The superior temporal sulcus (STS) has been dubbed the “chameleon of the human brain” because of its involvement in many social tasks. It is unknown whether its dysfunction underlies social responding deficits at the time of first clinical signs of autism. If so, it may prove to be a valuable biomarker of risk for autism in infants.

Objectives: To determine whether the STS fails to respond to social orienting sounds in ASD infants and toddlers as compared to typical infants and toddlers.

Methods: During natural sleep, fMRI responses to social and non-social orienting sounds were evaluated in 31 ASD and 31 typically-developing toddlers ages 12 to 45 months. Three sound conditions were delivered via headphones: *social orienting* consisting of emotionally salient sentences containing each toddler’s name (e.g., “look here, Johnny, look here!”); *non-social orienting* consisting of environmental noises (e.g., the sound of an airplane), and *language sounds* consisting of simple sentences (e.g., “Doll playing with doll”). AFNI was used for motion correction and regression analyses comparing the BOLD responses between each condition and periods of no stimulation. Whole brain group analyses as well as anatomically defined ROI analyses at the individual subject level were performed. After spatial blurring and normalization, whole brain group maps of significant social orienting-related

responses were created for each subject group as well as for direct between group comparisons. Functional maps were corrected for multiple comparisons (individual voxel level p<.01). STS was an a priori ROI for individual subject analyses. To handle anatomical variability in STS morphology, particularly in the developing brain, individual STS masks were created by expert anatomists. The number of significantly active voxels within the STS mask at p<.01 was calculated for each subject in each condition.

Results: Whole brain analyses revealed significantly greater activation in the left STS in TD as compared to ASD subjects. Individual subject analyses of STS revealed striking activation effects. In TD subjects, social orienting sounds produced the greatest number of significantly active STS voxels, while environmental sounds produced the least. ASD subjects displayed the opposite activation profile: the greatest STS activation was produced by environmental sounds and the least by social orienting sounds. In fact, TD infants and toddlers had a 2.2 times greater extent of STS activation than ASD in response to social sounds (TD=801mm^3 vs ASD=359mm^3 , p<.001).

Conclusions: Activity in STS is consistently recruited in response to social orienting sounds, such as the sound of each child's name being called, in TD toddlers but not in those with an ASD. Instead, in ASD infants and toddlers the strongest STS/STG activation was to environmental sounds. Thus, with suitable contrasting social and environmental stimuli, it may be possible to further refine sleep fMRI tests that reliably detect an abnormal profile of STS/STG activation that distinguishes infants at risk for an ASD.

120.002 Abnormal Functional Connectivity at Rest Among Sleeping Infants and Toddlers with ASD. L. T. Eyler*[1], K. Pierce[1], S. Solso[2] and E. Courchesne[1], (1)*University of California, San Diego*, (2)*University of California,San Diego*

Background: The development of coordinated brain networks is thought to serve as a foundation for sophisticated cognitive and social behavior. At rest, intrinsic coordinated activity is observed within the so-called default mode network, a system that is also often engaged during social, emotional, and introspective behaviors. Autism is characterized by deficits in these behaviors, and older children, teenagers, and adults with ASD generally show functional underconnectivity at rest compared to typical individuals. Little is known, however, about the pattern of coordinated resting brain activity at the youngest ages when ASD is first manifested.

Objectives: The aim of the study was to characterize potential differences in coordinated brain activity at rest between infants and toddlers with ASD compared to typically developing infants and toddlers.

Methods: We measured fluctuations in blood oxygenation level dependent (BOLD) signal in the absence of any stimulation for 6 minutes 25 seconds in sleeping infants and toddlers with ASD (n=40) and who were typically developing (TD; n=40). Participants ranged in age between 12 and 45 months; groups were well-matched on age and gender. Inter-regional correlations were calculated based on BOLD fluctuations with a frequency between 0.005 and 0.1 Hz that were not related to signal changes in whole brain, cerebral spinal fluid, white matter, or to motion. Functional connectivity maps were created for 6 different seed regions: 3 from a task-negative or default mode network and 3 from a task-positive network. Within- and between-group t-tests were used to create whole-brain group connectivity maps and compare ASD and TD groups. Significant clusters were those with a combined extent and voxel t-value threshold that protected a whole-brain probability of false positives less than or equal to 0.05.

Results: ASD infants and toddlers showed more positive associations than TD infants and toddlers between posterior seed regions of the default mode network (posterior cingulate and lateral parietal) and clusters within the anterior cingulate cortex and inferior frontal gyrus. Specifically, at rest, the ASD group lacked normal intrinsic anti-correlation between these regions and posterior default mode regions, and instead showed positive correlations. Abnormal functional connectivity was also found between anterior cingulate and a task-positive network seed (intraparietal sulcus); with weaker anticorrelations in ASD than typical. Although overconnectivity in the form of more positive or less negative correlations was the most prevalent finding, there were also clusters of underconnectivity (i.e., less positive correlations) found in different regions depending on the seed. Relationships between these aberrant connectivity patterns and clinical and neuroanatomic measures are currently being explored.

Conclusions: Abnormal patterns of intrinsic correlations during rest can be observed in infants and toddlers with ASD. In contrast to findings in older ASD children and adults, we see evidence for more positive correlations (i.e., over-connectivity), particularly in regions that show anticorrelated BOLD response in relation to the seed among typical infants and toddlers.

120.003 Abnormally Accelerated Development of Higher-Order Long-Distance Cerebral Tracts In ASD Infants and

Toddlers. S. Solso*[1], W. Thompson[2], K. Campbell[3], C. Ahrens-Barbeau[4], R. Stoner[5], C. Carter[4], M. Weinfeld[6], S. Spendlove[4], J. Young[4], M. Mayo[4], J. Kuperman[3], D. Hagler[3], R. J. Theilmann[3], L. T. Eyler[3], K. Pierce[3], E. Courchesne[3] and A. Dale[3], (1)*University of California San Diego, UCSD Autism Center of Excellence*, (2)*University of California San Diego*, (3)*University of California, San Diego*, (4)*University of California, San Diego, UCSD Autism Center of Excellence*, (5)*Neurosciences and UCSD Autism Center of Excellence*, (6)*University of California, San Diego, UCSD Autism Center of Exellence*

Background: Autism is a heritable disorder of early brain overgrowth that has been hypothesized, but not demonstrated, to involve abnormal structural development of local and long-distance connectivity and, thus, aberrant functioning (Courchesne & Pierce, 2005). Understanding putative early connectivity defects in autism could aid in the development of animal models, point to significant genetic pathways, and possibly be used as an early biomarker for autism to aid in early diagnosis and treatment. Unfortunately, currently there are no studies of cerebral tracts in the autistic brain at the age of first clinical signs.

Objectives: To identify abnormally as well as normally developing major long-distance cerebral tracts in ASD infants and toddlers.

Methods: We collected 51-angle DTI datasets from N=39 ASD and N=23 typically developing male infants and toddlers (13 months to 43 months) and analyzed FA values in 25 different tracts using a new DTI probabilistic atlas. Subjects were recruited as young as 12-months via the 1-Year Well Baby Check-up approach (Pierce et al., in manuscript) and diagnoses confirmed at later ages.

Results: Logistic regression models show that for multiple cerebral tracts infants and toddlers with greater FA values were more likely to have an ASD diagnosis. Significant tracts included the superior longitudinal fasiculus, forceps minor and uncinate as well as the corpus callosum. Furthermore within these tracts the ability of large FA values to predict ASD was strongest at the youngest ages.

Conclusions: Results are consistent with evidence of early brain overgrowth and suggests that it involves major cerebral white matter tracts as well as cortical gray matter. They are also consistent with MRI evidence of abnormal expansion of specific prefrontal and temporal subregions in ASD infants and toddlers. We theorize that these early developmental defects in connectivity in ASD result from genetic abnormalities in prenatal processes that regulate neuron numbers, migration and neurite outgrowth. We are currently exploring the degree to which DTI profiles could be used alone, or in combination with other imaging indices, as early predictive biomarkers of risk for autism.

120.004 Increased Local Connectivity and Decreased Long Range Connectivity In Autism Is Consistent with Immaturity of Cortical Networks. L. M. Hernandez*[1], J. D. Rudie[2], E. M. Kilroy[1], N. L. Colich[2], S. Y. Bookheimer[2], M. Iacoboni[3] and M. Dapretto[2], (1)*Brain Mapping Center, University of California, Los Angeles*, (2)*University of California, Los Angeles*, (3)*UCLA*

Background: A growing body of evidence suggests that autism spectrum disorders (ASDs) are related to altered communication between brain regions. Specifically, there are reports of reduced long-range connectivity across networks required for complex social behavior (e.g., Just 2004 2007; Koshino et al., 2005;Kleinhans et al., 2008; Kana et al., 2009). In an emotional facial processing task, we have previously found that, compared to typically developing children, children with ASD display increased local connectivity between different frontal regions and reduced long range connectivity between frontal and parietal cortex, as well as between amygdala and visual areas (Rudie et al. under review). Interestingly, recent work has shown that, during the course of typical development, functional brain networks show increases in long-range functional connectivity among nodes within a given network as well as reduced local (i.e., intralobar) connectivity among nodes in different networks (e.g. Fair et al 2009). Thus, the differences observed when comparing ASD and neurotypical individuals resemble the changes observed as a function of development.

Objectives: Here we sought to examine the hypothesis that individuals with ASD display an “immature” (as opposed to deviant) pattern of brain connectivity by examining how age may be related to altered connectivity patterns in ASD.

Methods: The data used in this study were collected in a sample of 23 high-functioning children and adolescents with ASD (mean age: 12.61, range 8.22-17.35) who passively observed faces displaying different emotions (angry, fearful, happy, sad, and neutral) while undergoing functional Magnetic Resonance Imaging (fMRI). Here we focused our analyses on correlating chronological age in children with ASD and connectivity for two brain regions (amygdala and right pars opercularis) where we previously observed reduced long-range connectivity and increased local connectivity in this ASD sample vs. to typically-developing (TD) matched controls.

Results: In regions where the ASD group showed greater local connectivity with the right pars opercularis as compared to TD controls, a significant correlation with age was observed such that younger children with ASD showed greater local connectivity (i.e., the younger the children, the more ASD-like the pattern of connectivity). Furthermore, in regions where TD controls showed greater long-range connectivity with the amygdala, a significant correlation with age was also observed such that older children with ASD showed greater connectivity between with the fusiform gyrus and occipital cortex (i.e., the older the ASD children, the more typical the pattern of connectivity).

Conclusions: Within a sample of children and adolescents with ASD in which we previously observed increased local and decreased long range connectivity, we found that age was significantly related to such altered patterns. More specifically, younger ages were associated with greater local connectivity with the right pars opercularis, whereas increasing age was associated with greater long-range connectivity with the amygdala. Taken together, these findings provide support for the notion that altered functional connectivity in autism may in part reflect delayed or more immature patterns of brain connectivity.

120.005 Longitudinal Analysis of the White Matter Microstructure of the Arcuate Fasciculus In Autism. P. T. Fletcher*[1], X. Hao[1], K. Zygmunt[1], M. B. DuBray[1], A. Froehlich[1], N. Lange[2] and J. E. Lainhart[1], (1)*University of Utah*, (2)*Harvard University*

Background: A key feature of autism spectrum disorder is impairment in language function and development. Recent findings from cross-sectional diffusion tensor imaging (DTI) studies have found the arcuate fasciculus to have abnormal microstructure, which may partly explain the neurobiological basis for language problems in autism. However, no study to date has examined the white matter microstructure of the arcuate fasciculus longitudinally in autism. Even in typical development, there is little information about development of the arcuate fasciculus from longitudinal studies that follow the same individuals over time. These are essential steps to further our understanding of why language development is aberrant in autism with deficits often persisting into adulthood and adversely affecting adult outcome.

Objectives: The goal of this study was to investigate the development of white matter microstructure of the arcuate fasciculus during late neurodevelopment in autism using longitudinal DTI.

Methods: The data were collected as part of an ongoing longitudinal MRI study on brain development in autism. High resolution DTI was acquired at three time points, each approximately two years apart, from a 3T MRI scanner and analyzed on 27 male individuals with autism (mean age at Time1: 15.98, s.d. 5.59) and 29 typical male control subjects (mean age at Time1: 16.31, s.d. 5.48). The arcuate fasciculus was extracted from the images using a new automated volumetric DTI segmentation algorithm. Derived measures of microstructure (fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD)) were computed in the arcuate fasciculus and compared across groups. Longitudinal mixed-effects models were fit to each derived measure as a function of age.

Results: As a group, those with autism displayed a significant increase in MD ($p = 0.021$), which was due to increases in both AD ($p = 0.032$) and to a lesser extent, RD ($p = 0.059$). No significant differences were found in FA between the groups. Both groups displayed a significant negative slope in MD, RD, and AD versus age ($p < 0.001$) and a significant positive slope in FA ($p = 0.016$). No significant differences were found between the slopes of the autism and control group for any diffusion measurement.

Conclusions: Rather than “normalization” of the microstructure of the arcuate fasciculus with increasing age in autism, which would require steeper developmental trajectories in order for arcuate fasciculus development in autism to “catch-up” to typical development, the findings suggest a persistent gap arcuate fasciculus development between autism and typical individuals from late childhood into adulthood. The persistent significant delay in microstructural development of the arcuate fasciculus and the neurobiological mechanisms that cause and maintain it may help explain why language deficits persist into adulthood in autism. Understanding factors that cause the gap may lead to new interventions that improve language functioning and overall adult outcome in autism.

120.007 Longitudinal Relationships Between Autism Severity and Brain Tissue Volumetry: Individual Change Over Time In Autism Spectrum Disorders. N. Lange*[1], E. D. Bigler[2], T. Abildskov[3], A. Froehlich[4], M. B. DuBray[4], A. L. Alexander[5] and J. E. Lainhart[4], (1)*Harvard University*, (2)*Brigham Young University*, (3)*BYU*, (4)*University of Utah*, (5)*University of Wisconsin*

Background:

Individual overall and tissue-specific brain development over time are, in general, known to be correlated with language,

social, and emotional development. The severity of cognitive and behavioral functioning in autism spectrum disorders, therefore, may influence longitudinal brain development in affected individuals. At present, reliable quantification of such correlations is unavailable for autistic individuals. We thus investigated these relationships in a small sample of subjects with ASD.

Objectives:

The purpose of our study was to examine individual concurrent changes in the volumes of the total brain (TBV), total gray matter (TGM) and total white matter (TWM) and autism severity measures collected during the course of a five-year longitudinal study of high-functioning individuals with ASD. Our hypotheses were (1) a more rapid decrease of individual TBV, TGM and TWM volumes in autism vs. healthy development, and (2) the rapid volumetric decreases in autism would be associated with established measures of autism severity longitudinally.

Methods: Structural volumetric MR images were collected at 3T from 36 high-functioning individuals with ASD, each scanned between one and five times, with mean age 20.7 years (range 8.1 to 38.9 years) and mean inter-scan interval 3.1 years (range 0.25 to 10.2 years). TBV, TGM and TWM volumes were obtained from manually edited FreeSurfer segmentations. These volumetric time series were then inspected by longitudinal analysis of covariance that accounted for age, age at first scan, and change in ADI-R score, with multiple scans per subject as the repeated measure.

Results: For those subjects that improved clinically (better ADI-R score), TBV with initial mean 1380.4 (range 1006.2, 1632.5) decreased by 19.9 cm^3/year ($p < 0.000005$). TGM for this group, with initial mean 824.9 (range 569.2, 958.8), decreased by 13.4 cm^3/year ($p < 0.000005$). TWM for this group, with initial mean 517.3 (range 379.9, 730.5), decreased by 6.1 cm^3/year ($p < 0.000005$). For those that worsened or had no change clinically (poorer or no change in ADI-R score), TBV with initial mean 14.89.9 (range 1151.5, 1606.2) decreased by 17.0 cm^3/year ($p = 0.00002$). TGM for this group, with initial mean 888.2 (range 670.1, 953.1), decreased by 14.2 cm^3/year ($p < 0.000005$). TWM for this group, with initial mean 564.9 (range 403.2, 659.6), decreased by 3.4 cm^3/year ($p > 0.35$, n.s.).

Conclusions: In our sample of high-functioning individuals with autism, we have identified precipitous drops in the volumes of the total brain, total gray matter, and total white matter that are greater than the mean decreases (TBV, TGM) and increases (TWM) seen in healthy development by a factor of four. These extreme changes appear to occur between late childhood and early-mid adulthood. Rapid decreases in brain size are not associated with clinical improvement, and, in many cases, autism severity appears to worsen over time for those with larger initial brain volumes, while accounting for the effect of age at first scan. These drops were more pronounced in total gray matter volume, with no significant change in white matter volume in the group that did not improve clinically.

120.008 A Longitudinal Study of the Amygdala and Hippocampus In Autism. G. Y. Lee*[1], T. W. Frazier[2], N. J. J. Minshew[3], L. Piacenza[1], A. Reiss[1] and A. Y. Hardan[1], (1)*Stanford University*, (2)*Cleveland Clinic*, (3)*University of Pittsburgh*

Background: Previous structural MRI studies suggest early life enlargement of the amygdala in autism but it is not clear whether this size increase persists beyond childhood. Interestingly, evidence from cross-sectional imaging investigations examining adolescents and adults with autism suggest that volumetric differences disappear in the older individual. In contrast, structural studies of the hippocampus have been inconsistent, with some studies suggesting decreased volume and others no differences or slight increases.

Objectives: The goal of this investigation was to compare the pattern of amygdala and hippocampal volume changes in older youth with autism and healthy controls using a longitudinal design. Additionally, relationships between structural changes over time and clinical features were also examined.

Methods: Magnetic resonance scans were obtained from male children with autism and age- and gender-matched controls at baseline and 2-year follow-up. Volumes of the left and right amygdala and hippocampus were measured. A comprehensive cognitive and clinical phenotyping was obtained at baseline and included the Autism Diagnostic Observation Schedule (ADOS), Social Responsiveness Scale, and the Wechsler Intelligence Scale for Children. Scores from these measures were used to examine behavioral correlates of brain volumes. Mixed effects regression models were computed with Participant Group (Autism, Control) as a fixed effect factor and Age as a time-varying covariate. Analyses were performed with and without total brain volume and full scale IQ as covariates. Exploratory correlations examined behavioral correlates of volume growth.

Results: Forty-eight male youth (ages 8-13 at baseline) participated in the longitudinal imaging study. Thirty-eight participants had amygdala or hippocampal measurements at

baseline and/or 2-year follow-up. Enlargement of the right, but not left, hippocampus was observed in the autism group at baseline, with a trend toward normalization - small increases with age in autism relative to large increases with age in controls. Differences in total amygdala growth were observed (autism 3.9% increase; controls 11.1% increase), but did not reach significance (p<.200).

Despite a very small autism sub-sample, greater social impairment at baseline on the ADOS was associated with less normalization of the volume of the right hippocampus. Interestingly, there were also strong relationships between better eye contact at baseline and larger increases in the right amygdala (r=.86, p=.006) and between better social motivation and higher verbal comprehension at baseline and larger increases in the left amygdala in youth with autism.

Conclusions: Enlargement of the right hippocampus supports previous findings of larger hippocampal volumes in autism and is consistent with the learning and memory deficits often observed in this disorder. Correlations with social dysfunction may suggest a specific role of the right hippocampus in learning social cues or may simply reflect a marker of more severe dysfunction. The amygdala did not show volume differences cross-sectionally or longitudinally which is consistent with evidence of increased size in early childhood and normalization later in life. The relationships of amygdala volume with social and verbal behavior suggest that increases in the size of this structure in the age range studied (ages 8-15) may identify a less impaired autism sub-group.

121 Intervening In Autism In Infancy: Causal Models, Research Approaches, Ethics Barriers (Scientific Panel)
Moderator: S. J. Rogers *UC Davis MIND Institute*

This symposium will focus on the emerging science of preventative intervention for infants at risk of ASD in the first and second year of life. A number of new studies focused on this age period are currently in progress across the world. The approaches used in these infant intervention studies differ markedly from those with older children, and the theories behind them differ as well. The symposium will focus on the application of knowledge from developmental psychology based on studies of normal developmental patterns in infancy, the ethics, the barriers, and the multi-disciplinary and multi-level science that needs to underlie efficacy research in infant intervention. Learning goals:1. Participants will understand the transactional causal model of ASD at the core of infant intervention studies;2. Participants will understand the potential multi-level effects (behavior, information processing, brain function, brain structure) of infant interventions and research methods that can test for them; 3. Participants will understand some of the design issues, ethical issues and social emotional barriers that are part of infant preventative interventions.

121.001 Transactional Models of ASD and Infant Interventions. S. J. Rogers*, *UC Davis MIND Institute*

A transactional model of autism is at the heart of infant toddler treatments, in which biology underlying autism is not deterministic, but rather probabilistic, and autism is not an inevitable outcome, but rather one possible outcome. Starting state differences may result in small changes that may or may not progress into the full syndrome, and environmental changes introduced early enough during the period of maximum brain plasticity may be able to partially or fully alter these initial differences and support much more typical development. Data from current intervention studies of infants 6-12 months and 12-24 months will be shared to illustrate the underlying model, its measurement challenges, and results.

121.002 A Prodromal Intervention Programme for Infant Siblings. J. Green*, *University of Manchester*

An infancy (10-14 months of age) intervention programme with families of infant siblings autistic probands (initial case series (n=7) and a pilot RCT has brought to light a number of ethical issues related to a prodromal, prevention, programme. The presentation will describe the 'three level' theory and empirical background to this intervention procedure and our apriori basis for thinking that it may improve the developmental trajectory of risk infants. Design issues involving: i) the heterogeneity of risk in the sample and outcome trajectories in autism generally; ii) levels of measurement from the behavioural to biological, and iii) adapted analytic design will be discussed. Early infant outcome data will be shared, including the feasibility and acceptability of the programme for parents.

121.003 The Importance of Early Intervention and the Challenge of Early Detection. A. M. Wetherby*, *Florida State University Autism Institute*

The national priority of early intervention for infants and toddlers with autism spectrum disorders (ASD) has led to the need for improved early detection methods. The CDC/NIH funded FIRST WORDS® Project on red flags of ASD in infants and toddlers implemented a developmental surveillance system using a community-based screening of a general population sample of children 9-18 months of age. Preliminary findings on an RCT involving parent-implemented social communication intervention for young toddlers with ASD will be presented. The focus of the discussion will be on the challenges of providing parent-implemented intervention for newly diagnosed toddlers

with ASD, the utility of a crossover design to recruit families, the measure of active engagement in everyday activities as an index of intensity of treatment, barriers that impede, and strategies that improve parent participation in screening and diagnosis of ASD and early intervention.

121.004 Research Design and Analysis: Challenges that Arise in Infant ASD Prevention Studies. A. S. Carter*, *University of Massachusetts Boston*

Parent delivered interventions, beginning before the point at which accepted diagnostic practices exist for ASD, prevent significant challenges in both the design and the analysis of such studies. This presentation will focus on the design and analysis problems raised in such studies and some solutions to them, including analysis of mediator and moderator effects.

122 Multinational Registry-Based Analyses of Autism Risk Factors and Trends: The International Collaboration for Autism Registry Epidemiology (iCARE) (Scientific Panel)
Organizer: D. E. Schendel *Centers for Disease Control and Prevention*

Population-based disease registry systems are invaluable research resources due to their prospective data collection, large size, and length of follow up. Due to the relatively low prevalence of autism and many risk factors, integration of multiple population-based registry systems provides enhanced statistical power for epidemiologic analyses on pooled data. Further, multi-registry integration has the capability of applying data harmonization and uniform analytic methodologies – either on pooled data or for cross-registry comparisons – thereby facilitating data interpretation. The International Collaboration for Autism Registry Epidemiology (iCARE) was established among collaborators in Scandinavia (Denmark, Sweden, Finland and Norway), Australia, Israel and the US with the initial goals to: 1) establish the infrastructure for multi-national registry autism research, including establishing a multi-registry virtual data set approach to analysis, and 2) demonstrate the capabilities of the multi-national registry approach to investigate candidate perinatal factors and autism, autism trends and geographic variation. The panel presentations will describe the: 1) iCARE concept, goals and site characteristics data; 2) cross-registry data harmonization methods and results; 3) virtual pooled data set approach to multi-site analysis and results of implementation; and 4) results of an analysis of parental age and autism based on the multi-national virtual pooled dataset.

122.001 The International Collaboration for Autism Registry Epidemiology: Concept, Goals, and Consortium Characteristics. D. E. Schendel*[1], M. Bresnahan[2], K. W. Carter[3], R. W. Francis[3], M. Gissler[4], T. Grønborg[5], R. Gross[2], M. Hornig[2], C. Hultman[6], A. Langridge[7], H. Leonard[7], A. Nyman[8], E. T. Parner[5], M. Posada[9], A. Reichenberg[10], S. Sandin[6], A. Sourander[11], C. Stoltenberg[12], P. Surén[12] and E. Susser[2], (1)*Centers for Disease Control and Prevention*, (2)*Columbia University*, (3)*UWA Centre for Child Health Research*, (4)*THL National Institute for Health and Welfare*, (5)*University of Aarhus*, (6)*Karolinska Institutet* , (7)*Telethon Institute for Child Health Research*, (8)*Karolinska Institutet*, (9)*Carlos III Health Institute*, (10)*Kings College*, (11)*University of Turku*, (12)*Norwegian Institute of Public Health*

Background: Autism trends and the relationships between perinatal factors, such as parental age and gestational age, and autism remain unclear. Factors hampering interpretation and comparison across studies include: sample size limitations; methodological and analytical variation; time trends in ASD and risk factors; and inability to assess independent effects of multiple, potentially correlated, risk factors. To address these issues, one cost-effective approach is to create large epidemiological samples of existing data. The International Collaboration for Autism Registry Epidemiology (iCARE) was designed to create such an analytical resource, addressing the unique challenges of multinational collaboration, data confidentiality, access and management. A key feature of iCARE's epidemiologic utility will be to insure valid data pooling and/or across-site comparisons.

Objectives: Establish 1) the collaborative goals and infrastructure for multi-national registry autism research, including critical data confidentiality, access and management solutions, and 2) partner characteristics, including local autism administrative and registry features that will inform multi-site analytical decisions and interpretation.

Methods: 1) By consensus, prepare structural framework for the design and implementation of collaborative studies, the collection and sharing of data, and other consortium issues; 2) Site-completed queries regarding data access parameters and site characteristics, including local autism referral patterns, diagnosis, treatment and service provision and registry characteristics (population, time coverage, reporting processes).

Results: Memorandum of agreement specified collaborative parameters. Differences in site requirements concerning data confidentiality and access led to development of options for data access and handling. All sites have access to complete birth population data for their respective countries/states from which autism cases are ascertained. There are site similarities

in autism referral and diagnostic evaluation practices and accessibility (e.g., public funding), but some administrative changes over time within sites that could affect ASD reporting (e.g., inclusion of in- and/or outpatient data; services provision). All registries are nation/state-wide and government sponsored; all use ICD diagnostic criteria except for Australia and Israel which use the DSM. Based on each site's available birth years, unrestricted data pooling from 1980 onwards yielded 26,317 ASD cases from 8.2 million births; 10,544 children with autism were ascertained among 3.4 million births in the years 1987-1994 with the greatest site overlap. For 1987-1994, average birth prevalence was 84.3 per 10,000 births in Denmark, 49.8 per 10,000 births in Finland, and 28.1 per 10,000 births in Western Australia; Sweden, Israel and Norway were similar at 14–15 per 10,000 births.

Conclusions: Options for data access and handling provide flexibility that enhances the collaborative and analytic breadth among current iCARE sites and increases iCARE long-term potential. Given site differences in autism identification, registry reporting and birth prevalence overall and through time, it is necessary to give careful consideration to potential biases associated with ascertainment (e.g., registry-specific variation in ascertainment of different ASD diagnostic or phenotypic subtypes), as well as effects of changes in diagnostic criteria, and their impact on case characteristics and associations with risk factors. Data harmonization and analytic approaches to address some of these issues will be key.

122.002 The International Collaboration for Autism Registry Epidemiology: Data Harmonization. M. Bresnahan*[1], K. W. Carter[2], R. W. Francis[2], M. Gissler[3], T. Grønborg[4], R. Gross[1], M. Hornig[1], C. Hultman[5], A. Langridge[6], H. Leonard[6], A. Nyman[7], E. T. Parner[4], M. Posada[8], A. Reichenberg[9], S. Sandin[5], D. E. Schendel[10], A. Sourander[11], C. Stoltenberg[12], P. Surén[12] and E. Susser[1], (1)*Columbia University*, (2)*UWA Centre for Child Health Research*, (3)*THL National Institute for Health and Welfare*, (4)*University of Aarhus*, (5)*Karolinska Institutet* , (6)*Telethon Institute for Child Health Research*, (7)*Karolinska Institutet*, (8)*Carlos III Health Institute*, (9)*Kings College*, (10)*Centers for Disease Control and Prevention*, (11)*University of Turku*, (12)*Norwegian Institute of Public Health*

Background: International collaborations using linked, population-based disease and birth registries are increasingly common in health research. The adoption of this approach by the International Collaboration for Autism Registry Epidemiology (iCARE) provides unique opportunities; however, it is not without challenges. iCARE collaborators represent six countries or states, with a total of 26,317 cases of ASD arising from 8.2 million births. By site, data are drawn from two or more sources (e.g., autism registry, birth registry, and other health and population data sets). Very little iCARE registry or administrative data are standardized by definition or method of collection, thus requiring a large investment in data harmonization across sites before combined analysis.

Objectives: To create a unified iCARE dataset consisting of variables that measure the same construct, obtaining/retaining sufficient information to query for artefact and potential sources of bias.

Methods: To develop comprehensive site variable descriptions, a series of questionnaires were distributed to each data-contributing site, moving from the general to the specific: a) description of each registry, and its inclusion criteria; b) description of potential sources for specific variables; c) for each potential source, the variable definition, method of collection, modification to the data during archiving, method of measurement, unit of measurement, missingness and patterns of missingness; d) availability of and changes in variable characteristics over time.

Results: Variations in definition, measurement and availability across sites and over time were synthesized and presented in table format. Inquiries identified three levels of harmonization: a) variables that required little or no modification from the site-specific source variables, b) constructed variables based on one or more variables, and c) constructed variables based on careful examination of the data across all sites. A master algorithm was prepared and distributed to all sites for each iCARE variable, specifying the variable name, definition, missing values, eligible range and values. Each site created an iCARE dataset in accordance with the algorithm and generated a log that tracked iCARE-variable creation for purposes of quality control

Conclusions: Data harmonization was achieved for a basic set of variables across all sites and for additional variables across two or more sites. Given the complexity and diversity of material involved in the harmonization process, it will be essential to maintain archival documentation throughout the studies.

122.003 Building the iCARE Web-based Analysis Portal. R. W. Francis*[1], K. W. Carter[1], M. Bresnahan[2], M. Gissler[3], T. Grønborg[4], R. Gross[2], M. Hornig[2], C. Hultman[5], A. Langridge[6], H. Leonard[6], A. Nyman[7], E. T. Parner[4], M. Posada[8], A. Reichenberg[9], S. Sandin[5], D. E. Schendel[10],

A. Sourander[11], C. Stoltenberg[12], P. Surén[12] and E. Susser[2], (1)*UWA Centre for Child Health Research*, (2)*Columbia University*, (3)*THL National Institute for Health and Welfare*, (4)*University of Aarhus*, (5)*Karolinska Institutet* , (6)*Telethon Institute for Child Health Research*, (7)*Karolinska Institutet*, (8)*Carlos III Health Institute*, (9)*Kings College*, (10)*Centers for Disease Control and Prevention*, (11)*University of Turku*, (12)*Norwegian Institute of Public Health*

Background:

Modern day studies exploring the determinants of disease require increased power to detect small effects. This in turn demands large sample sizes. Obtaining sufficient sample size is often achieved through the pooling of datasets, invariably located in disparate locations, into a single master database. However, it is often the case that ethico-legal and data-ownership issues exist that potentially hamper the pooling of datasets into a single resource. Database federation techniques offer a viable solution to this problem by permitting the access to datasets located in disparate locations through a single database interface without the need for pooling.

Objectives:

To created a computational infrastructure based around database federation and develop a web-based, secure analysis interface to facilitate querying of the federated datasets.

Methods:

Federation is implemented through MySQL. Each data contributing site holds a harmonised dataset in a Local iCARE Database (LID), stored on either a physical or virtual server at their respective site. A central Master iCARE Database (MID) contains federated tables that do not contain data themselves but point to the data held at each site. The connections between the MID and each LID are maintained through secure SSH tunnels. The iCARE Web-based Analysis Portal (iWAP) is implemented using PERL CGI, Ajax and secured using SSL server and client certificates and further protected by user authentication and session cookies. Popular analysis packages (R, Stata, SAS) are available to users who interact with them by submitting relevant syntax into a text field provided when an analysis is initiated.

Results:

Separate projects examining specific variables from specific sites are preconfigured for access by only authorised users of the system prior to analysis. Within a single project, users only have access to these pre-defined variables and resources. Through the simple iWAP interface, analysis runs for each defined project can be initiated and subsequent result files viewed. When a run is submitted, the iWAP queries the MID, which sequentially queries each LID and retrieves the data for the requested variables. The retrieved data are not stored on the MID or iWAP or committed to disk in any way on these servers. Instead named pipes (FIFO) are used to pipe the data to the requested analysis package. Only run-specific output files are stored on the server and can be viewed through the provided file manager. Data retrieval times are adequate with a simple analysis of ~3 million records split between 5 sites completed from start to finish in around 4 minutes (with the MID based in Australia, and other sites based in Europe). All analyses are logged, including user syntax and data retrieval times.

Conclusions:

We have created a secure, easily accessible, user friendly analysis framework for pooled data analysis built on open source technology. Its flexibility allows us to easily grow if new groups wish to join their datasets into the system. In addition it allows us to adopt other technologies for pooled analysis such as DataSHIELD (Wolfson et al) which we aim to implement within the existing framework early 2011.

122.004 Advancing Paternal Age, Advancing Maternal Age and Autism.

A. Reichenberg*[1], S. Sandin[2], C. Hultman[2], M. Bresnahan[3], K. W. Carter[4], R. W. Francis[4], M. Gissler[5], T. Grønborg[6], R. Gross[3], M. Hornig[3], A. Langridge[7], H. Leonard[7], A. Nyman[8], E. T. Parner[6], M. Posada[9], D. E. Schendel[10], A. Sourander[11], C. Stoltenberg[12], P. Surén[12] and E. Susser[3], (1)*Kings College*, (2)*Karolinska Institutet* , (3)*Columbia University*, (4)*UWA Centre for Child Health Research*, (5)*THL National Institute for Health and Welfare*, (6)*University of Aarhus*, (7)*Telethon Institute for Child Health Research*, (8)*Karolinska Institutet*, (9)*Carlos III Health Institute*, (10)*Centers for Disease Control and Prevention*, (11)*University of Turku*, (12)*Norwegian Institute of Public Health*

Background: Despite compelling evidence for genetic and environmental contributions to autism risk, etiological mechanisms remain unknown. Evidence for a relationship between parental age and autism is important because it may provide clues to the biological pathways leading to the disorder. Epidemiological findings on the association between advancing paternal age, advancing maternal age and risk of autism are mixed. Several studies report a strong association for both

paternal age and maternal age, yet others report an association only for paternal age or only for maternal age.

Objectives: To examine the association between paternal age, maternal age and autism in the offspring using robust and novel methodological approaches.

Methods: Multiple study methods were adopted. First, a meta-analysis included previously published, population-based, epidemiological studies. Second, a consortium of six birth cohorts from Australia, Denmark, Finland, Israel, Norway and Sweden with similar data on variables of interest was established. Linkage to national registers ascertained autism cases and associated perinatal, familial, and demographic data for all births in each cohort.

Results: Meta-analysis demonstrated an association of advancing paternal (>=40) and maternal age (>=35) with increased risk of autism across studies [OR=1.78 (95%CI:1.52-2.07); OR=1.38 (95%CI:1.28-1.49) for paternal and maternal age, respectively]. There was no evidence for publication bias; Heterogeneity across studies was substantially influenced by the covariates included in the analyses. Data from the six birth cohorts are currently being analyzed**,** first separately for each birth cohort, then followed by a pooled analysis. Informed by the meta-analysis, the separate analyses are aimed at characterizing the functional form of the relationship between parental age and autism and identifying confounders to be included in adjusted models. This will allow creating common scaling across birth cohorts, and reliable data pooling.

Conclusions: These findings, if corroborated in the additional analyses, will provide the strongest evidence to date of an association between advanced parental age and autism in the offspring. Previously proposed biological mechanisms for the relationship between parental age and autism, including de-novo aberrations, mutations and epigenetic alterations associated with aging, will be critically evaluated in relation to the findings from the pooled analysis.

123 Reward Processing In Autism (Scientific Panel)
Organizer: G. S. Dichter *University of North Carolina*

A novel conceptualization of core autism deficits is that they may reflect dysfunction of brain systems that process rewards. Specifically, it may be that decreased responsivity to social stimuli in autism reflects a failure to assign reward value to social interactions. Similarly, it may be the case that restricted repetitive and stereotyped patterns of behavior, interests and activities reflect hyper-reactive brain reward circuitry responses to certain classes of stimuli, a model that could help to explain symptoms of circumscribed interests that are highly prevalent in ASDs. The brain's reward system, composed of dense dopaminergic projections from the striatum to the prefrontal cortex, has been the focus of systematic study in other neuropsychiatric disorders, resulting in first-line psychopharmacologic treatments that target this system. However, reward system integrity has received relatively little research attention to date in autism. The purpose of this scientific panel is to present new brain imaging, eye-tracking, psychophysiological, behavioral, and animal model data that addresses reward system function in autism. We hope that this panel will encourage increased research into reward system function in autism.

123.001 Reward Processing In Autism Depends on What and When. G. S. Dichter*[1], J. A. Richey[2], A. Rittenberg[2], N. J. Sasson[3] and J. W. Bodfish[4], (1)*University of North Carolina*, (2)*University of North Carolina at Chapel Hill*, (3)*University of Texas at Dallas*, (4)*University of North Carolina - Chapel Hill*

Background: Despite the potential centrality of reward circuitry dysfunction to core autism symptoms, few studies have addressed neurobiological responses to rewarding stimuli in individuals with autism. This is surprising given that a number of theorists have postulated that diminished responsivity to social stimuli in autism may reflect a failure to assign reward value to social interactions.

Objectives: To assess fMRI, psychophysiological, behavioral, and subjective responses to standard laboratory reward stimuli as well as stimuli relevant to core autism symptoms.

Methods: We present a series of interconnected functional magnetic resonance (fMRI) and psychophysiological studies in groups of individuals with autism and matched controls. The fMRI studies used a monetary incentive delay (MID) task designed to assess responses during both anticipatory and outcome phases of reward processing. The psychophysiological studies examined affective modulation of the startle eyeblink and post-auricular reflexes. Across all studies, responses were assessed to (1) standard laboratory rewards; (2) images of non-social objects that have shown to garner greater visual attention in autism (e.g., trains, electronics, etc); and (3) images of faces.

Results: fMRI studies indicated that participants with autism showed decreased nucleus accumbens activation while anticipating and receiving monetary rewards. Responses to autism-relevant non-social objects revealed hyperactivation in ventromedial prefrontal cortex during reward outcomes in the autism group. Responses to social rewards revealed

hyperactivation in bilateral amygdala during face anticipation and in bilateral insular cortex during face outcomes in the autism group, and responses to social rewards predicted the severity of autism symptoms.

Psychophysiology data revealed anomalous eyeblink and post-auricular reflex modulation and corrugator patterns to both IAPS images and images of faces, but not to salient non-social objects. These fMRI and psychophysiology results stand in stark contrast to self-report and behavioral responses to the same stimuli, suggesting dissociations between neurobiological, behavioral, and subjective responses to rewards.

Conclusions: Results suggest that autism is characterized by reward system dysfunction, but that the nature of this dysfunction is category-specific and dependent on the temporal phase of reward processing. We interpret these findings within the broader context of the functions of the reward system, namely to facilitate behavioral approach towards biologically meaningful goals. In this context, these data suggest that individuals with autism are characterized by decreased motivation towards primary rewards and social stimuli, but intact incentive responses towards certain categories of autism-specific, non-social rewards. The potential clinical implications of these results will be discussed.

123.002 Testing deficits in processing social rewards in high functioning people with autism. R. Adolphs*, A. Lin and A. Rangel, *California Institute of Technology*

Background: People with autism have difficulty in social functioning, yet the underlying basis for this impairment is unknown. One hypothesis is that social stimuli are not linked to motivated behavior normally, resulting in category-specific impairments in social reward processing. Such impairments in social reward processing early in life could account for many of the later aspects of the autism phenotype, including impairments in face perception and language development.

Objectives: To use model-based methods from reward learning to test the above hypothesis, using behavioral and fMRI data.

Methods: We designed a task that compared monetary reward with directly social reward. The social rewards and punishments consisted of friendly and unfriendly faces together with verbal statements, whereas the monetary rewards and punishments consisted of winning or losing money. Both social and monetary rewards were used in an instrumental reward learning task that was structurally identical: participants had to learn to choose among three slot machines each associated with different probability distributions over the rewards (one resulting in punishment, one resulting in reward, and one being neutral). We measured people's choices over time on this task while we acquired BOLD-fMRI. The data were then modeled using reinforcement-learning models to compare directly the possible stages in reward processing. We tested a group of 9 high-functioning people with autism and compared their data to those from 9 healthy matched controls.

Results: We found that both controls and people with autism quickly learned to choose in favor of the most rewarding slot machine on our task, regardless of whether the outcome was monetary or social reward. In general the autism group performed behaviorally very comparably to the controls on measures such as learning rate, switching, and asymptotic task performance. Moreover, ratings of the valence of the stimuli was very similar between groups.

fMRI results showed that in controls a common network of brain structures is activated when processing either monetary or social reward. This included parts of the medial prefrontal cortex and the ventral striatum. Initial fMRI results from the autism group using the same model-based approach suggest a very different pattern of brain activations. We are exploring the hypothesis that people with autism may be able to generate very similar behavioral performances on this task, but through a very abnormal strategy that is possible more model-based as opposed to resulting from standard reward learning of the value of the slot machines.

Conclusions: Whereas high-functioning people with autism can perform normally in learning to choose rewarding or avoid punishing outcomes, and can do so both with respect to monetary or social outcomes, the underlying neural computations appear to be very different from those seen in healthy controls

123.003 Functional MRI of reward circuitry in Autism: The effects of different reward types. S. Y. Bookheimer*[1], D. Shirinyan[2], A. A. Scott-Van Zeeland[1] and M. Dapretto[1], (1)*University of California, Los Angeles*, (2)*UCLA, Center for Autism Research and Treatment*

Background: The social motivation hypothesis of autism holds that a decrease in ASD individuals' fundamental drive to engage in social interactions sets up a cascade of events culminating in lack of social experience, decreased learning of socially cued information, and ultimately a failure to develop expertise in social cognitive skills such as face processing. A potential neural mechanism for social motivation deficit is decreased or abnormal responsiveness in the brain's reward

circuitry, specifically networks involving the ventral striatum/accumbens region.

Objectives: To characterize reward circuitry function in autism with fMRI.

Methods: In a series of fMRI studies we examined fMRI responses to social rewards (smiling faces), non-social rewards (money) and individual-specific rewards based on each subject's special interest. We also examined the extent to which subjects learned implicit but deterministic associations with reward mediation. FMRI scanning was conducted on a Siemens 3Tesla Trio system, using an implicit learning paradigm based on Knowlton's Probabilistic Classification task. Subjects were shown a series of fractal-like images and pressed a button to indicate whether each item belonged to "1" or "2". In Exp. 1 (16 ASD, 16 TD; VanZeeland et al, 2010), subjects received information only feedback (correct or incorrect), feedback with a social reward (smiling face vs. pouting face), or monetary feedback (money cure or crossed-out money icon). In Exp 2 (D. Shirinyan, IMFAR 2011), subjects (19TD, 17ASD) were first questioned about their specific interests; a picture of their desired reward (or a crossed out picture of it) and a control picture from another subject's reward were used to provide feedback

Results: In comparison to typically developing children, those with ASD showed reduced responses in the VS to social rewards, and a non-significant reduction for monetary rewards. In contrast, children with ASD showed enhanced VS responses to rewards associated with their specific interest compared to TD children.

Conclusions: These results present a more complex picture of reward circuitry dysfunction in autism, suggesting a model of restricted, item-specific reward responsiveness that may be excessive, while responses to other rewards, including primary reinforcers, is reduced. This pattern is consistent with a more general deficit in information processing in autism characterized by increased local processing and decreased implicit/extraneous of background processing, affecting reward as well as other systems.

123.004 Translational research on interests and reward in autism: identifying novel treatment targets. J. W. Bodfish*[1], J. J. Nadler[2] and S. S. Moy[2], (1)*University of North Carolina - Chapel Hill*, (2)*University of North Carolina at Chapel Hill*

Background: Unusual and intense interests, preoccupations and attachments comprise a unique subtype of repetitive behavior, occur commonly in ASD, and can be associated with functional impairment. We developed a method for quantifying the presence of this phenotypic feature using an exploration paradigm and found that children with ASD demonstrate atypical exploration in general, and explore social stimuli less when nonsocial stimuli associated with unusual interests and preoccupations are present. The biasing effect of idiosyncratic types of nonsocial stimuli suggests that social and nonsocial sources of information may differ in reward value for persons with ASD.

Objectives: To develop a preclinical model of interest / reward deficits analogous to those seen in ASD that could be used to identify novel molecular treatment targets and ultimately screen for novel compounds in a high-throughput manner.

Methods: Our translational studies have proceeded in four stages: (1) development of a reliable and valid mouse analog of our exploration paradigm for quantifying restricted interests; (2) identification of specific inbred strains of mice that show features of atypical social and repetitive behaviors AND show restricted interests in a social vs. nonsocial stimuli exploration test; (3) examination of candidate inbred strains using high-density genotype data to identify discrete regions of the genome that could be contributing to phenotypic differences associated with atypical exploratory behavior; and (4) cross reference candidate genetic regions with existing data on genetic factors associated with (a) ASD, and (b) atypical motivational behaviors such as addiction.

Results: 6 inbred strains have been tested on a variant of the hole board exploration paradigm using a set of procedural modifications that allow us to examine exploration of social vs. nonsocial stimuli. Repeated testing confirms stable patterns of strain-specific findings on these parameters of exploration. Among these strains, only C58/J mice show (a) atypical social behavior, (b) increased stereotyped behaviors, and (c) exploratory deficits characterized by increased exploration of nonsocial stimuli relative to social stimuli. Using available high-density genotype data, we identified genomic regions that are identical-by-descent between C58/J and the two most genetically similar strains in our sample (C57BL/6J and C57L/J) that did not show exploratory deficits. These regions of the genome are unlikely to contribute to differences in exploratory behavioral phenotype observed in these three strains. This analysis allows us to exclude over two thirds of the mouse genome from contributing to the behavioral differences observed between these three strains of mice. One genomic region where the C58/J differs contains several GABA receptor

genes that could contribute to the observed differences in exploratory behaviors.

Conclusions: GABA pathways are part of the brain's "motive circuit" and GABA receptor genes have been associated with autism and with addiction-related disorders. Thus, GABAergic compounds may represent viable targets for drug development in preclinical models like C58/J that are characterized by social deficits, repetitive behaviors, and prominent restricted nonsocial interests.

Genetics Program
124 Genomics and Gene Expression In ASD
Moderator: M. Bucan *University of Pennsylvania*

124.001 Blood-Based Gene Expression In Infants and Toddlers with ASD. M. E. Winn*[1], N. Schork[2], K. Pierce[3] and E. Courchesne[3], (1)*University of California San Diego*, (2)*Scripps Research Institute*, (3)*University of California, San Diego*

Background: Autism Spectrum Disorder (ASD) is a genetically complex neurodevelopmental disorder characterized by deficits in communication, social reciprocity, and patterns of repetitive or stereotypic behaviors that emerge during the first three years of life. Previous gene expression studies of lymphoblastoid cell lines implicate genes involved in circadian rhythm, nervous system development, inflammation, cytoskeletal organization, steroid biosynthesis, and ASD-specific physiological symptoms (i.e. gastrointestinal symptoms), while analysis of peripheral blood gene expression profiles point to the involvement of NK cells in ASD susceptibility. These studies demonstrate the utility of whole genome gene expression profiling in identifying genes associated with ASD.

Objectives: Few, if any, studies of blood or lymphocyte gene expression have been done at young ages in ASD, while most studies have been pursued with a small sample size. Gene expression profiles from older ASD subjects may only reflect secondary perturbations of ASD. Evaluation of infants and toddlers with ASD may be beneficial in identifying the primary genetic effects that lead to early developmental abnormalities, thus being more relevant to the development of the ASD prognostic and diagnostic biomarkers. Our objective was to identify genetic pathways, networks, and processes altered in autism at the age of first clinical signs.

Methods: Gene expression profiles of peripheral blood mononuclear cells (PBMCs) from 73 young male subjects (12 months to 45 months of age; ASD = 41, typically developing = 32) were assessed via direct hybridization to Illumina Human Ref-8 bead-arrays. Linear regression analysis on probes filtered for average intensity less than background (n=14921) was performed to identify differentially expressed genes between ASD and typical subjects. Significantly identified genes (n=461; $p < .01$, FDR = .26) were imported into MetaCore for enrichment analysis in GeneGO Pathway Maps, GeneGO Process Networks, and GO Processes.

Results: Genes involved in prenatal neural developmental functions were represented among the networks that were significantly differentially expressed in ASD infants and toddlers. Specifically, significant differences between ASD and typical subjects were found in cell cycle regulation, DNA damage response, apoptosis and survival, and cytoskeleton pathways, as well as in several neurophysiological processes.

Conclusions: These findings suggest that PBMC-based gene expression profiling of ASD may reveal unique and possibly fundamental dysregulated gene expression patterns that may be of use as clinically significant biomarkers of ASD. Moreover, the dysregulated expression profile detected in living ASD infants and toddlers maps remarkably well onto profiles derived for CNV analyses of large autism samples (Pinto et al., 2010), and new CNV and gene expression profiles derived from prefrontal cortex brain tissue of young autistic postmortem cases. In each of these very different types of genetic analyses (brain, blood, CNV, RNA), the strongest signals were dysregulation of proliferation, cell cycle, cell differentiation and cyctosketelon mitosis- and migration-relevant pathways. We theorize these processes reflect the first prenatal steps of maldevelopment that lead to autism. They underlie early brain overgrowth, migration defects, defects in cortical lamina and aberrant connectivity.

124.002 Allelic mRNA Expression of Cellular Adhesion Molecules, Glutamate and GABAergic Genes, and RNA Splicing Modulators In Typically-Developed and ASD Frontopolar Cortex. R. M. Smith*[1], A. C. Papp[1], G. E. Herman[2] and W. Sadee[1], (1)*The Ohio State University*, (2)

Background: Clinical genetic association studies and gene sequencing frequently implicate cellular adhesion molecules, such as neurexins and neuroligins, as autism risk genes. These genes can regulate the maturation of glutamatergic and GABAergic synapses based on the expression of alternatively-spliced mRNA transcripts. Often, the consequence of disease-associated variants in cellular adhesion molecules is marked

changes in synapse structure and/or function, especially relating to glutamatergic or GABAergic signaling.

Objectives: The goal of this study is to uncover *cis*-acting variants responsible for directing mRNA expression by measuring allelic expression of genes related to synapse structure and signaling in human frontopolar cortex tissue from autistic patients and typically-developed controls.

Methods: mRNA and genomic DNA was isolated from 56 post-mortem frontopolar cortex tissues provided by the Autism Tissue Program. Allele-specific expression was measured via quantitative SNaPshot for synapse-related genes *CNTNAP2*, *CNTN4*, *DLG4*, *EPB41L1*, *NRCAM*, and *PCDH9*; glutamatergic and GABAergic genes *GABRB3*, *GAD1*, *GRIA2*, *GRM5*, *SLC1A1*, *SLC1A2*, *SLC25A12*, and *SLC6A1*, and alternative splicing genes *HNRNPA3*, *NCBP2*, *NOVA1*, *RBFOX1*, and *SF4*.

Results: Significant and robust allelic expression differences were observed for *CNTNAP2*, *DLG4*, *EPB41L1*, *NRCAM*, *GAD1*, *GRIA2*, *SLC1A1*, *RBFOX1*, *HNRNPA3*, *NOVA1*, and *SF4*, suggesting the presence of *cis*-acting functional variants responsible for modulated mRNA expression in these genes. For most genes, including *DLG4, EPB41L1, NRCAM, GAD1, GRIA2,* and *RBFOX1*, significant allelic differences were only observed in a small number of autistic patients, suggesting the variants responsible for directing differential mRNA expression of these genes are rare. In contrast, significant allelic expression differences for *SLC1A1* and *CNTNAP2* were observed for multiple samples from both the ASD and control cohorts, suggesting the presence of common *cis*-acting functional variants driving expression of these genes.

Conclusions: Differential mRNA expression of numerous genes pertinent to synapse structure and function are driven by *cis*-acting genetic factors. For some genes, the responsible genetic factors appear to be rare and we observed their presence only in brain samples from autistic patients. This scenario fits the hypothesis that highly-penetrant rare mutations could be responsible for producing autistic phenotypes. In contrast, the presence of common functional variants in *CNTNAP2* and *SLC1A1* in both autism and control cohorts argue for the role of disorder-modifying genetic variants in these genes, with the ability to affect either language (*CNTNAP2*) or restrictive and repetitive behaviors (*SLC1A1*). Further studies are necessary to evaluate the clinical relevance of expression-related functional variants in autism.

124.003 Identification of Shared Molecular Pathway Involved In Autism by Transcriptional Profiling. Y. Tian*, I. Voineagu, R. Luo, R. A. Mar-Heyming and D. H. Geschwind, *University of California, Los Angeles*

Background: ASD is a heterogeneous disorder of neural development that results from the combined effects of genetic changes interacting with environmental factors. It is highly inheritable, yet only a few genetic factors have been specifically identified. Rare chromosomal disorders, such as copy number variations (CNVs), are among the most common causes of ASD so far, yet each loci accounting for less than 1% of ASD. Given its complexity, focusing on recurrent monogenic forms of ASD with rare CNVs can provide important insights into disease pathogenesis.

Objectives: With genome-wide transcriptional profiling, we aim to identify genes that are dysregulated concurrently in different recurrent monogenic forms of ASD with rare CNVs: 15q11-q13 duplication (dup(15q)), 16p11.2 deletion (del(16p)), and 22q11.2 duplication (dup(22q)). The shared genetic changes may underlie the common molecular pathways involved in ASD pathogenesis.

Methods: We performed genome-wide measurement of RNA expression using Illumina Human Ref8_v2 microarrays on lymphoblast cells lines from 13 cases (4 del(16p), 6 dup(15q), 3 22q(dup)) and 14 age and gender matched controls. Differential expression was assessed using the limma R package with threshold of p-value < 0.05. We applied Weighted Gene Co-expression Network Analysis (WGCNA) to identify co-expressed gene groups (modules), under the assumption that the genes in the same module were more likely to be functionally related.

Results: We identified 67 genes differentially expressed (DE) between all autism and controls. GO analysis revealed enrichment for genes categorized by neurological process of cell lines (p-value=1.65E-5) and neurite branching (p-value=3.30E-3). Hierarchical clustering using the 67 genes clearly distinguished different ASD forms from each other and controls. Remarkably, del(16p) and dup(22q) showed very similar gene expression pattern over the DE genes, indicating the convergence of molecular pathways in these two distinct ASD conditions. WGCNA identified four gene co-expression modules that were significantly correlated with autism, one of which was enriched with known autism candidate genes, such as PAK2, and ATRX. Two modules separated the del(16p) and dup(22q) autism groups from the dup(15q) and controls, supporting the notion that del(16p) and dup(22q) may share molecular pathways. One of the top gene ontology categories

in these modules was related to alternative splicing, a mechanism commonly employed during normal neural development.

Conclusions: These results support the use of blood-derived lymphoblastoid cells to identify etiological subsets of autism. The DE analysis and network analysis bring the initial evidence of convergent molecular dysregulation exists in autism, especially for the del(16p) and dup(22q). We plan to run more arrays from these recurrent CNV to try to extend and replicate these results. The new samples will be run with current cases together as a new cohort to remove potential confounders, such as batch effects, so as to increase our statistic power.

124.004 Monoallelic Expression In the Human Brain May Be Associated with Autism Risk. S. Shifman*, E. Granot-Hershkovitz and E. Ben-David, *The Hebrew University of Jerusalem*

Background: Normally, the maternally and paternally derived copies of each gene are expressed simultaneously at comparable levels. This is termed biallelic expression. However, in some cases, gene expression is monoallelic, as only one of the copies of the gene is expressed, whereas the other is silent. The choice of which allele is expressed may be a non-random process, determined by the parental origin of the allele (imprinting), or may be entirely random. Monoallelic expression can be also caused by genetic or epigenetic mutations that disrupt one of the two copies of the gene. Autism-related disorders are already known to be associated with genomic imprinting; Angelman and Prader-Willi syndromes are caused by deletions or duplications of imprinted genes on chromosome 15. However, it is not clear if other imprinted regions or other types of monoallelic expression are associated with autism.

Objectives: Our aims were to study the pattern and extend of monoallelic expression and genomic imprinting across the genome in the human brain and to identify their relation to autism risk.

Methods: We screened 30 postmortem brain tissues (prefrontal cortex) from autistic cases and normal controls (obtained from the Autism Tissue Program) for monoallelic expression. We used Single Nucleotide Polymorphism (SNP) arrays to measure the allelic expression across the genome. We were able to identify occurrences of monoallelic expression by comparing the SNP genotyping results in genomic DNA and cDNA of the same individual. We developed an algorithm to identify segments of the genome that show a significant deviation from biallelic expression. We used deep sequencing and Sanger sequencing for validation. To identify the parental origin of the silence alleles, we genotyped or used available SNP data from parents of four different autistic subjects.

Results: We identified many regions across the genome that show significant deviation from biallelic expression in most brain samples. Among them are known imprinted regions. Using this data we were able to refine the boundaries of known imprinted regions and to identify abnormal imprinting in autistic cases. Many of the regions include coding and noncoding genes that are new imprinted candidates and should be further studied.

Conclusions: The results of this study may shed new light on current views on the mechanisms of brain development and brain diseases. Monoallelic expression of multiple genes in the brain could be essential for proper brain development and function. However, having only one functional allele for some genes – some of which have been identified in this study – may explain the sensitivity of the brain to haploinsufficiency, as expression from only one copy disables the possibility of compensation in the case of deleterious genetic mutations or epigenetic aberrations.

124.005 Blood-Based Transcriptomic Biomarker Profiles of Autistic Spectrum and Other Developmental Disorders. S. J. Glatt*[1], M. E. Winn[2], C. Roe[1], T. Wong[1], C. Ahrens-Barbeau[3], S. Chandler[4], M. Collins[4], L. Lopez[4], M. Tsuang[4], K. Pierce[4], N. Schork[5] and E. Courchesne[4], (1)*SUNY Upstate Medical University*, (2)*University of California San Diego*, (3)*Neurosciences and UCSD Autism Center of Excellence, University of California, San Diego*, (4)*University of California, San Diego*, (5)*Scripps Research Institute*

Background: One way to combat autistic spectrum disorders (ASDs) would be to discover biological markers—or "biomarkers"—for these illnesses, which potentially could revolutionize their rational diagnosis and management. Biomarkers could facilitate diagnosis, lead to earlier identification and intervention, and possibly suggest "treatable targets" for medicinal chemistry and drug-discovery research. Given such immense promise, ASD biomarkers (especially genomic biomarkers, given the high heritability of ASDs) have been pursued through many decades and approaches, but little headway has been made focusing on individual biomarkers in isolation. **Objective**s: For the past three years, we have been studying young children with, or at-risk for, a variety of

neurodevelopmental disorders with the intent of identifying multi-modal biomarkers of presentation, course, and treatment-response of ASDs. Here we report cross-sectional results of whole-transcriptome expression profiling in freshly drawn peripheral blood mononuclear cells (PBMCs) from Wave I of data-collection, when the enrolled infants and toddlers were first evaluated and diagnosed with (or identified as being at-risk for) an ASD, language delay (LD), other developmental delay (DD), or judged to be typically developing (TD), between the ages of 12 and 46 months. We also evaluated subjects who initially failed the developmental screening but were later judged to be developing typically (type-I errors; TIEs). **Methods**: After ensuring mRNA quality, we assayed PBMC mRNA expression profiles on Illumina WG-6 microarrays. Data were transformed, normalized, and adjusted for probe GC content before a further assessment of quality was made. Gene expression intensities were modeled as dependent measures in ANCOVAs with diagnosis as primary predictor and age and sex as covariates. Shared and unique expression profiles were identified by intersection-union tests. The biological characteristics of sets of dysregulated genes were determined by analyses of pathways, ontologies, and protein domains in DAVID. **Results**: After applying all quality controls, the final sample left for the present analyses included 60 subjects with or at-risk for autistic disorder (AD), 23 subjects with or at-risk for pervasive developmental disorder not otherwise specified (PDD-NOS), 17 subjects with or at-risk for a DD, 34 subjects with or at-risk for a LD, 27 TD subjects, and 41 TIE subjects. All groups were comparable in their male:female ratio, and most groups were comparable in mean age, except the LD and TIE groups which were significantly younger than each of the other diagnostic groups. We found numerous genes with low false-discovery rates that distinguished developmental disorders from each other and from TD and TIE subjects. The 313 genes that were most reliably changed in AD subjects relative to both TD and TIE subjects were most strongly associated with mitotic cell cycle regulation; other biological processes over-represented among the dysregulated genes included endopeptidase activity, cerebral cortex development, microtubule processes, negative regulation of neuron apoptosis, and neuron migration. **Conclusions**: PBMCs may serve as a useful tissue for deriving biomarker profiles of ASDs that are highly specific to particular neurodevelopmental disorders. Ongoing longitudinal analyses of these subjects will determine if these blood-based biomarker profiles fluctuate as symptom profiles change over time with intensive behavioral treatment.

124.006 Aberrant Proliferative and Organizational Pathways with Disrupted Cortical Lamination In Young Autistic Males.

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Background: Autism is a highly heritable neurodevelopmental disorder with abnormal brain enlargement and dysfunction in early years, but the genetic mechanisms remain unknown. Aberrant brain overgrowth, then premature growth arrest and decline is a well-documented observation, but genetic and expression studies have failed to explain this abnormal growth pattern. Due to the scarcity of well-preserved brain tissue, few studies investigated genome-wide expression patterns in the autism brain, especially in regions that display the most flagrant growth abnormality. Using small sample size and subsets of the genome, previous studies have suggested possible alterations in expression levels of neurodevelopmental and immune-related genes. To confirm and extend these findings, we used tissue from key brain regions and tested the hypothesis that genotypic variation may account for the gene dysregulation of these pathways. Furthermore, cortical phenotypic correlates of aberrant genetic expression must be examined to identify possible morphological consequences of these expression abnormalities and genotypic variation associated with autism.

Objectives: We aimed to identify genome-wide expression signatures, copy number variation (CNV), and cortical microstructure in autistic and control tissue from prefrontal cortex where growth abnormality is pronounced. We then sought to expand upon the genetic analyses using publicly available genotypic datasets.

Methods: Genome-wide expression analyses were performed in 33 autistic and control postmortem frozen tissue cases (ages 2-56 years). mRNA was processed with the DASL protocol and hybridized on Illumina microarray. Differential expression was assessed using 2-way ANOVA with diagnosis and categorical age as variables of interest and validated by RT-PCR. Enrichment analyses were performed using Metacore. Nissl staining and in situ hybridization (ISH) of laminar specific genes were performed to identify microstructural correlates of

aberrant expression in a subset of young autistic males. Nissl sections were examined by a blinded neuropathologist and through blinded stereological measurement of neuron density. Subjective impressions of ISH abnormalities in autistic cases were systematically recorded.

Results: Pathways and processes mediating cell cycle, DNA damage, apoptotic, cellular specification and neural patterning functions were aberrantly expressed in the young autistic prefrontal cortex. CNVs were highly enriched in cell cycle and cytoskeleton processes. In AGRE/BROAD/JHI datasets, genes mediating cell cycle processes were significantly associated with autism, but not genes regulating inflammation, apoptosis, or synaptogenesis. Histological examination of sections from young cases correctly identified 6/7 autistic cases as having areas of pathologically disorganized cortex. Regions neighboring or overlapping with these disorganized areas showed deficits of ISH laminar marker labeling. Examination of neuron density showed a 17% increase in regions showing disorganization or ISH deficits compared to controls.

Conclusions: Dysregulation of proliferative processes, particularly cell cycle and DNA-damage pathways during neurodevelopment, could give rise to increased cell density and susceptibility to incorporation of DNA-damaged cells in the autistic cortex. Aberrant expression of neural patterning genes may lead to gross morphological and functional lateralization and anterior/posterior abnormality patterns identified by MRI and fMRI in individuals with autism. Finally, these expression deficits may be related to common and rare genotypic variation, playing a mechanistic role in the pathogenesis of autism. Other implications will be discussed.

124.007 X Chromosome Inactivation and Alternative Splicing In Autism: An Integrated Approach to Cross Link Gene Regulatory Processes. Z. Talebizadeh* and R. Aldenderfer, *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. An increased prevalence of autism in males suggests a role for the X chromosome. Evaluating X chromosome inactivation (XCI) in autistic females has been recommended by us and other groups. Despite some interesting hypotheses (e.g., imprinting and epigenetic mechanisms), it is not yet clearly understood if and how XCI might be important to understanding the mechanism of autism. One way to tackle this important topic is to assess if autistic females with X-inactivation skewness (XIS) have a unique genomic profile. Exploring such a question first requires knowing how this gene regulatory process is connected with other genomic processes. X chromosome inactivation is a DNA methylation process. Previously we have shown the trend of a higher degree of XIS in autistic females compared to non-autistic females. We also reported on the potential role of aberrant alternative splicing in X-linked neuroligin genes in autism. More recent findings have shown a cross link between DNA methylation and alternative splicing. These lines of evidence prompted us to systematically evaluate alternative splicing of NLGN3 in relation to autistic females' XCI status.

Objectives: To assess the relationship between XCI patterns and alternative splicing, we evaluated the expression level of multiple alternative splicing transcripts for NLGN3, an X-linked autism gene, in autistic females with and without XIS.

Methods: Subjects were ascertained from the Autism Genetics Resource Exchange (AGRE). XCI status was determined using the Androgen Receptor gene assay on blood-derived genomic DNA. TaqMan gene expression experiments for multiple NLGN3 splice variants were conducted using RNA from AGRE lymphoblastoid cell lines. Exon boundaries/compositions of amplified products were confirmed by DNA sequencing.

Results: In addition to the two known NLGN3 variants, we identified three novel splice variants for this gene. A distinct, statistically significant pattern was detected in the expression level of examined alternatively spliced NLGN3 isoforms for autistic females with XIS compared to those without XIS and controls.

Conclusions: This is the first study to evaluate the expression level of NLGN3 at the alternative splicing level taking into consideration the X-inactivation status of autistic females. Our study indicates that NLGN3 undergoes complex splicing process resulting in multiple splice variants. Furthermore, our expression data demonstrates that autistic females with XIS 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 and epigenetic mechanism in autism. Our study introduces a novel and effective method to connect different lines of genomic data in unraveling the etiology of this complex neurodevelopmental disorder.

124.008 Co-Expression Network Analysis of Activity-Dependent Gene Expression In Human Neurons Identifies Expression Changes Associated with the Timothy Syndrome CACNA1C Mutation. I. Voineagu*[1], D. H. Geschwind[2], S. P. Pasca[3], M. Yazawa[3], A. M. Pasca[3], T. Portmann[3] and J. Hallmayer[3], (1)*UCLA*, (2)*University of California, Los Angeles*, (3)*Stanford University*

Background: Depolarization-induced gene expression is a fundamental process underlying synaptic activity, which involves several calcium-signaling pathways. Most of the current knowledge regarding gene expression changes in response to depolarization comes from experiments involving mouse neurons or human neuroblastoma cell lines. Timothy syndrome is caused by a mutation of the voltage-dependent Ca-channel CACNA1C and is manifested by cardiac abnormalities and high frequency of autism among affected individuals(>60%).

Objectives: Here we aimed to (a) thoroughly characterize gene expression changes induced by depolarization human neurons and (b) establish whether the Timothy syndrome CACNA1C mutation causes alteration in resting state gene transcription in human neurons and/or affects depolarization-induced gene expression

Methods: We obtained genome-wide transcription profiles iPSC-derived human neurons from normal individuals and Timothy Syndrome patients, in either a resting state or after 9h of depolarization by KCl treatment. Gene expression changes associated with depolarization as well as the TS mutation were characterized by weighted-gene co-expression network analysis. Motif-enrichment analysis was used to identify transcription factors driving specific network modules

Results: We identified modules of co-expressed genes corresponding to gene upregulation as well as downregulation in response to neuronal depolarization. We find that genes with significant depolarization-dependent expression changes are enriched for binding sites of several transcription factors, including known regulators of activity-dependent gene expression (CREB) and we find evidence for novel trascription factors regulating activity-dependent transcription. In addition we describe co-expression modules associated with the CACNA1C mutation and discuss their relationship to depolarization-induced changes.

Conclusions: The Timothy syndrome mutation affects gene expression in human neurons, and the dysregulated genes are primarily involved in inositol phosphate signaling pathway.

125 Infants At High-Risk for Autism: Findings From the Infant Brain Imaging Study (IBIS)(Scientific Panel)
Moderator: J. Piven *University of North Carolina, Chapel Hill (UNC-CH)*

Organizer: H. C. Hazlett *University of North Carolina at Chapel Hill*

The IBIS (Infant Brain Imaging Study) Network is an NIH funded Autism Center of Excellence. The study involves longitudinal assessment of infants at high-risk for autism and a low-risk comparison group at 6, 12, and 24 months. Developmental, behavioral, and brain imaging data are collected at each time point. The study is midway through data collection and has seen over 200 six month olds and almost 100 12 month olds. This represents the largest prospective sample of high-risk infants reported to date. This panel will present new developmental, behavioral, and neuroimaging data from the study and early characteristics of high-risk infants.

125.001 Prospective characterization of behavioral development in high-risk infants from 6 to 12 months of age. A. M. Estes*[1], S. Paterson[2], H. Gu[3], L. Zwaigenbaum[4], J. Piven[5] and I. B. I. S. Network[6], (1)*University of Washington*, (2)*Children's Hospital of Philadelphia*, (3)*University of North Carolina*, (4)*University of Alberta*, (5)*University of North Carolina, Chapel Hill (UNC-CH)*, (6)*Autism Center of Excellence at UNC*

Background: Autism Spectrum Disorders (ASDs) are currently diagnosed through expert behavioral assessment, as no reliable neurobiological risk markers have yet been identified. A particular challenge for studies of infants at-risk for ASD is that the defining features specific to ASD may not be present until the second half of the first year of life or later. Initial studies suggest potential differences in non-defining features such as temperamental profiles and motor development in high-risk infants early in development, but further study is warranted. Earlier identification of infants at very high risk for ASD would allow earlier intervention, reduce parental stress, and increase our understanding of the underlying neurobiology of ASD.

Objectives: We examined infants at high risk for autism (HR) and a low-risk comparison group (LR) for a larger, longitudinal brain imaging study (IBIS). We hypothesize that behavioral manifestations of ASD-risk will not yet differentiate high-risk from low-risk infants at 6-months of age, but that differences will begin to emerge at 12 months.

Methods: Data collection is ongoing and we currently have available data from 115 6-month-olds, (HR n = 88; LR n =27).

Data were collected at four clinical sites: University of North Carolina, Children's Hospital of Philadelphia, Washington University, and the University of Washington. As part of a larger battery, infants were assessed for 1) cognitive development using the Mullen Scales of Early Learning (Mullen), yielding a total score and 5 subscale scores, 2) early autism signs using the Autism Observational Scale for Infants (AOSI), 3) adaptive functioning using the Vineland, and 4) temperament using the Infant Behavior Questionnaire-R.

Results: Preliminary analyses indicate no significant difference between HR and LR groups in overall cognitive development as assessed by the Mullen Early Learning Composite (ELC). The mean ELC score for the High Risk group was 95.3 (SD 11.9) and the mean score for the controls was 102.2 (SD 8.9). Further analyses will be conducted on a larger sample of infants and will include measures of early signs of ASD, adaptive functioning, and temperament.

Conclusions: The results from this preliminary analysis suggest that differences in cognitive development are not yet present at 6 months in infants at high risk for ASD. Our future analyses will investigate whether this holds in a larger sample and for other domains of functioning. This longitudinal study will allow us to characterize the emergence of differences in cognitive development and possible early markers of ASD. By identifying when and how children at risk for ASD diverge from their peers, we hope to help improve early identification, provide opportunities for earlier intervention, and ultimately, improve the lives of individuals with ASD and their families.

125.002 Disengagement: Associations with Putative Neural Circuitry and Repetitive Behaviors at 12 Months. J. T. Elison*[1], J. Wolff[2], S. Paterson[3], K. Botteron[4], H. Gu[2], J. Piven[5] and I. B. I. S. Network[6], (1)*University of North Carolina - Chapel Hill*, (2)*University of North Carolina*, (3)*Children's Hospital of Philadelphia*, (4)*Washington University School of Medicine*, (5)*University of North Carolina, Chapel Hill (UNC-CH)*, (6)*Autism Center of Excellence at UNC*

Background: If impaired early in development, the disengagement operation of selective visual attention could theoretically account for developmental deficits in social orienting and repetitive or perseverative cognitive patterns. Additionally, it has been suggested that early attentional and/or motor abnormalities may precede the social deficits evident in the early autism phenotype.

Objectives: The primary aim of the current study is to examine the disengagement operation and its associations with 1) putative neural circuits and 2) repetitive behavior measured at 12 months of age in a large cohort of high-risk infant siblings of children with autism and low-risk typically developing infants. We hypothesize that genetic liability for autism will moderate the relationship between both disengagement and repetitive manipulation of objects and the relationship between disengagement and indices of white matter fiber development of the splenium.

Methods: The final sample will include approximately 40 low-risk and 100 high-risk infants who have eye tracking data, behavioral data, and brain imaging data at 12 months of age. The sample includes participants recruited and assessed at the UNC, CHOP, and WashU clinical sites of IBIS. The modified gap/overlap paradigm is designed to examine the disengagement operation and is administered using Tobii eye-tracking equipment at each site. The Repetitive and Stereotyped Movement Scales (RSMS), a coding scheme developed as a companion to the behavioral sample of the Communication and Symbolic Behavior Scales (CSBS), is used to extract stereotyped motor behaviors and repetitive manipulation of objects. Finally, as part of an imaging protocol that includes structural MRI and resting BOLD, the 25 direction DTI sequence yields diffusion images that allow for analysis of diffusion properties and fiber tracking.

Results: Preliminary analyses indicate group differences in repetitive behavior at 12 months as measured by the RSMS ($p < 0.05$), suggesting a greater prevalence of 'repetitive manipulation of object' behaviors in the genetically high-risk group (HR, n=40; LR, n=20). Preliminary analyses of the disengagement operation indicate no differences ($p > 0.05$) between high-risk (n=36) and low-risk (n=25) infants. Analyses between the disengagement operation and white matter fiber integrity of the splenium are ongoing.

Conclusions: Repetitive behaviors appear to be more prevalent among high-risk infants than low-risk infants and thus may be endophenotypic marker of the disorder. Future examinations promise to explicate the role of attention disengagement in the early development of repetitive behaviors. Additionally, no published data to date has examined associations between white matter fiber integrity and cognitive performance in this age range. Collectively, this study will directly inform future analyses of the longitudinal outcome data and may point to putative neural markers important in the pathogenesis of autism.

125.003 Comparisons of Brain Size Between High-Risk Infants and Controls at 6 and 12 Months of Age. H. C.

Hazlett*[1], H. Gu[2], S. Paterson[3], M. Styner[4], G. Gerig[5], K. Botteron[6], S. R. Dager[7], R. T. Schultz[8], A. C. Evans[9], J. Piven[10] and I. B. I. S. Network[11], (1)*University of NC*, (2)*University of North Carolina*, (3)*Children's Hospital of Philadelphia*, (4)*UNC*, (5)*University of Utah*, (6)*Washington University School of Medicine*, (7)*University of Washington*, (8)*Children*, (9)*Montreal Neurological Institute*, (10)*University of North Carolina, Chapel Hill (UNC-CH)*, (11)*Autism Center of Excellence at UNC*

Background: Brain enlargement has been observed in individuals with autism as early as age 2. There is no literature on brain development during infancy, so the early trajectory of brain growth remains unknown. Studies of head size using head circumference measurements suggest that the period of brain enlargement is a postnatal event and may occur between 6-12 months of age.

Objectives: In this report, we examined the structural MRI data from a sample of 6 month olds at high risk for autism and typically-developing controls with follow-up scans at age 12 months.

Methods: Imaging data was obtained from all four IBIS data collection sites. In addition to an imaging protocol that included structural MRI and DTI scans, subjects received include a battery of behavioral and developmental tests. All the brain MRI scans were completed on a 3T Siemens scanner during natural sleep. This longitudinal study is currently ongoing, so we are reporting on findings from the cross-sectional data at age 6 months and age 12 months.

Results: Brain volume measures were performed on 83 high-risk and 34 low-risk controls infants at age 6 months. At the 6 month time point, we measured intracranial volume (ICV), total brain volume (TBV), cerebrum, cerebellum, lateral ventricles, and head circumference. At age 12 months, we were also able to examine the tissue volume of the cortical lobes (frontal, temporal, parietal, occipital). Statistical analyses included covariates such as gender, site, body size, and age at scan. We find no group difference in the brain volumes at age 6 months, with the exception of significantly decreased size of the lateral ventricles in the high-risk siblings (right $p = .01$, left $p = .03$). We find no group differences in the global brain volume measures at age 12 months. Our data on the cortical lobe volumes is preliminary at this point in time, as we have not yet completed quality checks (QC) on our data, but this data should be available for the meeting. Preliminary looks at brain volume across this longitudinal period (6-12 months) finds evidence for age effects but so far no group differences are observed in the rate of brain growth.

Conclusions: The results from this ongoing study provide evidence for normal total, cerebrum, and cerebellum volume at age 6 months in infants at high-risk for autism, with bilaterally decreased volume of the lateral ventricles observed in the high-risk infants. Preliminary data at 12 months indicates that there are no global brain differences at this time. Analysis is currently ongoing to characterize regional cortical lobe volumes and potential related group differences.

125.004 Diffusion Tensor Imaging In 6-Month-Old Infants at High-Risk for ASD. S. Paterson*[1], G. Gerig[2], S. Gouttard[2], H. Gu[3], H. C. Hazlett[4], K. Botteron[5], R. McKinstry[6], S. R. Dager[7], R. T. Schultz[1], A. C. Evans[8], J. Piven[9] and I. B. I. S. Network[10], (1)*Children's Hospital of Philadelphia*, (2)*University of Utah*, (3)*University of North Carolina*, (4)*University of NC*, (5)*Washington University School of Medicine*, (6)*Washington University*, (7)*University of Washington*, (8)*Montreal Neurological Institute*, (9)*University of North Carolina, Chapel Hill (UNC-CH)*, (10)*Autism Center of Excellence at UNC*

Background: Several studies of older children and adults with ASD have reported atypicalities in white matter using both structural MRI and Diffusion Tensor Imaging. In addition, studies of functional connectivity have pointed to abnormalities in the connections between different brain areas.

Objectives: Given the importance of brain connectivity for cognitive and social functioning, we wished to examine whether there were already differences at 6 months of age in the degree of maturation in white matter tracts between infants at low and high risk for ASD.

Methods: In addition to undergoing structural MRI, infants who participated in the IBIS study were also scanned using a 25 direction Diffusion Tensor Imaging Sequence. Data collected using this sequence enabled us to investigate the diffusion properties of white matter fiber tracts in 79 infants at high risk for ASD and 27 infants at low risk for ASD (Age 6 months -1 wk/ +3 wks) . Diffusion properties including fractional anisotropy, Frobenius Norm, and radial and axial diffusivity were calculated. Tract statistics were computed for the genu, splenium, mid corpus callosum, inferior longitudinal fasciculus, uncinate, and the motor and sensory tracts. Several of these tracts were chosen because previous work has demonstrated that the support social cognition, an area in which individuals with ASD are impaired.

Results: Results from multivariate functional tract analyses revealed that there were no differences in tensor shape, as measured by FA, or tensor volume, as measured by FRO, between the two groups in any of the tracts of interest. However, a further analysis, in which infants were split into two narrower age groups (Infants below 203 days, Mean 190d, std 7.8d and infants above 203 days: Mean 227d, std 19.7d), revealed a reduction in diffusion in all of the fiber tracts in the group of older infants. This age effect confirmed that DTI is sensitive to differences in white matter maturation even within a narrow time window at this young age and indicated that the lack of difference found between the HR and LR groups was not due to a lack of sensitivity of our method.

Conclusions: The results from this ongoing study do not reveal any differences between infants at high risk for ASD and those at low risk for ASD in the diffusion properties of several major fiber tracts in the brain. However, these children are being followed longitudinally until 24 months old, so future work will examine the fiber tract diffusivity across time, to see if developmental trajectories differ between those children who receive a diagnosis of ASD and those who do not.

126 International Applications of the Modified Checklist for Autism In Toddlers (M-CHAT) In Level 1 Screening (Scientific Panel)

Moderators: D. L. Robins[1]D. A. Fein[2] (1)*Georgia State University*, (2)*University of Connecticut*

Organizer: D. L. Robins *Georgia State University*

Toddler screening for autism spectrum disorders (ASD) has become a widely discussed topic in recent years. Level 1 screening, conducted with unselected samples, is quite challenging in many ways. Large samples are costly and time-intensive to collect, follow-up is not always feasible and if cases are followed, standard protocols have not been created, leading to variability in outcome measures. However, it is critical to validate instruments in different cultures and geographic regions, in order to verify that the tool performs as expected across settings. The Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, & Barton, 1999) is a parent-report measure of autism risk to be used in toddlers 16-30 months. The M-CHAT has been translated into more than 30 languages, but most have not yet been validated. This scientific panel includes reports of studies using the M-CHAT in four countries: Spain, Japan, Mexico, and the United States. Emphasis is placed on describing study procedures and carefully characterizing the sample collected, outcome variables, and preliminary psychometric properties of the M-CHAT in each study. This panel will allow direct comparison of the M-CHAT's performance in identifying toddlers at risk for ASD.

126.001 Population Based Autism Screening Program Using the M-CHAT In Spain.

P. García-Primo*[1], R. Canal-Bedia[2], M. V. Martín Cilleros[3], Z. Guisuraga Fernández[3], L. Herráez-García[2], M. M. Herraez García[3], J. Santos[3], J. Fuentes-Biggi[4] and M. Posada-de la Paz[5], (1)*National Research Institute for Rare Diseases. Instituto de Salud Carlos III*, (2)*University of Salamanca*, (3)*University of Salamanca* , (4)*Policlínica Guipúzcoa and GAUTENA*, (5)*National Research Institute of Rare Diseases. Instituto de Salud Carlos III*

Background:

There is not enough information about the feasibility and validity of the M-CHAT (Robins et al., 2001) in a population-based study or the feasibility of any ASD screening program in Spain. Beginning in 2005 an ASD screening program has been piloted in several paediatric outpatient clinics of Salamanca and Zamora and one year later in one health area of Madrid for the following two years.

Objectives:

1. To analyze the validity properties of the Spanish-Spain version of the M-CHAT for early detection of ASD in Spain.
2. To analyze the feasibility of a population based screening program for ASD in the public Health System in Spain.

Methods:

Period: From September 2005 to November 2010. *Geographical area*: Provinces of Salamanca, Zamora and Madrid, Spain. *Population*: All children of both genders aged 18 to 36 months, whose parents resided in the geographical area during the study period were selected when attending the mandatory measles, mumps and rubella vaccination program at age 18 months and/or the general well-baby check-up examination at age 24 months. *Procedure:* 2 phases: 1) M-CHAT Spain Version Validity Study. 2) Feasibility Study of a Population Based Screening Program using the M-CHAT in Spain. In both cases, screen positive on the M-CHAT led to the M-CHAT Follow-up Interview (FUI), screen positive on the FUI resulted in a diagnostic evaluation.

Results:

Number of paediatrician participants: 30 in Madrid, 39 in Salamanca and 18 in Zamora. *Response rate*= 8047/2910 (36.16%) in Madrid, 13633/4095 (30.03%) in Salamanca and 5860/2775 (47.35%) in Zamora. *Data from M-CHAT Study in Madrid (April 2006- May 2008):* 3317 MCHAT were administered to 2910 children 1567 girls and 1343 boys; 1871 at 18 months and 1446 at 24 months. 794 positive cases after the M-CHAT questionnaire; 35 positive cases confirmed with FUI and 35 evaluated cases (9 ASD, 15 GDD, 8 SLI, 3TD). Both data sample showed a PPV =.26 with 95% Confidence interval, [.11-.40] in Madrid [.15-.38] in Salamanca-Zamora. *Data from Zamora and Salamanca Ongoing Screening Program:* 8344 MCHAT have been administered so far to a total of 6870 children (3329 girls and 3541 boys; 4579 at 18 months and 3765 at 24 months). In Salamanca: 551 positive cases followed by the FUI; 31 FUI-positive cases evaluated: 8 ASD, 4 typically developing (TD), 15 Global developmental disorder (GDD), 3 specific language impairment (SLI), 1 Attention-Deficit/Hyperactivity Disorder (AD/HD). In Zamora: 521 positive cases followed by the FUI; 16 positive cases confirmed and evaluated: 7 ASD, 5 GDD, 3 SLI, 1 LD.

Conclusions:

The M-CHAT shows promise as a screening tool for developmental disorders in a population based screening program. Although there have been a high rate of false positives, this has facilitated an early start on effective intervention therapies for children with ASD as well as those with other disorders not previously identified. This work is still ongoing but so far it is an important contribution to the existing research on screening tools and identification of ASD at a young age.

126.002 Early Detection of Autism Spectrum Disorder at 18 Months.

Y. Kamio*[1], N. Inada[2], E. Inokuchi[3] and K. J. Tsuchiya[4], (1)*National Center of Neurology and Psychiatry, National Institute of Mental Health*, (2)*National Center of Neurology and Psychiatry, Japan, National Institute of Mental Health*, (3)*National Institute of Metal Health*, (4)*Hamamatsu University School of Medicine*

Background:

Recently reported prevalence of autism spectrum disorders (ASD) is 1-2% in Japan (Kamio et al., 2010; Kawamura, Takahashi, & Ishii, 2008) and the U.K. (Baird et al., 2006; Baron-Cohen et al., 2009). The Japanese government has started to promote health-social policy of early detection and intervention for children with ASD and their families. In Japan, although the child health checkup system from infants to 3-year-olds has been well established nationwide and the visit rate is over 90%, the 18- and 36-month checkups focus on language/intellectual development but not social development. Because socio-communication abnormalities begin to manifest at 1 year of age in ASD, the checkup at 18 months appears to provide a good opportunity to detect early symptoms of ASD. We considered that the Modified Checklist for Toddlers with Autism (M-CHAT), a 23-item, parent-report questionnaire (Robins et al., 2001), may complement and enhance the existing checkup system, since the checklist was developed for children 16-30 months of age and is easy to administer without increasing the burden on both the families and check-up staff. For these reasons, we developed the Japanese version of the M-CHAT. After a preliminary study (Kamio & Inada, 2006), with the permission of the authors, we added illustrations (items 7, 9, 17, and 23: see www.mchatscreen.com) to help caregivers to recognize negative symptoms.

Objectives:

To examine whether the early ASD screening procedure using the Japanese M-CHAT (J-MCHAT, Inada et al., 2010) is effective when it is added to 18-month checkup in Japan similarly as in the U.S.

Methods:

2113 children (94.2% of the total population, males 50.7%) who visited the 18-month health check-up (97.5% were between 18-19 months of age) in a suburb of Fukuoka, Japan were screened using the J-MCHAT with a 2-stage procedure, a parent-administered 23 item questionnaire screen and the M-CHAT Follow-up Interview (FUI) by telephone. We lowered the threshold at the 1st screening due to the younger age such that a child screened positive if he/she failed 3/23 or 1/10 critical items. 312 children were screen-positive at the 1st stage, and 42 children stayed positive at the 2nd stage and were invited for a developmental evaluation at age 2. A subgroup of screen-positive children and screen-negative children under the community health surveillance system were invited to developmental/diagnostic evaluations at 2, 3, 4, 5, 6 years of age, and each case received evaluations more than twice. Probable ASD was considered when a child was evaluated at 2 and showed ASD symptoms, did not attend follow-up evaluation, but surveillance at kindergarten or elementary school entry indicated likely ASD.

Results:

Twenty-nine children of 39 children later diagnosed as ASD/probably ASD were screen-positive at the 1st and 20 children were positive at the 2nd screening. Psychometrics for J-MCHAT alone are sens=.74, spec=.91, PPV=.15, and NPV=.99. When the J-MCHAT + FUI is considered, sens=.56, spec=.99, PPV=.69, and NPV=.99.

Conclusions:

With a few modifications of threshold criteria according to age, the M-CHAT screening can successfully differentiate children with ASD from the other children at 18 months.

126.003 Modified Checklist for Autism In Toddlers (Spanish Mex. Version): Transcultural Mexican Study. L. E. Mejia*[1] and C. A. Marcin[2], (1)*National Council of Evaluation of Social Public Policy*, (2)*CLIMA Clinica Mexicana de Autismo*

Background:

A Spanish-Mexican translation of the *Modified Checklist for Autism in Toddlers, Revised* (*M-CHAT-R**; Robins, Fein, & Barton, 2009) was administered to a sample of 420 Mexican children aged 18 to 36 months. The importance of early detection in the outcome of individuals with *Autistic Spectrum Disorder* (ASD) is now well established; however in Mexico there is often a significant time lag between parent concerns and confirmation of diagnosis.

The M–CHAT is a screening instrument designed to detect ASD in young children that was introduced into Mexico by the author and Dr. Deborah Fein as part of Autism Speaks' *Pan American Autism Awareness Training Initiative 2009* and Clínica Mexicana de Autismo.

Objectives:

Methods:

The *M-CHAT-R Spanish-Mex. version* was applied to a sample of 300 Mexican typical children (control group) aged 18 to 36 months compared with a sample of 120 Mexican children with ASD of the same age. A binary logistic regression was used in order to verify the statistical **reliability, sensitivity and predictive ability** of the M-CHAT-R Spanish-Mex., in which the dependent variable is a dichotomous measure ("*ASD children* =1" and "*control group*=0"). The independent variables consist of the 20 items contained in the *M-CHAT-R Spanish Mex. version* which also are dichotomous (0 if the answer to the question suggests no ASD risk and "1" if the answer to the question *suggests ASD risk*).

Results:

The results of binary logistic regression model suggest that **ten** out of the 20 items of the *M-CHAT-R Spanish-Mex. version* instrument are enough to predict *children with ASD* accurately. These items included 1 (follows point) , 2 (pretend play), 6 & 7 (points), 8 (peer interest), 9 (brings to show), 11 social smile), 14 (eye contact), 17 (seeks parent's attention), & 18 (understands). Predictive ability of the **ten most sensitive** items indicates that the selected questions will **predict accurately 80%** of the *ASD cases,* and also 97% of the *control group* cases would be classified correctly **(global percentage of correct prediction was 92%);** (goodness of fit test *Cox and Snell* R^2=.632; *Nagelkeke´s* R^2=.843; cutoff value=.5). The measure of the internal ***consistency*** of the test score for this sample indicates a good reliability, *Cronbach's α (alpha)* =.837.

Conclusions:

This study highlights some of the difficulties in diagnosing very young children reliably and emphasizes the need for the development and evaluation of instruments that are sensitive to ASD in a very young population. The M-CHAT R is, however, available in a Spanish version for a Mexican study and may provide a suitable ***"Level 1 screen"*** for the toddlers in Mexico; to date, this study is the first quantitative/empirical research study available in Mexico that reports the statistical reliability, sensitivity and predictive ability regarding the results of the M-CHAT-R Spanish Mex. version. Future research will examine the performance of the M-CHAT-R, Spanish Mexican version in a Level 1 sample.

126.004 Preliminary Findings From the Modified Checklist for Autism In Toddlers, Revised (M-CHAT-R). D. L. Robins*[1] and D. A. Fein[2], (1)*Georgia State University*, (2)*University of Connecticut*

Background:

Level 1 screening for autism spectrum disorders (ASD) requires balance between minimizing false negatives, or missed cases, who miss out on needed early diagnostic and intervention services and false positives, who undergo unnecessary stress and increase burden by lengthening waiting lists and/or increasing demands for services from providers. The Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, & Barton, 1999) has been validated in Level 1 samples. Positive predictive value (PPV) is lower than would be optimal at .05-.11 for M-CHAT alone and .28-.65 for M-CHAT plus Follow-up Interview (FUI), although when all developmental disorders are considered, PPV is much higher.

Objectives:

A revision of the M-CHAT (Robins, Fein, & Barton, 2009) was developed to reduce the false positive rate while maintaining maximal sensitivity. The current study presents the initial validation of the M-CHAT-R.

Methods:

The M-CHAT-R is composed of 20 yes/no parent-report items. M-CHAT items were reworded to reduce misinterpretation, item order was revised to prevent parents from falling into a response set of answering "yes" to all items, examples were provided for many items, and the three worst-performing M-CHAT items were dropped. The M-CHAT-R was piloted in 3238 toddlers (50.96% male, mean age=21.69 months, *SD*=3.45 months, range: 14-40 months) screened during 18- or 24-month well-child visits to participating pediatric offices in metropolitan Atlanta. Parents of children who screened positive on the M-CHAT-R were offered the M-CHAT-R Follow-up Interview (FUI), and those who continued to screen positive were offered a free diagnostic evaluation. Screen positive was defined as failing two of the best7 items or any three items.

Results:

7.13% of toddler (*n*=231) screened positive on M-CHAT-R, and 22.46% of those who completed the FUI continued to screen positive (*n*=42 of 187); 23 of these 42 completed the evaluation, and 16 were diagnosed with ASD. Five additional toddlers with ASD were detected based on physician or parent concern, although four of these had screened positive on M-CHAT-R (but not FUI). It is too early to calculate sensitivity, but considering that the original M-CHAT detected 45 cases per 10,000 screened and the M-CHAT-R is detecting 49 cases per 10,000 screened, sensitivity does not appear to be reduced compared to the original M-CHAT. PPV was calculated excluding cases who declined to complete the study, and was .11 (20/178) for M-CHAT-R and .70 (16/23) for FUI. Only one child evaluated based on M-CHAT-R + FUI score had no diagnosis, bringing the PPV for all developmental delays to .96.

Conclusions:

The M-CHAT-R demonstrates promising psychometric properties, and appears to improve the rate of detection of ASD. Additional improvements may be made by developing new scoring algorithms, which should be undertaken once the sample is larger.

127 Shank Synaptic Genes In Autism: Human Genetics to Mouse Models and Therapeutics (Scientific Panel)

Moderator: C. M. Powell *The University of Texas Southwestern Medical Center*

Organizer: C. M. Powell *The University of Texas Southwestern Medical Center*

Human genetic studies have revealed multiple, related synaptic genes as potential causes for a small subset of Autism Spectrum Disorders (ASD). Several recent human studies implicate mutations, deletions, and duplications of the postsynaptic density scaffolding genes SHANK3 and SHANK2 in ASD and in the related disorder Phelan-McDermid Syndrome (PMS, 22q13 Deletion). The human genetics case for Shank mutations as a cause of ASD and PMS will be presented followed by unpublished studies on three completely different, novel mouse genetic models based on disease-linked mutations. At least one of these presentations will present preclinical evidence suggesting a novel potential therapeutic target for ASD related to Shank3 mutation.

127.001 Human Genetics of Shank2 and Shank3 in Autism and Phelan McDermid Syndrome. C. Betancur*, *INSERM U952*

Background:

Autism spectrum disorders (ASDs) can arise from rare highly penetrant mutations and genomic imbalances. Phelan-McDermid syndrome, due to 22q13.3 deletions involving the synaptic scaffolding gene *SHANK3,* is one of the more frequently reported chromosomal abnormalities in ASD. It is characterized by intellectual disability and severe language impairment; autism or autistic traits are common. Rare *de novo* mutations in *SHANK3* have been identified in patients with ASD. More recently, *de novo* intragenic *SHANK2* deletions and a mutation were reported in ASD and/or intellectual disability.

Objectives: The molecular and clinical characteristics of patients with mutations in *SHANK2* and *SHANK3* will be presented. We also review reports in the literature from additional groups.

Methods:

Patients with *SHANK* mutations were identified through sequencing and gene dosage experiments (FISH, MLPA, and microarray studies). A detailed clinical assessment is performed by clinical geneticists and psychiatrists.

Results:

De novo deletions and mutations in *SHANK2* and *SHANK3*, as well 22q13 duplications including *SHANK3* have been reported

in patients with ASD and/or intellectual disability. The significance of rare inherited variants in *SHANK2* is unclear at present.

Conclusions:

These findings provide further support for the involvement of postsynaptic proteins in the etiology of ASD and intellectual disability and further confirm a common genetic etiology in these two neurodevelopmental disorders.

127.002 Synaptic Dysfunction in a Novel Shank3 Mouse Model of Autism. J. D. Buxbaum*, *Mount Sinai School of Medicine*

Background: SHANK3 is a protein in the core of the postsynaptic density (PSD) and has a critical role in recruiting key functional elements to the PSD and to the synapse, including components of AMPA, NMDA and metabotropic glutamate receptors, as well as cytoskeletal elements. Loss of a functional copy of the *SHANK3* gene leads to the neurobehavioral manifestations of 22q13 deletion syndrome and/or to autism spectrum disorders.

Objectives: The goal of this study was to examine the effects of haploinsufficiency of full-length *Shank3* in mice, focusing on synaptic development, transmission and plasticity, as a model for understanding *SHANK3* haploinsufficiency in humans.

Methods: We used mice with a targeted disruption of *Shank3* in which exons coding for the ankyrin repeat domain were deleted and expression of full-length Shank3 was disrupted. We studied synaptic transmission and plasticity by multiple methods, including patch-clamp whole cell recording, two-photon time-lapse imaging and extracellular recordings of field excitatory postsynaptic potentials. We also studied the density of GluR1-immunoreactive puncta in the CA1 stratum radiatum.

Results:

In *Shank3* heterozygous mice, there was reduced amplitude of miniature excitatory postsynaptic currents from hippocampal CA1 pyramidal neurons and the input-output (I/O) relationship at Schaffer collateral-CA1 synapses in acute hippocampal slices was significantly depressed; both of these findings indicate a reduction in basal neurotransmission. Further studies demonstrated that the decrease in basal transmission reflected reduced AMPA receptor-mediated transmission. This was further supported by the observation of reduced numbers of GluR1-immunoreactive puncta in the stratum radiatum. Long-term potentiation (LTP), induced either with θ-burst pairing (TBP) or high-frequency stimulation, was impaired in *Shank3* heterozygous mice, with no significant change in long-term depression (LTD). In concordance with the LTP results, persistent expansion of spines was observed in control mice after TBP-induced LTP; however, only transient spine expansion was observed in *Shank3* heterozygous mice. The deficits suggested delays in synaptic development and the addition of a neuroactive peptide derived from a growth factor reversed all electrophysiological deficits in the mice.

Conclusions: We documented deficits in synaptic function and plasticity in *Shank3* heterozygous mice. Our results are consistent with altered synaptic development and function in *Shank3* haploinsufficiency, highlighting the importance of Shank3 in synaptic function and supporting a link between deficits in synapse function and neurodevelopmental disorders. The reduced glutamatergic transmission in the *Shank3* heterozygous mice represents an interesting therapeutic target in *SHANK3*-haploinsufficiency syndromes. The beneficial effects of a peptide provide important proof-of-concepts for intervention in *SHANK3*-haploinsufficiency syndromes. Follow-up studies in knockout mice and assessment of additional preclinical pharmacological interventions in heterozygous animals are underway.

127.003 Genetic and epigenetic analysis of SHANK3 in humans and mice. Y. H. Jiang*, *Duke University*

Background:

SHANK3 is a synaptic scaffolding protein enriched in the postsynaptic density of excitatory synapses. Point mutations in the *SHANK3* gene have been identified in individuals with autism spectrum disorder (ASD) and these mutations are isoform specific. *SHANK3* lies also within the critical region of chromosome 22q13.3 microdeletion syndrome (Phelan-McDermid syndrome), which includes ASD as a major clinical feature. SHANK3 protein has 5 conserved domains that interact with diverse of synaptic proteins at postsynaptic density. SHNAK3 gene displayed tissue specific DNA methylation for its 5 CpG islands in different brain regions.

Objectives:

To test a hypothesis that epimutation of DNA methylation of SHANK3 in brains contribute to the susceptibility of idiopathic ASD cases. To understand the role of SHANK3 protein in synaptic function and model the pathogenesis of ASD caused by SHANK3 deficiency in mice.

Methods:

We carried out extensive DNA methylation profiling for SHANK3 CpG islands using pyrosequencing and bisulfite genomic sequencing methods. We also performed RNA expression analysis using real time RT-PCR analysis in postmortem ASD brain tissues. We used mouse embryonic stem cell gene targeting and chromosomal engineering approach to generated Shank3 mutant mice by deleting a different set of Shank3 coding exons. We analyzed Shank3 mutant mice by biochemical, morphological, neurophysiological, and neurobehavioral methods.

Results:

We have discovered both human and mouse SHANK3 gene have a complex transcriptional pattern with multiple promoters and extensive alternative splicing of coding exons. Through analysis of a large set of ASD brain tissues and controls**, we discovered ASD brain tissues have significant increase DNA methylation (epimutation) in selective promoter bound intragenic CpG islands of SHANK3. We further showed that increased DNA methylation of CpG islands is associated with aberrant SHANK3 isoform specific expression and alternative splicing of coding exons. The epimuations of SHANK3 is associated with repressed chromatin conformation of *SHANK3.* These data support a causative association between epimutation of SHANK3 and the pathogenesis of ASD in these cases.** We produced three different lines of Shank3 mutant mice by disrupting a different set of Shank3 coding exon. Shank3 mutant mice lacking the major isoforms display impaired social behaviors, abnormal communication patterns, repetitive behaviors, and deficient cognitive abilities-reminiscent of the core features of ASD in humans. *Shank3* isoform-specific mutant mice have reduced levels of the synaptic proteins at the postsynaptic density, and attenuated response of activity-dependent distribution of the AMPA receptor. The ultrastructure of synapses in Shank3 mutant mice is normal but the maturation of dendritic spine in cultured neurons is impaired. Although synaptic transmission is normal in CA1 hippocampus, long-term potentiation is deficient in *Shank3*$^{e4\text{-}9}$ mice.

Conclusions:

We discovered that epimutation of SHANK3 is by far the most significant molecular defect found in brain tissues of idiopathic ASD. The results from Shank3 mutant mice support the hypothesis that loss of major *Shank3* isoforms produces synaptic dysfunctions that lead to behavioral abnormalities that have many similarities to ASD in humans. The data from epigenetic and genetic analysis Shank3 support a much broad role of SHANK3 in the pathogenesis of ASD.

127.004 Behavioral and Synaptic Abnormalities in a Novel PDZ Domain Shank3 Mutant Model of Autism. G. Feng*, *MIT McGovern Insitute for Brain Research*

Background:

Autism spectrum disorders (ASDs) comprise a range of disorders that share a core of neurobehavioral deficits characterized by widespread abnormalities in social interactions, deficits in communication as well as restricted interests and repetitive behaviors. The neurological basis and circuitry mechanisms underlying the manifestation of these abnormal behaviors are poorly understood. Shank3 (SH3 and multiple ankyrin repeat domains 3) is a postsynaptic protein, whose disruption at the genetic level is thought to be responsible for the development of the 22q13 deletion syndrome (Phelan-McDermid Syndrome) and other non-syndromic ASDs.

Objectives:

To understand the *in vivo* function of Shank3 at the synapse and how a disruption of *Shank3* may lead to ASD-like behavior.

Methods:

We used homologous recombination in mouse ES cells to generate Shank3 mutant mice. We combined biochemical, morphological, electrophysiological and behavioral approaches to characterize the synaptic and circuitry defects in Shank3 mutant mice.

Results:

Mice genetically engineered with *Shank3* gene deletions exhibit self-injurious repetitive grooming and deficits in social interaction. Morphological analysis revealed an increase in dendrite complexity and a reduction of spine in striatal medium spiny neurons (MSNs) of Shank3 mutant mice. Furthermore, both postsynaptic scaffolding proteins and glutamate receptor subunits are reduced in the postsynaptic density of the mutant mice. Field recordings of cortico-striatal synaptic function from acute brain slices showed that field excitatory population responses were significantly reduced in *Shank3B*$^{-/-}$ mice when compared with controls. Whole cell recordings revealed that the frequency of mEPSCs was significantly reduced in *Shank3B*$^{-/-}$ MSNs, suggesting a reduction in the number of functional synapses since no defects on presynaptic function were observed. In addition, a significant reduction of peak amplitude

in *Shank3B*$^{-/-}$ MSNs was also observed, indicating a reduction in the postsynaptic response from the available synapses. Together, these data demonstrate a critical role for Shank3 in postsynaptic function in cortico-striatal circuitry.

Conclusions:

Our findings demonstrate a critical role for Shank3 in the normal development of neuronal connectivity and establish causality between a disruption in the *Shank3* gene and the genesis of autistic-like behaviors in mice.

Clinical Phenotype Program
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128.001 1 Exploring Patterns of Change In Social Attention In Young Children with Autism Spectrum Disorder. L. B. Swineford* and A. M. Wetherby, *Florida State University Autism Institute*

Background: Research on early social communication development in young children is needed to assist in more accurate and earlier identification of autism spectrum disorder (ASD), which will allow for earlier intervention and improved outcomes. Research has shown that social attention deficits such as difficulties orienting to social stimuli and developing dyadic and triadic gaze patterns are among the earliest symptoms of ASD and are present across the 2nd year of life (Dawson et al., 1998), but the deficits may become easier to detect late in the 2nd year of life (Chawarska et al., 2007; Landa et al., 2007; Gamliel et al., 2009; Paul et al., 2008). Many of the studies examining social attention in young children have included high-risk samples and further research is needed to examine social attention in children under 18 months of age using a prospective design with a general population sample.

Objectives: The purpose of this study was to determine if children with ASD show distinct profiles early (between 12-17 months of age) and late (between 18-24 months of age) in the 2nd year, compared to children with developmental delay (DD) and typical development (TD). Changes in social attention in all three groups across the 2nd year of life were also examined to better understand developmental patterns of social attention in children with ASD as compared to children with DD and TD.

Methods: Participants were from the longitudinal prospective study of the FIRST WORDS® Project and included 89 children categorized into one of three diagnostic groups; 32 diagnosed with ASD, 25 with DD in which ASD was ruled out, and 32 with TD. Each of the participants received at least two Behavior Samples; one between the ages of 12-17 months and one between 18-24 months. Archived videotaped behavior samples of the *Communication and Symbolic Behavior Scales* (CSBS; Wetherby & Prizant, 2002) were coded using the Observer® Video-Pro software by Noldus Information Technology, allowing for precise measurement of social attention behaviors.

Results: Results indicated that social attention skills differentiated children with ASD from children with TD early and late in the 2nd year. Furthermore, the pattern of social attention seen across the two time points indicated that diagnostic features of social attention were seen early in the 2nd year of life in children with ASD and these deficits increased over the 2nd year of life.

Conclusions: The findings of this study suggest that a deficit in social attention is an early symptom of ASD that may be present but more subtle early in the 2nd year of life and become more apparent late in the 2nd year of life. Therefore, it is important that ASD not be ruled out under 18 months of age and children be screened between 18 and 24 months of age as recommended by the AAP (2007).

128.002 2 Diagnostic Stability In Toddlers Diagnosed with Developmental Delay without Autism. J. N. Greenson*[1], S. Faja[1] and G. Dawson[2], (1)*University of Washington*, (2)*Autism Speaks, UNC Chapel Hill*

Background: While there has been increasing research and clinical interest in of the stability of diagnosis in young children with autism, less is known about the stability of diagnosis in children with developmental delay (without autism). Development of interventions for increasingly young children (e.g., Dawson et al., 2010; Green, Brennan, & Fein, 2002; McGee, Morrier, & Daly, 1999) and increasing public awareness of early risk for autism have led to greater numbers of referrals of very young children for differential diagnosis of autism versus developmental delay during toddlerhood. Further, recent work lends strong support for the idea that autism is detectable between 18-30 months in *some* children (Lord, 1995; Lord et al., 2006; Stone et al., 1999), but there is evidence that there may *also* be a subgroup of children whose core symptoms manifest closer to the third birthday. Indeed, Chawarska, Klin, Paul & Volkmar (2007) found that 1 of 4 children with developmental delay that they followed-up received a PDD diagnosis one year later.

Objectives: The goal of the study was to examine the stability of diagnosis in young children with developmental delay.

Methods: Twenty toddlers (4 female) referred for concerns regarding delays in development between 18-30 months received a diagnostic evaluation and then were followed-up as preschoolers. As toddlers, they displayed delays in at least one sub-domain of the Vineland and the Mullen, and had standard scores below 85 on the Mullen. Importantly, these children also were administered the Autism Diagnostic Observation Schedule (ADOS) and the toddler version of the Autism Diagnostic Interview-Revised (ADI-R), and they did not meet criteria for an autism spectrum disorder based on expert clinical judgment and combined scores from these measures.

Results: At follow-up (mean age = 41.35 months, range = 30-59), three of the twenty children (15%) previously diagnosed with development delay received a diagnosis of an autism spectrum disorder (ASD) based on administration of the ADOS, ADI-R, and clinical judgment. In terms of cognitive ability, at follow-up four children with initial diagnosed with developmental delay achieved Mullen composite scores in the average range. Baseline composite scores in the sample were significantly related to scores at follow-up, $r(20) = .51$, $p = .02$.

Conclusions: The current study suggests that some children initially diagnosed with developmental delay without autism will develop ASD symptoms during the preschool period and later qualify for a diagnosis of ASD. Although cognitive ability as measured during toddlerhood was predictive of later cognitive ability during preschool, 20% of toddlers initially included in a group with developmental delays performed within the average range when retested as preschoolers.

128.003 3 Change In ADOS Classification In An Inception Cohort of Preschool Children with ASD. A. Thompson*[1], P. Szatmari[1], E. Duku[1], S. Georgiades[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)*University of Toronto*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*

Background: The Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000) assesses communication, social and play skills, and restrictive/repetitive behaviours. Gotham et al. (2007, 2009) revised the ADOS algorithms for modules 1 to 3 to improve diagnostic validity, and developed a calibrated metric as an index of ASD symptom severity. The revised algorithms and severity metric allow for comparison across modules, age and time.

Objectives: To investigate change in ADOS classification in a sample of preschool children with ASD participating in a Canadian longitudinal study and to identify factors that may be associated with this change.

Methods: The sample consisted of 191 children assessed with the ADOS at enrolment (within 4 months of diagnosis) between ages 2 and 4 (Time 1; T1) and when they were 6 (Time 2; T2). Within this sample, 147 children (77%) were in the ADOS autism category at T1 and T2 (AA group); 8 (4%) went from an autism diagnosis at T1 to ASD at T2, and 19 (10%) went from autism at T1 to non-ASD at T2 (AN group). For the 17 (9%) children with ASD at T1, 12 moved to autism at T2, 2 remained ASD at both T1 and T2, and 3 shifted to non-ASD at T2. The analyses focused on the AA and AN groups as they had the largest sample sizes and the AN group showed greatest diagnostic change. Comparisons were made between the two groups on selected baseline variables. Change between T1 and T2 was assessed using Multivariate Analysis of Variance (MANOVA) for baseline variables showing a medium-to-large effect size (ES≥.5) while controlling for age and gender.

Results: No significant AA versus AN differences were found in the children's ages (2, 3 or 4) at T1 (p=.94). More boys were in the AA group (87%) than in the AN group (68%, p=.03). Variables significantly different at baseline or showing at least a medium effect size included the Merrill Palmer-Revised (MP-R) developmental index growth score (p=.05, ES=.5), PLS-4 total language SS (p=.007, ES=.7), VABS-II communication SS (p=.056, ES=.5) and ADI-R social domain total score (p=.002, ES=.7). Similar or larger effect sizes were observed at T2 on these variables. MANOVA results indicated parallel paths between the groups for MP-R, PLS-4 and ADI social scores. A trend towards divergent paths was found on the VABS communication score with the AN group having a steeper slope.

Conclusions: These preliminary results revealed that 10% of the children with ASD changed from an ADOS autism diagnosis at T1 (diagnosis/enrolment) to non-ASD at T2, 2-4 years later (age 6). This change could be due to misclassification, or variation in baseline characteristics, or level of services received. In addition, a greater improvement in functional use of communication as reported by the parents for the AN group is seen relative to the AA group. Further research is necessary to understand why these children moved from autism to non-ASD, and to examine the implications of VABS communication scores in relation to change in ADOS classification.

128.004 4 A Prospective Study of Sub-Threshold Autistic-Like Traits In Unaffected Siblings of Children with Autism

Spectrum Disorder. S. Georgiades*[1], P. Szatmari[1], L. Zwaigenbaum[2], S. E. Bryson[3], J. A. Brian[4], W. Roberts[5], I. M. Smith[3], T. Vaillancourt[6] and C. Roncadin[7], (1)*Offord Centre for Child Studies, McMaster University*, (2)*University of Alberta*, (3)*Dalhousie University/IWK Health Centre*, (4)*Bloorview Research Institute* , (5)*University of Toronto*, (6)*University of Ottawa*, (7)*Peel Children's Centre*

Background: Given that autism spectrum disorder (ASD) is influenced by genetic factors, there has been considerable interest in the examination of autistic-like traits/characteristics sometimes seen in relatives. This milder manifestation of familial liability to ASD has been termed the Broader Autism Phenotype (BAP). To date, most studies of the BAP have focused on parents; only a few have examined siblings of children with ASD. Furthermore, these studies are based on retrospective data, raising concerns about measurement limitations including recall bias.

Objectives: The current study employs a high-risk design to prospectively investigate the occurrence of sub-threshold autistic-like traits among "unaffected" infant siblings of older children already diagnosed with ASD.

Methods: The study draws on data from a longitudinal study of younger siblings of children with ASD, who are enrolled and assessed prospectively. Beginning at age 6 months, these "high-risk" siblings are followed with comprehensive developmental assessments at regular intervals. The current study examined autistic-like traits among high-risk siblings who were *not* given a diagnosis at age 3 years ("unaffected sibs") and a low-risk comparison group ("controls") with no family history of ASD. Participants included 170 "unaffected sibs" and 90 "controls", for a total of 260 children. Total scores from the Autism Observation Scale for Infants (AOSI) at age 12 months were used in cluster analysis of the entire sample to identify a distinct sub-group of children with sub-threshold autistic-like traits. Cross-tabulation with chi-square test was used to describe the count of "unaffected sibs" and "controls" in the two clusters. Finally, mean scores from the two clusters were compared on ASD symptoms (indexed by the ADI-R & ADOS), cognitive and adaptive abilities, and social emotional difficulties at 36 months of age.

Results: Two distinct clusters with significantly different scores on the AOSI at 12 months were identified. The two clusters had significantly different counts of "unaffected sibs" and "controls" ($\chi^2_{(1)}$=10.8; p<.01). Cluster 1 consisted of 37 children (14.2% of total sample) with a mean AOSI score of 10. Within Cluster 1, 33 children came from the "unaffected sibs" (19.4% of that group) while only 4 came from the "controls" (4.5% of that group). Cluster 2 consisted of 223 children (85.8 % of total sample) with a mean AOSI score of 2. Within Cluster 2, 137 children came from the "unaffected sibs" (80.6% of that group) and 86 came from the "controls" (95.5% of that group). Compared to children in Cluster 2, children from Cluster 1 had significantly higher scores on measures of social-communication impairment (indexed by ADI-R domains) and internalizing problems, and lower scores on measures of cognitive and adaptive abilities at 36 months of age.

Conclusions: Study findings provide support for the existence of the sub-threshold autistic-like traits in a proportion of high-risk siblings who do not meet criteria for ASD at 36 months of age. These data suggest that such autistic-like traits may arise at a very early age but that these children follow a different developmental course than those high–risk sibs who are subsequently diagnosed with ASD.

128.005 5 Finding the Trees In the Forest: Predictors of Typical and Atypical Outcome Based on ADOS-T Item Analysis at 12 Months. S. Macari*[1], D. Campbell[2], C. A. Saulnier[3], K. Bearss[1], F. Shic[1] and K. Chawarska[1], (1)*Yale University School of Medicine*, (2)*Yale University*, (3)*Yale Child Study Center*

Background:

Prospective monitoring of high-risk infant sibling studies provides a window into the early course of autism spectrum disorder (ASD). Recent studies suggest that infants who go on to develop ASD begin to manifest some symptoms around 12 months of age. The patterns of performance at 12 months that are predictive of either typical or ASD outcomes later in infancy have yet to be identified.

Objectives:

To explore whether clinical outcome at 24 months could be predicted based on performance on ADOS-T items at 12 months.

Methods:

A total of 79 infants (54 males) were assessed with the ADOS-T at 12 (n=79), 18 (n=78), and 24 months (n=79); 48 were at high risk for ASD (HR-ASD) and 31 had no familial risk factors (LR). The ADOS-T is a new module of the ADOS designed for 12-30-month-old infants. At 24 months, a team of experts classified infants as having ASD (n=11), specific developmental delays (SDD), broader autism phenotype (BAP), subthreshold difficulties (SUB), and typical development (TYPICAL; n=28).

To predict the clinical outcome at 24 months, individual ADOS-T items were analyzed using classification tree modeling, an exploratory data analytic technique that makes predictions about group membership. Two types of outcome classifications were considered: (1) TYPICAL (N=28) (children with no clinical concerns between 12-24 months) *versus* CONCERNS (n=43) (children with concerns ranging from mild language delays to ASD); and (2) ASD (n=11) *versus* NON-ASD (n=68) (both typical and atypical presentation but without ASD symptoms).

Results:

The TYPICAL group had a significantly lower ADOS-T Social Affect algorithm score at 12 months (mean=7.1, SD=4.0; $F(1,77)=10.6$, $p<.005$) than the CONCERNS group (mean=10.9, SD=5.5) and the ASD group (mean=18.2, SD=3.3) Classification modeling aimed at separating TYPICAL from CONCERN outcomes at 24 months classified correctly 78% infants in the TYPICAL group based on only 3 items: *showing*, *overactivity*, and *imitation*. The second analysis correctly classified 73% of the ASD group based on their performance on four items at 12 months: *eye contact*, *level of language*, *ignore*, and *pointing*. A higher-functioning subgroup with ASD was predicted by a combination of inconsistent eye contact, no bids for attention during the ignore probe, and no pointing, despite the presence of emerging verbal skills. A lower-functioning ASD subgroup was predicted by the combination of poor eye contact and lack of pointing at 12 months.

Conclusions:

Our analysis suggests that the presence of robust and frequent showing behavior, good object imitation skills, and age-appropriate activity level at 12 months bode well with regard to developmental outcome in infancy. However, limited eye contact, limited spontaneous overtures to others, and the absence of pointing were highly associated with ASD outcome at 24 months. The findings suggest that item-level analysis of performance on the ADOS-T at 12 months can be extremely useful in predicting clinical outcomes at 24 months.

128.006 6 Non-Directed Gesture Use In Infant Siblings at Risk for ASD. S. J. Mitchell*[1], W. Roberts[2], J. A. Brian[3] and L. Zwaigenbaum[4], (1), (2)*University of Toronto*, (3)*Bloorview Research Institute* , (4)*University of Alberta*

Background: Gestures in infancy play a fundamental role in prelinguistic communication and the development of language and play. Early gesture use predicts language outcomes in both typical and atypical development. Our previous work showed that infants who went on to have a diagnosis of ASD showed delayed gesture development by 12-months. Conventionally, three elements, taken together, define a gesture: 1) an action produced with hands, arms, fingers, body or face, that is 2) directed to a person, and 3) serves a communicative function (e.g., requesting objects). However, gesture use in infants at risk for ASD may not contain all components; for example, it is possible that they produce gestures (e.g., point) but do not *direct* them to a person.

Objectives: This study compared directed and non-directed gesture use in 15-month-old infant siblings at risk for ASD (AR-ASD) and infants at low risk (LR) for developmental concerns.

Methods: Sixteen, 15-month old, infant siblings were recruited from a longitudinal study of infants with an older sibling with ASD (AR-ASD, $n = 8$; LR, $n = 8$). The AR-ASD group was selected from the longitudinal study on the basis of having elevated scores on our Autism Observation Scale for Infants (AOSI: Bryson et al., 2008). LR infants were selected on the basis of having passed a parent-reported evaluation of prelinguistic development (*CSBS-DP* ITC; Wetherby & Prizant, 2002) prior to age 15 months. Average scores on the Mullen Scales of Early Learning at 12 months confirmed absence of developmental delays in the LR group. Infants were videotaped during a standardized administration of the *CSBS-DP* (15-20 minutes). Gestures were coded for *directedness*. Directedness included; a) gave or moved an object toward a person, b) touched a person, d) coordinated a gesture with eye gaze or vocalization, or e) produced a gesture in response to a previous statement or action. Directed gestures were also coded by *type* (e.g., deictic) and *function* (e.g., joint attention) although only data on directedness are reported here. Directed (d+) and non-directed (d-) gesture rates (per minute) were calculated for each infant.

Results: Two independent samples t-tests were conducted to evaluate the hypothesis that infants at risk for ASD have a lower rate of d+ gestures and a higher rate of d- gestures than LR infants. AR-ASD infants had a significantly lower rate of d+ gestures, $t(14) = 2.86$, $p<.05$, $d = 1.43$, and a higher rate of d- gestures than LR infants, $t(14) = -2.84$, $p<.05$, $d = -1.42$.

Conclusions: Compared to infants without developmental concerns, 15-month old infants at risk for ASD use directed gestures at a lower rate and more often produce gestures that are not directed to others. These results have important implications for early intervention. Intervention goals may need to include targeting directedness (e.g., adding eye gaze or vocalization to non-directed) to gestures produced in order to increase their saliency by making them more communicative.

This may then impact caregivers' responsiveness to these less clear communicative attempts, thereby increasing the likelihood of their recurrence.

128.007 7 Infants at Risk for ASD Show Aberrant Preferences for Speech Stimuli at 6 and 9 Months. R. Paul*[1], G. W. McRoberts[2], E. Schoen[1], M. Lyons[1] and K. Chawarska[1], (1)*Yale Child Study Center*, (2)*Haskins Laboratories*

Background:

The role played by genetic factors in the incidence of ASD has led to studies of infants siblings of children with ASD, in order to identify earliest-appearing symptoms of the disorders, with the aim of potential early identification. Observations of poor responsiveness to language in older children with ASD suggest the possibility that abnormal attention to language may be one root of the communication deficits in this population. Research in infant speech perception (McRoberts, et al., 2009) has demonstrated that preferences for listening to speech-like sounds change at about 6 months from those based on prosody to those more focused on content.

Objectives:

This study examines differences in preferences for child-directed speech in infants at high and low risk for ASD at 6 and 9 months of age.

Methods:

Participants. High Risk (HR) participants had a full sibling with a validated diagnosis of ASD. Low Risk (LR) infants had no sibling who had received a diagnosis of autism. Infants were seen multiple times during their first year. The present report examines data from the 6 and 9 month visits of HR and LR children. Groups were matched for nonverbal developmental level.

Auditory Preference Procedure. The infants sat on their parent's lap before a video monitor with a speaker below it. The monitor flashed a picture, calling the subject's attention. When the child oriented to the display, an auditory stimulus was played, and continued until the child turned away for at least two seconds, or until the entire trial was completed (15 seconds).

Stimuli. Child-directed (CD) speech vs. Adult-directed (AD) speech: Nursery rhymes were read twice each; once with "motherese" prosody and once with adult-directed prosody. Time spent orienting to the CD vs. AD samples was compared across diagnostic groups.

Results:

In the LR group, there was no evidence of a preference for speech with CD prosody at 6 mo., but there was a preference at 9 mo. This pattern replicates findings for TD children in McRoberts et al., (2009), which indicated that at 6 months infants do not prefer CD based on its prosodic character, but only when it contains high levels of repetition of content words, and return to preferring speech with motherese prosody at 9 months, when structural properties of language input become relevant. For the HR group, this pattern seen in typical infants was reversed; that is, a preference for CDS at 6 months, but not at 9 months.

Conclusions:

Infants at risk for ASD show a different pattern of preferences for CD speech when compared to LR peers. We will argue that this pattern represents a delay on the part of the HR infants, and is congruent with delays in vocal production reported in the literature at the same point in development. The implications of these delays for language acquisition will be discussed.

McRoberts, G.W., McDonnough, C., & Lukusta, L. (2009). The Role of Verbal Repetition in the Development of Infant Speech Preferences From 4 to 14 Months of Age. *Infancy, 14*(2), 162-194.

128.008 8 The Association Between Developmental Risk Status and Early Feeding Patterns. K. O'Loughlin*[1], A. Klin[2] and K. Chawarska[1], (1)*Yale University School of Medicine*, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Feeding practices: a vital physical and psychological aspect of the parent-infant interaction are influenced by an array of factors. Although the presence of a child with Autism Spectrum Disorder (ASD) contributes to a markedly different family milieu than the presence of an unaffected child (Davis & Carter, 2008), there has been little research on the effect of having an older child with Autism Spectrum Disorder (ASD) on the feeding practices employed with younger offspring.

Objectives: This descriptive and exploratory study examines whether a risk status for ASD influences early feeding patterns.

Methods: We analyzed questionnaire data submitted by the parents of 81 infants classified as high risk (HR) or low risk (LR) for ASD. HR infants (N=47) had an older sibling with ASD,

whereas LR infants (N=34) did not. Participants were enrolled in a longitudinal study examining early signs of ASD. Data collected at 12 months included questions on the feeding method (breast, bottle-fed, or both), feeding difficulties, and parental education level. At 24 months, infants were classified based on Mullen, ADOS, Vineland, and CSBS data as likely having ASD (N=12), Broader Autism Phenotype (BAP; N=14), or other specific delays (DD; N=16), or no concerns (N=39).

A chi-square test was used to examine a relationship between risk status (HR or LR) and feeding method (breast/both or bottle). The HR sample was further examined for an association between feeding method and clinical concerns.

Results: HR infants were more likely to be fed exclusively with a bottle (23%) than LR controls (3%), $x^2(1)= 6.55$, p=.01. However, neither group reported feeding difficulties (13% and 21% for HR and LR groups, respectively). No relationship to education level was found.

A comparison within the HR group suggests a significant relationship between feeding method and the presence of clinical concern at 24 months, $x^2(1)=5.49$, p=.02. When separated into 24 month diagnostic categories, HR infants who raised clinical concerns at 24 months were more likely to be exclusively bottle-fed than infants with no clinical concerns, $x^2(6)=10.85$, p=.09 (30%, 36%, 30%, and 0% for the ASD, BAP, DD, and No Concerns groups, respectively).

Conclusions: Results suggest a significant association between risk status and feeding method. HR infants who later exhibited clinical concerns were less likely to be breast-fed (exclusively or in combination with bottle) than LR and HR infants without clinical concerns at 24 months.

While the exact nature of this relationship remains unclear, this study raises questions related to feeding practices in high-risk populations. Some hypotheses potentially explaining this phenomenon include: high stress levels associated with raising an older child with ASD or the influence of previous breast feeding experience with an older child with ASD on parental choices regarding breastfeeding of the younger sibling. In the group that demonstrated a varied degree of developmental difficulties at 24 months, feeding practices may have been influenced by oral-motor or behavioral regulatory difficulties during the neonatal period. We are examining some of these hypotheses both in high-risk and high-density samples; this data will be available in May 2011.

128.009 9 Early Cognitive Trajectories Associated with Autism Spectrum Disorders In A High-Risk Longitudinal Cohort.

J. A. Brian*[1], C. Roncadin[2], S. E. Bryson[3], I. M. Smith[3], E. Duku[4], I. E. Drmic[5], T. McMullen[5], W. Roberts[6], P. Szatmari[4] and L. Zwaigenbaum[7], (1)*Bloorview Research Institute* , (2)*Peel Children's Centre*, (3)*Dalhousie University/IWK Health Centre*, (4)*Offord Centre for Child Studies, McMaster University*, (5)*Hospital for Sick Children*, (6)*Holland Bloorview Kids Rehabilitation Hospital*, (7)*University of Alberta*

Background: As our understanding of autism spectrum disorders (ASD) evolves, so too do diagnostic definitions and conceptualizations of the core and co-occurring conditions. Although not a cardinal diagnostic feature of ASD, cognitive ability can significantly influence daily functioning, response to treatment, school placement, and overall prognosis in ASD (e.g., better outcomes for children with higher IQ). As with many features of ASD, cognitive functioning varies along a continuum from severely impaired to well above average, but little is known about the early developmental trajectories of cognitive functioning in ASD. Identification of trajectories predictive of later diagnosis can enhance our understanding of the mechanisms underlying the emergence of developmental challenges in children with ASD, and may in turn guide the development of screening methods, program planning and focused early interventions.

Objectives: To examine and compare cognitive trajectories across developmental domains from 6 to 36 months in high-risk infants/toddlers later diagnosed with ASD, relative to high-risk infants with no ASD, and low-risk controls.

Methods: 239 younger siblings of children with ASD (hereafter, 'high-risk sibs') and 90 low-risk controls received cognitive assessment at 6, 12, 24 and 36 months of age, using the Mullen Scales of Early Learning (MSEL). MSEL Early Learning Composite (ELC) standard scores are presented here.

Results: Semi-parametric group-based modeling identified 3 distinct developmental trajectories in MSEL-ELC: (1) average-to-high average performance throughout the assessment interval, with a slight increase over time; (2) solidly average performance across time; and (3) marked decline in standard scores from the average to the intellectually disabled range by age 2, and persisting to age 3. Trajectory group membership was a significant predictor of 36-month diagnostic status (χ^2 = 117.84; $p < .001$); ASD sibs were most highly represented in MSEL Trajectory groups 3 (44%) and 2 (40%). Non-ASD sibs were most likely to be members of Trajectory groups 1 (65%) or 2 (31%), and the vast majority of controls were in group 1 (83%); none were in group 3. Language and nonverbal cognitive skills appear to play the greatest role in defining these

trajectories. Specifically, the declining trajectory (3) appears to be attributable mostly to declining performance in Visual Reception and Receptive and Expressive Language scores across age. Gross Motor development remained relatively consistent across time for all Trajectory groups, and Fine Motor performance followed a u-shaped curve, with slight improvements for all groups at 12 months and a slight drop for all at 24 months.

Conclusions: A pattern of decreasing cognitive abilities between 12 and 24 months is highly predictive of a diagnosis of ASD at age 3. However, it is important to underscore that 40% of high-risk infants later diagnosed with ASD, and 96% of high-risk siblings with no diagnosis of ASD had average-to-high-average cognitive abilities, as measured by the MSEL-ELC, that were stable over this period.

128.010 10 Early Attentional Abilities Are Stable In Infant Siblings of Children with An Autism Spectrum Disorder (ASD). L. V. Ibanez*[1], W. L. Stone[2], N. V. Ekas[3], W. Gealy[3] and D. S. Messinger[3], (1)*University of Washington Autism Center*, (2)*University of Washington*, (3)*University of Miami*

Background:

In the first year of life there are rapid changes in the development of attention. Both dyadic and triadic attention have been examined as early markers of Autism Spectrum Disorder (ASD) in the at-risk infant siblings of children with an ASD (ASD-sibs). Studies comparing ASD-sibs and infant siblings of typically developing children (COMP-sibs) have, however, yielded conflicting results. This study examined dyadic and triadic attention between six and nine months in ASD-sibs and COMP-sibs to identify the stability of these skills in each group. This information paves the way for understanding future development in these infants.

Objectives:

To compare: 1) the stability of early dyadic attention, 2) the stability of triadic attention, and 3) mean group differences in these abilities among ASD-Sibs and COMP-Sibs.

Methods:

Seventeen ASD-sibs and twenty COMP-sibs participated at six and nine months. Dyadic attention was measured in the Face to Face-Still-Face Protocol (FFSF) at six and nine months. In the FFSF, parents were instructed to play normally with their infant, hold a still-face, and then resume play. Dyadic attention was indexed as the rate per minute of infants' gaze shifts at and away from the parent's face. Triadic attention was measured in the Early Social Communication Scales (ESCS) at six and nine months. In the ESCS, an examiner plays with the infant in a semi-structured interaction. Triadic attention was measured as the rate per minute of infants' initiating joint attention bids.

Results:

Among ASD-sibs, there was a significant association between rates of gaze shifts at six and nine months, $r = .65$, $p = .02$; this association was not significant for COMP-sibs, $r = .15$, $p = .57$. Among ASD-sibs, there was also a significant association between rates of initiating joint attention at six and nine months, $r = .51$, $p = .04$; again, this association was not significant for COMP-sibs, $r = .28$, $p = .24$. There were no group differences on either measure at either age.

Conclusions:

Among ASD-sibs**,** both rate of gaze shifting toward and away from the parent's face and rate of initiating joint attention with an examiner were stable across a three-month period; neither behavior showed stability among COMP-sibs. While ASD-sibs and COMP-sibs did not differ on mean levels of dyadic and triadic attention, only ASD-sibs exhibited significant stability. The lack of significant stability demonstrated by COMP-sibs may reflect dynamic development, characterized by transformation and reorganization. Conversely, ASD-sibs at the same chronological age may be undergoing static development, characterized by continuity and stability. This suggests a endophenotype that tethers attentional behaviors and limits the range of developmental pathways available to at-risk infants in both dyadic and triadic contexts. The current findings have important implications for those ASD-sibs who have lower levels of dyadic or triadic attention at six months because they continue to show lower levels of these abilities at nine months. We will continue to examine the stability of dyadic and triadic attention at later ages to further explore this hypothesis.

128.011 11 Two Year Outcome and Developmental Progress of Toddlers with Autism Spectrum Disorders (ASD) Receiving Early Intervention. R. Choueiri*[1], S. Wagner[2], S. Mangan[1] and E. Perrin[2], (1)*Floating Hospital for Children*, (2)

Background: Intensive treatment in toddlers with ASD is associated with clinical improvement. However, in clinical practice, we sometimes see toddlers receiving little therapy

make progress while others receiving intensive therapy make less progress

Objectives: We compared the developmental progress of toddlers with ASD receiving variable hours of treatment over 2 years.

Methods: Seventeen children with an ASD, ages 26 and 32 months, were followed every 6 months for 2 years. All received baseline assessments with the Autism Diagnostic Observation Schedule (ADOS), Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales (VABS) and Pervasive Developmental Disorders Behavior Inventory (PDDBI) . Intensive treatment at 20 hours a week was recommended for all. At follow-up, all received the MSEL, VABS, PDDBI and ADOS.

Results: 3 girls and 14 boys with mean age of 28.8 months were followed for 2 years. At baseline assessment, 10 met criteria for Autism and 7 for PDD,NOS on the ADOS; This table shows the mean scores and range of the Early Learning Composite (ELC) scores on the MSEL,the PDDBI autism index T-scores and Behavior Adaptive Composite Scores (ABC)at baseline and at 2 years follow-up.

At the 2-year follow-up: Three children changed ASD diagnoses: 2 from Autism to PDD,NOS and one lost his ASD diagnosis .

	Baseline Mean scores (Range)	2 years Follow-up Mean Scores (Range)
MSEL	72.2 (49-111)	86 (49-150)
PDDBI Autism Index scores	46.8 (36-61)	37.9 (18-67)
VABS	78.8 (58-93)	85.8 (50-109)

Positive trends, indicating improvement, were observed on all scores in all children. No significant correlation (r=0.02; p=0.93) was found between cumulative total number of hours and change scores on the ELC, ABC, Autism index scores, or the ADOS scores using the Spearman Corelation test. Individual baseline visual motor scores on the MSEL were found to correlate significantly with ADOS change scores (r=0.6;p=0.009).

Conclusions: These data suggest that greater intensity of treatment does not necessarily lead to more clinical improvement in toddlers with ASD. Further data collection with larger samples is needed and is underway to better clarify these associations and to identify the elements that are important in treatment response.

128.012 12 Examining Early Developmental Trajectories for Children with and without Parent-Reported Skill Regression. C. E. Ray-Subramanian*[1] and S. Ellis Weismer[2], (1)*Waisman Center, University of Wisconsin-Madison*, (2)*University of Wisconsin-Madison*

Background: Roughly 20 - 30% of parents of children with ASD report that their child experienced a loss of previously acquired language skills (Jones & Campbell, 2010; Meilleur & Fombonne, 2009). Findings have been somewhat inconsistent as to whether developmental regression in ASD is associated with different autism symptomatology or skill profiles as compared to children with non-regressive ASD (Jones & Campbell, 2010; Meilleur & Fombonne, 2009; Rogers, 2004). Much research in this area has relied on parent reports made after early childhood, which can lead to parents reporting developmental milestones being achieved at later ages than they actually occurred (Lord et al., 2004; Luyster et al., 2005). Therefore, there is a need for further investigation of developmental regression in ASD utilizing parent reports during early childhood and examining longitudinal associations between different types of skill loss and developmental outcomes.

Objectives: The objective of this study was to examine parent-reported developmental regression on the ADI-R Toddler version and its association with language skills, nonverbal cognition, and autism severity at ages two and five.

Methods: Participants were 114 children (mean age at Time 1 = 31 months) with ASD who are part of a larger study of early language development. Best estimate diagnoses were determined at Time 1 using comprehensive diagnostic evaluations that included the ADOS or ADOS-Toddler and a Toddler version of the ADI-R. Measures used in the current study (ADOS; Mullen; Preschool Language Scale-4th Edition) were drawn from Time 1 for all participants and, for a subset of children, a subsequent visit three years later (mean age at Time 2 = 68 months).

Results: 27% of participants had a parent-reported language loss of 3 or more words for at least 1 month. Approximately 20% had a clear loss of other skills (e.g., social engagement, play skills). Children with language loss spoke their first words

at a significantly earlier age (mean = 15 months) than children with no language loss (mean = 21 months; $t = 4.83$, $p < .001$). Among children with language loss, the majority also lost vocal imitation skills and/or communicative intent. Among those who lost other skills, most children lost social engagement/responsiveness. Language or other skill regression did not predict performance on the Mullen, PLS-4 or ADOS at Time 1. Preliminary analyses indicate loss of communicative intent was associated with higher ADOS severity scores at Time 2.

Conclusions: Consistent with previous research, children with ASD who experience language regression begin talking earlier than their peers with ASD who do not have a loss. Although differences between the two groups in language skills, nonverbal cognition, and autism severity were not present at age 2, some differences may emerge by age 5. This research can improve our understanding of the significance of early regression for developmental trajectories in ASD.

128.013 13 Developmental Regression In the Simons Simplex Collection. R. P. Goin-Kochel*[1], A. N. Esler[2], S. M. Kanne[3] and V. Hus[4], (1)*Baylor College of Medicine*, (2)*University of Minnesota*, (3)*Thompson Center for Autism and Neurodevelopmental Disorders*, (4)*University of Michigan*

Background: It is generally recognized that the development of autism spectrum disorders (ASD) is not uniform across children. Currently, two patterns of ASD onset are cited: *early onset*, which is characterized by delays and/or unusual patterns of development from birth or shortly thereafter, and *regressive onset*, in which children experience a period of seemingly typical development, followed by a loss of previously acquired skills. Regressive onset has been reported in approximately one third of children with ASD. However the duration of loss, the types of skills lost, and the length of time that children had the skills prior to losing them are variable. The "gold standard" for assessing regression has been parent report, and the *Autism Diagnostic Interview—Revised* (ADI-R) is a commonly-used measure for this purpose. Recently, additional questions were created to capture subthreshold skill losses that do not meet the original ADI-R criteria for full losses. New prospective studies suggest that a majority of children with ASD experience regression, particularly in social engagement, but this is often missed by current ADI-R questions. The expanded questions may allow detection of more subtle losses that would not have been captured previously.

Objectives: (a) To provide descriptive information about the types and duration of skill losses among a large sample of children with ASD; (b) To determine whether children differ in terms of cognition, communication, indices of adaptive functioning, and/or ASD symptom severity based on whether they experienced full, subthreshold, or no skill losses.

Methods: Data from the Simons Simplex Collection (SSC; https://sfari.org/simons-simplex-collection) were analyzed for probands with ASD who received both the ADI-R and the expanded loss insert ($N = 1657$). Frequencies of regressions were calculated by type of skill loss and whether they were full losses, as defined by the original ADI-R questions, or subthreshold losses detected by the expanded questions. T-tests were used to compare ages of onset for and duration of full and subthreshold losses. One-way ANOVAs were computed to determine effects of type of loss (full, subthreshold, no loss) on cognition, communication, indices of adaptive functioning, and ASD severity.

Results: Full losses were experienced by 17.1% for language and by 28.8% for other skills, whereas an additional 11.7% experienced subthreshold losses in language and 3.1% in other skills. Subthreshold losses appeared at significantly later ages than full losses. While the duration of other-skill losses was significantly longer for subthreshold losses than full losses, this was not the case for language losses. Children who experienced any degree of loss scored significantly lower than those without loss on indices of cognition, communication, and adaptive functioning but not ASD severity.

Conclusions: The original ADI-R questions may not capture subtle regressions or other, non-word language losses. While the expanded questions increased the number of regressions detected, regressive onset continued to be reported less frequently than early onset. Future research should (a) compare the expanded loss-insert questions prospectively with observational data to further explore their accuracy and (b) examine the influence of any degree of loss on developmental outcomes.

128.014 14 Characteristics of Developmental Regression In Autism Spectrum Disorders. L. D. Nations*, M. A. Pericak-Vance and M. L. Cuccaro, *John P Hussman Institute for Human Genomics*

Background: Autism spectrum disorders (ASD) are characterized by significant social, communicative, and behavioral impairments. A substantial number of individuals with ASD experience developmental regression (DR). DR is defined as the loss of previously established speech and/or other skills, which had been present for at least 3 months before the age of 36 months. The prevalence of DR in ASD

ranges from 15% to 47%. The relationship of DR to other features of ASD is not clear. Defining clinical features associated with DR will facilitate identification of a distinct ASD-DR phenotype and enhance both research and clinical efforts.

Objectives: The primary aim of this study is to define the nature and scope of associated features and behavior problems in children with ASD and DR vs. those with ASD only. We hypothesize that children with ASD and DR will show more behavior problems across several measures.

Methods: 499 participants between the ages of 4 and 21 years of age with ASD were identified from a larger dataset of individuals participating in a genetic study of ASD. These participants had a mean age of 9 years (SD=4.4) at study entry and were predominantly male (86%). As part of a standard clinical protocol, all participants were assessed with the ADI-R, Aberrant Behavior Checklist (ABC), Repetitive Behavior Scales (RBS), Social Responsiveness Scale (SRS), and Vineland Adaptive Behavior Scales (VABS or VABS-II). DR was defined as the presence of language or behavioral regression based on a positive score (1 or 2) on any ADI-R regression item. An individual was classified as DR if they were positive for either language regression or behavioral regression. We did not include individuals who experienced regression with illness in either group. The ASD and DR subset (ASD-DR) consisted of 160 individuals (32%); the remaining 339 ASD individuals (68%) did not have DR. We conducted multivariate analysis of variance adjusting for age at ADI-R and developmental level as measured by the VABS/VABS-II.

Results: The two groups did not differ with respect to sex. The MANOVA, adjusted for age and developmental level, showed that the ASD-DR and ASD only groups differed significantly on the dependent measures (Wilks' λ=0.944, $F(11,477)=2.58$, $p=0.003$). Examination of univariate tests indicated that the ASD-DR group had significantly higher (greater impairment) mean scores on the ABC Lethargy scale ($p=0.04$) and Inappropriate Speech scale ($p=0.02$). The ASD-DR group also had a significantly higher mean RBS total score ($p=0.04$) indicating more frequent repetitive behaviors. Finally, the ASD-DR group had more autism symptoms as noted in significantly higher scores for the Reciprocal Social Interaction ($p<0.001$), Nonverbal Communication ($p=0.01$), and Repetitive Behavior ($p=0.04$) domains on the ADI-R.

Conclusions: The presence of DR in ASD appears to be associated with increased impairments in both autism symptoms and associated features. The increased prevalence of these symptoms and behavior problems suggests that ASD and DR may represent a meaningful subgroup for further study. Understanding the range of behaviors associated with DR can help elucidate the biological underpinnings of DR in ASD as well as highlight potential therapeutic targets.

128.015 15 Patterns of Early Skill Attainment and Loss In Young Children with Autism. A. Thurm*[1], S. Shumway[1] and D. Luckenbaugh[2], (1)*National Institutes of Health - National Institute of Mental Health*, (2)*National Institute of Mental Health*

Background: Recent emphasis on early diagnosis has led to focused attention on the development of symptoms of ASD, including "when" and "how" symptoms unfold (e.g. as overt symptoms, loss of previously gained skills). However, few studies examining onset and skill loss have provided systematic descriptions of pre-loss skill attainment, including specific ages of skill attainment for social-communicative skills.

Objectives: The purpose of this study was to extend the literature on the ontogeny of ASD by examining the attainment and loss of specific socio-communicative skills in the early years. Reports of ages for skill attainment and loss were used to answer the question: at what age do children with ASD diverge from children with developmental delays and typical development in attainment of early socio-communicative skills?

Methods: Participants included 244 children: 125 autism (AUT; mean age at parent interview = 48.6 months), 42 Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS; 48.0 months), 46 non-spectrum Developmental Delay (DD; 43.3 months), and 31 typical development (TD; 52.4 months). The Regression Validation Interview-Revised (RVI), a parent interview, was used to obtain precise ages of skill attainment and loss of 15 specific socio-communicative skills.

Results: Kaplan-Meier survival analyses indicated that the TD group developed all skills significantly earlier than AUT, and all skills except smiling to mom/dad significantly earlier than PDD-NOS and DD. The AUT group had the largest percentage of children with any skill loss (63%), followed by PDD-NOS (60%), DD (24%), and TD (3%). Loss of eye contact, pointing to express interest and waving bye-bye were all reported in over 50% of children with AUT who had gained those skills. Only 5% of children in the AUT group attained all 15 skills, and only one child of the 125 in the AUT group acquired and then lost all 15 skills.

A linear mixed model examining the pattern of skill acquisition and loss from birth to 30 months indicated significant main effects for group ($F=920.92$, $df=3,3239$, $p<.001$) and time

(F=278.80, df=29,254, p<.001) as well as a significant interaction (F=21.39, df=87,257, p<.001). Post hoc tests indicated that TD were reported to have significantly more skills compared to the AUT, PDD-NOS, and DD groups from 2-30 months. In addition, the DD group began to have significantly more skills compared to AUT and PDD-NOS at 14 and 18 months, respectively, with significant differences remaining through 30 months. The PDD-NOS group had significantly more skills than the AUT group at 21 months and from 24 to 30 months.

Conclusions: This study contributes to answering the specific question of "when" divergence from typical development occurs in ASD, with findings indicating early in the first year of life. Results reveal that loss was quite common in ASD; however, the number and type of skills lost were variable. Children with varying degrees of skill attainment showed similarly varying degrees of skill loss, and children with even very few skills attained also were reported to lose skills. Findings indicate that symptom onset and regression in ASD may be best represented as a continuum.

128.016 16 Investigation Into the Genetics of Regression In Autism: Concordance Rates of Regression Obtained From the Autism Genetic Resource Exchange (AGRE) Database. K. R. Dobkins*[1], Y. Zhang[2] and J. N. Constantino[2], (1)*University of California, San Diego*, (2)*Washington University School of Medicine*

Background:

Autism is a pervasive developmental disorder with a strong genetic component, which is supported by results from twin studies (e.g., Bailey et al, 1995) and genome-wide association studies (see Abrahams & Geschwind, 2008). There is believed to be a type of autism, *regressive* autism, which accounts for roughly 20% of autism cases (e.g., Lord et al, 2004, based on parent report from the ADI-R), wherein an infant attains, and then loses, language and/or social skills. With rare exception (see genetic studies by Molloy et al. 2005), whether regression in autism also has a genetic component has yet to be investigated.

Objectives:

To investigate a genetic component in regressive autism by determining whether observed *concordance rates* for regression between sibling pairs with autism is greater than would be expected by chance.

Methods:

The data for our analyses came from the Autism Genetic Resource Exchange (AGRE) database. It included families who have two biological siblings who met criteria for an Autism Spectrum Disorder (i.e., Autism, Not Quite Autism or Broad Spectrum) based on the ADI-R (2003), parent report. The total number of sibling pairs were 451 (total subjects = 902), separated into three subject groups: (1) 24 monozygotic (MZ) twin pairs, (2) 49 same gender dizygotic (DZ) twin pairs, (3) 378 same gender non-twin pairs. Individuals were considered as having regressed if their parents said "yes" to questions 11 (language regression) or 25 (social regression) on the ADI-R. Observed concordance rates (i.e., both siblings regressed or both siblings did not regress) were compared to rates that would be expected by chance, using actual regression rates and binomial statistics. Analyses were conducted on four different regression categories: (A) either language or social, (B) only language, (C) only social, or (D) both types.

Results:

Across all 902 subjects, the mean rates of regression were 28.6%, 17.4%, 21.4% and 10.1% for the four different regression categories, A, B, C and D, respectively. Of 12 analyses (3 subject groups x 4 regression categories), only MZ twins showed concordance rates that were significantly greater than chance. Among MZ twins, greater-than-chance twin concordances were observed exclusively for category A (observed concordance rate = 75.0%, chance concordance rate = 51.1%, p = 0.02) and C (observed concordance rate = 83.3%, chance concordance rate = 58.4%, p = 0.01). The corresponding concordance rates for DZ twins (category A = 67.3%, category C = 67.3%), and non-twin siblings (category A = 61.4%, category C = 69.6%) did not exceed what would be predicted by chance.

Conclusions:

Although the higher concordance rate observed in our small sample of MZ twins suggests a possible component of genetic influence on regression, the fact that neither same gender DZ twins nor non-twin siblings exhibited concordance rates that differed significantly from chance suggests that genetic effects are likely limited and complex. Regression as measured by the ADI-R may be substantially influenced by non-genetic factors, and efforts to study inherited influences on regressive autism may require alternate methods and approaches to refine characterization of this phenotype.

128.017 17 Narratives Abilities In Optimal Outcome Children with a History of Autism Spectrum Disorders. J. Suh*[1], I. M. Eigsti[1], M. Barton[1], K. E. Tyson[1], A. Green[1], M. A.

Rosenthal[1], E. Troyb[1], M. Helt[1], A. Orinstein[1], R. T. Schultz[2], M. C. Stevens[3], E. A. Kelley[4], L. Naigles[1] 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 the current study was to analyze the narrative ability of individuals who have achieved “optimal outcome” (OO) and compare it to the narrative ability of individuals with high-functioning autism (HFA) and typically developing (TD) children to investigate whether OO individuals continue to maintain more subtle pragmatic language deficits.

Methods: The “Tuesday” narrative from the Autism Diagnostic Observation Scale (ADOS) was collected from 45 participants (n = 15 per group), who were matched on age gender, 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]. Results from n = 15 (mean age= 13.3, range=12.2-14.6; VIQ [*M (SD)*= 107.2 (18.6), 104.4 (19.1), and 109.6 (9.56) for OO, HFA, and TD respectively, p=.88]), have been transcribed and analyzed by coders naive to diagnosis. Based on prior research (Kelley et al., 2006; Capps et al., 2000) a set of narrative qualities were targeted for analysis: length of narrative (i.e., mean number of words, utterances); lexical richness (i.e., number of different adjectives, and type-token ratio); production of emotion words and mentalizing terms; stereotyped or idiosyncratic use of language; and dysfluency (i.e., false starts, repetitions, and self-corrections).

Results: The three groups produced narratives of similar length [*M(SD)* = 26.2 (7.1), 27.0(4.8), 29.0 (8.4) for OO, HFA, and TD, respectively; p = .81]. Controlling for total number of words in the narrative (which differed considerably across individuals, though not across groups), there were striking differences in fluency. Specifically, the HFA group produced significantly more dysfluencies [*M(SD*) = 17(11)] than either the OO or TD groups [*M(SD*) = 4.0(4.2) and 4.3(4.3), respectively]. Because of the preliminary sample size, potential trends on other narrative characteristics did not reach significance.

Conclusions**:** Because pragmatic and discourse features of language are among the most universal and clinically impairing in individuals with HFA, it is important to establish whether these abilities continue to show subtle impairments in individuals with optimal outcomes. Preliminary results indicate that adolescents with HFA produce narrations that are characterized by significant dysfluency; in contrast, individuals with an optimal outcome are indistinguishable from their TD peers. Ongoing analysis with a larger sample will establish the robustness of this finding. Furthermore, analyses will continue to explore whether OO, HFA, and TD individuals exhibit differences in other narrative qualities. In addition to expanding the sample size, analyses will examine the degree to which pragmatic and discourse language abilities (e.g., narrative qualities) are distinct from grammatical and structural language skills (e.g., CELF scores).

128.018 18 Restricted and Repetitive Behaviors In Children and Adolescents with ASDs Who Have Achieved Optimal Outcomes.

E. Troyb*[1], A. Orinstein[1], K. E. Tyson[1], M. Helt[1], M. A. Rosenthal[1], I. M. Eigsti[1], E. A. Kelley[2], M. C. Stevens[3], R. T. Schultz[4] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Queen's University*, (3)*Institute of Living, Hartford Hospital / Yale University*, (4)*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 past and present restricted and repetitive behaviors (RRBs) of children and adolescents who achieved OO.

Methods: Parents of 30 individuals who achieved OO (M(age) =13.1) completed the Autism Diagnostic Interview-Revised (ADI-R) and their past and present ratings of items relating to RRBs were compared to parent responses of 27 high functioning individuals with a current ASD diagnosis (HFA, M(age) = 12.8). Codes for items on the ADI-R range from 0 to 3; higher scores indicate the presence of more severe or frequent behaviors. Additionally, 22 individuals in the OO group, 21 individuals in the HFA group and 21 typically-developing (TD) peers (M(age) = 13.4) were compared on the number of items endorsed by parents on subtests of the

Repetitive Behavior Scale-Revised (RBS-R). The RBS-R measures current RRBs and consists of six subtests: *Stereotyped Behavior* (6 items), *Self-Injurious Behavior* (8 items), *Compulsive Behavior* (8 items), *Ritualistic Behavior* (6 items), *Sameness Behavior* (11 items), and *Restricted Behavior* (4 items). The groups were matched on age, gender and nonverbal IQ; however the groups differed significantly on verbal IQ (M(HFA)=103.7, M(OO)=113.2, M(TD)=113.7, p<.05).

Results: Parent responses to ADI-R items indicated that individuals in the HFA group exhibited significantly more circumscribed interests (current: M(HFA)=1.33, M(OO)=0.43, p<.05; past: M(HFA)=1.81, M(OO)=1.20, p<.05) and insistence on sameness behaviors (current: M(HFA)=0.59, M(OO)=0.20, p<.05; past: M(HFA)=1.22, M(OO)=0.53, p<.05) than did individuals in the OO group both currently and in the past. When comparing the number of items endorsed by parents on subtests of the RBS-R, the OO group exhibited significantly more ritualistic behaviors, insistence on sameness behaviors and restricted behaviors than did the TD group. Parents of the individuals in the HFA group endorsed significantly more items on each subtest of the RBS-R than did the individuals in the OO and TD groups (all *p's*<.05; *Stereotyped Behavior*: M(HFA)=2.35, M(OO)=0.52, M(TD)=0.11; *Self-Injurious Behavior*: M(HFA)=0.91, M(OO)=0.15, M(TD)=0.05; *Compulsive Behavior*: M(HFA)=1.48, M(OO)=0.50, M(TD)=0.05; *Ritualistic Behavior*: M(HFA)=2.69, M(OO)=1.23, M(TD)=0.01; *Sameness Behavior*: M(HFA)=3.77, M(OO)=1.05, M(TD)=0.01; *Restricted Behavior*: M(HFA)=1.61, M(OO)=0.50, M(TD)=0.05).

Conclusions: The results of this study suggest that individuals who achieved OO exhibited fewer RRBs throughout development than did individuals who retained their ASD diagnosis. Individuals who achieved OO continue to exhibit mild symptoms of RRBs more frequently than is seen in typical development. However, further research is needed to support these conclusions, including studies that involve larger samples and RRB ratings that are not based exclusively on parent report.

128.019 19 Development of Restricted and Repetitive Behaviors In Autism Spectrum Disorders From Childhood to Adulthood. J. Richler*[1], S. L. Bishop[2] and C. Lord[3], (1)*Department of Psychological & Brain Sciences*, (2)*Cincinnati Children's Hospital Medical Center*, (3)*University of Michigan*

Background:

Over the past several years, numerous studies have reported improvements in restricted and repetitive behaviors (RRBs) as individuals with autism spectrum disorders (ASD) enter adulthood. These studies have yielded important findings, but are limited by aspects of their design, including reliance on retrospective parent report and use of cross-sectional data to make inferences about how behaviors change over time.

Objectives:

The primary aim of the present study is to learn more about the development of RRBs in ASD from childhood to adulthood. The study uses a longitudinal sample of children diagnosed with ASD at a very young age and repeatedly assessed throughout childhood and into early adulthood. The fact that the same individuals underwent repeated assessments using the same measures, and that parents were asked to report about their children's *current* behaviors, allows us to make stronger conclusions about how RRBs change over time in ASD.

Methods:

Data were collected as part of a longitudinal study of toddlers referred for possible autism. Children were seen at approximately 2, 3, 5, 9, and 18 years of age. At each wave, children completed a battery of cognitive and diagnostic measures. Parents completed several questionnaires and interviews. RRB data for this study were obtained from the Autism Diagnostic Interview-Revised. At all waves (except the age 3 assessment), each child was assigned a consensus best-estimate clinical diagnosis of ASD (autism or pervasive developmental disorder-not otherwise specified) or a non-spectrum developmental disorder. Of the 161 children diagnosed with ASD at age 2, data are currently available for 78 participants. Data for approximately 20 additional participants will be available shortly.

Results:

Most behaviors were present in a substantial proportion of the young adults. Prevalence rates ranged from 22% for *unusual preoccupations* to 54% for *unusual sensory interests* and *hand/finger mannerisms*. Consistent with previous studies, there was also abatement of all RRBs over time; substantial proportions of those who had reportedly exhibited a behavior at one or more of the previous waves no longer exhibited that behavior at age 18. Rates of abatement ranged from 31% for *circumscribed interests* to 89% for *resistance to trivial changes in the environment.* For nearly all behaviors, those who showed abatement at age 18 had higher non-verbal IQ scores at age 2 than children who did not show abatement, but the only

statistically significant result was for *unusual sensory interests,* $t(70) = -2.4$, $p < .05$.

Conclusions:

These initial findings provide further evidence for improvement in RRBs as individuals with ASD enter adulthood. Abatement may be associated with higher early NVIQ scores; this relationship requires further examination. Further analyses will examine RRBs subtypes (e.g., 'repetitive sensorimotor' versus 'insistence on sameness'). We will determine whether trajectories of RRB development vary depending on the RRB subtype, and whether individual variables (e.g., IQ) predict patterns of change in RRB subtypes over time. Findings from the present study will have implications for the identification of subtypes of ASD based on RRB trajectories, and for our understanding of the prognosis of RRBs for different subgroups.

128.020 20 Parent Report of ASD Symptom Change In Children From Multiplex Families. K. Ankenman*, S. J. Webb, R. T. Lowy, R. A. Bernier and E. M. Wijsman, *University of Washington*

Background:

Genetic studies of autism spectrum disorders (ASD), as well as other disorders, rely on gold standard diagnostic criteria that are assessed at one time point. In autism research, the ADI-R and/or ADOS are used to confirm a diagnosis of ASD. While empirical results suggest that the diagnosis of autism spectrum disorders is stable over time in children who are diagnosed at a young age (Lord, et al., 2006), symptom levels and, therefore, specific DSM criteria may be less stable over time.

Objectives:

Change in diagnostic symptom level may be an important variable to consider in long-term genetic studies of autism. The objective of this project is to assess changes in parent report of diagnostic symptom levels in children with ASD who participated in two studies at the University of Washington.

Methods:

The Family Study of Autism (1998 – 2006) enrolled families with two or more children with diagnosed or suspected autism aged 3 to17 years. Diagnoses of ASD were confirmed using the gold standard diagnostic criteria of the ADOS and ADI-R. Families are presently being re-contacted to participate in the Family Traits Research Project (2010 – present; data collection is ongoing) in which current functioning of children diagnosed with ASD is being measured using the Social Communication Questionnaire (SCQ), a questionnaire based on the ADI-R. Descriptive data about these children includes their sex, IQ, age at diagnosis, specific DSM diagnosis, and SCQ-current score. We are analyzing differences in those who continue to (or do not continue to) meet ASD phenotype cutoffs on the SCQ. Also, parent report of item scores on the SCQ are being compared to their corresponding items on the ADI-R to determine trends of growth in specific domains (social interaction, communication, and restricted/repetitive interests/behaviors) for these children.

Results:

The average time between assessments was 8 years (range 5-12 years). Preliminary data from a subset of the sample suggest that approximately 52% of children diagnosed with ASD scored at or above the cutoff (greater than 15) on the SCQ, confirming symptom levels corresponding to the autism phenotype. Of the 42% of children who did not meet the SCQ cutoff, scores were evenly distributed from 3-13, indicating that many parents perceive significant changes in their children's ASD symptoms over time.

Conclusions:

As our sample size increases, we predict significant stability in symptom level for children who at time of diagnosis were: (1) older and (2) had more severe symptoms. Preliminary analyses suggest that parent's perception of autism symptoms may significantly change during childhood, adolescence, and early adulthood. While presented samples sizes are small, additional investigation of parent report and observational evaluations are warranted for children in multiplex families. Quantifiable change in autism traits may be an important variable for analysis.

128.021 21 Transition of Young Adults with Autism Spectrum Disorder. N. Gillan*[1], C. M. Murphy[2], D. Robertson[3], D. Spain[4], M. J. Doyle[5], E. Wilson[6], C. Ecker[7], E. Daly[8], V. D'Alemeida[6] and D. G. Murphy[7], (1), (2)*King's College London, Institute of Psychiatry*, (3)*south London & Maudsley NHS Trust*, (4)*King's College London, Institute of Psychiatry,*, (5)*Institute of Psychiatry*, (6)*King's College London*, (7)*Institute of Psychiatry, King's College London*, (8)*Institute of Psychiatry, Kings College London*

Background:

To date there have been few studies of the transition from child to adult healthcare among young people with autism spectrum disorder (ASD.

Objectives:
To investigate the transition of young adults with an ASD from child to adult services.

Methods:
We reviewed adults aged 18-23 years diagnosed with ASD at a specialist tertiary referral clinic during a 6 month period for evidence of planned transition from child to adult health services. ASD was diagnosed using the Autism Diagnostic Interview-Revised (ADI-R) or Autism Diagnostic Observation Schedule (ADOS).

Results:
50% of those diagnosed with ASD had been previously known to child and adolescent mental health services (CAMHS). Of these, none had experience a planned transition to an adult mental health services. Yet, all of those previously known to CAMHS reported a lack of current friendships; 93% experienced educational difficulties (e.g. dropping out of university), 85% required daily support with adaptive behaviours, 20% had been homeless, 20% had acquired a forensic history, 12% had been sexually exploited, and 12% had a drug and alcohol problem

Conclusions:
Preliminary results suggest that young adults with ASD are poorly transitioned from children to adult health services and the findings suggest that they are highly vulnerable to difficulties as they move into adult life. This has significant health and economic implications. We plan to present data from a larger 12 month sample at the conference investigating the transition of young adults with ASD and associated co-morbid difficulties.

128.022 22 Complex Autism and Clinical Severity In the Simons Simplex Collection (SSC). M. Lasala*[1], C. M. Brewton[2], C. P. Schaaf[2] and R. P. Goin-Kochel[2], (1), (2)*Baylor College of Medicine*

Background: Grouping children with Autism Spectrum Disorders (ASDs) into phenotypically distinct categories creates homogeneous subgroups for studying etiological mechanisms. One way to classify ASDs is by dysmorphic features. In the presence of dysmorphology, ASDs are classified as “complex,” while in the absence of dysmorphology, “essential.” The latter is heritable but not necessarily associated with known medical/genetic syndromes. The *Autism Dysmorphology Measure* (ADM) is a tool that standardizes the evaluation of dysmorphology across individuals with ASD. Using the ADM, a clinician evaluates 12 body areas for physical anomalies, then compares the results to the individual’s neurotypical family members. Anomalies are recorded along a hierarchical algorithm, which leads to the classification of dysmorphic or nondysmorphic (Miles et al., 2008). Prior work has found an inverse relationship between number of anomalies and cognitive functioning scores (Miles et al., 2005). However, it is unclear whether a comparable relationship exists between dysmorphology and autism severity, as measured with the Calibrated Severity Score (CSS; Gotham et al., 2009). Understanding whether such an association exists would clarify whether an individual’s ASD is linked with dysmorphic traits.

Objectives: To determine whether a relationship exists between dysmorphology and CSS among children with ASD.

Methods: Participants are children with ASD from the Simons Simplex Collection (SSC). All received diagnoses of ASD via research-reliable administrations of the ADI-R and ADOS, and all data of interest have been collected. Currently there are 1,887 probands in the SSC; however, ADM data have been collected only at four sites, thus the final sample will contain approximately one third of this pool. The sample will be described in terms of sex, age, race/ethnicity, annual household income, and parent education levels. Point-biserial correlations will be used to determine whether associations exist between ADM dysmorphology status and (a) the CSS and (b) verbal, nonverbal, and full-scale IQ scores.

Results: We hypothesize that dysmorphic probands will have a higher CSS and lower IQ indices than their nondysmorphic peers. It has been shown previously that CSS does not correlate with measures of IQ, but we will examine whether such a relationship exists and control for IQ in the analysis between dysmorphology and CSS, if necessary. Preliminary results from two SSC sites (University of Missouri, Baylor College of Medicine) indicate that between 14—15% of SSC probands are dysmorphic. We anticipate this proportion to hold true across the collection.

Conclusions: If a relationship is found between dysmorphology and CSS, this could suggest the need for children with more severe ASD symptoms, based on CSS scores, to be directed for clinical-genetic assessment to identify possible dysmorphic features consistent with genetic causes for their ASD. Likewise, children who display dysmorphic features (i.e., are at risk for greater clinical severity) could be referred to intensive intervention programs that could favorably influence their long-term outcomes. Further implications will be discussed, including next steps for use of the ADM if no association is found between dysmorphology and CSS.

128.023 23 An Examination of Head Circumference In Autism Spectrum Disorders. J. Varley*[1], J. Munson[2], J. Wenegrat[2], K. Sullivan[2] and R. A. Bernier[2], (1), (2)*University of Washington*

Background: Increased head circumference (HC) is often noted in children and adults with autism spectrum disorder (ASD). Occipitofrontal HC is a proxy for brain volume and brain overgrowth appears to represent both greater brain tissue volume and greater lateral ventricle volume (Piven, et al., 1995). Despite this well-replicated finding of increased head size and brain volume in ASD, it is unclear whether macrocephaly defines a specific subgroup of ASD clinical features. Limited research available suggests that head size is also increased in family members of individuals with ASD. Only one study has examined the relation between HC and broader autism phenotype (BAP) traits in relatives of individuals with ASD (Elder, et al, 2007).

Objectives**:** The first objective of this study is to examine the relationship between HC and behavioral symptoms in children with ASD. Our second objective is to explore HC and BAP traits in family members within simplex families.

Methods: The sample consisted of mothers, fathers, and probands (1,814 males, 281 females) from 2,095 families participating in the Simons Simplex Collection (SSC) project (data release 10; SFARI.org). Data from 1,979 siblings were included as well (935 males, 1044 females). Families were carefully screened for a family history of ASD. Probands met clinical cutoffs on the ADI and ADOS and received a clinical diagnosis of ASD. HC and height were measured during the family's research visit. Proband behavioral measures included the ADOS severity score, Social Responsiveness Scale: Parent and Teacher Forms, and an assessment of IQ. To assess the BAP, the Broader Autism Phenotype Questionnaire (BAPQ) was used in parents and the SRS was used in parents and siblings.

Results: Multiple linear regressions were conducted to analyze the relationship between HC and BAP/ASD symptoms. Bushby and colleagues (1992) reported significant effects of height on HC. We found a moderate relationship between height and HC in our sample as well (r=.31). Therefore, height z score was entered into the regression equation to control for its effects on HC. Z scores for HC were computed using the normative sample reported in Roche, et al, 1987 while z scores for height were computed using the CDC norms published in 2000. HC significantly predicted multiple outcomes in probands across modalities and informants. Specifically, HC predicted SRS: Parent (ß=.06, p<.05) and Teacher (ß=.08, p<.05), ADOS severity score (ß=.07, p<.01), VIQ (ß=-.07, p<.01), NVIQ (ß=-.05, p< .05), and FSIQ (ß=-.05, p<.05). HC was not predictive of BAPQ or SRS scores in parents and siblings.

Conclusions: Larger HC was generally maladaptive for probands in our sample across parent, teacher, and clinician ratings and assessments. Higher SRS scores, greater symptom severity on ADOS, and lower IQ scores were associated with larger HC. This finding is consistent with previous research in younger children showing that increased rate of growth in the first year of life (resulting in larger HC) was associated with greater symptom severity (Courschesne, et al, 2003). HC was not found to be related to the BAP in parents and siblings.

128.024 24 2D:4D Digit Ratio In Boys with ASD. C. Green*[1], C. Dissanayake[1] and D. Z. Loesch[2], (1)*Olga Tennison Autism Research Centre*, (2)*La Trobe University*

Background:

Second to fourth digit (2D:4D) ratios have been previously measured as an indicator of prenatal testosterone levels. It is believed that a lower ratio (a longer fourth finger to second finger) is indicative of higher prenatal exposure to testosterone.

Objectives:

The objective in the current study was to compare 2D:4D ratios between boys with an Autism Spectrum Disorder (ASD) and typically developing (TD) boys to ascertain if ASD is related to higher exposure to prenatal testosterone. Associations between 2D:4D ratio and autism severity were also explored.

Methods:

Participants comprised of 65 boys (4-16 years of age) with an ASD and 30 TD boys, along with their parents. Diagnosis of ASD was confirmed by administration of the Autism Diagnostic Observation Schedule (ADOS). Measurements of the second and fourth fingers were obtained by measuring from the metacarpophalangeal joint to the finger-tip to establish 2D:4D ratios of participants and their parents.

Results:

The 2D:4D ratio was significantly lower in boys with ASD compared to TD boys. Significantly lower ratios were also found in the mothers of children with ASD compared to the mothers of TD boys. Although a similar pattern of lower 2D:4D ratio was observed in fathers of boys with ASD, the group differences were not significant.

In addition, boys who met the ASD cut-off scores on the ADOS had significantly lower 2D:4D ratios than boys who met the AD criteria. Likewise, the mothers and fathers of boys with ASD had lower 2D:4D ratios than mothers and fathers of boys with AD; however, these latter parental differences were not significant.

Some relationships were found between 2D:4D ratio and autism severity.

Conclusions:

Consistent with previous research, the data indicated a lower 2D:4D ratio amongst boys with an ASD, implying higher prenatal testosterone levels, compared to TD boys. Genetic factors may also be involved given the similar patterns found in the mothers and fathers of children with an ASD. A lower ratio amongst boys with ASD compared to those with AD implicates other factors may be involved in the relationship between 2D:4D ratio and autism severity. The implications of these findings will be discussed.

134.123 24A Sensory Seeking Behaviors and Orientation to Social and Non-Social Sensory Stimuli In Infant Siblings of Children with Autism Spectrum Disorders. C. Damiano*[1], W. L. Stone[2], E. H. Catania[3], K. Woodburn[3], Z. Warren[3], A. P. F. Key[3], M. Murias[2] and C. J. Cascio[3], (1)*University of North Carolina- Chapel Hill*, (2)*University of Washington*, (3)*Vanderbilt University*

Background: Autism spectrum disorders (ASD) are neurodevelopmental disorders characterized by social and communicative deficits along with repetitive behaviors and restricted interests. Although not included in the diagnostic criteria, atypical sensory processing has been observed in many individuals with ASD from infancy to adulthood. The study of sensory processing in infants at risk for ASD, such as infant siblings of children with ASD (sibs-ASD), may be particularly important as sensory processing atypicalities in infancy could have considerable downstream effects on the development of complex social, language, and cognitive skills. Further, atypical sensory processing in sibs-ASD may be a useful endophenotype in understanding the genetic etiology of ASD.

Objectives: The primary aim of the current study is to examine sensory seeking behaviors in sibs-ASD and infant siblings of typically-developing children (sibs-TD) using a standardized measure, the Sensory Processing Assessment (SPA), and to investigate how these behaviors may affect orienting to social and non-social stimuli.

Methods: This study included 12 sibs-ASD and 18 sibs-TD recruited at approximately 18 months of age (sibs-ASD: M = 18.35, SD = 0.61; sibs-TD: M = 18.43; SD = 0.34, t (28)= 0.50 p > .63). All ASD diagnoses of older siblings were confirmed by a clinical psychologist using the ADOS and ADI-R. The SPA is a play-based assessment that includes items for sensory approach/avoidance and seeking behaviors, as well as habituation and orientation items that are presented while the child is engaged with the sensory stimuli. The measures of interest in the current study were: 1) sensory and repetitive behaviors (e.g., flapping, sighting, posturing, spinning) in response to visual, auditory, and tactile stimuli ('sensory seeking'); and 2) orienting to social stimuli (e.g., wave, name call, shoulder tap) and non-social stimuli (e.g., lights, sound, air puff) presented across visual, auditory, and tactile modalities. All videos were consensus-coded by two trained observers who were blind to diagnostic status.

Results: Relative to the sibs-TD, the sibs-ASD group demonstrated a greater intensity, t (28) = -2.86, p = .008, and a larger inventory of sensory seeking behaviors, t(28)= -3.28, p = .003. Although no group differences were detected in social and non-social orienting measures from the SPA, the intensity of sensory seeking across both groups was found to be significantly correlated with a failure to orient to social, r = .59, p = .01, and non-social stimuli, r = .41, p = .03. A greater inventory of sensory seeking behaviors was also found to be related to a failure to orient to social stimuli, r = .51, p = .004, yet this relationship was not significant for non-social stimuli, r = .25, p = .19.

Conclusions: The results of this study suggest that sibs-ASD as young as 18 months engage in sensory seeking behaviors to a greater extent than sibs-TD and that these behaviors are associated with their ability to orient to salient social and non-social stimuli in the environment. This tendency may ultimately cause sibs-ASD to miss important opportunities for social interaction and learning over the course of development.

Clinical Phenotype Program

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128.025 25 Do Sensory Markers Improve ASD Screening Accuracy at 12-months?. A. Ben-Sasson*[1] and A. S. Carter[2], (1)*University of Haifa*, (2)*University of Massachusetts Boston*

Background: The drive to screen for autism spectrum disorder (ASD) earlier emerges from accumulating evidence indicating that intensive autism specific interventions provided prior to the age of three lead to better outcomes. Screening using markers

from all ASD symptom domains, including social, communication, and sensory-behavioral, is controversial. Examining the impact of including sensory-behavioral markers (e.g., spinning objects, sensitivity to sound) on the accuracy of ASD screening can inform the design of efficient screening procedures.

Objectives: (1) Validate First Year Inventory (FYI) norms in Israel; (2) Examine the contribution of sensory markers to the accuracy of ASD screening at follow-up.

Methods: Participants were 589 families of 12-month old infants (52% boys) who completed the FYI, a norm-referenced ASD screening questionnaire, manually or electronically. A subsample of 84 families was followed at 13-months based on their meeting the FYI 95th percentile risk status on the sensory-regulatory and/or social-communication scales. Follow-up assessments included the Autism Observation Scale for Infants (AOSI) and the Mullen Scales for Early Learning. Infants were referred for evaluation based on previously documented cutoffs for AOSI and Mullen scores as well as clinical judgment. A 30-month diagnostic follow-up is underway.

Results: The Israeli version of FYI had a Chronbach's Alpha of 0.75. The 95th percentile risk cutoff of the current sample was 4.44 points higher than the US sample. The 13-month developmental status was compared between four groups of infants at FYI risk in (1) the *sensory* domain (n=19); (2) *social-*communication domain (n=22); *(3) both* sensory and social-communication domains (n=16); and (*4) no risk* (n=27; matched by gender and SES to risk groups). The Mullen Early Learning Composite Score was significantly lower for the *social* and *both risk* groups versus *sensory* and *no risk* groups. In Expressive Language, *social* and *both risk* groups had significantly lower t-scores than the *sensory* and *no risk* groups while in Receptive Language and Fine Motor only the *both risk* group showed lower scores than the *no risk* group. Total AOSI scores were higher for *social* versus *sensory risk* groups, and for the *both risk* group compared to *sensory* and *no risk* groups. Sensitivity and specificity were calculated for *social* and *both risk* groups relative to *sensory* and *no risk* groups combined. The outcome was defined by a clinical evaluation referral at 13-months (as a factor of AOSI and Mullen scores). Using the social domain risk only, sensitivity was 44% and specificity 69%, while using meeting risk in social and sensory domains yielded sensitivity of 73% and specificity of 89%.

Conclusions: Applying the FYI, a norm-referenced screener, requires adaptations of risk cutoff for use in Israel. Including sensory markers in ASD screening criteria rather than screening only for social risk was associated with higher sensitivity and specificity and in identification of infants with lower developmental status at 13-months. Screening criteria in infancy that takes into consideration type of marker together with frequency may lead to greater accuracy.

128.026 26 National Survey of Sensory Features In Children with ASD: Factor Structure of the Sensory Experiences Questionnaire. K. K. Ausderau*[1], J. H. Sideris[2], L. M. Little[3] 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. The Sensory Experience Questionnaire 3.0 (SEQ), a recently expanded caregiver-report assessment specific to children with ASD, measures behavioral responses to sensory experiences. Lacking in the literature is an instrument with sufficient empirical validation for a factor structure specific to ASD that includes sensory response patterns, modalities, and contexts.

Objectives: This study describes the methodology of a large national survey that aims to characterize sensory features in children with ASD using the SEQ, and presents results from a confirmatory factor analysis used to test a conceptual model of sensory features in ASD.

Methods: Data were collected as part of a national online survey from 1308 participants with an ASD diagnosis, ages 2-12 years. The SEQ was converted to an electronic format in Qualtrics and distributed through an online national research registry and multiple autism organizations. Sample consisted of 1069 boys (CA 93 (34) mos.) and 239 girls (CA 96 (35) mos.). ASD symptom severity was assessed using the Social Responsiveness Scale (SRS/SRS-P). A factor analytic model with six substantive factors of hypothesized sensory response patterns (i.e., hyporesponsiveness, hyperresponsiveness, seeking, enhanced perception, social context, non-social context) and six method factors of sensory modalities (i.e., auditory, visual, tactile, gustatory, vestibular, multi-sensory) were tested. Method factors provide a parsimonious technique for modeling shared error variance. Model was fit as a confirmatory factor analysis. Correlations between the substantive factors were freed, but fixed to zero between the method factors, as well as between the method factors and the substantive factors.

Results: The above structure was tested as a confirmatory factor analysis. Model fit was assessed using standard fit measures: chi-square (3889) = 14,458.12, RMSEA =.04 and

SRMR =.06. The latter two measures indicate strong model fit. Factor loadings for the items on the latent variables were generally strong and provided excellent support for each of the hypothesized factors. Between-factor correlations were high, ranging from .29 to .71, which implies that while these factors are distinct, they covary significantly.

Conclusions: The survey was a feasible method of obtaining a large national, geographically distributed sample. The large sample allowed a complex hypothesized model to be confirmed for a specified factor structure, including sensory response patterns in ASD across both social and non-social contexts. Further analyses will determine the extent to which there are significant associations between the substantive factors and various demographic variables (i.e. autism severity, IQ, gender, age).

128.027 27 Validation of Proposed DSM-5 Criteria for Autism Spectrum Disorder. T. W. Frazier*[1], E. A. Youngstrom[2], L. Speer[1], R. 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/Lucile Packard Children's Hospital*

Background: Proposed DSM-5 criteria posit a single autism spectrum disorder (ASD) category with two symptom criteria sets – social communication and interaction and restricted, repetitive behavior. Recent work from our group has found a latent categorical distinction between ASD and typical autism symptom levels and numerous studies support a broad range of autism symptom severity spanning both social communication and repetitive behavior domains.

Objectives: The primary purpose of the present study was to examine whether parent-reported symptom data from a large internet registry support the validity of the structure of proposed DSM-5 diagnostic criteria. The study also evaluated whether proposed DSM-5 criteria showed enhanced sensitivity and specificity to autism relative to DSM-IV-TR criteria.

Methods: Data were obtained from the Interactive Autism Network (IAN; N=14,744). IAN preferentially recruits families with at least one affected child who has been diagnosed with an ASD. Caregivers reported autism symptoms using the Social Responsiveness Scale (SRS) and the Social Communication Questionnaire (SCQ). Exploratory factor (FA), latent class (LCA), and factor mixture (FM) models were computed for each measure and across the total sample and a parent-designated unaffected sibling sub-sample. Empirical classifications from FM models were compared to parent-designated affected status. Additionally, SCQ and SRS symptoms were mapped onto specific DSM-5 and DSM-IV-TR criteria. DSM-5 and DSM-IV-TR criteria were then used to predict parent-designations and empirical classifications of ASD using diagnostic efficiency statistics.

Results: Two-factor/two-class FM models showed superior fit to FA and LCA models and replicated across measures and in the total sample and unaffected sub-sample. The two factors were represented by social communication and repetitive behavior indicators. Factor means and variances supported the presence of autism and non-autism classes with broad, overlapping symptom distributions. Classes closely mirrored parent-designated affected and unaffected status (κ=.78; classification % overlap=89%). Social communication and repetitive behavior factors showed strong correlations in the autism-affected (r=.76) and unaffected groups (r=.84). Proposed DSM-5 criteria showed superior specificity relative to DSM-4 criteria (.97 vs. .87), however sensitivity was weaker (.81 for DSM-5 vs. .95 for DSM-IV-TR). Relaxing DSM-5 social communication criteria to 2 of 3 criteria met instead of the proposed 3 of 3 criteria increased sensitivity (relaxed .88 vs. proposed .81), without substantively reducing specificity (relaxed .96 vs. proposed .97).

Conclusions: The validity of DSM-5 criteria was supported, with the exception that requiring only 2 of 3 social communication criteria may enhance sensitivity with minimal decrease in specificity. The strong correlation between social communication and repetitive behavior domains in the autism category supports the requirement for symptom criteria to be met in both domains. A categorical autism distinction reinforces the need for an evidence-based medicine approach to ASD diagnosis where post-test probabilities are iteratively generated using the population or clinical base rate and non-redundant predictors of ASD diagnosis. The lack of additional sub-categories within ASD substantiates the validity of a broad categorical diagnosis containing two sub-dimensions. Genomic and neurobiological research may benefit by using mixed models that accommodate both the categorical and dimensional nature of ASD symptoms.

128.028 28 Use of a Severity Scale In Clinical Practice. P. Manning-Courtney*, D. Murray, S. L. Bishop and J. Reinhold, *Cincinnati Children's Hospital Medical Center*

Background: There are few, if any, practical tools to measure clinical severity in children with autism spectrum disorder. A

simple measure of autism severity can aid in following children over time, and may also help to better segment a large clinic population. It may also aid in a better understanding of which children progress more, and why.

Objectives: To test the use of a simple measure of severity in a large clinical practice, and to analyze the findings, specifically severity distribution, and changes in severity over time.

Methods: As part of work assessing clinical effectiveness, a simple measure of autism severity was developed based on consensus of autism specialists, including physicians, psychologists, speech pathologists and nurse practitioners. The measure is comprised three domains, communication, cognition, and behavior. Each domain has a 1 to 5 likert scale of degree of impairment (1 being most impaired, 5 being least). The panel of autism specialists defined each level of impairment on the likert scale. The severity scale was loaded into the electronic medical record, and two autism clinicians (DDBP physician, and autism specific nurse practitioner) completed the severity scale on follow-up patients in clinic who had been previously diagnosed with autism. Autism clinicians also assigned a diagnosis of autism, or autism spectrum disorder (including PDD-NOS and Asperger Syndrome), after the completion of a 45 minute in clinic follow-up assessment. The severity scale was completed based on the clinical impression of the autism clinician.

All severity scale measures will be collected by CHMC clinical effectiveness data staff. Specifically, overall severity distribution, as well as severity changes in children who have multiple measures completed will be analyzed.

Results: At the time of presentation, results will include total number of children on whom severity scales have been completed (currently estimated at approximately 900), overall distribution of severity, and patterns of severity change over time in patients with more than one measure completed. This information may be used to adapt the current severity scale. Completion of severity scale took 1 minute or less on average.

Conclusions: Simple, clinician completed measures of severity can yield important information about an overall population, change over time, and ultimately, factors that may predict rates of progress, and possibly outcome, in children with ASD.

128.029 29 Examining the Stability of the Autism Diagnostic Interview-Revised In the Autism Genome Project Sample of Children 4 to 18 Years. P. Szatmari*[1], E. Duku[1], S. Georgiades[1], A. Thompson[1], X. Q. Liu[2] and A. D. Paterson[3], (1)*Offord Centre for Child Studies, McMaster University*, (2)*University of Manitoba*, (3)

Background: The Autism Diagnostic Interview-Revised (ADI-R) is a standardized semi-structured interview for caregivers of children and adults used in assessing autism spectrum disorder (ASD). The instrument focuses on behaviour in three areas - reciprocal social interaction, communication and language, and restricted and repetitive, stereotyped interests and behaviors. Earlier published works have indicated different numbers of quantitative traits using the ADI-R items.

Objectives: The objective of this study is to examine the stability of the ADI-R in subgroups of children with Autism Spectrum Disorder and to derive psychometrically sound quantitative traits from the ADI-R that can be used in genetic analyses.

Methods: Data came from the Autism Genome Project (AGP), a collaborative genetics research project studying genetic mechanisms of autism susceptibility. The fixated interests and repetitive behaviours (FIRB) items were selected from the repetitive, stereotyped interests and behaviors and items related to it. The social communication (SOCCOM) items were selected from the algorithm items for reciprocal social interests and non-verbal communication. The sample consisted of 4237 individuals with autism or ASD, selecting one random individual aged between 4 and 18 years per family from the combined Phases I and II data sets. The sample was divided into two equal samples – Exploratory and Confirmatory - using random selection. The analyses consisted of (a) examining the factor structure using the exploratory samples, assessing the fits of selected models using the confirmatory samples and (b) finally, the measurement invariance of the best-fitting factor models with the full sample consisting of a random sample of verbal subjects equal to the number of non-verbal subjects in the sample were tested in a confirmatory factor analysis (CFA) framework.

Results: The results indicate that: (a) CFA indicated that the best fitting models for the data are a 2 factor solution for FIRB (insistence on sameness, IS and repetitive stereotyped behaviours and unusual sensory interests, RSMB; CFI=0.943,TLI=0.924,RMSEA=0.038) and a 4-factor solution for SOCCOM (joint attention, JTATT; social interactions, SOCINT; peer interactions, PEERINT; and nonverbal communication, NVCOMM; CFI=0.921,TLI=0.907,RMSEA=0.50). The means of the non-verbal group are higher than that of the verbal group for factors of the SOCCOM and FIRB except for IS and mean scores were higher for autism than ASD on SOCCOM factors. (b) Tests of

measurement invariance showed that the final factor solutions measured the same constructs in the groups. However, levels of intensity of behaviour were different by verbal status group for both the FIRB and SOCCOM.

Conclusions: The constructs measured by the FIRB related items and the SOCCOM algorithm items of the ADI-R are the same in both verbal and nonverbal subjects in the AGP sample. There are differences in levels of FIRB as well as the SOCCOM factors between the two groups (verbal vs. nonverbal individuals) in the AGP sample. Differences in levels of FIRB and SOCCOM factors can be attributed to different levels of intensity of behaviour between the groups. Thus, the use of the ADI-R quantitative traits in genetic analysis should take into account the differences between verbal groups.

128.030 30 Diagnosis of Autism Utilizing the ADOS and ADI-R: Are There Factors to Account for Discrepancies?. C. L. Grantham*[1], M. W. Gower[1], M. K. McCalla[1], A. N. Harris[1], S. E. O'Kelley[2] and K. C. Guest[1], (1)*University of Alabama at Birmingham*, (2)*UAB Civitan-Sparks Clinics*

Background: Past experimental findings show that using a combination of both the ADOS and the ADI-R is more effective when making a clinical diagnosis than using a single instrument (Risi et al, 2006). There is often a higher sensitivity on the ADOS when compared to the ADI-R regarding final clinical diagnosis (Gray, 2008). The present study seeks to identify specific factors that may account for the lower sensitivity in the ADI-R. The ADI-R manual recommends that the informant be a parent or caregiver who has known the child through their preschool years, but this is not always possible as some children have been placed in a setting that does not provide this type of informant. Thus the relationship between type of caregiver and ADI-R reports and scores will be explored. Given the diversity of children and families seen in typical practice, it is important to explore and understand the impact of "real world" variables on these assessment tools to assist clinicians in better understanding how to utilize these results. Additional factors related to the respondent/caregiver, such as their age, race, and level of education will be examined along with child factors, such as age and race. The study will also examine the number of children in the home, and the number of children in the home with developmental disabilities as additional factors contributing to the discrepancies in ADOS and ADI-R reports.

Objectives: To improve the understanding of any discrepancies between the two “gold standard measurements” (Lord et al., 2000; Lord et al., 2001) used for diagnosing autism and the factors that may influence these discrepancies.

Methods: Both the ADOS and the ADI-R were performed as part of an autism evaluation at an interdisciplinary autism clinic. The final diagnosis was made based on team discussion of clinical impressions and scores on related tests.

Results: Based on initial data analysis (N = 131; mean age = 5.3 years), it has been determined that there is a discrepancy between the ADI-R and ADOS in 15% of the cases, and it is predicted that respondent and child characteristics will be related to these discrepancies in the larger sample. Research is still being completed for this study.

Conclusions: The results of this study will potentially produce a clarified understanding of any discrepancies between the two “gold standard measurements” (Lord et al., 2000; Lord et al., 2001) used for diagnosing autism. The factors that may influence these discrepancies, such as maternal education level or number of children in the home with developmental disabilities, would be clinically useful in determining which test to put more emphasis on for diagnosis when these discrepancies are present, particularly if any known mitigating factors are present.

128.031 31 Concurrent Validity and Stability of Diagnosis Using Three Measures of ASD Symptom Severity. B. Boyd*[1], K. Hume[2], M. McBee[1] and S. Odom[3], (1)*University of North Carolina at Chapel Hill*, (2)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (3)*University of North Carolina*

Background: Proposed changes to the forthcoming Diagnostic and Statistical Manual of Mental Disorders would include severity criteria for the Autism Spectrum Disorders (ASD) category. Currently, the Childhood Autism Rating Scale (CARS) and Social Responsiveness Scale (SRS) are two readily used measures of symptom severity. In addition, the Autism Diagnostic Observation Schedule (ADOS) was recently standardized to yield a severity score. Evaluating symptom severity could promote further understanding of the clinical phenotype, response to intervention, and underlying neurobiology of the disorder. The primary purpose of this study was to examine if children’s symptom severity was similarly categorized across the three measures.

Objectives: To examine (1) concurrent validity of the ADOS, CARS, and SRS; (2) categorization of children’s diagnostic status or symptom severity across measures; and (3) stability of their diagnostic status.

Methods: Data for this study were collected on 140 children (ages 3 – 5) as part of a larger study comparing the efficacy of school-based, comprehensive treatment models for preschoolers with ASD. The reported data were collected across four states (CO, NC, FL, and MN), and at the beginning and end of one school year (range of 6-9 months between assessment time points).Trained and reliable research staff administered the ADOS and CARS. Parents of children enrolled in the study completed the SRS. Correlational analysis was used to determine concurrent validity, cross-tabulations were performed to examine children's categorizations across measures, and weighted kappas were used to examine diagnostic stability.

Results: The ADOS severity score was significantly correlated with the CARS total score (r = .47) but not the SRS total score (r = .09). The CARS and SRS were significantly correlated with each other (r = .26). Cross-tabulations were performed to examine children's diagnostic and severity classification across the three measures. Forty-five percent of the sample was similarly classified across all three measures, 24% on the ADOS and SRS but not CARS, 16% on the ADOS and CARS but not SRS, 13% on the ADOS but not CARS or SRS, and 2% on the SRS but not ADOS or CARS. In examining longitudinal data, children's scores on each measure at the beginning of the school year were significantly correlated with their end of the year scores; the weighted kappas values were (ADOS, k = .35; CARS, k = .61; SRS, k = .61). (Note: Per Chlebowski et al. 2010, the CARS cut-off score of 25 was used).

Conclusions: Diagnostic status and symptom severity is a mostly stable construct across measures. Children's scores on the measures were correlated with the exception of the SRS and ADOS. This may reflect method variance in that parents completed the SRS; however, research staff completed the ADOS and CARS. However, for the near majority of the sample, children were similarly classified across the three measures. Further, children's diagnostic status remained largely unchanged from the beginning to the end of the school year; although kappa values were lower for the ADOS this was primarily an artifact of using weighted kappas.

128.032 32 The Structure of Autism Symptoms as Measured by the ADOS. M. Norris*[1] and L. Lecavalier[2], (1)*University of Rochester*, (2)*Ohio State University*

Background:

Several recent studies have examined the structure of autism symptoms (e.g., Frazier et al., 2008; Georgiades et al., 2007). This exercise can inform the instruments used to measure autism spectrum disorders (ASDs) as well as diagnostic classification systems. This is especially relevant with the impending release of DSM-V. Quantitative phenotypes also can help clarify the relationship between genes and behavior.

Thus far, research examining the structure of autistic symptoms has been inconclusive. There are important variations across studies in terms of sample characteristics and methodology. Most studies have relied on the ADI-R. Overall, studies support either two- or three-factor solutions, though the composition of these factors varies across studies.

Objectives:

The primary objective was to compare different models of autism symptoms within a large sample of individuals with ASDs using the ADOS. Three models were compared: a one-factor model; a model based on the DSM-IV diagnostic criteria; and a two-factor model proposed by the DSM-V committee. In the latter model, one factor consisted of social and communication behaviors and the other factor consisting of restricted, repetitive behavior and language items. A secondary objective was to examine the impact of age and level of functioning on model fit.

Methods:

Participants included individuals aged 3-18 years (N = 1,409) recruited from the Autism Genetic Resource Exchange (AGRE) database. Participants were excluded if they did not have an ASD diagnosis, diagnosis was unclear, or if spectrum cut-offs on the ADOS were not exceeded. Modules 1 and 3 of the ADOS were examined.

Confirmatory factor analysis was performed using LISREL. Polychoric correlation matrices were used due to the ordinal nature of the data. Various indices of fit (RMSEA, SRMR, NNFI, CFI, and GFI) were compared across models, as well as across subsamples within models. RMSEA was used as the primary index.

Results:

Results indicated that models were very similar to each other. Within Module 1, all three models fit well (RMSEAs ranged from .056 to .062). Within Module 1, model fits improved when analyses where conducted on subsamples based on age (those ≤6 years) or level of functioning (VABS composite and DLS <55); RMSEAs for subgroup analyses ranged from .04 to .059. Models did not fit as well with Module 3 data, but again were similar to each other (RMSEAs ranged from .074 to .083).

Within Module 3, indices of fit improved when analyses were conducted on a subgroup of older children (those ≥10 years); RMSEAs ranged from .068-.079. Fits worsened when analyses were conducted on lower and higher functioning subsamples (based on VABS composite and DLS cut-off of 70); RMSEAs ranged from .078 to .148.

Conclusions:

Generally, there was little differentiation between models. Indices of fit were impacted by sample characteristics, though not always as anticipated. There were notable differences between Modules 1 and 3, which may be further evidence that symptom structure changes with development. Multivariate statistics are but one method to study autism symptoms; other methods will be necessary.

128.033 33 Assessing Autism Symptoms with ADOS Calibrated Severity Scores. A. C. Vehorn*[1], E. H. Dohrmann[2] and H. Noble[1], (1)*Vanderbilt*, (2)*Vanderbilt*

Background: As proposed by Gotham et al. (2008), ADOS calibrated severity scores (CSS) are a standardized metric developed to assess core autism symptoms as a clinical entity distinct from cognitive and adaptive differences. According to preliminary findings, this metric may provides a means by which to better assess symptoms of autism over time, in both individuals and populations. In the original validation study these scores were shown to be less influenced by factors such as verbal IQ, which accounted for 43% of variance in raw ADOS totals and only 10% in CSS scores. Despite promising initial work the development of this metric took place within a sample of convenience and as such further study of this metric in additional samples is necessary.

Objectives: We aimed to assess the nature of CSS and its relations to current diagnostic categories (i.e., PDD-NOS, autism, Asperger's Disorder) within a sample of children recruited into an ASD genetics study.

Methods: Analyses were conducted on data from 227 participants collected through the Simons Simplex Collection site at Vanderbilt University. Each participating child received a clinical diagnosis of ASD based on a complete psychological evaluation including assessment with the ADOS and ADI-R.

Results: In our sample, 111 individuals received a diagnosis of autism, 64 a diagnosis of PDD-NOS, and 52 a diagnosis of Asperger's Disorder. For the total sample, we found that verbal IQ accounted for 29.16% of variance in raw ADOS totals and only 2.865% of variance in CSS scores, echoing Gotham's original findings. Similarly, our analyses of raw ADOS totals and CSS scores by age and language map well onto previous results, with the CSS scores showing more uniform distributions. Additionally, we found in our sample a significant difference in CSS scores between those diagnosed with autism and PDD-NOS, while differences between autism and Asperger's, and Asperger's and PDD-NOS, were not significant.

Conclusions: Our results indicate that CSS scores appear to be of greater utility than ADOS raw totals in marking the severity of autism symptoms relative to age and language level and independent of cognitive and adaptive differences. CSS scores also map consistently to current autism and PDD-NOS diagnoses. Further directions include analysis of CSS scores from over 60 study participants who did not meet criteria for an ASD.

128.034 34 Comparing Performance of Children with ASD and ADHD on the Autism Diagnostic Observation Schedule. E. Molloy*[1], P. Manning-Courtney[2], D. Murray[2], C. A. Molloy[2] and S. L. Bishop[2], (1)*Washington University in St. Louis*, (2)*Cincinnati Children's Hospital Medical Center*

Background: Autism Spectrum Disorder (ASD) and Attention Deficit-Hyperactivity Disorder (ADHD) are prevalent developmental disorders with significant symptom overlap. Among school age children/adolescents with fluent language, differentiating social deficits associated with ASD from those of ADHD may be difficult. For example, ASD symptom measures such as the Social Responsiveness Scale and the Social Communication Questionnaire have been shown to have reduced specificity in samples of children with ADHD (e.g., Reiersen et al., 2007; Charman et al., 2001).

Assessment of ASD often involves administration of the Autism Diagnostic Observation Schedule (ADOS), a semi-structured diagnostic instrument that provides a classification of Autism, ASD or non-spectrum. The ADOS is one of the most well-established measures for assessment of ASD. However, as with other ASD measures, children with certain non-ASD diagnoses may be likely to receive falsely elevated scores on the ADOS (e.g., C. Molloy et al 2010; Bishop et al., 2007)

Objectives: To assess the utility of the ADOS scoring algorithm in differentiating ASD referrals who received a clinical diagnosis of ASD from those who received a clinical diagnosis of ADHD, and to identify the most discriminating items.

Methods: Records were reviewed for all children who underwent a multidisciplinary clinical evaluation for ASD (including ADOS) at Cincinnati Children's Hospital Medical

Center in 2009. The subset of children evaluated with a Module 3 (Fluent Speech) was examined. The group with a final diagnosis of ASD was compared to the group given a final diagnosis of ADHD on demographics, measures of behavior and cognition and ADOS total and domain scores. Sensitivity and specificity was calculated. Item scores were dichotomized to 0 (no abnormality) and non-0 (at least some abnormality). The proportion of children per group with some evidence of abnormality was compared for each item.

Results: 504 children were evaluated for ASD in 2009. Of the 164 assessed with a Module 3, 52 were diagnosed with ASD, 44 with ADHD. Groups did not differ on age, race, sex or Full Scale IQ. The ADOS had a .77 sensitivity and .44 specificity for differentiating ASD from ADHD in this sample. Median total scores for both groups were above ASD cut-offs. The communication domain score was significantly higher in the ASD group ($p = 0.01$). Overall, six items (two on the algorithm) showed significant differences.

Conclusions: These results underscore the importance of considering information from the ADOS together with other sources when making clinical diagnoses of ASD or ADHD. Children with ADHD who are referred for ASD evaluations may be particularly likely to receive elevated scores on ASD measures. Given recent referral trends in ASD clinics (e.g., to "rule out" ASD in children with higher cognitive and language abilities), future revisions to ASD diagnostic instruments may benefit from the inclusion of additional items better able to differentiate ASD from ADHD in verbally fluent children. More research directly comparing ASD and ADHD is needed to determine which symptoms and behaviors have the highest levels of ASD specificity.

128.035 35 Sensory Symptoms In ASD: Overreported by Caregivers or Underreported by Children? A Comparison of Two Versions of the Sensory Profile. F. Velasquez*[1], C. R. Stewart[1], S. Sanchez[1], E. L. Grenesko[1], A. J. Lincoln[2] and R. A. Müller[1], (1)*Brain Development Imaging Laboratory, San Diego State University*, (2)*Alliant International University;Center for Autism Research, Evaluation and Service*

Background: Atypical responses to sensory stimuli are frequently seen in children with autism spectrum disorders (ASD), implying that sensory information may be processed abnormally. Such atypical responses can be detected using the Sensory Profile, an instrument often used in ASD and ADHD to measure sensory perception aptitude. In view of the heterogeneous nature of ASD, accurate individual assessment is necessary for behavioral and neuropsychological research and/or intervention.

Objectives: Our objective was to test for differences between sensory perception assessment by caregivers and self-assessment by participants with ASD. Previous ASD studies have shown inconsistencies between self and parent assessments. We therefore hypothesized that Sensory Profile responses would show discrepancies based on assessment source.

Methods: Fifteen children and adolescents with ASD (Mean age=12.77, SD=2.75; non-verbal IQ =109.4, SD=16.35) and their caregivers completed two versions of the Sensory Profile: (i) an assessment completed by caregivers of individuals with these disorders (Dunn's Sensory Profile); and (ii) the Adolescent/Adult Sensory Profile created for self-assessment and composed of an entirely different set of questions than the ones used in the caregiver version. Responses to both versions of the Sensory Profile can be interpreted by being broken down into quadrants. Each quadrant is composed of a sensory processing pattern: registration, avoiding, sensitivity and seeking. Raw scores were converted to z-scores using published standardized scores from the Sensory Profile manuals. We used a one-way analysis of variance (ANOVA) to compare z-scores for each quadrant from both instruments.

Results: We found significant differences for all four quadrants. Caregivers reported significantly more sensory symptoms in the sensation seeking quadrant, $F(1,28)=10.71$, $p=.006$, sensory sensitivity, $F(1,28)=7.50$, $p=.016$, the sensation avoiding quadrant, $F(1,28)=11.53$, $p=.013$, and the low registration quadrant $F(1,28)=18.65$, $p=.001$.

Conclusions: Our study indicates that caregivers report more sensory symptoms for their children with ASD than the children attribute to themselves. Inconsistencies between caregiver assessment and self-assessment should be taken into account when applying results from the Sensory Profile in behavioral or neuropsychological research and/or intervention. Our study could not determine whether these inconsistencies are due to overreporting of sensory symptoms by caregivers or underreporting by ASD participants. Caution is required given the as yet small sample size of our study.

128.036 36 The Assessment of Adaptive Functioning In Children and Adolescents with ASD: A Comparison of Two Widely Used Measures. J. Pandey*, H. W. Kang, I. Giserman, L. Bradstreet, S. J. Cayless and R. T. Schultz, *Children's Hospital of Philadelphia*

Background: In addition to deficits in communication, socialization, and repetitive interests, individuals with autism spectrum disorders (ASD) experience difficulties in adaptive functioning. Adaptive functioning, therefore, is often a target of intervention. However, the relationship between adaptive functioning deficits, IQ, and autistic symptomatology remains unclear. For instance, a study by Liss and colleagues (2001) divided individuals with ASD into high- and low-functioning groups and found that deficits in adaptive behavior were strongly correlated with autistic symptomatology only in the high-functioning group, but that IQ was strongly predictive of adaptive behavior in the low-functioning group. Liss's study and many others utilized the Vineland Behavior Rating Scales (VABS).

Objectives: The current study seeks to clarify these relationships and to compare the new edition of the VABS to another measure, the Adaptive Behavior Assessment System, 2nd Edition (ABAS-II).

Methods: To date we have studied 87 participants between the ages of six and eighteen (59 males, 28 females; mean age = 10.8 years) with ASD, using gold standard diagnostic measures; with at least 50 more participants for the final presentation. The study is examining the relationship between adaptive functioning, IQ, and autism symptomatology for individuals with low- and high-functioning ASD using two parent-report measures of adaptive functioning: VABS-II and the ABAS-II.

Results: In this presentation we will describe the relationship between the two measures and their pattern of correlations to clinical symptoms and IQ profiles.

Conclusions: A detailed understanding of these relationships should clarify (a) profiles of adaptive behavior difficulties in ASD; and (b) differences in two commonly used measures.

128.037 37 Examining the Criterion-Related Validity of the PDD-BI. C. A. McMorris*[1], A. Perry[1] and M. Ebrahimi[2], (1)*York University*, (2)*York Central Hospital*

Background: The Pervasive Developmental Disorder – Behavior Inventory (PDD-BI; Cohen, et al., 2003) is a questionnaire that was designed to aid in the diagnosis of children with Pervasive Developmental Disorders (PDDs). The PDD-BI assesses both adaptive and maladaptive behaviours associated with PDD's. The adaptive subscales (Expressive Social Communication Abilities Composite; ESCSA/C and Receptive/Expressive Social Communication Abilities Composite; REXSCA/C) measure phonological skills, social approach behaviours, receptive language, semantic pragmatic skills, learning, and memory. In contrast, the maladaptive subscales (Repetitive, Ritualistic and Pragmatic Composite; REPRIT/C and Approach/Withdrawal Problems Composite; AWP/C), include sensory/perceptual approach behaviours, fears, arousal problems, aggression, and social pragmatic problems. Additionally, the PDD-BI provides an age-standardized autism score. Previous research has shown the PDD-BI to have criterion-related validity in a sample of children aged 3 to 6 (Cohen, et al., 2003).

Objectives: The objective of the present study is to replicate and extend previous research investigating the criterion-related validity of the PDD-BI. We expected the Adaptive sections of the PDD-BI to be correlated with developmental scores on the Vineland Adaptive Behaviour Scales, 2nd Edition, and the Mullen Scales of Early Learning; and the Maladaptive scores on the PDD-BI to be related to other autism diagnostic measures, the Childhood Autism Rating Scale (CARS; Schopler et al., 1988) and the DSM-IV criteria for Autism.

Methods: This study examined previously collected data from 63 children (55 boys; 8 girls) seen for a psychological assessment as part of a larger research study. Participants ranged between 2 years 7 months and 9 years 3 months (*M* = 4 years 6 months). Forty-six participants had been diagnosed with Autistic Disorder and 14 had received a diagnosis of PDD-NOS.

As part of the assessment, the Mullen was administered to each child and the Vineland-II was administered by interviewing parent(s). The CARS and DSM-IV diagnostic criteria were completed for each child by examiners conducting the assessment. Caregivers also completed the parent version of the PDD-BI.

Results: As predicted, the Adaptive scores on the PDD-BI were moderately correlated with the cognitive and adaptive scores. However, there were no significant correlations between the PDDI Maladaptive and Autism composite scores with the other diagnostic measures. In addition, results from independent samples *t*-tests indicated that PDD-BI scores did not differ by diagnostic group or gender.

Conclusions: The present findings are consistent with previous research confirming the criterion-validity for the Adaptive section of the PDD-BI, in that it was strongly correlated with the other cognitive and adaptive measures. However, the Maladaptive section and Autism summary score from the PDD-BI were not related to two other well established measures of

autism severity, leading to questions around the validity of this section of the PDD-BI. Implications for the conceptualization of Autism and clinical implications will be discussed.

128.038 38 Reliability and Validity of the PDD Behavior Inventory-Screening Version (PDDBI-SV) Scoring System. I. L. Cohen*[1], C. Gray[2], E. M. Lennon[3], M. Gonzalez[4], T. R. Gomez[4], B. Z. Karmel[3] and J. M. Gardner[1], (1)*New York State Institute for Basic Research in Developmental Disabilities*, (2)*Puget Sound Psychology & Consulting*, (3)*NYS Institute for Basic Research in Developmental Disabilities*, (4)*NYS Institute for Basic Research in DD*

Background:

Many young children with Autism Spectrum Disorder (ASD) respond well to intensive early intervention and therefore early diagnosis is important. However, it is also critical to screen for ASD at older ages as well because signs can be missed in children who are young and have not yet regressed, as well as in those who do not show problems until school age because they are mildly affected. The PDDBI-SV (containing 18 items) was developed as a screening tool to help clinicians quickly identify children at risk for ASD, and covers a broader age span (18 months to 12-1/2 years of age) than that found with most other screening instruments. It was derived from the PDD Behavior Inventory, a reliable and valid informant-based assessment tool. Previous data (Cohen et al., 2010) indicated that the PDDBI Social Discrepancy Score, a measure of social competence, has excellent sensitivity (98%) and specificity (93%) and so the PDDBI-SV score was based on this measure. We found that the PDDBI-SV score agrees very well with the Social Discrepancy Score, is reliable, agrees well with other instruments, and reflects the severity of ASD.

Objectives:

The aim of this study was to develop a scoring system for a brief screening version of the PDDBI and to evaluate its reliability and validity.

Methods:

Using the original PDDBI standardization sample of 369 cases, multiple regression analyses were computed to identify a subset of 18 items that best correlated with the Social Discrepancy Score. The internal consistency, one year test-retest, and mother-father interrater reliability were then computed. Diagnostic validity (ROC analyses), and criterion-related validity were examined in terms of agreement with the M-CHAT, CARS, and Social Responsiveness Scale (SRS). PDDBI domain profiles were also examined as a function of degree of severity of the composite score (in SD units) using multivariate analysis of variance.

Results: A composite score (called the Social Deficit Score; SOCDEF) was identified that correlated highly (r=-0.97) with the PDDBI Social Discrepancy Score. Internal consistency reliability (alpha) was 0.87 (n=100); one-year test-retest reliability was 0.74 (n=38); and the mother-father intraclass r was 0.62 (n=121). ROC analyses (n=100; 50 ASD; 50 matched controls) yielded an area under the curve (AUC) value of 0.96 (C_{95} = 0.92 - 0.99). Correlation with the M-CHAT (n=25) was 0.73 for the total score and 0.67 for the number of critical items failed. The correlation between the SOCDEF score and the SRS was 0.83 (n=26) and the correlation with the CARS was 0.54 (n=84). PDDBI domain profiles were found to reflect increasing levels of severity (manifested by greater problem behaviors and fewer communicative skills) as the SOCDEF score increased in value.

Conclusions:

The SOCDEF score appears to be both reliable and valid. The PDDBI-SV should therefore serve as a useful Level 1 screening device for social deficits in children between 18 months and 12-1/2 years. It also should serve as a brief quantitative measure of ASD severity.

128.039 39 Differential Diagnosis of Autism Spectrum Disorders and Other Developmental Delays Using the BASC-2 PRS-P. J. I. Juechter*[1], D. L. Robins[1], R. W. Kamphaus[1] and D. A. Fein[2], (1)*Georgia State University*, (2)*University of Connecticut*

Background:

The Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus 2004) is a behavior rating scale commonly used in elementary and preschool settings. In addition to ratings of behavior such as hyperactivity, withdrawal, social skills, and adaptive functioning, the BASC-2 includes a Developmental Social Disorders content scale that evaluates the presence of behaviors commonly associated with pervasive developmental disorders, such as self-stimulation, withdrawal and poor socialization. Previous research by Volker et al. (2010) demonstrated that the DSD content scale reliably distinguished children with High-Functioning Autism Spectrum Disorders from typically developing peers.

Objectives:

The aim of the current study is to extend the research of Volker et al. (2010) to a lower age group by comparing the BASC-2 PRS-P scores of toddler and preschool-age children diagnosed with different developmental disorders.

Methods:

The BASC-2 PRS-P scores of 39 children ages 24 to 50 months were analyzed, including 11 children diagnosed with Autistic Disorder (AD; 8 boys, 3 girls; mean age=32.73 months, *SD*=8.33), 11 children diagnosed with Global Developmental Delay (GDD) and/or Language Delay (LD; GDD/LD group had 5 boys, 6 girls; mean age=28.91 months, *SD*=5.19), and 17 children diagnosed with Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS; 11 boys, 6 girls; mean age=34.00 months (*SD*=9.63).

Results:

For the Developmental Social Disorder (DSD) scale, mean T-scores for the AD, PDD-NOS, and GDD/LD groups were 70.27, 60.06, and 61.18, respectively. It should be noted that the mean score for AD group was within the "clinically significant" range according to the BASC-2 manual, T-score > 70, whereas the mean T-scores for both the PDD-NOS and GDD/LD groups fell in the "at risk" range, T-score > 60. A one-way analysis of variance revealed significant differences between T-scores for the three groups $F(2, 37)=5.01$, $p=.012$. Post hoc analyses utilizing independent t-tests revealed a significantly higher score for the AD (mean T-score=70.27) group on the DSD scale compared to the GDD/LD group (mean T-score=61.18), $t(20)=2.968$ $p=.008$, and compared to the PDD-NOS group (mean T-score=60.06), $t(25)=2.943$ $p=.007$. Children in the AD group also obtained a significantly higher score (mean T-score=64.18) on the Attention Problems scale than the GDD/LD group (mean T-score=54.82), $t(20)=2.631$ $p=.016$. There were no significant differences in scores between the GDD/LD group and the PDD-NOS group $t(25)=-.300$ $p=.767$.

Conclusions:

Preliminary data analyses suggest that the Developmental Social Disorders scale of the BASC-2 PRS-P accurately distinguishes between children with Autistic Disorder and those diagnosed with PDD-NOS or other developmental delays. These results suggest that the BASC-2 PRS-P may be a useful tool as part of a comprehensive evaluation for developmental disorders in toddler and preschool age children. It is interesting to note that the PDD-NOS group was distinguished from the AD group on this measure, given that the differences in phenotypic expression of autistic symptoms between these groups may not be that striking in toddlers. Future analyses should disaggregate samples by age (i.e., 2 year olds versus 4 year olds) to determine if these differences remain significant across age groups within the Preschool form.

128.040 40 Stereotyped Behaviors and Restricted Interests In Toddlers with ASD: Prevalence and Diagnostic Significance. L. H. Shulman*, K. Hottinger, R. M. Seijo, D. Meringolo and N. Tarshis, *Albert Einstein College of Medicine*

Background: The early diagnosis of autism spectrum disorder (ASD) has become an important clinical and public health goal. Autism-specific screening instruments designed for use with toddlers rely heavily on documentation of social communicative impairment rather than the presence of atypical interests and behaviors for characterizing young children as at risk for ASD. The literature has suggested that mannerisms, unusual sensory interests, and restricted interests/repetitive behaviors become more evident in the clinical profile of children with ASD closer to 3 years of age. That said, what is the diagnostic significance when these atypical behaviors and interests are present in toddlers with social communicative impairment?

Objectives: To examine the prevalence and types of mannerisms (MAN), unusual sensory interests (USI), and restricted interests/repetitive behaviors (RRB) present in young children who received a diagnosis of ASD by age 24 months (mo) and to assess the relationship between early manifestation of MAN/USI/RRB and stability of ASD diagnosis.

Methods: Retrospective chart review of 74 children presenting by age 24 mo to a University Affiliated early intervention program from 2003 to 2009 who received an ASD diagnosis based on multidisciplinary evaluation and who had follow-up at least 1 year later. Data from initial evaluation included: age, demographics, cognition, DSM-IV criteria, Childhood Autism Rating Scale (CARS) and, in some, the Autism Diagnostic Observation Schedule (ADOS). Characterization of MAN/USI/RRB was based on observations across the multidisciplinary evaluation sessions. ASD diagnosis at follow-up was based on CARS, DSM IV, ADOS, and educational classification. Data of those who retained ASD diagnosis and those who did not were compared. Statistical analysis included chi-square, t-test and nonparametric testing.

Results: Mean age at presentation was 19.9 mo; 68% male; 64% cognitive standard score > 70. At follow-up, mean age was 54.1 mo. 87% of the sample continued to meet criteria for

ASD at follow-up. At initial presentation, 87.8% of the sample displayed atypical behaviors.

Frequency of Atypical Behaviors					
ms (MAN):	74%	**Unusual Sensory Interests (USI)**: 45/74	61%	**Restricted Interests/ Repetitive Behaviors (RRB)**: 39/74	93%
g (24%), Toe pinning		e.g., **Visual**: Eye level play, Squinting, etc. (27%); **Other**: Licking, Smelling, etc. (34%)		e.g., Spinning objects/ wheels (24%), Lining up toys (24%)	

The children who continued to meet criteria for ASD at follow-up were more likely to have displayed MAN/USI/RRB at presentation than those who did not (92% vs. 60%, p=0.004). They were especially likely to display motor mannerisms (78% vs. 20%, p<0.001) and to exhibit 2 or more types of MAN/USI/RRB (95% vs. 73%, p=0.006). Those who presented with any MAN/USI/RRB had a significantly higher total CARS score at follow-up (32.8±6.8 vs. 25.7±6.1. p=0.03).

Conclusions: Atypical behaviors were commonly seen in children presenting early with social communicative deficits given an ASD diagnosis. The vast majority of this cohort retained ASD diagnosis at follow-up. The presence of atypical interests and behaviors was predictive of stability of the early diagnosis.

128.041 41 Measuring Repetitive Behaviors In Toddlers with ASD. J. L. Mussey*, A. B. Barber and L. G. Klinger, *University of Alabama*

Background: Repetitive and stereotyped behaviors (RSB) are hallmark symptoms of autism spectrum disorder (ASD), yet have received little research attention in early childhood. Some studies have suggested that RSB were not pronounced in toddlers and were later developing symptoms (Cox et al., 1999; Charman et al., 2005). Other studies reported that RSB distinguish toddlers with ASD from toddlers with typical development and developmental delays (Richler, 2007; Wetherby et al., 2004; Watt et al., 2008). These discrepancies suggest that there is a need to identify an instrument that is sensitive to RSB in toddlers with ASD. Further, the relationship between RSB and developmental level in the first years of life remains unclear.

Objectives:

1. To examine whether an instrument developed to assess repetitive behaviors in typical toddlers and preschoolers (i.e., the Childhood Routines Inventory; 1997) is sensitive to repetitive behaviors in toddlers with ASD.

2. To explore the relationship between RSB and developmental level in toddlers with ASD.

Methods: Thus far, data is available for 13 toddlers between 19 and 34 months of age (mean = 29.15 months) diagnosed with ASD through The University of Alabama ASD Clinic. ASD was diagnosed using the ADOS and ADI-R. Developmental level was assessed using the Mullen Scales of Early Learning. Two caregiver-report RSB measures were administered, The Childhood Routine Inventory (CRI; Evans et al., 1997) and the Repetitive Behavior Scales Revised (RBS-R; Bodfish et al., 1999; Lam & Aman, 2007). RSB-R includes 6 subscales measuring both repetitive motor movements and compulsive behavior. The RBS-R was developed to measure RSB in children with ASD but has not been used with toddlers. The CRI has 2 subscales that measure compulsive behavior. The CRI was developed specifically for a toddler and preschool population.

Results: Compared to normative means provided on the CRI, every toddler with ASD showed repetitive behaviors greater than the 95th percentile. Specifically, toddlers with ASD scored four times higher on the CRI than toddlers with typical development in both the 12-23 and 24-35 month normative intervals. Further, children's total scores from the CRI and RBS-R were significantly correlated (r = .82; p = .001) such that high scores on one measure was related to high scores on the other. Finally, total scores on the RBS-R and the CRI were negatively correlated with the Mullen Early Learning Composite (RBS-R; r = -.59; p = .04 and CRI; r = -.70; p <. 01). Children with high levels of RSB received lower standard scores on all Mullen subscales (visual motor, language, and fine motor).

Conclusions: Results suggest that toddlers with ASD do engage in high levels of RSB. Further, both the RBS-R and the CRI appear to be useful tools for identifying RSB in toddlers with ASD. Findings regarding the CRI are particularly exciting as this measure is sensitive to RSB in typical children. The CRI may be useful in research comparing diagnostic groups or research examining sub-threshold symptoms in at-risk toddlers. Further research is ongoing to identify specific patterns of RSB in toddlers with ASD.

128.042 42 The Development of A New Brief Measure of Social and Nonsocial Autistic-Like Traits In Young Children. A. Ronald*[1], K. Hudry[2], L. A. Tucker[3], G. Pasco[4], C. Byrd[5], M. Elsabbagh[6], T. Charman[4], M. H. Johnson[7] and .. The BASIS Team[8], (1)*Birkbeck College*, (2)*La Trobe University*, (3)*Birkbeck, University of London*, (4)*Institute of Education*, (5)*University of North Carolina at Chapel Hill*, (6)*Centre for Brain and*

Cognitive Development, Birkbeck, (7)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (8)*Birkbeck*

Background: The prodrome of autism spectrum disorders (ASDs) has received considerable attention over the last twenty years, in terms of both theoretical interest but also because of the potential for early intervention (Yirmiya & Charman, 2010) A brief measure of social and nonsocial autistic-like traits for early childhood would be valuable in epidemiological research, for detecting subtle manifestations of the broader autism phenotype in at risk sibling studies, and in molecular genetic research of population-based samples.

Objectives: The aim of this study was to develop a new brief parent report measure of social and nonsocial autistic-like traits (also known as restricted repetitive behaviours and interests) and to investigate the factor structure, validity, reliability and specificity of the measure.

Methods: A sample of eighty-six 24-month-old children, half of whom were young siblings of children with autism, was employed from the British Autism Study of Infant Siblings (BASIS). Items were designed to capture the range of autistic-like social and nonsocial traits that have been reported in this age group. The variance shown by individual items was assessed and principal components analysis was conducted. The validity, reliability and specificity of the scales were studied.

Results: The principal components analysis suggested a two-factor solution, which formed the basis of the social and nonsocial autistic-like trait scales. Social and nonsocial autistic-like trait scales correlated weakly in 24-month-olds (r = 0.11, p = 0.35, n = 83). Children with high scores on the Autism Diagnostic Observational Scale--Generic (ADOS-G; Lord et al., 2000) had higher mean scores on social and nonsocial autistic-like trait scales compared to children with low ADOS-G scores. The social and nonsocial autistic-like trait scales showed significant positive correlations with the Quantitative-Checklist for Autism in Toddlers (Q-CHAT; Allison et al., 2008) which supported their validity (r = .37, p = .001, and r = .43, p < 0.001, respectively). Low-to-modest, mostly nonsignificant, correlations were found with general temperament scales (the Early Childhood Behavior Questionnaire; Putnam et al., 2006), supporting the specificity of these social and non-social scales to autistic-like traits rather than temperament or behaviour problems more generally.

Conclusions: A new, brief parent report measure of social autistic-like traits (12 items) and nonsocial autistic-like traits (9 items) was developed for research on young children. In part this was developed because the majority of existing dimensional assessments of autistic-like traits are for children over the age of 36 months. The principal components analysis and correlations supported the division of social and non-social autistic-like traits into separate scales. The practical uses of these scales are as brief measures of social and non-social autistic-like traits in samples of typically developing young children, in epidemiological research, and in at risk infant sibling studies. The scales may also be useful in molecular genetic research of ASDs, which is moving towards incorporating dimensional assessments of *degree* of autistic-like traits in addition to the conventional case-control design (e.g., Ronald et al., 2010).

128.043 43 Discriminating Reactive Attachment Disorder From Autism Spectrum Disorders: Key Symptoms and Clinical Characteristics. M. Murin*[1], C. Willis[2], H. Minnis[3], W. Mandy[4] and D. H. Skuse[5], (1), (2)*Great Ormond Street Hospital for Children*, (3)*University of Glasgow*, (4)*University College London*, (5)*Institute of Child Health*

Background:

Differentiation between children with Autism Spectrum Disorder (ASD) and Reactive Attachment Disorders (RAD) is problematic. Both have similar social and communication difficulties. There is a need for scientific studies and guidelines to assist clinical decision-making.

Objectives:

The main objectives of the study were to answer the following questions: i) Do the social and communication difficulties, associated with ASD, affect the quality of parent-child relationships? ii) Are there qualitative differences between the relationship and attachment difficulties experienced by children with ASD and RAD?

Methods:

We used the Relationship Problem Questionnaire (RPQ) to measure parent-reports of symptoms characteristic of RAD. ~The RPQ is a 10-item parent-rated questionnaire, with two subscales, measuring socially inhibited and disinhibited behaviours respectively. A cross sectional design was used to examine the discriminative value of the RPQ in a sample of 224 participants in age range 3 to 16 years (clinical diagnoses RAD (20%), ASD (35%) and population controls (45%). RAD diagnosis was made by a modified Child and Adolescent Psychiatric Assessment interview (CAPA), and all clinical participants had standardized ASD interviews and observations

(3Di/ADOS), as well as extensive cognitive and other behavioural and observational measures. ASD/RAD families were recruited from specialist clinics in London and Glasgow, and controls were a representative sample of Scottish families.

Results:

There were highly significant differences between all three groups on our measure of relationship and attachment difficulties, the RPQ ($p<0.001$). Children with ASD had more attachment relationship problems than those in the general population, but those with RAD obtained more abnormal scores than either of the other groups ($p<0.001$). A logistic regression was used to identify items that distinguished children who had been clinically diagnosed with RAD from ASD. The optimal model found a limited set of items correctly classified over 80% of cases. RAD was characterized by indiscriminate and insincere affection, self-directed aggression, and frozen fear. In contrast, ASD was characterized by the use of personal, intrusive questioning. RAD inhibition did not distinguish these clinical groups, but disinhibition was significantly greater in the RAD sample. Neither age nor IQ had any significant impact on RPQ scores, in any of the 3 samples. 34% with a clinical diagnosis of ASD scored above the RPQ threshold for RAD, of whom 26% (9% of total ASD) had callous and unemotional (CU) traits. No CU traits were reported in ASD children who scored below the RAD threshold. On basis of ADI-R algorithm scores, the ASD group scored significantly higher than either RAD or general population, but 46% RAD scored above threshold for reciprocal social interaction problems; 63% had communication problems; 20% had repetitive and stereotyped behaviours.

Conclusions:

Whilst RAD and ASD can look superficially similar to the clinician, and share autistic symptoms, there are characteristics of both conditions that assist in their discrimination. The RPQ provides a useful means of distinguishing between RAD from ASD, and just five items contribute to the greater part of the variance.

128.044 44 The Use of the Social Responsiveness Scale to Discriminate Between Autism Spectrum Diagnoses and Communication Disorders. B. Gorka*, *Children's Hospital of Michigan*

Background:

The Social Responsiveness Scale (SRS) is a parent-report instrument often used in clinical settings. It is commonly is used to obtain information on symptom magnitude in children suspected of having social problems, and in particular, children suspected of having autistic spectrum problems and/or developmental impairment. The SRS total score has been found to distinguish between children who have an Autism Spectrum Disorder (ASD) and typically developing controls (Constantino, et al. 2007) and unaffected siblings of children diagnosed with an ASD (Frazier, et al, 2009). A limited amount of research has been conducted on the SRS using comparison populations with overlapping symptom presentation. One study compared SRS scores in ASD and non-ASD special education children with intellectual and behavioral problems (Charman et al. 2007), and found the SRS to useful in discriminating ASD and nonASD children in this population. As yet, there is relatively little research that has been conducted to evaluate the use of the SRS in discriminating between children with ASDs and specific communication disorders (i.e., specific language impairment).

Objectives:

The goal of the present study was to investigate the use of the SRS total score and/or subscales in discriminating between children with an autism spectrum diagnosis and those diagnosed with specific language disorder, controlling for level of intellectual and/or adaptive behavior functioning.

Methods:

Participants included 80 children (63 male) referred to a hospital based clinic for assessment of a possible autism spectrum disorder. Children ranged in age from 48 months to 156 months (Mean = 80.7, S. D. = 30.1). Children and their primary caregivers participated in a neuropsychological evaluation which included diagnostic assessment (ADI-R, ADOS), assessment of intellectual, language, magnitude of triad and associated symptoms. Sixty-six children received an autism spectrum disorder diagnosis (autistic disorder, PDD-NOS) and 14 children received a diagnosis of a communication disorder (either expressive language disorder or mixed receptive-expressive language disorder), according to DSM-IV TR criteria. Caregivers of all participants completed the SRS as well. Initial analyses tested for between-group differences on age, gender, and intellectual functioning; those that differed between diagnostic groups were included in subsequent analyses as covariates. Between-group differences on the SRS scales were evaluated using a one-way MANCOVA, with diagnostic group as the between-subjects factor and SRS subscales and total score as the outcome variables(s).

Results:

The two groups did not differ on age, gender, or intellectual functioning . The overall test was significant (F(6, 73)=3.91; p=0.016). Follow up tests revealed that the ASD group had increased scores (indicative of increased social problems) on the Social Motivation, (F (1, 78) = 18.0, p < .001), Autistic Mannerisms (F (1, 78) = 7.73, p= 0.008), Social Communication (F (1, 78) = 7.70, p = 0.008) and Total SRS scale, (F (1, 78) = 10.71, p =0.002). The groups did not significantly differ on the remaining SRS subscales.

Conclusions:

Caregiver-report of social behaviors related to social communication, motivation and autistic mannerisms on the SRS does distinguish between children diagnosed with an ASD and those with a Communication disorder.

128.045 45 The Association of the Social Responsiveness Scale (SRS) with Measures of Global Intelligence and Adaptive Functioning In the Assessment of Children with ASDs. B. Gorka*, C. Mader, B. Patel and N. Gjolaj, *Children's Hospital of Michigan*

Background:

The Social Responsiveness Scale (SRS), a parent-report screening measure of autistic traits in individuals between the ages of 4 and 18, has been widely used in both clinical and research settings to assess the degree of social impairments specific to Autism Spectrum Disorders (ASDs). Early studies of the measure revealed that the SRS total score was independent of global cognitive functioning. However, there has been relatively little research that has examined the relationship of the SRS subscales to overall level of cognitive functioning. Further, given the difficulties of reliable assessment of children with ASDs, evaluation of the relationship of the SRS subscales to an alternative measure of overall functioning may also be warranted.

Objectives:

The aim of the present study was to evaluate the relationship of global and specific intellectual indices and adaptive behavior functioning to the SRS subscales.

Methods:

Diagnostic data retrieved from a sample of 117 children (24 females; 92 males) between the ages of 48 and 312 months (mean= 93.43 ; sd= 38.80) with diagnoses of ASDs were evaluated. Results from measures of cognitive functioning (Wechsler Intelligence Scale for Children, Fourth Edition [WISC-IV], Wechsler Preschool and Primary Scale of Intelligence, Third Edition [WPPSI-III]), adaptive functioning (Vineland Adaptive Behavior Scales, Second Edition [Vineland-2]), and social responsiveness (SRS) were examined. Pearson bivariate correlations were used to evaluate the magnitude of relationships between the SRS subdomains and intellectual indices and adaptive behavior domain scores.

Results:

Overall, results indicate that intelligence was independent of SRS subdomains. However, SRS scores were not independent of the Vineland-2. Total scores on the SRS were significantly correlated with Vineland-2 domains in the areas of Communication (r=-.471, p=.001), Socialization (r=-.634, p=.000), and the Adaptive Behavior Composite (r=-.516, p=.000). Additionally, SRS subscales were significantly inversely related to Vineland-2 domains in all areas with the exception of Motor Skills. In particular, associations were observed between the Vineland-2 Communication composite and three SRS subscales (Social Communication r= - .416, p=.002; SRS Social Motivation r= -.540, p=.000; SRS Autistic Mannerisms r= - .332, p=.034). Daily Functioning Skills according to the Vineland-2 were found to be negatively associated with the SRS Motivation subscale (r= - .469, p=.000). Finally, the Socialization domain of the Vineland-2 was found to be inversely related to four domains of the SRS (Autistic Mannerisms r= -.569, p=.000; Social Cognition r= -321, p=.020; Social Communication r=-.552, p=.000; Social Motivation r= -.469, p=.000).

Conclusions:

In conclusion, results support that the SRS total and subscales are independent of intellectual functioning. The SRS subscales were not independent of the subdomain scores of the Vineland-2. These findings are promising, as adaptive skills have more potential for development and improvement than does general ability. Future research will evaluate if the dependence observed is reliant upon learned adaptive skills in general or if particular aspects of social functioning, such as those assessed by the SRS, are preferred predictors for overall functioning in individuals who meet criteria for diagnoses of ASDs. Implications for adaptive skills intervention are discussed.

128.046 46 Use of the Social Responsiveness Scale to Discriminate Between Autism Spectrum Diagnoses and Communication Disorders. A. Veenstra*[1], N. Gjolaj[2], M. Palance[1], B. Patel[1] and M. E. Behen[1], (1)*Children's Hospital of Michigan*, (2)*Children's Hospital of Michigan Autism Center*

Background:

The Social Responsiveness Scale (SRS) is a parent-report instrument often used in clinical settings. It is commonly is used to obtain information on symptom magnitude in children suspected of having social problems, and in particular, children suspected of having autistic spectrum problems and/or developmental impairment. The SRS total score has been found to distinguish between children who have an Autism Spectrum Disorder (ASD) and typically developing controls (Constantino, et al. 2007) and unaffected siblings of children diagnosed with an ASD (Frazier, et al, 2009). A limited amount of research has been conducted on the SRS using comparison populations with overlapping symptom presentation. One study compared SRS scores in ASD and non-ASD special education children with intellectual and behavioral problems (Charman et al. 2007), and found the SRS to useful in discriminating ASD and nonASD children in this population. As yet, there is relatively little research that has been conducted to evaluate the use of the SRS in discriminating between children with ASDs and specific communication disorders (i.e., specific language impairment).

Objectives:

The goal of the present study was to investigate the use of the SRS total score and/or subscales in discriminating between children with an autism spectrum diagnosis and those diagnosed with specific language disorder, controlling for level of intellectual and/or adaptive behavior functioning.

Methods:

Participants included 80 children (63 male) referred to a hospital based clinic for assessment of a possible autism spectrum disorder. Children ranged in age from 48 months to 156 months (Mean = 80.7, S. D. = 30.1). Children and their primary caregivers participated in a neuropsychological evaluation which included diagnostic assessment (ADI-R, ADOS), assessment of intellectual, language, magnitude of triad and associated symptoms. Sixty-six children received an autism spectrum disorder diagnosis (autistic disorder, PDD-NOS) and 14 children received a diagnosis of a communication disorder (either expressive language disorder or mixed receptive-expressive language disorder), according to DSM-IV TR criteria. Caregivers of all participants completed the SRS as well. Initial analyses tested for between-group differences on age, gender, and intellectual functioning; those that differed between diagnostic groups were included in subsequent analyses as covariates. Between-group differences on the SRS scales were evaluated using a one-way MANCOVA, with diagnostic group as the between-subjects factor and SRS subscales and total score as the outcome variables(s).

Results:

The two groups did not differ on age, gender, or intellectual functioning . The overall test was significant ($F(6, 73)=3.91$; $p=0.016$). Follow up tests revealed that the ASD group had increased scores (indicative of increased social problems) on the Social Motivation, (F (1, 78) = 18.0, $p < .001$), Autistic Mannerisms (F (1, 78) = 7.73, $p= 0.008$), Social Communication (F (1, 78) = 7.70, $p = 0.008$) and Total SRS scale, (F (1, 78) = 10.71, $p =0.002$). The groups did not significantly differ on the remaining SRS subscales.

Conclusions:

Caregiver-report of social behaviors related to social communication, motivation and autistic mannerisms on the SRS does distinguish between children diagnosed with an ASD and those with a Communication disorder.

128.047 47 Validity of the Autism Dysmorphology Measure (ADM) for Assessment of Generalized Dysmorphology.
J. H. Miles*, *Thompson Center at the University of Missouri*

Background:

ADM is a statistically valid measure originally designed to allow non-geneticist physicians to assign dysmorphology status of autism patients presenting for diagnosis or participation in research protocols. The ADM assesses 12 physical structures (height, hair growth pattern, ear size, structure and placement, nose size, face size and structure, philtrum, mouth and lips, teeth, hand size, fingers and thumbs structure, nails and feet size and structure); each structure is labeled dysmorphic or non-dysmorphic based on comparisons with non-affected parents. Using the 12 results the ADM algorithm leads the physician to a decision of dysmorphic or non-dysmorphic. This report provides information on the success of various learning groups using the ADM.

Objectives:

Determine whether non-geneticist physicians can accurately assign dysmorphology status of autism patients and what training and testing modalities are most effective.

Methods:

More than 100 individuals received training on the use of the ADM, including receiving the Training Manual, ADM Training PowerPoint, in person instruction, practice scoring sessions and 10 test cases. Learners seeking validation of their training were asked to submit results of one or more case studies. Results from 16 individuals (11 physicians, 5 non-physicians (RNs, psychologists) who submitted a total of 34 ADM cases are presented here. Each ADM case was graded on 51 responses; ability to convert growth measures to centiles using standard growth charts, ability to judge the dysmorphology status of 12 physical structures and conclude whether each structure fell within or outside the range of normal, based on comparison with parents, and use of the ADM scoring algorithm to formulate the final dysmorphology decision.

Results:

Seventy-five percent of test takers obtained a passing score of 85%. The primary predictor of success was physician status. Physicians passed 81% of cases, non-physicians only 25%. The average score for physicians was 88% and 74% for non-physicians. Analysis by question type revealed learners plotted growth curves with 95% accuracy (physicians 96%; non-physicians 90%). Physicians were 84% accurate assigning dysmorphology status to the 12 structures; non-physicians 76%. Assignment of final dysmorphology status was 88% correct for physicians and 61% for non-physicians. Each of the 12 structures assessed by the ADM measure was analyzed individually to identify areas of difficulty. Though nose size, philtrum, and face size/structure were correctly classified less often, overall the 12 structures presented similar challenges, based on low SDs (84% ± 7% for MDs; 79% ± 17% for non-MDs). Physician geneticists scored only minimally higher than geneticists and both groups assigned dysmorphology status with 88%.

Conclusions:

With minimal training on the ADM physicians can correctly assign dysmorphology status 88% of the time. Extending training time to 2+ hours and providing 3 dimensional photographs raised accuracy to 95%. Non-pediatricians who don't routinely plot growth curves require extra training in this area. Comparisons of results indicate training targeted specifically for MDs versus non-MDs could improve results especially for the non-physicians. Though 3 dimensional face photographs were available for most cases, the inherent difficulty of assessing dysmorphology via photographs is considered the main limitation.

128.048 48 Exploring the Relationship Between Essential/Complex Autism Subgroups and Parent Report of ASD Phenotypic Variables. T. N. Takahashi*[1], S. M. Kanne[1], M. O. Mazurek[2] and J. H. Miles[3], (1)*Thompson Center for Autism and Neurodevelopmental Disorders*, (2)*University of Missouri - Columbia*, (3)*University of Missouri*

Background: Previous studies examining ASD heterogeneity have identified a subgroup of individuals, termed "Complex" autism. These individuals, comprising about 20% of the ASD population, have been found to have lower IQs, more seizures, and more abnormalities on EEGs and MRIs, and are defined as being dysmorphic or microcephalic. The remaining 80% have been termed "Essential" autism, which is more heritable with higher sib recurrence rates and a higher male to female ratio.

Objectives: In addition to replicating prior work identifying the differences between Complex and Essential autism, a primary aim of this study is to examine the relationship between parent report of ASD features (i.e., ADI-R) and genotypic subtypes of Essential vs. Complex.

Methods: A subsample of 389 participants who had completed a dysmorphology examination was selected from the total sample of 1888 children who had participated in the Simons Simplex Collection (SSC). The SSC is a North American multi-site, university-based research study that includes families with only one child with an ASD. Comparisons between the Complex and Essential autism participants were made across a number of demographic and phenotypic variables using chi-square and t-tests. Logistic regression was then used to examine whether specific variables were significantly related to an individual being classified as complex or essential autism.

Results: The majority of the participants were in the Essential group (84%). No overall group differences were found with respect to age, SES, ethnicity, sex ratio, autism severity (i.e., ADOS Calibrated Severity Scale), regressive onset, abnormal EEG or MRI, autism syndrome diagnoses, or parent report of ASD symptoms (i.e., ADI-R subscales). The groups differed significantly with respect to intellectual functioning, with the Complex group having lower overall IQs (FSIQ = 70.9) compared to the Essential group (FSIQ = 86.9). The groups also differed in adaptive skills, with the Complex group being slightly more impacted than the Essential (Vineland 2 ABC = 72.3 vs. 75.4). The Complex group had more than twice as many reported seizures (17.5% vs. 7.6%). Initial logistic regression indicated that FSIQ was the strongest predictor of Essential vs. Complex autism, with higher IQ predicting Essential autism. Autism severity was also significant with

greater severity predicting Essential autism. When behavioral predictors alone were examined, FSIQ was again significant, with the addition of core ASD communication symptoms as reported by parents (i.e., ADI-R Communication subscale). When this scale was examined independently, the specific symptoms of pointing, chatting, and stereotyped/echolalic language were most predictive – with greater symptom severity associated with Essential autism.

Conclusions: Results generally supported prior conclusions regarding the differences between Essential and Complex autism subgroups, with the Complex group comprising 16% of the sample, lower IQs, and more seizures. This SSC sample excluded individuals with a family history of ASD, which may account for discrepancies from prior results, such as differences in sex ratios. Further results indicated a relationship between the subgroups and behavioral phenotypic information, suggesting that beyond IQ, ASD symptoms associated with core communication deficits were also significantly associated with Essential or Complex autism.

128.049 49 How Are Diagnostic Tools Used In Clinical Practice? Evidence From a Nationwide Survey of Children's Diagnostic Services In Wales, UK. S. R. Leekam*[1], D. Wimpory[2], J. Lidstone[1], C. Ramsden[1] and H. Morgan[3], (1)*Cardiff University*, (2)*Bangor University*, (3)*Welsh Assembly Government*

Background: Standard diagnostic tools such as ADI-R, ADOS, DISCO and 3di are routinely used to screen research participants for inclusion in research studies. However when it comes to their clinical use in diagnosis, the scores on these instruments guide rather determine diagnostic decisions.

Objectives: The objective of this research was to clarify the extent to which standardized diagnostic instruments contribute to the diagnostic process for clinicians diagnosing children with ASD.

Methods: A questionnaire study was carried out, recruiting psychiatrists, paediatricians and clinical psychologists and other clinicians involved in diagnosing children with ASD throughout Wales, UK. There were 118 respondents (an estimated response rate of 57%). The content of the questionnaire study was informed by an initial qualitative focus group study. This dealt with issues related to clinicians' evaluation and use of clinical tools. For the questionnaire study, questions were asked about elements of assessment used in the diagnostic process and the use and perceived value of specific diagnostic tools.

Results: Results showed that while observation and history taking were routinely used in clinical practice for virtually all cases, the four standardized diagnostic tools—ADOS, ADI-R, DISCO and 3di—were used by only 55% of respondents. Of these, the most extensively used, by 48% of the sample, was the ADOS. Of those who did use ADOS and ADI, 75-81% used the tool in its entirety and usually used the scoring system to complement their clinical judgement. Of those who had received training on the ADOS and ADI, only a very small proportion had followed up their training to qualify to a recognized standard of agreement (i.e., standards required for research use and/or in-house training of colleagues). Furthermore, some clinicians who have undertaken formal training on diagnostic tools use those tools in a minority of cases. For example, one third of clinicians who have attended ADI training use this tool in less than 50% of cases. There was evidence that clinicians highly valued the standardization and objectivity offered by all diagnostic tools. They also appreciated the evidence base of the tools and positive reactions of parents to them. Barriers to the use of the tools included time and other resources. However, qualitative data also strongly indicated that formal instruments should not be over-emphasized compared with professional clinical judgement and practice.

Conclusions: Clinicians in Wales, UK, do not necessarily make use of standardized diagnostic tools to guide their clinical judgement when making a diagnosis of ASD. If this picture is common elsewhere in the UK or internationally, this has broader implications for research recruitment, international comparisons, and the development of a consistent conceptual understanding of ASD.

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128.050 50 The Observation of Spontaneous Expressive Language: A New Measure for Spontaneous and Expressive Language of Children with Autism Spectrum Disorders and Communication Disorders. S. H. Kim*[1], D. Junker[2], K. Houck[2] and C. Lord[3], (1)*University of Michigan Autism and Communication Disorders Center* , (2)*Univeristy of Michigan Autism and Communication Disorders Center* , (3)*University of Michigan*

Background: An assessment of language level and delay is one of the crucial parts of identifying and describing Autism Spectrum Disorders (ASD). Language impairments (e.g. echolalia, pronoun reversal, and odd intonation) have been found to be one of the strongest indicators of ASD. For the assessment of spoken language in ASD, transcriptions or formal linguistic analyses (e.g. CHILDES, SALT) can be used,

which can be time consuming and highly technical. However, there have not been instruments that measure spontaneous expressive language (defined as language not directly elicited as part of the test) of children with ASD in a more naturalistic setting.

Objectives: The main objective of the present study is to evaluate a newly developed assessment tool, the Observation of Spontaneous Expressive Language (OSEL) that measures children's social use of spontaneous expressive language in natural contexts.

Methods: Data were obtained from 160 typically developing children between 2 to 5 years who were administered a set of language measures, such as Preschool Language Scale (PLS) and the OSEL. During the OSEL, children's use of spontaneous expressive language in natural social contexts (e.g. playing with a variety of toys, interacting with an examiner during imaginative play, telling stories from a cartoon strip) were coded. Caregivers were administered a set of parent questionnaires, such as the Vineland Adaptive Behavior Scales (VABS). The first set of analyses focused on inter-rater and test-retest reliabilities using weighted kappa. Internal consistency was assessed using Cronbach's alpha. Concurrent and convergent validity were also assessed through calculating correlations between the OSEL scores and other measures, as well as age and verbal/nonverbal IQ scores. Another focus of analyses was to derive age equivalents based on item means and standard deviations

Results: Inter-rater and test-retest item reliabilities ranged from kappa of 0.58 to 0.77 and from 0.49 to 0.78 respectively. Cronbach's alpha for internal consistency was 0.94. Most OSEL items showed moderate associations with age (65% showing r >0.3). Correlations between the OSEL items and expressive communication scores in the PLS and communication domain scores in the VABS were moderate (for both, more than 50% showing r >0.3). Correlations between the OSEL items and verbal and nonverbal IQ scores were generally low (90% showing r <0.3 for verbal IQ, 85% showing r <0.3 for nonverbal IQ). As expected, item means for grammatical uses for older cohorts were higher than for younger cohorts. In contrast, the opposite trend emerged for ungrammatical uses.

Conclusions: Results indicate moderate to strong inter-rater and test-retest reliabilities and strong internal consistency for the OSEL. Generally, age showed moderate associations with the OSEL items scores. The OSEL scores were also moderately associated with other language measures including the PLS and VABS. Verbal and nonverbal IQ scores were fairly independent of the OSEL scores. Age equivalents are in the process of being derived. We expect that the further assessment of the OSEL in children with ASD and other communication disorders can address the potential utility of quantified language profiles obtained from the OSEL in intervention, genetic and neuroimaging research.

128.051 51 Gender Differences In Presentation of Autism Spectrum Disorders. C. Tam*[1], A. Johnston[2], J. M. Doerr[1], S. J. Brewster[1] and E. Hanson[1], (1)*Children's Hospital Boston*, (2)*UNC*

Background: It is well established that the incidence of Autism Spectrum Disorders (ASD) is higher in males than females, with ratios estimated as high as 4:1 (Fombonne, 1999). However, differences that may occur between genders in developmental profiles or clinical presentation of ASD are not fully understood. Numerous studies have found gender differences in IQ (Carter et al., 2007; Banach et al., 2009; Volkmar et al., 1993; Lord et al., 1982), but these results have been variable.

Objectives: Through exploratory analyses, this study will further examine sex differences among individuals diagnosed with ASD.

Methods: Over 240 families, with at least one child clinically diagnosed with ASD, have been enrolled in our study. Participating children ranged in age from two to eighteen years (203 males, 39 females). A comprehensive battery was used to assess the cognitive and social functioning of the children with ASD. ASD diagnostic information was collected through direct observation and parental report, including the Autism Diagnostic Observation Schedule (ADOS), and the Autism Diagnostic Interview (ADI). We examined various characteristics of ASD clinical presentation, including social communication, interaction skills, and repetitive and stereotypical behaviors with respect to gender. We also looked at aspects of developmental functioning, including verbal, nonverbal, motor, and adaptive skills as well as psychopathological and maladaptive behaviors.

Results: Our data supports previous research that males with ASD tend to have higher IQ than females with ASD. In addition, we found that males and females did not differ in their presentation of ASD. In our sample, females demonstrated more autistic behaviors as reported on the Social Responsiveness Scale, however, these differences were not detected in our other behavioral measures.

Conclusions: Although our behavioral measures did not indicate significant gender differences in the presentation of ASD, in our next round of analyses we plan to further expand our data set, as well as to explore whether sex differences vary among individuals with or without a family history of ASD.

128.052 52 Visual Scanning of Faces In Childhood Disintegrative Disorder. A. C. Voos*[1], A. Westphal[2], M. D. Kaiser[1], D. R. Sugrue[1], F. R. Volkmar[1] and K. A. Pelphrey[1], (1)*Yale University*, (2)*Yale Child Study Center*

Background: Childhood disintegrative disorder (CDD) is a rare developmental disorder characterized by at least two years of normal development, followed by a loss of language, social and motor skills. Little research on the disorder exists, due mostly to its rare occurrence, with estimates ranging from .11 to .64 per 10,000. The unique natural history of the disorder, specifically the late age of onset, is the foundation of the definition and diagnosis of CDD. Otherwise, its clinical features, post regression, are very similar to those of the other Autism Spectrum Disorders (ASD) coupled with moderate to profound Intellectual Disability. However, the unique natural history of CDD raises the possibility that it may represent a different pathophysiological process than ASD, which might be marked by subtle behavioral differences. Eye-tracking studies have repeatedly identified disrupted facial scanning as a hallmark of ASD, but have yet to be applied to individuals with CDD. Eye-tracking may enable us to determine whether CDD is associated with the same behavioral phenotype as ASD.

Objectives: We sought to characterize the gaze behavior of children with CDD, relative to children with ASD and typically developing (TD) children, while scanning pictures of faces.

Methods: Two children with CDD (mean age = 149 months), 16 with ASD (mean age = 114 months) and 8 TD children (mean age = 129 months) were eye-tracked using a Tobii T60 XL. The stimuli included 14 adult faces from the NimStim Face Stimulus Set (shown three times expressing either a happy, fearful or neutral expression) and 14 houses. The task consisted of two, 4 minute 13 second runs of randomly ordered faces and houses with staggered fixations (in either the upper and lower left or right corners of the screen). Regions of interest were created for the eyes and the mouth on each face, using Tobii Studio 2.1, and were applied to every face in the stimulus set.

Results: Overall, children with CDD looked less at the faces (total fixation duration for eyes= 14.2 seconds and mouth= 3.37 seconds) compared to both TD children (eyes= 27.90 seconds and mouth= 9.40 seconds) and children with an ASD (eyes= 16.70 seconds and mouth= 12.64 seconds). Notably, the CDD group had the highest ratio of total fixation of eyes to mouth (4.29), compared to TD children (2.97) and children with ASD (1.32).

Conclusions: Children with CDD look less at faces than either the ASD, or TD groups. This may be related to some difference in their intellectual function. However, when they do attend to faces they look more at the eye region compared to the mouth region of the face. Although this work is limited to two subjects (data collection is ongoing), it raises the possibility that despite their low levels of intellectual function, children with CDD, in comparison to ASD, explore faces in a manner more similar to their TD counterparts. These results suggest that CDD represents a distinct pathophysiology from ASD despite the similarities in clinical presentation of these disorders.

128.053 53 Salient Feature Extraction From Video Stimuli for Diagnostic Gaze Tracking Paradigms. D. Conant*, R. Stoner, E. Musker, S. Marinero, E. Borchert and K. Pierce, *University of California, San Diego*

Background:

Free standing eye tracking technology is a powerful tool that has shown promise in early identification efforts. For example, a previous study by our center has identified a clear subgroup of toddlers with autism as young as 14 months that display unusually prolonged visual fixation patterns in response to dynamic geometric images (Pierce et al., 2010). Visual fixation patterns alone were clear enough to discriminate toddlers with an ASD from those that were typically developing with 100% positive predictive value. From this work however it was unclear as to which segments of the dynamic video and/or which salient features were driving the classification. In order to produce a robust diagnostic tool, it is critical to identify the most salient components. Doing so will facilitate the rapid development of powerful stimuli for early identification and discover of other gaze-specific phenotypes.

Objectives:

To develop technology for use with eye tracking technology that automatically identifies salient features in dynamic video that best discriminates toddlers with autism from those that are developmentally delayed or typically developing.

Methods:

To date, ninety toddlers (44 ASD; 41 Typical; 27 LD; 5 DD, mean age = 27 months) ranging in age between12-42 have participated in a series of eye tracking experiments each

containing dynamic video. Results from the first eye paradigm that examined visual fixation to an actor engaged in various gestures, served as the test sample for the current experiment.

During the “gesture experiment” each toddler was presented with a 43 second video containing 8 scenes of an actor performing socially engaging actions. These actions vary from a simple 'wave hello' to emotionally salient actions, e.g. crying 'boo hoo', to bids for shared attention. Gaze fixation was monitored continuously with a TOBII T120 eye tracker. Areas of interest (AOI) for body, head, eye, mouth and hand regions were created on a per-scene basis and applied within TOBII and Matlab code.

To extract salient regions from the video stimuli, AOI data were grouped by diagnostic category and normalized by the number of valid samples per group. Difference metrics per scene were calculated and used to select individual frames of greatest deviation by diagnostic group and AOI. Mean gaze location was then determined and used as a secondary metric of comparison.

Results:

Based on preliminary feature extraction algorithms, multiple segments during the gesture experiment strongly discriminated visual fixation patterns between at-risk and control groups ($p < 0.005$ for mean vertical position). In contrast, when the duration of gaze fixation across primary areas of interest were averaged across an entire scene, as is common in most eye tracking experiments, the group differences disappeared ($p > 0.05$ for all AOIs compared).

Conclusions:

Using a salient feature extraction, we were able to identify segments of video stimuli that produced deviation in gaze location between at-risk and control toddlers that would not be apparent in broader analyses. The current algorithms are easy to use, and could be of considerable benefit during the creating of maximally potent early eye tracking tests for autism.

128.054 54 Geometric Responders: A Clearly Definable Subgroup of Toddlers with ASD. R. Hazin*, D. Conant, R. Stoner, S. Marinero and K. Pierce, *University of California, San Diego*

Background: Eye tracking technology holds promise as an objective methodology for characterizing early features of autism. Given the choice, typically developing (TD) toddlers prefer to observe social over non-social images. It is unclear if this preference exists in toddlers with autism (ASD), particularly during early stages of clinical onset. Using a preferential looking paradigm, we recently discovered (Pierce et al., 2010) that a subset of toddlers as young as 14-months with later confirmed autism spent considerably greater time visually fixating on dynamic geometric shapes versus social images, a pattern not found in TD or developmentally delayed (DD) toddlers. Specifically, when using a 67% fixation time cut off, the positive predictive value for accurately classifying toddlers as ASD was 100%. In this first study, 40% of ASD toddlers displayed a preference for geometric repetition and 60% displayed the typical pattern-an interest in social images. Thus, the sensitivity of the geometric test for autism is low, but the specificity is exceptionally high.

Objectives: To determine, in a new sample, if toddlers at-risk for ASD prefer to look at dynamic geometric images (DGI) over dynamic social images (DSI) and the degree to which preferential looking patterns can discriminate toddlers at-risk for an ASD from those at-risk for a DD as well as TD controls.

Methods: Using a population-based screening method, toddlers with later confirmed ASD or DD as young as 12-months were recruited and longitudinally tracked. One hundred and thirty-nine toddlers ranging between 12-42 months participated (51 ASD; 65 TD; 23 DD; mean age=27 months) and only those with later confirmed diagnoses were included. As in the original study, toddlers viewed a 1-minute movie consisting of the simultaneous and adjacent presentation of DGI and DSI. Fixation length was determined using a TOBII eye tracker and preference was defined as looking time >50% of total time looking towards one movie type.

Results: Overall, toddlers at-risk for ASD spent significantly more time looking at DGI than TD, $t(114)=5.5$, $p <.001$ and DD $t(72)=1.9$, $p <.05$ toddlers. Thirty-seven percent of the ASD group displayed a DGI preference in contrast to only 1.5% of typical and 21% of DD toddlers. Several of the ASD toddlers exceeded 67% DGI viewing time, a pattern not found in any other group in either study. Thus, as in the first study, when 67% DGI viewing time is used as a cut off, the positive predictive value for accurately classifying that toddler as ASD is 100%. Out of the >100 TD and >100 ASD toddlers that have participated in either the original or current study, only 3 TD have preferred DGI slightly (<60% viewing time) in contrast to 34 geometric responders from the ASD groups.

Conclusions: Results of the present study replicate the original findings. Both studies strongly suggest that a preference for geometric repetition is a clearly definable phenotype of early autism and thus can be considered an early marker of autism.

The degree to which brain, blood, and other behavioral correlates exist with this unique subgroup will be explored.

128.055 55 Do Lateral Glances Characterize a Specific Autistic Phenotype? Evidences From a Systematic Study. G. S. Doneddu*[1], M. Foscoliano[1], G. Frigo[1], P. M. Peruzzi[1], F. Casano[1], S. Congiu[1] and R. Fadda[2], (1)*AOB*, (2)*University of Cagliari*

Background: Some studies demonstrated that children with Autism Spectrum Disorders (ASDs) might show atypical visual exploration, like a preferential use of peripheral fields (Ritvo et al., 1986) or might look at the objects out of the corner of their eyes (Filipek et al.,1999). Recently, these atypical visual exploratory behaviours have been investigated by Mottron and colleagues (2007), who defined them as lateral glances towards a moving object, a manipulated object, or either towards the child's own fingers. According to Mottron et al. (2007), these behaviors might be important distinctive signs of ASDs, although they are not specifically targeted in the standardized diagnostic tools but are merged with a miscellaneous of repetitive behaviors involving other perceptual modalities. For this reason, their frequency and their relationship with autism symptoms severity and cognitive development needs to be further investigated.

Objectives: On the basis of these considerations, our study aimed to investigate the incidence of the lateral glances directed and not directed toward a specific target in a group of young children with autism, and to explore their relationship with symptoms severity and cognitive development.

Methods: 31 children with ASDs (26M and 5F; aver.chron.age=52months; 21 Autistics, 10 Pdd-Nos) participated at the study. The 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 thanks to a coding system specifically constructed by the authors, consisting in a list of all possible kind of lateral glances. In particular we defined 4 atypical visual behaviours: LG not directed to specific stimuli; LG not directed to specific stimuli associated to head rotation; LG directed to an object; LG directed to an object associated to head rotation. We divided the sample into two groups, using the mean score of total lateral glances as a cut-off, as follows: the first group included children with a high number of LG (above mean), the second one including children with a low number of LG (below mean). Then, we compared symptoms severity, assessed with the ADOS, and non-verbal IQ, measured with the Leiter-R scale, between the two groups.

Results: The children with a high number of LG were more severe in ADOS total scores (ADOS High LG Group total scores mean=18.45, sd=2,77; ADOS Low LG Group total scores mean=15, sd=6,1; t=1,765; df=29; p=0.005). There were no differences between the two groups neither in non verbal intelligence nor in ADOS stereotypic behavior scores, suggesting that LG seems to be neither a sign of mental retardation nor a cue of stereotypic behavior classically coded in ASDs.

Conclusions: These results seem to indicate that the lateral glances might be typical of a specific autistic phenotype. Therefore, these behaviors need to be further investigated as they could represent an early sign of ASDs, that could be used by paediatricians and parents in screening protocols and potentially included in standardized diagnostic tests.

128.056 56 Peaks of Ability Combined with Speech Onset Identify Subgroups within Autism Spectrum. M. M. Geoffray*[1], I. Soulières[2] and C. Berthiaume[3], (1)*Institut des sciences cognitives*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (3)*Hopital Riviere-des-Prairies*

Background: Despite clinical recognition of contrasted phenotypes in autism spectrum, DSM-IV subtypes (e.g. autism vs. Asperger syndrome) are often considered as arbitrary segments, and might disappear in DSM-V. This decision stems from low reliability of the autism vs. Asperger syndrome distinction based on DSM-IV criteria and inconsistent findings about cognitive profiles. We propose that using cognitive profiles in conjunction with targeted behavioral characteristics to stratify the autism spectrum might result in more meaningful subgroups than using DSM-IV criteria.

Objectives: To investigate the association between different cognitive strengths and behavioral characteristics in order to identify subgroups within the autism spectrum.

Methods: All participants aged 6 to 40 years with a positive ADI-R score and Wechsler IQ above 70 were extracted from the Rivière-des-Prairies Hospital database. This procedure yielded a cohort of 146 participants (mean age 16.9 years, IQ 96.6). Performance on each Wechsler subtest was compared to the mean of all Wechsler subtests, using paired samples t tests (Bonferroni corrected), to reveal significant cognitive strengths and weaknesses. The behavioral characteristics associated with these significant strengths were then investigated based on information collected with the ADI-R. Data from 47 ADI-R items were used as predictors of

performance on the Wechsler subtests in linear regression analyses. Two-steps cluster analyses allowed identifying subgroups among participants based on the cognitive strengths and behavioral characteristics identified.

Results: The Wechsler profile of the autism spectrum sample was consistent with previous descriptions, with significant strength in Block Design and Similarities, and weakness in Comprehension and Coding. The *presence* of several autism characteristics predicted higher performance in Block Design, among which delay in age of first single words or phrases, reduced social smiling, poor response to approaches of other children, pronominal reversal, repetitive use of objects/interest in parts of objects, and unexpected computational, drawing or visuospatial abilities. On the contrary, the *absence* of several autism characteristics (e.g. behaviours similar to typically developing children) predicted higher performance in Similarities : no delay in first single words or phrases, interest in other children, spontaneous offering to share with others, and typical use of objects. Cluster analyses (with Block Design performance, Similarities performance and age of first phrases) identified a subgroup of participants (49% of sample) who had a strength in Block Design and developed 2 word phrases later (mean 47 months), and a subgroup (51% of sample) with higher Similarities, no strength in Block Design and who developed 2 word phrases earlier (mean 24 months). Going back to the clinical files of these participants, 97% of the participants in the first subgroup had a best estimate clinical diagnosis of autism, and 64% of the participants in the second subgroup had a diagnosis of Asperger syndrome.

Conclusions: Specific behaviors and cognitive strengths (e.g. visuospatial vs. verbal) aggregate within some individuals on the autism spectrum. It allows identifying meaningful subgroups within the spectrum and offers a more operational, objective definition of autism spectrum subgroups. Using cognitive strengths and specific behaviors could strengthen both the diagnosis and the development of targeted education methods.

128.057 57 Social Communication Deficits Are Measurable In Very Young Infants at Risk for ASD. M. M. Abdullah*[1], P. A. Filipek[2], P. L. Horner[3], J. T. Phan[3] and K. L. Pham[3], (1)*University of California, Irvine*, (2)*University of Texas Health Science Center at Houston*, (3)*For OC Kids Neurodevelopmental Center*

Background: The early identification of atypical development among very young infants at risk for a later diagnosis of autism (ASD) is important to facilitate the earliest possible implementation of early intervention.

Objectives: To examine if there are measurable early differences in social communication at 3- and 6-months of age (mo) in infants who were later classified as either having or not having ASD (ASD+/ASD-) in toddlerhood using the Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T).

Methods: Forty infants (20 females) were enrolled in this study by age 2mo, including infant siblings of children with ASD, infants conceived through infertility treatments, and infants without either history; 58% were Caucasian, and 30% reported mixed ethnicity. At 3mo and 6mo, social communication skills were assessed using the Rossetti Infant-Toddler Language Scale (RITLS). At chronological and nonverbal mental ages of ≥ 12mo, based on the Mullen Scales of Early Learning (MSEL), and after having achieved independent ambulation, participants were administered the ADOS-T to obtain ASD classification. There were no significant differences on the MSEL between the ASD+ and the ASD- groups ($t(38)=1.04$, $p=.304$).

Group differences in the subscale domains of the RITLS (Interaction-Attachment, Pragmatics, Play, Language Communication, and Language Expression) were examined using Mann-Whitney analyses; differences in individual subscale items were evaluated by Chi-Square analyses.

Results: Seventeen participants met classification for ASD and 23 did not based on the ADOS-T. Subscale and item analyses results are presented in the Table.

Rossetti Infant-Toddler Language Scale		
	3mo	**6mo**
Subscale Analyses		
Interaction/Attachment	*NS*	$z= -2.87$, $p=.034$
Pragmatics		$z= -2.94$, $p=.003$
Play		$z= -1.45$, $p=.148$
Language Comprehension		$z= -2.92$, $p=.004$
Language Expression		$z= -3.31$, $p=.001$

Item Analyses					
Interaction/Attachment	• *shows differing responses to vocalizations* ($\chi^2(1)=6.01$, $p=.014$)	• *smiles spontaneously to human contact* ($\chi^2(1)=4.39$, $p=.036$) • *smiles when playing alone* ($\chi^2(1)=6.01$, $p=.014$) • *stops crying when spoken to* ($\chi^2(1)=5.97$, $p=.015$)		$p=.036$)	• *when another person vocalizes* ($\chi^2(1)=3.88$, $p=.049$) • *initiates "talking"* ($\chi^2(1)=4.09$, $p=.043$) • *demonstrates sound play when alone or with others* ($\chi^2(1)=7.73$, $p=.005$) • *whines with a manipulative purpose* ($\chi^2(1)=4.18$, $p=.041$)
Pragmatics		• *imitates facial expressions* ($\chi^2(1)=5.63$, $p=.018$)			
Language Comprehension		• *stops crying when spoken to* ($\chi^2(1)=11.53$, $p=.001$) • *discriminates between threatening and friendly voices* ($\chi^2(1)=7.41$, $p=.006$)			
Language Expression	• *vocalizes to caregiver's smile* ($\chi^2(1)=4.39$, $p=.036$) • *produces a hunger cry* ($\chi^2(1)=6.01$, $p=.014$) • *vocalizes to express pleasure* ($\chi^2(1)=4.39$,	• *vocalizes feelings through intonation* ($\chi^2(1)=6.01$, $p=.014$) • *takes turns vocalizing* ($\chi^2(1)=11.47$, $p=.001$) • *babbles* ($\chi^2(1)=6.81$, $p=.009$) • *stops babbling*			

Conclusions: Early social communication deficits among infants later classified as ASD+ appear to be measurable as early as age 3mo using the *Rossetti Infant-Toddler Language Scale,* in particular skills in the Interaction/Attachment and Language Expression domains. Absence of any of these early social communication behaviors may be clinically significant "red flags" for heightened vigilance and monitoring of an infant's development. Although requiring replication in larger samples, these findings may ultimately prove helpful in developmental surveillance efforts in clinical settings as part of a screening instrument for very young infants.

128.058 58 Children with Autism Spectrum Disorders and 'Special Abilities' Represent a Unique Clinical Subgroup. E. Ben Itzchak*[1], A. Binet[2] and D. A. Zachor[3], (1)*Ariel University Center/ Assaf Harofeh Medical Center*, (2)*Bar Ilan University*, (3)*Tel Aviv University / Assaf Harofeh Medical Center*

Background: Increased incidence of 'special abilities' in autism spectrum disorders (ASD) in comparison to other neurodevelopmental disorders has been described. Only a few studies have addressed the phenomenon of 'special abilities' in ASD, their frequencies, types, and relations to specific symptoms of autism.

Objectives:

1. to assess the prevalence and distribution of different types of 'special abilities' in a large cohort with ASD. 2. To compare children with and without 'special abilities' in autism severity, sensory modulation problems severity; adaptive skills abilities; developmental regression; head circumference and family variables (parental education; ASD in the family). 3. To examine whether child characteristics ('special abilities'; age; gender; autism severity) and parental education can predict adaptive skills functioning.

Methods:

From a cohort of 550 children who came to a tertiary autism center and were diagnosed with ASD, only 398 children that were in the age range of 24-84 months, were included in the study. A score of 2 on one of the 'Special isolated skills' items (visuospatial, memory, musical, drawing, reading and computational skills) from the Autism Diagnostic Interview-Revised (ADI-R) was used as a criteria for inclusion in the 'special abilities' group. Pair-matched control group (N=79) without 'special abilities' was selected from the entire ASD group. Medical, developmental familial histories were obtained from the parents. Evaluations of autism severity, sensory problems, and developmental regression were based on the ADI-R, Autism Diagnosis Observation Schedule (ADOS) and the new ADOS severity scale. Adaptive skills were assessed using the Vineland Adaptive Behavior Scales. A neurological assessment including head circumference measure was conducted by a pediatric developmental neurologist.

Results:

Of the 398 children, 112 (28%) were identified with 'special abilities'. Of this group, 40% had memory skills, 24 % music skills, 21.4% visuospatial, 20% reading skills, 6.8% computational skills and 2.6% drawing skills. The 'special abilities' group had significantly better functioning in adaptive communication, socialization and daily living skills domains in comparison to the control group. The two groups did not differ in the overall autism severity score, but the 'special abilities' group had significantly less severe communication (ADOS A) and Social-reciprocal (ADOS B) deficits than the control group. The 'special abilities' group had significantly less severe stereotypic repetitive behaviors and sensory modulation problems than the control group using both the ADI and ADOS relevant items. Head circumference in the control group was significantly smaller than in the 'special abilities' group. Paternal and maternal education of the 'special abilities' group was significantly higher than that of the control group. No differences were noted in developmental regression and familial history of ASD. In our prediction model of adaptive skills' functioning, autism severity contributed 29% and 'special abilities' added 28% to the explained variance.

Conclusions:

'special abilities' are very common in ASD. The 'special abilities' group represents a special subgroup with less severe autism symptoms and sensory modulation problems, better adaptive skills functioning, greater head circumference and higher parental education. Future studies should focus on genetic and imaging research that will shed light on the origin of these 'special abilities'.

128.059 59 Relation Between Cognitive Profile and Social Functioning. P. Ventola*, M. Levine, J. Tirrell, D. DePedro, J. Wolf, C. A. Saulnier and K. D. Tsatsanis, *Yale Child Study Center*

Background:

Children with ASD have varied cognitive profiles (Goldstein et al., 2008; Szatmari et al., 1995; Zander & Dahlgren, 2010). The research on the relationship between cognitive patterns and the core symptoms of autism is more limited. One study reported a significant relationship between the magnitude of social impairment and degree of divergence between cognitive abilities in school age children whose nonverbal abilities were greater than their verbal abilities (Joseph et al., 2002). Another reported significant relationship between discrepantly high verbal and nonverbal abilities and social impairment (Black et al., 2009).

Objectives:

Ascertain frequency of scatter in global cognitive scores in children with ASD and explore the relationship between magnitude and direction of cognitive variability and (a) severity of social disability, (b) level of social ability, and (c) discrete domains of social impairment.

Methods:

The DAS-II was administered to163 children: 112 from a genetics study of ASD (Simons Simplex Consortium study) and 51 from a longitudinal study of ASD. The sample ranged in age from 7 to 17 years (mean = 10.5, s.d. = 2.83) with a mean GCA score of 93.59 (s.d. 18.88). Social functioning was measured using the ADOS, Vineland-II, and SRS.

Results:

Discrepancies greater than 1 s.d. (15-points) in either direction were found at the following frequencies: verbal and nonverbal reasoning
abilities (29.3%); verbal and spatial abilities (39.3%); nonverbal reasoning and spatial abilities (31.8%). The direction of the discrepancy was fairly equally divided in each instance. Discrepancies of greater than 2 standard deviations were less frequent: 8.5%, 12.2%, and 2.9%, respectively, but still greater than what would be expected based on the normative sample.

In children with verbal > spatial abilities, the magnitude of the discrepancy between verbal and spatial abilities was significantly correlated with ADOS calibrated severity ($r = 0.54$, $p < 0.01$) and Vineland-II socialization ($r = 0.40$, $p < 0.05$) scores. In children with verbal > nonverbal scores, the magnitude of the discrepancy between verbal and nonverbal abilities was correlated with the ADOS calibrated severity score ($r = 0.56$, $p < 0.05$) but not the Vineland socialization score. ADOS and Vineland-II scores were not significantly related to magnitude of cognitive variability in children with nonverbal strengths. Relationships between cognitive variability and domain scores on the SRS will also be reported.

Conclusions:

Many children with ASD have significantly varied cognitive profiles. Given the variability and individual differences, cognitive profiles, not just overall ability, are important to consider when conceptualizing the abilities of children with ASD. Although significant variability in cognitive profiles is found with some frequency, it is not associated with magnitude of social impairment in all children. Magnitude of social impairment was associated with degree of cognitive variability in children with stronger verbal than nonverbal/spatial skills. These results differ from prior results (Joseph et al., 2002; Black, et al., 2009), which may be due to differing measurement properties and differing sample characteristics. Overall, increased cognitive variability may be related to severity of neurocognitive disturbance in a subset of children with ASD.

128.060 60 Social Cognition Mediates the Relationship Between Autism-Associated Social Traits and Social Skill. R. B. Nowlin* and N. J. Sasson, *University of Texas at Dallas*

Background: Traits associated with autism have been found in a milder, subclinical level in a subset of non-affected first degree relatives of individuals with autism, a phenomenon that has been deemed the “Broad Autism Phenotype” (BAP; Piven et al., 1997). A subset of BAP individuals who exhibit socially aloof or untactful personality characteristics demonstrate reduced performance on social cognitive tasks (Losh et al., 2009). These findings suggest a relationship between a specific social BAP profile and impaired social cognitive performance. Whether this relationship affects social functioning and extends to the general population has yet to be explored.

Objectives: To determine whether aspects of the BAP predict real world social functioning in the general population, and if this relationship is mediated by social cognitive ability.

Methods: 64 individuals varying on the presence of BAP traits as measured by the Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al. 2007) were assessed by an in vivo observational measure of social skill (“Conversation Probe role-play” [CP]; Pinkham et al. 2006), and completed standardized social cognitive tasks of face and affect recognition. To determine whether social cognition mediates the relationship between BAP traits and social skill, a series of regression analyses were conducted according to Baron and Kenny (1986).

Results: Social BAP traits significantly predicted approximately 6% of the variance in overall social skill (adjusted $R^2 = .063$; $F(1, 63) = 5.26$, $p < .05$), and approximately 7% of the variance in a composite score of performance on the tasks social cognition (adjusted $R^2 = .071$, $F(1, 63) = 5.82$, $p < .05$). To test social cognition as a mediator, social BAP was entered as a predictor of social skill, followed by the addition of social cognition. Once social cognition was added to the model, social BAP traits were no longer a significant predictor of social skill ($p = .17$), demonstrating that social cognitive ability partially mediates the relationship between social BAP traits and social skill.

Conclusions: Findings from this study are the first to demonstrate that social BAP traits in the general population are related to real world impairments in social skill, a relationship that is partially mediated by social cognitive abilities. Data collection and analyses on the mediating role of other social cognitive skills (e.g., theory of mind), as well as a more detailed analysis of subcomponents of social skill (e.g., eye to eye gaze, facial expressivity, clarity and fluency of language) are ongoing and will be available in time for the conference.

128.061 61 Social Subtypes In High-Functioning ASD. A. M. Scheeren*, S. Begeer and H. M. Koot, *VU University*

Background:

Autism Spectrum Disorders (ASD) are characterized by a high degree of clinical heterogeneity (e.g., Jones & Klin, 2009;

Mundy, 2007). This heterogeneity complicates diagnostic assessments and the development of effective interventions. A possibly fruitful approach to this issue is to distinguish subtypes for ASD based on the style of children's approaches and responses in social interactions: aloof, passive and active-but-odd (cf. Wing & Gould, 1979). Studies show that the active-but-odd group is characterized by higher intelligence when compared to passive or aloof children (e.g., Borden & Ollendick, 1994; Waterhouse et al., 1996), but also by larger deficits in attention and motor control (Bonde, 2000). However, most of these findings are based on samples consisting of low-functioning children and adolescents with ASD (IQ < 70), making generalization to a high-functioning group with ASD difficult (HFASD: IQ > 70).

Objectives:

Our goal is to explore differences between social subtypes in HFASD regarding symptoms of autism, cognitive skills and comorbid problems.

Methods:

One-hundred and sixty Dutch children and adolescents diagnosed with HFASD (aged 6 to 18 years) and 53 typically developing controls participated in the study. Additional information on autistic symptoms was obtained with the Autism Diagnostic Observation Scale and the Social Responsiveness Scale. Children completed several competence tasks (e.g., advanced Theory of Mind task) and questionnaires, while parents and teachers completed questionnaires about the child's behavior. Social subtype of the children was assessed with the Wing Subtypes Questionnaire (WSQ) (Castelloe & Dawson, 1994).

Results:

Based on the WSQ most children with HFASD were indicated as active-but-odd (41.2%) or without an ASD social subtype (36.6%), followed by passive (19.6%) and aloof (2.6%). Note that HFASD children without an ASD social subtype still had significantly higher (more autistic) SRS-scores than control group children. The Wing subtypes did not differ in age, gender ratio, verbal IQ, clinical diagnosis, or Theory of Mind task performance (*p's* >.10). . However, the aloof subtype showed more symptoms of autism (ADOS and SRS) than the other subtypes, while the active-but-odd subtype showed stronger deficits in executive functioning (BRIEF), and higher levels of hyperactivity and problem behaviors at school when compared to the passive subtype (*p's* <.05). Data analysis on data collected on the Embedded Figures Test, the Pediatric Quality of Life Inventory and the Interpersonal Reactivity Index is still in progress.

Conclusions:

This study corroborates the heterogeneity observed in children and adolescents with ASD. Despite non-significant differences between the different social subtypes in age, verbal IQ and clinical diagnosis, aloof children clearly showed most autistic symptoms, while active-but-odd children showed more symptoms of hyperactivity, more behavior problems and more problems with executive functioning. These findings suggest that the social interaction styles as represented by the subtypes may originate from or interact with different problem areas such as deficits in executive functioning or impaired Theory of Mind. Unraveling the dimensions along which children with HFASD differ from each other, such as their social interaction style, may offer entries for enhancement of diagnosis and differential treatment.

128.062 62 Examining the Possible Impact of Specific Symptoms of Autism Spectrum Disorder on the Social and Behavioral Adjustment of Typically Developing Siblings. A. Lian*[1], K. Greenberg[1] and E. Hanson[2], (1)*Children's Hospital Boston*, (2)*Harvard Medical School*

Background: Sibling relationships are known to have a significant impact on the process of social and emotional development (Dunn, 1988). A number of studies have focused on potential challenges faced by typically developing (TD) siblings of children who have developmental disability, including autism spectrum disorder (ASD) (Bagenholm & Gillberg, 1991; Knott, Lewis & Williams, 1995; Opperman & Alant, 2003; Hastings, 2007; Barr, McLeod & Daniel, 2008). This study aims to examine how the varying symptom presentation in children with ASD may impact the adjustment of their TD siblings.

Objectives: Based on exploratory analysis examining the relationship between symptoms seen in children with ASD and the adjustment of their TD siblings, the current study aims to further clarify this relationship. We hypothesized that probands who have an increased presence of RRBIs are more likely to have siblings with social and behavioral difficulties.

Methods: Participants were a group of 298 families with at least one child with ASD and one TD sibling, drawn from the Simons Simplex Collection (SSC). Probands had a diagnosis of ASD confirmed using DSM-IV-TR criteria, the ADOS, and the ADI-R. In addition, as part of this study, an extensive battery of cognitive, developmental, and behavioral measures was

administered. Overall severity of the proband's symptoms was calculated using the Calibrated Severity Score (CSS) (Gotham, Pickles, & Lord, 2009). Neurotypical development in the TD sibling was also confirmed. Parents completed the Social Responsiveness Scale (SRS), as well as measures to characterize the emotional and behavioral development of their TD child, including the Vineland Adaptive Behavior Scales- II (VABS-II), and the Child Behavior Checklist (CBCL).

Results: As hypothesized, an increased presence of RRBIs on the ADI in the proband was associated with elevated scores on the social subdomain of the CBCL as well as the externalizing subdomain of the VABS-II for the TD sibling. Specifically, higher scores on Preoccupations and Circumscribed Interests (subdomain A), was significantly associated with sibling maladaptive externalizing behaviors at $p<.05$. Higher scores on Compulsions and Rituals (subdomain B), was significantly correlated with sibling social problems at a $p< .01$ level. Further, more difficulty on the Social domain of the ADI-R by the proband was found to be significantly associated with social problems in the TD sibling ($p<.05$). In testing for birth order effects, when proband was older, TD siblings tended to have elevated maladaptive externalizing behaviors ($p<.05$). Additionally, when testing for gender effects, same gender sibling pairs also predicted increased VABS externalizing behaviors in the TD sibling ($p<.01$). All models were controlled for IQ. CSS as well as all ADOS domains yielded no significant correlations.

Conclusions: There were a number of associations seen between proband and TD sibling behaviors, indicating that TD siblings of children with particular symptoms of ASD may be at increased risk for social and behavioral difficulties. Since this was a cross sectional study, causality cannot be determined with these data. Further studies will be required to better understand the complexity of these sibling relationships.

128.063 63 New Evidence of An Endophenotype Associated with Impaired Shifting Attention In Male Siblings of Probands with Autism. M. Germone*[1], A. J. Lincoln[2] and J. Townsend[3], (1)*Alliant International University*, (2)*Alliant International University;Center for Autism Research, Evaluation and Service*, (3)*University of California, San Diego*

Background:

Studies have shown deficits in rapidly shifting attention between auditory and visual modalities in individuals with known cerebellar pathology and who have a neurodevelopmental disorder associated with abnormal cerebellar growth, such as autism or Williams syndrome. Research also provides evidence for a broader phenotype of autism, characterized by autistic-like traits observed in biological relatives of autistic individuals.

Based on the strong influence that genetics play in the presence of autism and the broad phenotype often seen in first-degree relatives of individuals with autism, it is possible that typically developing siblings of children with autism might have subtle abnormalities affecting subcortical and cortical structures including the cerebellum or cerebellar-frontal systems. This could be indexed by difficulty in their ability to rapidly shift attention.

Objectives:

This study examined shifting attention abilities in typically developing male siblings of children with autism in order to identify whether shifting attention deficits may be an aspect of the broader autism phenotype.

Methods:

Participants included 20 typically developing males with a first-degree sibling with a diagnosis of autism (SIB) and 19 typically developing males with a typically developing first-degree sibling (NC), ages 8-16 years.

Participants were asked to participate in computerized attentional tasks. Each task required the participant to selectively attend to the designated stimulus modality, discriminate between targets, and exhibit a simple motor response (button press) to the detected targets.

The focus attention tasks required the participants to attend and respond to targets in the designated stimulus modality while ignoring targets in the other modality. Targets consisted of a red or green square (visual modality) or a high or low tone (auditory modality). The shifting attention tasks required the participants to detect a target in one stimulus modality, which served to then signal the disengagement of attention from the current modality and to shift to attend to the other modality.

The participant's responses were then categorized into five time bins (0.4 seconds to greater than 30 seconds). The time bins indicate the length of time between the presentation of the cue and the target stimuli. Responses from each time bin were then noted as hits, misses, false alarms, response accuracy (hits/hit+misses), and reaction time (in milliseconds).

Results:

The SIB and NC groups were significantly different in the first time bin (auditory: p=0.043; visual: p=0.002). The difference between the SIB and NC groups was not statistically significant in any of the focus condition time bines.

Conclusions:

When required to do so with less than 2.5 seconds, male siblings showed statistically significant lower response accuracy on both the auditory and visual shifting attention tasks as compared to matched controls. Male siblings demonstrated a pattern of functioning similar to that reported of persons with autism or known cerebellar abnormality.

This study provides support for an autism endophenotype involving rapid intermodality deficits in shifting attention and calls for future research examining gender differences in the expression of such a phenotype. Further research on how genetics influences the cerebellum and cerebellar-frontal system in autism and other neurodevelopmental disorders is warranted.

128.064 64 Social-Communicative Abilities In Young Siblings of Children with Autism Spectrum Disorder (ASD). S. Van der Paelt*, L. Ruysschaert, I. Schietecatte, P. Warreyn and H. Roeyers, *Ghent University*

Background: Previous research shows that the prevalence of social and communicative impairments in siblings of children with ASD is higher than in children without a family member with ASD, which points to a broad ASD-phenotype (e.g. Constantino et al., 2006). Joint attention which is one of the earliest markers for autism, also seems to be impaired in young siblings of children with ASD. However, results are somewhat mixed as to what forms of joint attention are impaired. (Cassel et al., 2007; Goldberg et al., 2005)

Objectives: The aim of the present study is to replicate previous findings, which show more symptoms of ASD and less joint attention in siblings of children with ASD.

Methods: Data were collected from 18 siblings of children with ASD and 22 typically developing controls at the age of 18 months. The Autism Diagnostic Observation Schedule-Generic (ADOS-G; Lord et al., 1989) was administered to assess symptoms of autism. The abridged version of the Early Social Communicative Scales (ESCS; Mundy & Hogan, 1996) was used to asses initiating joint attention (IJA), responding to joint attention (RJA) and initiating behavior request (IBR). A second measure for IJA was the infants' reaction to an unexpected positive event. The results for IJA were based on the average of the two measures.

Results: Siblings of children with ASD score higher on the ADOS ,$t(38)= -2.1$, $p<0.05$, which shows that they have more social-communicative symptoms of ASD than the controls. There is no difference between the groups in initiation or response to joint attention. There is a difference in requesting, but only in the low level behavior use of eye contact to request: siblings of children with ASD use less eye contact to request, $t(38)=2.4$, $p<0.05$.

Conclusions: The 18-month old siblings seem to share some characteristics with their older brothers and sisters with ASD as is shown in the higher score on the ADOS. However, the deficit in joint attention is less clear than in previous research. Follow-up of this sample will reveal to what extent the scores at 18 months are predictive for autism symptomatology and further development of joint attention skills.

128.065 65 The Broad Autism Phenotype Questionnaire: Mothers Versus Fathers of Children with An Autism Spectrum Disorder. N. Yirmiya*[1], I. Seidman[2], S. Milshtein[2], R. Ebstein[2] and S. Levi[2], (1)*Hebrew University Jerusalem*, (2)*The Hebrew University*

Background:

Personality traits such as aloofness, rigidity and pragmatic language difficulties were suggested as key components of the broader autism phenotype (BAP) in parents of children with autism.

Objectives:

To explore sex differences between mothers and fathers of individuals with autism using the Broad Autism Phenotype Questionnaire (BAPQ; Hurley, Losh, Parlier, Reznick, & Piven, 2007), an efficient screening tool for detection of BAP manifestations in adult relatives of individuals with autism. We hypothesized that fathers will manifest higher scores (i.e., more BAP-related difficulties) than mothers on the three scales of aloofness, rigid personality and pragmatic language.

Methods:

The BAPQ was administered to mothers and fathers of 38 children diagnosed with autism both as a self-report and as a spouse informant (e.g., mother reporting about father and father reporting about mother). Three set of scores were obtained for each parent: (1) self-report score; (2) the informant score; and (3) best-estimate score (average of self-report and informant scores). Parents' characteristics (e.g., parents' chronological age, IQ estimate score) as well as child's

characteristics (e.g., severity of symptoms score, developmental/IQ scores) were also obtained.

Results:

Fathers were rated as more "aloof" than mothers whereas mothers were rated as more "rigid" than fathers based on informant and best-estimate scores. As informants fathers perceived and described their wives as less "aloof" and more "rigid" compared to the self descriptions of the mothers. Parents' age, IQ and SES status as well as children's IQ, Vineland score, and ADOS severity scores' were not correlated with parental BAPQ scores.

Conclusions:

These findings are in line with other studies indicating that fathers of individuals with autism, as well as males in general, reveal BAPQ related characteristics. In contrast to previous findings, mothers in our sample revealed significantly higher scores of rigid personality compare to fathers. This finding may be associated with adherence to keeping routines which is important in bringing up a child with special needs or to a genetic liability to autism. The pattern of distinctive sex differences emerged for both the informant and best-estimate versions but not for the self-report version, highlighting the importance of using both self-report and informant versions for the measurement of BAP manifestations in parents of individuals with autism.

128.066 66 Behavioral Approach Characteristics and Variability In Onset Patterns and Symptom Presentation In ASD Siblings. A. P. Inge* and R. J. Landa, *Kennedy Krieger Institute*

Background: Prospective research from longitudinal studies with infant siblings of children with ASD has suggested that timing of symptom onset may vary for children who later receive the diagnosis with some children showing ASD profiles by 14 months of age. Both retrospective and prospective studies have suggested that variability in onset may be in part associated with individual differences in social approach-avoidance tendencies, where children with parent-reported approach tendencies are identified later (after 14 months) than their withdrawal inclined counterparts. Additionally, previous research with ASD children has shown associations between variability in behavioral approach characteristics and comorbid emotional-behavioral symptoms, such that children with approach biases showed greater comorbid internalizing impairment when compared with withdrawal-oriented children.

Objectives: Associations between clinician-observed behavioral approach tendencies and variability in onset patterns and symptom presentation in ASD siblings were examined. Consistency with parent-report data was assessed when available.

Methods: Early versus Later onset profiles were determined for 49 subjects based on best estimate clinical judgment (CJ) ratings completed at each study time point (14, 18, 24, 30, and 36 months). Children with CJ of ASD at or before 18 months of age were classified as “Early;” all others were classified as “Later.” Behavioral Approach (BA) characteristics were measured using the Communication and Symbolic Behavior Scales, Developmental Profile (CSBS-DP) at 14 months. A BA composite was computed by adding total scores for coded Gaze Shifts, Shared Positive Affect, and Initiating Joint Attention behaviors. High versus Low BA was indicated based on a median split of the group. Additional data on BA characteristics and comorbid symptoms were gathered via parent report on the CSBS-DP and the Behavioral Assessment System for Children – Second Edition.

Results: Results of a Chi Square analysis examining the association between High vs. Low BA and Early vs. Later onset patterns indicated significant differences for onset groups, X^2 (49) = 7.23, $p < .01$. Examination of the cross-tabulation indicated that the Later group consisted of significantly more subjects with High BA profile (15 High/7 Low), while the Early group consisted of more subjects with the Low BA profile (19 Low/8 High). However, parent report of BA characteristics did not show a significant relation to onset pattern. Results of a MANOVA examining the association between BA profiles and parent-reported comorbid symptoms at 36 months were not significant.

Conclusions: These data support previous findings showing an association between behavioral approach characteristics and onset patterns in children with ASD. Children with High BA tendencies were more often categorized as ASD Later when compared with children with Low BA tendencies. The lack of convergence with parent report data on behavioral approach tendencies may be due to limitations of the measure of approach, and/or caregivers’ lack of sensitivity to variability on this dimension at 14 months of age. Contrary to previous literature, behavioral approach tendencies were not associated with later comorbid symptoms. This may have been due to lack of sufficient longitudinal data on symptoms.

128.067 67 Social Cognitive Profiles of Children with Autism and Their Siblings. S. E. Thompson*[1], E. Scollin[1], R. A. Libove[2], J. M. Phillips[3], K. J. Parker[2] and A. Y. Hardan[2],

(1)*PGSP-Stanford PsyD Consortium*, (2)*Stanford University School of Medicine*, (3)*Stanford University School of Medicine/Lucile Packard Children's Hospital*

Background: Recent studies support evidence for the Broader Autism Phenotype (BAP), defined as autism spectrum traits in the relatives of children with Autistic Spectrum Disorders (ASD). Due to the increasing demand for etiologic clarity into ASD, siblings of children with ASD are of particular interest. However, this body of research is nascent, and the social cognitive characteristics of the BAP remain largely unspecified at this time.

Objectives: The primary aim of this investigation was to examine the social cognitive profiles of children with ASD, their siblings and neurotypical individuals. A secondary aim of this study was to help clarify possible gender differences in social cognitive profiles among children with ASD.

Methods: Children with autism, their siblings, and age-, gender-matched neurotypical individuals between the ages of 3 and 12 years were included in this study. Social abilities of participants were assessed using the Social Responsiveness Scale (SRS), a parent-report measure of social skills, and two Social Perception subtests – Theory of Mind and Affect Recognition – of the NEPSY-II. The NEPSY-II is one of the few established neuropsychological assessments to include Social Perception subtests which have been shown to be both reliable and valid in differentiating neurotypical individuals from children with ASD. This sample was recruited as part of a study examining the neurobiology of oxytocin as it relates to social abilities in children with autism and their siblings.

Results: A total of 178 participants were included in this investigation: 66 children with ASD, 56 siblings and 56 controls. There were no significant age or gender differences between groups (mean age 7.33; 118 boys, 60 girls). Age was used as a covariate in all analyses. No significant differences in Theory of Mind, Affect Recognition skills, or in parent report on the Social Responsiveness Scale were observed between siblings and controls. As expected, controls performed significantly better on both Social Perception tasks compared to children with ASD [Affect Recognition: $F(1,108)=10.191$, $p<.001$, Theory of Mind: $F(1,44)=13.912$, $p=.001$]. Similarly, children with ASD performed significantly worse than their sibling counterparts on both tasks [Affect Recognition: $F(1,107)=10.811$, $p=.001$, Theory of Mind: $F(1,38)= 11.525$, $p=.002$]. Additionally, statistical examination both across and within groups failed to yield significant gender differences on social perception measures.

Conclusions: Findings from this study suggest that siblings of children with ASD do not appear to show social deficits as measured by informant- and performance-based measures. These results suggest that siblings of children with ASD appear to be more similar on social perception tasks to neurotypical controls than to their sibling with an autism spectrum diagnosis. These observations are inconsistent with recent research suggesting a Broader Autism Phenotype in which siblings of children with ASD may exhibit more social deficits than neurotypical peers. These conflicting findings warrant additional investigations to comprehensively examine all aspects of social cognition in siblings of individuals with autism of all ages.

128.068 68 The Relationship Between Repetitive Behaviors In UIC-ACE Probands with Parent BAPQ. N. Maltman*, S. J. Guter, I. Chung, E. H. Cook and S. Jacob, *University of Illinois at Chicago*

Background: Features of autism spectrum disorders (ASD), both clinical and sub-clinical, have been noted in the general population and among families with members on the autism spectrum. The Broad Autism Phenotype (BAP) has been conceptualized as phenotypic expressions of genetic risk for autism spectrum and used to examine potential genetic links between parents and children.

Objectives: The study examined the relationship between the BAP in parents, and repetitive behaviors, notably insistence on sameness (IS), in their children. It was hypothesized that a significant relationship would exist between parental measurements of sub-clinical ASD features (BAPQ) and repetitive behaviors in children with ASD (RBS-R and ADI-R).

Methods: The current study's sample included parents (n (M) =95, n (D) =81), and their children (n=95, age 11.5 years +/- 8.1 (S.D.), 73 males, 22 females) who have been diagnosed with an ASD by ADI-R, ADOS, and best estimate. The BAP was measured through the Broad Autism Phenotype Questionnaire (BAPQ), which identifies three parental characteristics implicated in the autism phenotype: Aloofness, Rigidity, and deficits in Pragmatic Language. Repetitive Behaviors were measured through the Repetitive Behavior Scale- Revised (RBS-R) and the Autism Diagnostic Interview-Revised (ADI-R) Restricted, repetitive, and stereotyped patterns of behavior (RRSB) domain, subdomains, and insistence on sameness factor. Subjects were from the Autism Center of Excellence (ACE) at the University of Illinois at Chicago (UIC-ACE).

Results: A significant association was noted between maternal BAPQ-Rigid scores and the ADI-R Restricted, Repetitive Behaviors and Interests (RRSB)(C) domain (r=0.23, n=95,

p<0.03), and also the Encompassing Preoccupations (C1) subdomain (r=0.30 ,n=95, p<0.01). Analysis indicated a significant relationship between maternal BAPQ-Pragmatic Language score and RBS-R-Sameness (r=0.24, n=93, p<0.03), as well as RBS-R-Self Injurious Behaviors (SIB) (r=0.29, n=93, p<0.01); the correlation between maternal BAPQ Pragmatic Language and RBS-R Total was r=0.18, n=93, p=0.08. All other correlations were not significant (p > 0.15), including the non-significant relationship between parental BAPQ-Total scores and overall RBS-R scores for mothers or fathers (p > 0.49). None of the findings withstood corrections for multiple comparisons.

Conclusions: The data suggests an association between maternal BAPQ-Rigid scores and the ADI-R RRSB domain and encompassing preoccupations (C1) subdomain, but no associations between overall parental BAPQ-Rigid scores and RBS-R. There was an unanticipated, small positive correlation between maternal BAPQ-Pragmatic Language and the RBS-R-Sameness and RBS-R-SIB scores. Because the data is from an interim sample, further analysis of expanded data in this study and other samples may indicate relationships not noted in the current study.

128.069 69 The Contribution of the Broader Autism Phenotype to Well-Being In Mothers of Adolescents and Adults with An Autism Spectrum Disorder. G. I. Orsmond*[1], M. M. Seltzer[2] and S. Hartley[2], (1)*Boston University*, (2)*Waisman Center, University of Wisconsin-Madison*

Background: Research on parental well-being has largely emanated from a family stress perspective, assuming that the child with an autism spectrum disorder (ASD) poses challenges to the family system. Research from a family genetics perspective has shown that family members of individuals with ASD often show sub-threshold characteristics associated with the condition, labeled the broader autism phenotype (BAP). In this study, we unite these two approaches, and examine the combined contribution of child characteristics and parental BAP characteristics to maternal well-being.

Objectives: Our aims were to (1) describe broader autism phenotype characteristics in mothers and fathers, and (2) to examine the contribution of these characteristics to maternal well-being.

Methods: Data were available from 192 biological mothers (ages 41-84) of adolescents and adults with ASD participating in an ongoing longitudinal study. Mothers participated in interviews and completed self-report measures. Outcome measures of well-being included depressive symptoms (CES-D; Radloff, 1977) and anxiety symptoms (POMS; McNair et al., 1981). Broader autism phenotype characteristics were measured by mother report on herself and her spouse (or biological father of the child) with the Broader Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2007). Child behavior problems were measured using the maladaptive behaviors subscale of the Scales of Independent Behavior-Revised (SIB-R; Bruininks et al., 1996).

Results: One-quarter of mothers and one-third of fathers had BAPQ scores above the cut-off on at least one subscale. Only 2 mothers and 4 fathers scored above the cut-off on all three subscales. Mothers were most likely to score above the cut-off on Aloof (11.5%); fathers were most likely to score above the cut-off on Rigid (17.7%). Paternal BAP characteristics had a direct negative effect on maternal depressive and anxiety symptoms, controlling for maternal age, income, marital status, whether the son or daughter was living at home, gender of child with ASD, life stage of child with ASD, other children in the family with disability, and child behavior problems. The interaction between maternal BAPQ characteristics and child behavior problems was significantly associated with both maternal depressive and anxiety symptoms, such that mothers with higher BAPQ scores who had a son or daughter with more severe behavior problems reported the most depressive and anxiety symptoms.

Conclusions: Our findings suggest that in about one-quarter to one-third of families a parent exhibits at least some characteristics of the broader autism phenotype. Mothers and father appear to have slightly different profiles of BAP characteristics. BAP characteristics in the father appear to have a direct negative impact on the well-being of mothers, seemingly acting as an environmental stressor. However, BAP characteristics in the mother appear to put her at risk of experiencing more negative outcomes when she is faced with greater stress, such as when her son or daughter has more severe behavior problems. These findings are consistent with a diathesis-stress interpretation of the effects of BAP characteristics for an individual. The presence of such characteristics in mothers appears to put them at risk for adverse personal outcomes, particularly when their son or daughter poses challenges.

128.070 70 Expression of the Broad Autism Phenotype In Simplex Autism Families From the Simons Simplex Collection. J. A. Crittendon*[1], Z. Warren[2], R. Hundley[3], R. P. Goin-Kochel[4] and S. U. Peters[5], (1)*Vanderbilt Kennedy Center*, (2)*Vanderbilt University*, (3)*Vanderbilt. University*, (4)*Baylor College of Medicine*, (5)

Background: To investigate the biological pathways that contribute to autism, non-autistic relatives who manifest qualitatively similar traits of the disorder have been utilized in research. This broad autism phenotype (BAP) is principally measured in research through the use of a rating scale. Our group examined some of these measures previously on a smaller dataset. We concluded that classification differed depending on the measure used to assess the BAP; that the SRS:ARV and BAPQ may be assessing different constructs; and that some parents from simplex families demonstrate BAP traits. We extend our previous work by examining a larger dataset to determine if our previous findings hold.

Objectives: To examine the relationship among three of the most commonly used measures that assess the broader autism phenotype in parents of children who have an autism spectrum disorder diagnosis and explore how gender relates to scores on these measures.

Methods: Data were collected via the Simons Simplex Collection (SSC) which is operated by the Simons Foundation Autism Research Initiative. The SSC uses rigorous and uniformly applied phenotyping procedures to study families in which one child (ages 4 to 17) has been diagnosed with an autism spectrum disorder but neither parent nor any sibling has been determined to be on the autism spectrum. Parents in the study completed the Social Responsiveness Scale: Adult Research Version (SRS:ARV) on their spouses, the Broad Autism Phenotype Questionnaire (BAPQ) self-report; and some received ratings from clinicians on the Family History Interview (FHI). These three measures provide quantification of traits related to the BAP.

Results: Our sample (N=3311) was comprised of 1652 mothers and 1647 fathers. Correlations among measures used to assess the BAP were significant ($p<.05$) but weak ($r^2<.20$). Contingency analyses for BAPQ by SRS:ARV total scores were significant; but classification appears to overlap primarily at the extremes; that is, for participants who exceeded cutoff on the SRS:ARV, only 5% also exceeded cutoffs on the BAPQ; in contrast, for participants who exceeded cutoffs on the BAPQ, only 6% also exceeded cutoffs on the SRS:ARV. Differences by gender will also be discussed.

Conclusions: Differences suggest that the BAPQ, SRS:ARV, and FHI are not highly correlated even within this larger dataset and may be measuring different constructs. The SRS and BAPQ may concurrently predict presence or absence of the BAP, but only for individuals who are at the extremes, with a high level of variability at the moderate level of BAP expression. The results also suggest weak correlations between self, informant, and clinician ratings across measures. Findings suggest that the assessment of the BAP varies considerably depending upon the measure being used. Implications, including the need to combine multiple methods of measurement from multiple informants and to clarify underlying constructs being assessed will be discussed.

128.071 71 The Role of Attachment and Narrative In Parental Coping with a Child's Diagnosis of Autism. A. A. Harris*[1], M. Losh[2], E. F. Dillon[1], K. P. Wilson[3], A. M. Sam[4], B. Honeycutt[1], E. Lamarche[1] and G. Martin[1], (1)*FPG Child Development Institute, UNC Chapel Hill*, (2)*Northwestern University*, (3)*University of North Carolina at Chapel Hill*, (4)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*

Background: Having a child diagnosed with autism can be a traumatic experience and has been likened to bereavement. Employing coping strategies such as engaging social support (Hastings & Johnson, 2001) and becoming resolved to diagnosis have been linked to lower levels of parenting stress and more secure child-parent attachment in parents dealing with a child diagnosed with a life-long disability (Knight, 2001; Marvin & Pianta, 1996). Sharing narratives of stressful experiences is seen as an important step towards resolving them (Bowlby, 1980) and narrative discourse features have been implicated as one potential mechanism underlying the coping process (Capps & Bonanno, 2000). This study applies a specific coding scheme to two interviews given to parents of children diagnosed with ASD: the Adult Attachment Interview (AAI: George, Kaplan, & Main, 1985)—which codes feelings of security towards caregivers based on narrative coherence—and the Reaction to Diagnosis Interview (RDI: Pianta & Marvin, 1992)—which uses narrative to rate how parents resolve to diagnosis. When used in bereavement narratives, this coding scheme showed links between grammatical constructions and resolution to a loved one's death as well as an individual's likelihood to garner support from others (Capps & Bonanno, 2000).

Objectives: Adopting paradigms from attachment and bereavement theory, we employed narrative analysis to examine the relationships among discourse, adult attachment status, and patterns of resolution to a child's diagnosis of ASD. We speculated that (1) parents with secure attachment histories would show more successful patterns of grief resolution than parents with insecure or unresolved attachment styles and (2) narrative discourse styles would be associated with attachment history and resolution patterns.

Methods: Fourteen parents of children with ASD were administered the RDI and AAI. Interviews were coded for attachment and resolution status as well as narrative discourse devices previously shown to relate to resolution styles, including constructions of diminished agency (e.g. passive voice) and valence (e.g. positive or negative thoughts). Naïve individuals were then asked to read de-identified transcripts of the interviews and rate how likely they were to support the individual being interviewed. Relationships among narrative devices and attachment and resolution status were examined in relation to how likely others were to offer support.

Results: Preliminary results indicate an association between the increased use of constructions of diminished agency and being unresolved to diagnosis. Unresolved parents used passive voice 17% more often and expressed more negative thoughts and emotions (51% of total thoughts versus 35%) than those who were resolved. Those same unresolved narratives showed a trend towards raters indicating they would be more likely to avoid prolonged contact with the subject (12% higher ratings of avoidance).

Conclusions: Findings suggest a relationship among attachment status, the use of certain narrative discourse devices, and parents' resolution to their child's diagnosis. Such relationships require further investigation, however, these findings may have important implications for how professionals identify individuals who may be struggling with resolution and identify biases in their own reactions to parental discourse with the goal of increased sensitivity during the diagnostic process.

128.072 72 Towards Identifying Phenotypic Subtypes In Autism: Fragile X Syndrome, A Disorder of Lower-Order Repetitive Behaviors. J. J. Wolff*[1], J. Piven[2], H. C. Hazlett[1], A. A. Lightbody[3] and A. Reiss[3], (1)*University of North Carolina at Chapel Hill*, (2)*University of North Carolina at Chapel Hill* , (3)*Stanford University*

Background: Autism is well known to be an etiologically and phenotypically heterogeneous, behaviorally-defined syndrome. Genetics research has identified numerous distinct genetic markers associated with the diagnosis of autism and has come to refer to this group as constituting 'the autisms'. However, while structured, diagnostic instruments often lump these individuals into the same phenotypic category, there is good reason to expect that fine grained analysis will reveal a pattern of phenotypic differences that correspond to these distinct, etiologically-defined groups.

Objectives: In this study we undertake a more detailed characterization of restricted, repetitive behavior (RRB) in a cohort of 4 year old males with Fragile X syndrome and contrast them with an age and sex matched group of individuals with idiopathic autism (iAutism). Factor analyses have suggested a two factor structure underlying RRBs in idiopathic autism, including both so-called "lower" and "higher-order" RRBs. The aim of this study was to discern whether there exists a unique pattern of RRBs that characterize Fragile X individuals and distinguish autistic individuals with Fragile X Sydrome from those with iAutism.

Methods: Participants included 87 male children with a mean age of 4.3 years (SD = 1). Groups included autism (n = 39) and FXS (n = 48). A subset of the FXS group was comorbid for autism (FXS/autism) (n = 14). Diagnostic status was confirmed by joint ADI-R and ADOS assessments. Repetitive behavior was assessed using the Repetitive Behavior Scales-Revised (RBS-R; Bodfish, Symons, Parker, & Lewis, 2000). Developmental IQ (Mullen) and adaptive behavior (Vineland-II) measures were collected for all participants.

Results: Rates of higher-order RRB were significantly higher for those with iAutism compared to FXS ($p = .004$), while lower-order RRB was not significantly different between groups. Higher-order factors of compulsivity ($p < .001$) and ritual behavior ($p = .001$) in particular strongly differentiated FXS from iAutism. Sub-group analyses (iAutism, FXS/no autism, and FXS/autism) indicated that groups differed by higher-order, but not lower-order RRB. Post-hoc analyses indicated that higher-order RBs (with the exception of sameness) distinguished iAutism from FXS/no autism, but did not distinguish FXS/autism from either iAutism or FXS/no autism. Correlational analyses indicated that stereotypy was highly related to daily living skills ($r = -.42$) and developmental IQ ($r = -.5$) for the autism group, but not for those with FXS, FX + autism or FX/ no autism.

Conclusions: These data demonstrate that the profile of RRBs in four year old individuals with FX can be distinguished from that seen in individuals with iAutism by the predominance of lower order but not higher-order repetitive behaviors. Converging evidence supporting phenotypic distinction comes from additional data showing differential correlations between RRBs and both daily living skills and developmental IQ in iAutistic individuals and autistic individuals with FX. These data suggest that more refined behavioral analyses of 'the autisms' (i.e., individuals meeting diagnostic criteria for autistic disorder presumably resulting from distinct etiologies) will reveal unique behavioral profiles and provide increasingly fruitful targets for studies aiming to discern the biological factors underlying these overlapping but phenotypically distinct conditions.

128.073 73 Autism Symptomatology In Primary Agenesis of the Corpus Callosum. L. K. Paul*[1], C. Corsello[2], D. P. Kennedy[1], D. Childress[3], B. C. F. Cheng[1] and R. Adolphs[1], (1)*California Institute of Technology*, (2)*University of California, San Diego*, (3)*NDRC, University of North Carolina at Chapel Hill*

Background: The corpus callosum (CC) is one of several structures thought to feature abnormal long-range connectivity in autism, as borne out by decreased CC volume and decreased functional coupling between homotopic cortical regions in autism. Agenesis of the corpus callosum (AgCC) is a congenital condition in which the ~190 million callosal fibers that normally connect the cerebral hemispheres fail to develop, even though anterior, posterior, and subcortical commissures are generally intact. Primary AgCC is characterized by minimal additional neuropathology, and intelligence in the normal range. However, individuals with Primary AgCC exhibit localized deficits in non-literal language comprehension, humor, theory of mind, and social reasoning. These findings together with parent reports suggest that behavioral and cognitive impairments in people with AgCC may overlap with the profile of autism spectrum disorders, particularly with respect to impairments in social interaction and communication.

Objectives: To clarify the phenotypic overlap of AgCC and autism spectrum disorders (ASD). As part of a larger research programme, our initial objective was to assess such overlap with a standardized direct observation measure, the Autism Diagnostic Observation Schedule (ADOS)

Methods: The ADOS (Module 4) was administered to 24 adolescents and adults with Primary AgCC (age range = 16 - 54, mean = 28.54, sd = 11.53). Mean full-scale IQ was in the average range (range = 78 - 129, mean = 96.32, sd = 15.06), as were VIQ (mean = 99.11; sd =16.60) and PIQ (mean = 93.95; sd =17.08). The group included six individuals with partial AgCC and 10 females; a total 14 participants were fully right-handed.

Results: 7 out of 24 of AgCC group met ADOS criteria for an autism spectrum disorder. All of these seven individuals had complete AgCC. Of these seven, four met criteria for autism and three met ASD criteria.

Although the mean FSIQ was lower for AgCC subjects who met ASD criteria (range 77 - 113; mean = 93.60; sd =15.16) than those who did not (range = 78 - 129; mean = 97.80; sd =15.05), the ranges clearly overlapped and the group difference was not statistically significant ($p > .5$). The same held true for VIQ & PIQ scores.

Of the 17 AgCC subjects who did not meet ASD criteria on the ADOS, 4 met ASD criteria on either the communication or social interaction domains, documenting social and/or communication difficulties even though they did not meet criteria for an ASD.

Conclusions: Our findings from the ADOS strongly suggest that a significant subset of individuals with Primary AgCC will exhibit behavioral symptoms consistent with an ASD. Of those who met ASD criteria on the ADOS, all had complete callosal agenesis. Discussion will explore clinical implications of these findings and their support for the connectivity hypothesis of social deficits in autism.

128.074 74 Gait Analysis In Autistic Young Adults Indicates Motor Disregulation. M. Weiss*[1], M. F. Moran[2], M. E. Parker[3] and J. T. Foley[4], (1)*Fairfield University*, (2)*Sacred Heart University*, (3)*Texas State University*, (4)*State University of New York at Cortland*

Background: Unusual patterns of movement have historically been a hallmark of ASD, where people who have this diagnosis may exhibit altered body posture, stereotypical or repetitive movement patterns, general clumsiness, and they often score worse on clinical assessments of motor performance (c.f., Leary & Hill, 1996). Despite a general recognition of these unusual movement patterns, there has been little explicit research on disorders of movement with individuals diagnosed with ASD. In the few studies of gait that have been reported, there have been mixed findings to whether aberrations have been found or not in this population and the nature of the few anomalies have varied (Vernazza-Martin, et al., 2005; Rinehart, et al, 2006). However, this research has been extremely limited in scope with a small number of peer reviewed journal articles, limited specificity in what aspects of gait have been studied, small sample sizes, narrow ranges of ages, and largely "observational" methods and data, rather than using contemporary technology typically found in the study of movement sciences.

Objectives: This research aimed to determine how teenagers and young adults diagnosed with ASD compared to age-matched control participants in a variety of aspects of gait. Results of this study can: (1) further our understanding of the movement patterns demonstrated in this population and (2) provide a basis for a quantitative movement assessment tool that could be used to evaluate treatment efficacies.

Methods: Two groups were compared in gait patterns; individuals diagnosed with Low-Expressive-Language-Functioning ASD (n=1 female and 8 males), along with typically

developing matched control participants (undergraduates at Sacred Heart Univeristy; n=2 females and 8 males). Participants were all between the ages of 16-years, 11-months to 22-years, 4-months. Gait analysis was conducted as participants walk across a pressure sensitive GAITRite Walkway system for 6 trials each.

Results: Several aspects of gait were found to be significantly different between the two groups including measures of: velocity (t=3.23, p<.009); cycle time (F=9.02, p<.005); stance percentage (F=3.48, p<.07); foot position vis-à-vis toe in-out position (F=23.83, p<.0001); heal off-on percentage (F=3.32, p<.077); support load (F=31.48, p<.0001) and support unload (F=29.35, p<.0001) times.

Conclusions: Clear differences were found in a variety of aspects of gait between our ASD and control group participants. The widespread varieties and types of differences found not only depart from the patterns demonstrated by typically developing young adults, but they are also similar to aberrations found in individuals diagnosed with cerebellar ataxia (CA). These finding and comparable presentation to CA patients are consistent with prior identification of aberrations in the cerebellum in individuals diagnosed with ASD (Bauman & Kemper, 2005; Courchesne, et al., 2004).

128.075 75 Correlates of Repetitive Movements In Autism Spectrum Disorders. N. Sidhu*[1], D. L. Coury[2], G. Barnes[3], A. Loh[4] and T. Clemons[5], (1)*Columbia University Medical Center*, (2)*Nationwide Children's Hospital*, (3)*Vanderbilt*, (4)*Surrey Place*, (5)*EMMES Corp*

Background: Characterization of clinical phenotypes in autism spectrum disorders (ASD) may be useful in identifying potential complications and establishing treatment plans. Stereotypic and repetitive movements may help identify subtypes of ASD.

Objectives: To determine clinical findings associated with stereotypic movements in individuals with ASD enrolled in a large ASD registry.

Methods: Children and adolescents with a diagnosis of ASD (autism, Asperger disorder, or PDD-NOS) confirmed by ADOS, age 2 – 18 years were enrolled into the Autism Treatment Network (ATN) Registry which collects data on children with ASD at 14 sites across the US and Canada. Upon entry into the registry, parents complete a medical history questionnaire and subjects undergo a battery of assessments including cognitive testing and detailed neurologic examination. Repetitive movements were assessed and observed by clinician during examination.

Results:

Examination of 2482 children with ASDs revealed 892 with repetitive movement abnormalities (36%). Rates across ASD categories showed 41.6% in autism, 21.2% in Asperger syndrome, and 25.0% in PDD-NOS. Of the 892 children with at least one repetitive movement abnormality the most common abnormality was hand flapping (59%).

	Child's Diagnosis							
	All ASD		**Autism**		**Asperger's**		**PDD/NOS**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Total with repetitive movement abnormalities	892	100.0	699	100.0	42	100.0	151	100.0
Hand flapping	529	59.3	438	62.7	15	35.7	76	50.3
Finger licking	184	20.6	157	22.5	6	14.3	21	13.9
Knocking	33	3.7	31	4.4	0	0.0	2	1.3
Body rocking	160	17.9	128	18.3	11	26.2	21	13.9
Head banging	57	6.4	45	6.4	1	2.4	11	7.3
Hand wringing	54	6.1	40	5.7	3	7.1	11	7.3
Other	369	41.4	271	38.8	24	57.1	74	49.0

The relationship between repetitive movements and language regression, EEG results, IQ, and parent reported GI problems and sleep problems was examined. Using a p-value of 0.0055 as evidence of an association (Bonferroni adjusted for multiple (9) looks per item) two significant associations were found. Children with parent reported language regression and lower IQ had significantly higher presence of repetitive movements (p-value = 0.002 and 0.000, respectively).

Conclusions: Repetitive or stereotypic movements are common in ASDs, with hand flapping movements most frequently reported. Although common, stereotyped behaviors are not universal as a core feature of ASD. Individuals with lower cognitive ability <70 and with history of language

regression were significantly more likely to demonstrate repetitive movement abnormalities. It is possible that children with higher cognitive abilities have more verbally related obsessions, or are able to process verbal or physical redirection better than lower functioning children. While repetitive behaviors can be environmentally influenced, the association with other neurodevelopmental abnormalities suggests further study of a neurologic and genetic basis is indicated.

128.076 76 Assessing Gesture In Young Children with Autism Spectrum Disorders. A. Bean* and S. Ellis Weismer, *University of Wisconsin-Madison*

Background: Gesture has been correlated with language outcomes in young typically developing children and children with autism spectrum disorders (ASD). Given the importance of gestures as a predictor of later language outcomes, researchers have posited that gesture profiling should be incorporated into communication skills assessment and intervention procedures (Crais, Watson, & Baraneck, 2009).

Objectives: The objective of this study was to determine whether performance of three gestures (*point, give, show*) was correlated across three different assessment instruments routinely used to evaluate children with ASD. The methodology of two of the instruments, the Autism Diagnostic Observation Schedule (ADOS) and the Early Social Communication Scales (ESCS), involved children's participation in tasks designed to elicit behaviors, whereas the MacArthur Bates Developmental Communication Inventory – Words and Gestures (MCDI-WG) is a parent checklist.

Methods: Participants were children with ASD (mean chronological age = 30 months, SD = 3.77 months) without phrasal speech (n=78) who were participating in a larger ongoing longitudinal study. The gestures *point*, *give* and *show* were assessed using three different instruments. To equate scoring across the ADOS and ESCS children received a score of 0 if they demonstrated the behavior more than one time, a score of 1.5 if the behavior was observed once, and a score of 3 if the behavior was never observed. Ratings on the MCDI-WG were transformed according to the same guidelines. Children received a score of 0 if the behavior was reported to occur *often*, a score of 1.5 if the behavior was reported to occur *sometimes*, and a score of 3 if they parent reported that the child did *not yet* demonstrate the behavior.

Results: Correlations were run for each gesture. The correlations between *pointing* on the ESCS and ADOS (r=.47), the ADOS and MCDI-WG (r=.38), and MCDI-WG and ESCS (r=.30) had medium effect sizes (Cicchetti et al., 2010). The correlation between *showing* on the ESCS and ADOS (r=.449) also had a medium effect size. There was not a significant correlation between *showing* on the MCDI-WG and ADOS (r=.107) or the MCDI-WG and ESCS (r=-.032). The correlation between *giving* on the ESCS and the MCDI-WG (r=.261) had a small effect size. There was not a significant correlation between *giving* on the ADOS and the ESCS (r=.065) or the ADOS and the MCDI-WG (r=.072).

Conclusions: The results from this study suggest that gesture performance in young children with ASD is not entirely consistent across different assessment instruments. This may be attributed, in part, to the design of the instruments. For example, pointing is defined much more stringently on the ADOS and ESCS as compared to the MCDI-WG. In addition, many of the tasks in the ESCS are designed to elicit pointing gestures rather than giving gestures. Thus, when profiling the gestures of children with ASD it is important to gather data from multiple sources and consider performance in light of the instrument being used.

128.077 77 Factors That Assist Parents to Obtain Diagnoses of ASD for Their Children by 30 Months of Age. D. D. Barrie*, M. N. Gragg, S. Ehsan and M. Shamon, *University of Windsor*

Background: Considerable evidence supports the feasibility of identifying children with ASD by 18 to 36 months of age. Recent prospective studies have identified early behavioural profiles and developmental trajectories to aid in early identification of ASD. Further, the combination of clinical judgment with standardized diagnostic tools has made it possible to diagnose children with ASD reliably by 24 months. Finally, parents often become concerned about their children's development during the first two years of life and begin to seek answers for their concerns. One of the most compelling reasons for early diagnosis is that it allows for intensive behavioural interventions early in life that could lead to more positive outcomes for children with ASD. Early identification of ASD can also be beneficial to the families as it has been found to be a key contributor to reduced parental stress.

Objectives: To explore similarities and differences between diagnostic experiences of families who obtained diagnoses of ASD for their children before 30 months of age and families who obtained diagnoses later.

Methods: Participants were 29 parents/caregivers of children under 12 years of age with ASD (86% mothers), with a mean age of 33.8 years. Most had some college education or more

(89.7%), and average family income was $66,249 (Canadian). Their children (82.8% boys) ranged in age from 25 to 77 months; 22 had diagnoses of Autistic Disorder, 5 had diagnoses of PDD-NOS, 1 had a diagnosis of Asperger's Disorder, and 1 had a diagnosis of Autism Spectrum Disorder. Participants completed a questionnaire designed specifically for the study requesting demographic information and information about parents' concerns and their diagnostic experiences.

Results: Parents of children diagnosed with ASD at or before 30 months (Early Group) became concerned about their children's development at an average of 16 months, while parents of children diagnosed later (Later Group) became concerned at 25 months. The younger children were at parents' initial concern, the younger they received their diagnoses. In the Early Group, 75% of parents were referred to the diagnosing clinician by speech and language pathologists or occupational therapists and 25% were referred by family physicians or paediatricians. Parents in the Later Group were referred to the diagnosing clinician by their paediatricians (53%) and by speech and language pathologists or occupational therapists (47%).

Conclusions: The earlier parents become concerned about their children's development, the younger their children are likely to be when they receive diagnoses. Speech and language pathologists, occupational therapists, and other professionals who come in contact with very young children on an ongoing basis may be in a position to influence parents toward seeking help about their concerns earlier from clinicians qualified to diagnose ASD. This emphasizes the importance of educating parents and community professionals about the early signs and symptoms of ASD. Data collection is ongoing.

128.078 78 Stability and Change In Resolution of the Diagnosis Among Parents of Children with Autism Spectrum Disorder. N. Yirmiya*[1], I. Seidman[2], S. Milshtein[2], D. Oppenheim[3], N. Koren-Karie[3], S. Dolev[3] and S. Levi[2], (1)*Hebrew University Jerusalem*, (2)*The Hebrew University*, (3)*Haifa University*

Background:

Receiving a diagnosis of chronic medical condition or disability of one's child challenge families in coping with this new situation. Pianta and Marvin (1992) described resolution as the coming to terms with a diagnosis of one's child. It pertains to parents' reaction to, and coping strategies of dealing with this new situation of having a child with special needs. Using the Reaction to Diagnosis Interview (RDI; Pianta & Marvin, 1992) parents are identified as resolved versus unresolved with their child's diagnosis.

Objectives:

To examine stability/change in parental resolution over a period of 3 years in a sample of parents of children with autism, and whether it is associated with parental characteristics (parental stress and social support) and child's characteristics (cognitive abilities, daily living skills, and severity of autism symptoms).

Methods:

Mothers and fathers of 39 children with autism (ages 5 to 20 years) participated in both time points. At time 1 child's diagnosis and functioning level was confirmed using the ADI-R, the ADOS, the Vinland-II and a standardized intellectual or developmental test. Parents were administered the RDI, the Parenting Stress Index (PSI; Abidin, 1990) and the Social Network Form (SNF; Weinraub & Wolf, 1983). Three years later, at time 2, parents and children with autism were re-evaluated using the same measures (with the SCQ replacing the ADI-R).

Results:

Results indicated that (1) about half of the mothers and fathers were classified as resolved in both time 1 and time 2; (2) almost half of the mothers who were classified as unresolved in Time 1 were identified as resolved in Time 2, whereas no significant change emerged for paternal rates of resolution between the two time points; (3) no significant associations were found between stability or change in parental resolution status and changes in parental stress and social support, nor with child's characteristics.

Conclusions:

The stability in resolution status over the years suggested that time does not "heal the wounds" for fathers, whereas some of the mothers did reveal a significant change from an unresolved status in time 1 to a resolved status in time 2. However, rates of unresolved parents were still relatively high compared to other studies of parents of children with disabilities other than autism (Barnett et al., 2006), highlighting the need for intervention programs for parents of individuals with autism.

128.079 79 Peer Victimization of Adolescents with An Autism Spectrum Disorder. P. Kloosterman*[1], E. A. Kelley[1], J. Parker[2], W. `. Craig[1] and C. Javier[3], (1)*Queen's University*, (2)*Trent University*, (3)*Laurier University*

Background: Little research has explored victimization and bullying in individuals with an Autism Spectrum Disorder (ASD). Many individuals with ASD have been portrayed by clinicians as "perfect" targets for victimization, primarily because of impairments in social interaction and emotional competency (Heinrichs, 2003; Volkmar & Klin, 2000).

Objectives: The goal of this study was to compare the experiences of bullying/victimization in a group of adolescents with Asperger's syndrome or High Functioning Autism (AS/HFA) to a group of adolescents with a learning disability and/or Attention Deficit Hyperactivity Disorder (LD/ADHD), and a control group. A secondary goal was to determine whether parents were aware of the bullying behaviour experienced by their children.

Methods: Participants were 70 adolescents boys ranging in age from 11 to 18 years of age (M = 14.75; SD = 1.90) and their parents. Twenty-four adolescents had a primary diagnosis of AS/HFA, 22 had a primary diagnosis of LD and/or ADHD, and 24 were typically-developing. AS/HFA diagnoses were confirmed using the ADOS-G. All adolescents completed a questionnaire to assess their experiences with being both a victim and bullying others. Parents were also asked to report "*to their knowledge*" the frequency and types of bullying behaviour experienced by their child. The adolescents were also administered the *Wechsler Abbreviated Scale of Intelligence* (Wechsler, 1999).

Results: The three groups did not differ in age, however, the LD/ADHD group had a significantly lower IQ than the typically developing adolescents (p = .042). Overall, the AS/HFA adolescents reported significantly more victimization than the control group [F(1,47) = 7.86, p < .05, *Cohen's d* = .69] and the LD/ADHD group [F(1,45) = 5.27, p < .05, *Cohen's d* = .57], when controlling for age and IQ. The AS/HFA adolescents reported more physical bullying [F(1,47) = 4.59, p < .05, *Cohen's d* = .51] and social isolation [F(1,47) = 9.30, p > .05, *Cohen's d* = .68] than the control group. While reports of physical victimization and social isolation were highest in the AS/HFA group, this group did not differ from the LD/ADHD group on these two types. No differences were found between the three groups for bullying others. Parental reports did not differ from their child's reports across types of bullying behaviour for the AS/HFA group or the LD/ADHD group. However, adolescents in the control group reported significantly higher levels of being teased and being called mean names than reported by their parents [F(1,45) = 5.88, p < .05, *Cohen's d* = .73]. Adolescents in this group also reported higher levels of teasing and calling other students mean names than reported by their parents [F(1,45) = 8.94, p < .05, *Cohen's d* = .89].

Conclusions: Adolescents with AS/HFA experience more victimization than typical adolescents or adolescents with a LD/ADHD, most notably for physical bullying and social isolation. This is likely due to their impairments in social interaction and emotional competency. Parents with a child with an AS/HFA or LD/ADHD were quite aware of their children's experiences of victimization.

128.080 80 Predictors of Adaptive Functioning in Verbal and Nonverbal Individuals with ASD. A. J. Gerber*[1], S. M. Kanne[2] and C. A. Saulnier[3], (1)*Columbia University / New York State Psychiatric Institute*, (2)*Thompson Center for Autism and Neurodevelopmental Disorders*, (3)*Yale Child Study Center*

Background:

The relationship between adaptive functioning and other metrics of psychological functioning and psychopathology in individuals with autism spectrum disorders is poorly understood. Prior research suggests that this is due to the significant heterogeneity of individuals diagnosed with ASD, particularly the difference between those who are verbal and nonverbal.

Objectives:

The purpose of the current study is to examine the relationship between adaptive functioning and possible predictors in a sample of 1,380 individuals with ASD ages 4 to 17. Of these, 1,160 individuals are verbal and 220 are nonverbal. We explored the relationship between a summary measure of function on the Vineland Adaptive Behavior Scales, Second Edition (Vineland) and several possible predictors: age, gender, Verbal IQ, Nonverbal IQ, total scaled score on the Autism Diagnostic Observation Schedule (ADOS), subscales of the Autism Diagnostic Interview-Revised (ADI-R), and the Social Responsiveness Scale (SRS).

Methods:

All individuals participated in the Simons Simplex Collection (SSC), a North American multi- site, university-based research

study that includes families with only one child with an ASD. A linear regression analysis was performed using SPSS to determine the most significant predictors of overall adaptive functioning, as measured by the Vineland Daily Living Scale (DLS). Analyses were performed separately for verbal and nonverbal subjects.

Results:

In the verbal subgroup, which comprised 84% of the SSC sample, as predicted, younger age, higher verbal and nonverbal IQ scores, and a lower score on the SRS were the best predictors of increased age-adjusted adaptive functioning. On the ADI-R a lower score on social difficulties predicted higher functioning, as expected; however, a *higher* ADI-R score on restricted and repetitive behaviors (RRB) predicted higher functioning. The ADOS was not a predictor of adaptive functioning. In the nonverbal SSC sample, younger age and lower SRS score were the best predictors of adaptive functioning.

Conclusions:

Though a range of assessment measures has improved our ability to understand the heterogeneity of the autism spectrum, predicting adaptive functioning in individuals with ASD remains a complicated challenge. Across both verbal and nonverbal samples, the SRS is the best specific measure for predicting functioning. In a verbal sample, higher verbal and nonverbal IQ and lower ADI-R social difficulties are also good predictors of functioning. The correlation of these measures is likely to be due to the fact that they are either parent-report (as is adaptive functioning) or they capture a directly practical set of abilities (IQ). On the other hand, the ADOS, an observational measure of social cognition, does not predict adaptive functioning. Two findings also suggest sampling or diagnostic bias. Younger children have higher age-adjusted adaptive functioning because children identified early on are selected more because of difficulties with social cognition than functional problems. Also, verbal individuals with more RRB have *higher* adaptive functioning, likely because presence of these traits make the diagnosis of ASD more likely even in the absence of more pervasive dysfunction. These findings help shed light on the phenotypic heterogeneity of the ASD population and the idiosyncrasies of an ASD diagnosis.

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128.081 81 Evaluation of Active Engagement In Toddlers with Autism Spectrum Disorder. N. J. Sparapani*, L. Morgan, V. P. Reinhardt, J. L. Bartley and A. M. Wetherby, *Florida State University Autism Institute*

Background: The National Research Council (2001) recommended that children with autism spectrum disorder (ASD) should be actively engaged in interactions and activities for a minimum of 25 hours per week. Although active engagement has been a focus of educational research for school-age children, active engagement has yet to be operationalized and evaluated in very young children with ASD. An understanding of the dimensions of active engagement in toddlers with ASD can provide a common metric by which to monitor progress in intervention.

Objectives: The purpose of this study from the FIRST WORDS® Project was 1) to describe three dimensions of active engagement (i.e., productivity, emotional regulation, flexibility, and directed communication) in a sample of toddlers identified with ASD, and 2) to examine the relationship among dimensions of active engagement, and autism symptoms.

Methods: Participants were recruited by the FIRST WORDS® Project, a prospective longitudinal study. Children were diagnosed with ASD (n=60) before 24 months of age and completed a diagnostic battery that included the *Autism Diagnostic Observation Schedule*-Toddler Module (ADOS-T: Luyster et al., 2009), *Vineland Adaptive Behavior Scale* (Sparrow, Balla, Cicchetti, 1984), *Mullen Scales of Early Learning* (MSEL; Mullen, 1995) and a videotaped home observation of the child and caregiver. Observational data consisted of a 15-minute video sample across five different activities of three minutes each. Samples were coded using the Observer® Video-Pro software by Noldus Information Technology.

Results: Preliminary analyses were conducted on a subset of participants (n=29) between 16 and 21 months (M=18.9, SD=1.15). Large significant correlations were observed between the amount of time spent in a productive and flexible state, r = 0.67, p<0.01, the amount of time spent in a productive and well-regulated state, r = 0.56, p<0.05 as well as the amount of time spent in a productive state and the amount of directed communication, r = 0.51, p<0.01. After controlling for MSEL nonverbal developmental quotient, a significant, negative correlation was observed between the ADOS social affect and restricted and repetitive behavior total algorithm scores and all 4 dimensions of active engagement. The observed correlations were moderate for time spent in a productive, r = -.38, p<0.05 and flexible state, r = -.43, p<0.05, and large for time spent in a well-regulated state, r = -.57, p<0.01, and frequency of directed communication, r = -.52, p<0.01.

Conclusions: This study showed that toddlers who spent more time in a productive state also spent more time well-regulated and flexible and used more directed communication during samples of everyday activities at home. Relationships between these dimensions and the ADOS indicated that toddlers with more autism symptoms on the ADOS were more likely to spend less time in a well-regulated, productive, and flexible state and use less directed communication in the home environment. These preliminary results provide important implications for early detection based on home observations and for important dimensions of active engagement to monitor intervention outcomes for toddlers with ASD.

128.082 82 Measurement of Restricted, Repetitive Patterns of Behavior and Interests Using the CSBS In Children with ASD In the Second Year of Life. S. T. Stronach*, L. Morgan, D. McCoy and A. M. Wetherby, *Florida State University Autism Institute*

Background: Restricted and repetitive patterns of behaviors, interests, and activities is a core diagnostic feature in the draft DSM-5. Previous research on a smaller sample found that children with autism spectrum disorder (ASD) demonstrate repetitive and stereotyped behaviors during the second year of life (Morgan, Wetherby & Barber, 2008; Watt et al., 2008); however there is no evidence that restricted interests can also be identified in this age group.

Objectives: The purpose of this study of the FIRST WORDS Project was to measure repetitive and stereotyped behaviors and fixated interests in children with ASD, developmental delay (DD), and typical development (TD) from 18 to 24 months of age.

Methods: *Communication and Symbolic Behavior Scales* (CSBS; Wetherby & Prizant, 2002) Behavior Samples were video recorded for 100 children later diagnosed with ASD, 80 children with DD, and 100 children with TD. The samples were rated using the *Repetitive Movement and Restricted Interests Scales* (RMRI), a new companion to the CSBS. Scores were computed for the rate and inventory of repetitive or stereotyped behaviors, including repetitive movement or posturing of the body (RMB) and repetitive or stereotyped movement with objects (RMO); as well as restricted or fixated interests, including clutching objects across activities (CLCH), sticky attention to objects (STCK), and excessive interest in objects or actions (EXCS). Measures of developmental level using the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995) and autism symptoms using the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 1999) were obtained at an average age of 37.0 months (SD=7.71).

Results: Preliminary analyses of 85 samples indicate that the ASD group displayed significantly higher overall rates of both repetitive behaviors and restricted interests than the TD and DD groups. Specifically, the ASD group displayed significantly higher rates of RMB, RMO, and EXCS than the TD group and significantly higher rates of RMO and STCK than the DD group. There was large variability and no significant group differences in rates of CLCH. In children with ASD and DD, rates of repetitive and stereotyped behaviors were significantly correlated with MSEL verbal and nonverbal developmental quotients as well as ADOS algorithm scores. There was no significant correlation between MSEL scores and restricted or fixated interest rates; however these rates significantly correlated with ADOS Social Affect domain.

Conclusions: Both restricted and repetitive patterns of behaviors and interests were evident in children with ASD late in the second year using the RMRI with the CSBS behavior sample. These findings have important implications for the utility of the DSM-5 draft diagnostic criteria to identify symptoms during a structured observation in very young children with ASD.

128.083 83 The Adapted ADOS - Preliminary Findings Using a Modified Version of the ADOS for Adults Who Are Nonverbal or Have Limited Language. V. Hus*[1], M. Maye[2], L. Jackson[3], W. Guthrie[4], J. Liang[3] and C. Lord[1], (1)*University of Michigan*, (2)*University of Massachusetts - Boston*, (3)*University of Michigan Autism and Communication Disorders Center*, (4)*Florida State University*

Background: The Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) is widely used in both research and clinical diagnostic evaluations. However, Module 4, the only module intended for adults, is limited to use with individuals who are verbally fluent. Modules 1 and 2, appropriate for individuals who are nonverbal or have limited language, have not been validated in adult samples. Because these instruments were intended for use with young children, many of the materials and activities were chosen to maximize opportunities for social interaction, such as requests and shared enjoyment, between the child and examiner. These activities and materials may not be interesting to and/or appropriate for use with adults. In addition, items used to score behavior in young children may not be of the same diagnostic utility in older individuals.

Objectives: To adapt ADOS Modules 1 & 2 to be appropriate for use with adults who are nonverbal or have limited language.

Methods: To create the Adapted ADOS, Module 1 and 2 activities and materials were modified to be more interesting and appropriate for adults. A pilot version of the Adapted ADOS was administered to 61 adults with ASD or non-spectrum diagnoses. Participants ranged from 18-25 years of age. Protocol and algorithm items were chosen based on their ability to successfully discriminate ASD and non-ASD groups. Total scores were generated from the algorithm items and Receiver Operating Curves (ROC; Siegel et al., 1989) were calculated to determine appropriate diagnostic cut-offs.

Results: Modifications included changes to materials and activities. For example, Free Play toys were substituted with new, more adult-oriented materials (e.g., a real cell phone, a CD player) and some objects from the Module 3/4 Break. A new Conversation activity was added to Module 2 to provide an additional opportunity to observe whether the presence of supporting materials facilitates the participant's ability to carry on a conversation with the examiner. Ninety-seven percent of adults with ASD and 100% of adults with non-spectrum diagnoses shifted attention to a target across the room in response to the examiner's shift in eye gaze or point. Given the high rate of response, the Response to Joint Attention activity was removed from the protocol. For adults receiving a Module 1, sensitivity of 83% and specificity of 75% was achieved. For adults receiving Module 2, sensitivity was 93% and specificity was 71%.

Conclusions: The Adapted ADOS Modules 1 and 2 appear to be useful for the assessment of adults who are nonverbal or have limited language. Some behaviors that are diagnostically significant in young children (e.g., Response to Joint Attention) did not differentiate adults with and without ASD. These results are preliminary and the utility of the Adapted ADOS must be explored in larger samples. However, it is anticipated that these measures will facilitate future efforts to understand how ASD-related symptoms manifest across the lifespan.

128.084 84 Automated Analysis of Natural Language Samples: Comparison of Children with Autism Spectrum Disorders, Developmental Language Disorders, and Typical Development. R. W. Sproat*, L. M. Black, E. T. Prud'hommeaux, J. van Santen and B. Roark, *Oregon Health & Science University*

Background: There are areas of overlap between autism spectrum disorders (ASD) and developmental language disorders (DLD) that pose challenges for differential diagnosis. One such area is language impairment. There have been varying reports on the types of language impairments in ASD, their severity, and their incidence. These studies generally use structured, decontextualized instruments; yet, Language Sampling and Analysis (LSA) methods may provide information that critically complements structured instruments. Since the paucity of LSA-based studies is likely due to the labor-intensiveness of LSA, automated methods are urgently needed.

Objectives: First, to demonstrate the feasibility of automating the analysis of natural language samples, focusing on the IPSyn (Scarborough, 1991). Second, to apply these methods to document morphology and syntax in high functioning verbal children with ASD, children with DLD, and typically developing children (TD).

Methods: Children, 4-8, were given a comprehensive battery of language and neurocognitive measures. Classification into the ASD group (N=36) utilized the revised algorithm of the ADOS, the Social Communication Questionnaire, and DSM-IV-TR-based clinical consensus diagnosis. Classification into the DLD group (N=20) utilized Tomblin's Epi-SLI criteria or a CELF index score at -1 SD plus a spontaneous language measure at -1 SD, and DSM-IV-TR-based diagnosis. Stringent exclusion criteria applied to all groups; moreover, children with neurodevelopmental disorders, neuropsychiatric disorders, and a sibling with ASD or DLD were excluded from the TD group. The ASD group was divided into an "ASD+DLD" group that also met DLD criteria (N=25) and an "ASD-DLD" group that did not meet DLD criteria (N=11). Groups were well-matched on age, but only the DLD and ASD+DLD groups were matched on VIQ and PIQ.

ADOS recordings were transcribed manually into (un-coded) text.

The automated system, directly applied to such transcripts, comprised: (1) text normalization tools for clean-up and normalization of transcriptions; (2) morphological analyzer; (3) syntactic parser, which also produces parts of speech; (4) scoring module that maps language analysis output to IPSyn scores. Top-level IPSyn measures computed were: Noun phrases, Questions and Negations, Sentence Complexity, Verb Phrases, and Total (sum of these four measures), as well as MLU (in words per utterance).

The system was compared with manual coding by a team of trained linguists on a subset of the data.

Results: (1) The automated system differed as little from the manual coders as they differed from each other. (2) The TD group scored higher on IPSyn Total and MLU than the ASD+DLD group and also higher on MLU than the DLD group. (3) The DLD group scored higher than the ASD+DLD group on IPSyn Total but not on MLU. (4) ASD-DLD and DLD group scores were similar, despite substantial VIQ and PIQ differences. (5) The ASD+DLD and ASD-DLD groups tended to have different IPSyn score patterns.

Conclusions: The data show that the method is as accurate as human coding. Surprisingly, the methods showed that both ASD groups performed more poorly on IPSyn measures than one would expect based on their IQ characteristics. These results argue for the importance of developing additional automated LSA methods.

128.085 85 Screening for Autism In Toddlers: A Follow-up Study of the EACH CHILD Cohort. J. Miller*[1], M. E. Villalobos[2] and T. Gabrielsen[3], (1), (2)*Yale Child Study Center*, (3)*University of Utah*

Background:

In the last decade there has been an emphasis on identifying the earliest signs of autism, which would improve early identification, lower the age at which children can receive early intervention, and possibly help identify etiologies. To date, most of this research has been conducted on children either already diagnosed (e.g., retrospective research using early home videos of children with autism) or who were known to be at high risk (e.g., research on the infant siblings of children with autism). Population-based studies of how ASD unfolds in the early months and years of life have not yet been published. Screening studies conducted in community settings can begin to shed light on this issue by examining screened children over the first few years of life.

Objectives:

The present study follows children who were originally screened as toddlers through a large community-based pediatric practice using the MCHAT and CSBS-ITC. Children were evaluated after their 3rd birthday to examine diagnostic course and clinical presentation.

Methods:

Of the 796 families screened through the original screening study (The EACH CHILD Study; under review), 51 families were eligible for an in-person screening based on questionnaire results; 30 chose to participate. All 51 families were re-contacted and asked to participate in a follow-up evaluation. Twenty-four families participated in a three-hour diagnostic assessment including cognitive and adaptive testing and parent interviews. Overall accuracy (Positive Predictive Value) of the study was calculated and group cognitive and adaptive profiles were examined.

Results:

The PPV for the screening process as a whole was 0.90 for ASD (9 of 10 children were correctly identified as EAD). PPV from questionnaire scores alone (i.e., positive screen scores on either the M-CHAT or ITC) would have been 0.06 (9/145), and PPV from the phone-follow-up would have been 0.43 (9/24). The ASD group demonstrated lower scores on the nonverbal domains of the Mullen Scales of Early Learning and on the Socialization domain of the Vineland Adaptive Behavior Scales.

Conclusions:

Our results suggest that a systematic screening process in a large, community-based pediatric practice accurately identified toddlers who would go on to meet DSM-IV criteria for Autistic Disorder or PDDNOS after the age of 3 years, without over-identifying children or providing a significant number of unnecessary evaluations. Larger systematic screening studies are needed to further examine general population samples for ASD.

128.086 86 Comparison of Children with Autism Spectrum Disorders and Developmental Language Disorders on Measures of Language Impairment. L. M. Black*, J. van Santen, B. Langhorst, R. Sanger-Hahn and M. K. August, *Oregon Health & Science University*

Background: There are areas of overlap between autism spectrum disorders (ASD) and developmental language disorders (DLD) that pose challenges for differential diagnosis. One such area is language impairment. There have been varying reports on the types of language issues and percentage of children with ASD who show them, as well as varying positions with respect to the relationship between ASD and DLD. High functioning verbal children with autism have been reported to show no deficits in phonology, syntax, or lexical knowledge, and problems primarily in pragmatics; others have identified deficits in structural language and the same pattern of impairments as in DLD, pointing the way to a possible common genetic etiology for some (Kjelgaard and Tager-Flusberg, 2001; Joseph, et al., 2004). Still others think of there being multiple subtypes of language impairments in ASD (Rapin, et al., 2009). Clearly, a more detailed characterization

of comparative language impairments in ASD and DLD is needed, with particular attention to heterogeneity in ASD.

Objectives: Objective is to document incidence of language impairment in a well-characterized group of high functioning verbal children with ASD and to compare their language issues with those of an equally well-characterized group of children with DLD.

Methods: Children, ages 4-8, were given a comprehensive battery of language and neurocognitive measures. Classification into the ASD group (N=47) utilized the ADOS revised algorithm, the Social Communication Questionnaire, and DSM-IV-TR-based clinical consensus diagnosis of ASD. Classification into the DLD group (N=22) utilized Tomblin's Epi-SLI criteria or a CELF index score at -1 SD plus a spontaneous language measure at -1 SD, and DSM-IV-TR-based diagnosis. Stringent exclusion criteria were applied, such as bilinguality, neurological condition, metabolic or genetic disorder, severe intelligibility impairment.

Results: (1) 66% of the ASD group met criteria for language impairment ("ASD+DLD", N=31/47). (2) For most EpiSLI domains, *more* children with ASD+DLD than with DLD exceeded cut-off scores. (3) The ASD+DLD and "ASD-DLD" (i.e., children in the ASD group not meeting criteria for language impairment) subgroups differed on ADOS revised scores but had nearly identical SCQ scores. (4) The ASD+DLD, ASD-DLD, and DLD groups had equally slow Processing Speed scores. (5) Differential clinical markers: Both ASD subgroups significantly outperformed the DLD group on the NRT and on Expressive Vocabulary, while the ASD+DLD subgroup performed significantly worse than the DLD group on narrative comprehension and on the Receptive Language Index.

Conclusions: This ASD group, confined to verbal children with high functioning autism and meeting stringent criteria, is surprisingly heterogeneous. Also, even in this group, the percentage of children with language impairments is high. However, the pattern of language impairment in ASD+DLD is *different* from that of DLD. This does not imply, however, nor exclude the possibility that there may be a subtype within the ASD+DLD group that does have a pattern of impairment similar to DLD or to a DLD subtype. The question of distinctive subtypes in both ASD and DLD – and areas of both overlap and essential differences – beckons for further disclosure.

128.087 87 Autism Risk Moderates Developmental Pathways Between Infant Referential Requesting and Toddler-Mother Interaction.

J. K. Baker*[1], C. J. Grantz[2], D. S. Messinger[2] and N. V. Ekas[2], (1)*University of Wisconsin*, (2)*University of Miami*

Background: Early parent-child interaction has been linked to a host of later competencies in typically-developing children (e.g., NICHD ECCRN, 1999). Certain social deficits in infants with emergent autism spectrum disorders (ASD) may impede the development of more complex interactions with the environment, but early intervention aimed at increasing social communication can potentially alter these trajectories (Dawson, 2008; Rogers & Dawson, 2010). Parent-child interaction may similarly foster engagement and promote competence. Recent evidence indicated that mothers' sensitive structuring with their toddlers with emergent ASD promoted later language growth (Baker, Messinger, Lyons, & Grantz, 2010). The therapeutic potential of parent-child engagement begs the examination of possible contributors to the development of parent-child interaction in children at risk for ASD. Early referential communication has been a central focus of ASD research, and is thought to provide a foundation for more complex interpersonal interaction (Sigman & Ruskin, 1999).

Objectives: We examined the relations between ASD risk, referential requesting in the first year, and later parent-toddler interaction.

Methods: Autism risk was defined as having an older sibling with ASD (n = 45), and low-risk children had older siblings without ASD (n = 32). Referential requesting was measured with the Early Social Communication Scales (ESCS; Mundy et al., 2003) at 8 and 10 months, and parent-toddler interaction was measured during a free play at 15 and 18 months. Infant-initiated behavioral requesting (IBR) included eliciting help from a social partner regarding an object or event. Toddler behavior was measured with the NICHD ECCRN scales (1999) and included play engagement, affect toward mother, and prosocial behavior. Maternal sensitive structuring included behavior that engaged and structured the child in a sensitive manner (Baker, et al., 2010).

Results: None of the three factors differed significantly as a function of risk. Hierarchical regressions did not demonstrate main effects between IBR and later toddler-parent interaction, but ASD risk moderated relations between IBR and later child, $\beta = -.45$, $p < .05$; $R^2 = .08$, and parent behavior, $\beta = -.36$, $p < .05$; $R^2 = .05$. Associations were found between IBR and child and parent behavior for low-risk children (simple slopes: $t = 2.70$ and 3.02, $ps < .01$), but not for children with ASD risk ($t = .03$, $p = .98$, and $-.10$, $p = .70$). Child behavior mediated the relation between IBR and later parenting behavior in the low-risk children at the level of a trend, $z = 1.88$, $p = .06$.

Conclusions: Consistent with developmental theory, results suggest that certain social competencies in low-risk children during the first year may show continuity into the second year, contributing to the development of parent-child interaction. In contrast, infant communication was unrelated to parent-toddler interaction among children at risk for ASD, suggesting a potential break-down of a normative child-driven developmental process. We are currently exploring the possibility that parent-toddler interaction may be more dependent upon parent factors for children with ASD-risk.

128.088 88 Residual Social and Communication Deficits In Optimal Outcome Children and Adolescents with a History of Autism Spectrum Disorders. A. Orinstein*[1], K. E. Tyson[1], E. Troyb[1], M. Helt[1], M. A. Rosenthal[1], J. Suh[1], M. Barton[1], L. Naigles[1], E. A. Kelley[2], M. C. Stevens[3], R. T. Schultz[4] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Queen's University*, (3)*Institute of Living, Hartford Hospital / Yale University*, (4)*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. This study examines social and communication functioning in a group of OO individuals.

Methods: The Autism Diagnostic Observation Schedule (ADOS) was conducted with 30 OO individuals (M(age)=13.1), 29 individuals with high-functioning autism (HFA) (M(age)=12.8), and 25 typically developing (TD) peers (M(age)=14.4). The groups were matched on age, sex and nonverbal IQ; however the groups differed significantly on verbal IQ (M(TD)=111.8, M(OO)=113.2, M(HFA)=103.5, $p<.05$). Due to limited variability in this high-functioning sample, ADOS scores for each item were collapsed so that behaviors were coded as either present (0) or absent (1). The groups were compared on individual items of the ADOS Communication and Social domains, which contain 10 and 11 items respectively, and on a summation of all scores within each domain

Results: None of the OO individuals met diagnostic criteria for ASD on the ADOS. T-tests were conducted to determine whether OO individuals differed from TD individuals on the summation score for all items in each ADOS domain. The groups were not significantly different on the Communication domain (M(OO)=1.70, M(TD)=2.12, $p=.35$), but were significantly different on the Social domain (M(OO)=2.47, M(TD)=.84, $p<.05$). A subsequent t-test comparing the OO individuals to the HFA individuals on the Social domain was also significant (M(OO)=2.47, M(HFA)=9.31, $p<.05$). Exploratory chi-square tests were conducted to determine whether OO individuals presented any minor residual deficits as evidenced by the individual ADOS items. As compared to TD individuals, a significantly greater percentage of OO individuals exhibited restricted range of facial expressions ($\chi^2(1,N=55)=4.10$, $p<.05$), and limited insight into social relationships ($\chi^2(1,N=55)=4.10$, $p<.05$). There was a marginally higher percentage of individuals in the OO group who had trouble communicating their affect ($\chi^2(1,N=35)=3.58$, $p=.06$), showed a limited number of social overtures ($\chi^2(1,N=55)=3.60$, $p=.06$), and had poorer rapport with the examiner ($\chi^2(1,N=55)=3.44$, $p=.06$). Follow-up chi-square tests were conducted to compare the OO individuals to HFA individuals on these items. OO individuals had as much trouble as HFA individuals communicating their own affect. However, HFA individuals exhibited a higher rate of all the other deficits.

Conclusions: These results suggest that, relative to TD peers, OO individuals continue to exhibit subtle deficits in specific aspects of social interaction. Additional research with larger samples that includes information about peer relationships will be important to examine this question further. Future research should also examine age effects on these deficits through adolescence, to see if the difficulties abate or worsen with development.

128.089 89 Social Cognitive Differences Among Children on the Autism Spectrum. E. Scollin*[1], S. E. Thompson[1], R. A. Libove[2], J. M. Phillips[3], K. J. Parker[2] and A. Y. Hardan[2], (1)*PGSP-Stanford PsyD Consortium*, (2)*Stanford University School of Medicine*, (3)*Stanford University School of Medicine/Lucile Packard Children's Hospital*

Background: Autism Spectrum Disorders (ASD) include individuals diagnosed with Autistic Disorder (AD), Asperger's Disorder (AS), and Pervasive Developmental Disorders, Not Otherwise Specified (PDD-NOS). As the field begins to move toward grouping these conditions together, researchers and clinicians have also attempted to better understand the differences along this spectrum. Of particular interest is gaining

a better understanding of the differences in social cognition along the spectrum.

Objectives: The goal of this study was to determine whether children diagnosed with AD and those with other ASD conditions, such as PDD-NOS, differ on measures of social cognition.

Methods: Children with autism and other ASD conditions (as determined by Autism Diagnostic Interview-Revised and Autism Diagnostic Observation Schedule) between the ages of 3 and 12 years were included in this study. Social abilities of participants were assessed using the Social Responsiveness Scale (SRS), a parent-report measure of social skills, and two Social Perception subtests –Affect Recognition and Theory of Mind– of the NEPSY-II. The NEPSY-II is one of the few established neuropsychological assessments to include a theory of mind subscale. The Social Perception subtests have been shown to be both reliable and valid in differentiating normal controls from children with ASD. This sample was recruited as part of a study examining oxytocin biology and social abilities in children with ASD.

Results: A total of 66 children with ASD were included in this analysis. Thirty-seven were diagnosed with AD and 28 with Other ASD. There were no significant age or gender differences between groups (AD mean age 7.34 years, 28 males, 9 females; Other ASD mean age 8.98 years, 21 males, 7 females). While there were no significant differences on total SRS measures of social cognition, significant differences were found on the Motivation subscale of the SRS [p=.027], showing that children with Other ASD were significantly more socially motivated. As expected, children diagnosed with Other ASD had significantly less difficulty on Affect Recognition measures when compared to children with a diagnosis of AD [p=.004]. In addition, children with Other ASD performed significantly better than those with AD on Theory of Mind tasks [p <.001].

Conclusions: Significant differences in social motivation and affect recognition were detected between children with AD and other ASD conditions. These findings support the notion of a spectrum of social cognitive deficits in children with ASD. However, additional investigations with larger samples using comprehensive phenotypic assessments are needed to further elucidate the differences between groups.

128.090 90 Use of the Pervasive Developmental Problems Subscale on the Child Behavior Checklist 1.5 to 5 to Screen for Autism Spectrum Disorders. B. Gorka*, A. Veenstra, C. Wolfe Christensen, B. Patel, C. Mader and M. E. Behen, *Children's Hospital of Michigan*

Background:

The Childhood Behavior Checklist (CBCL), is a parent-report standardized questionnaire developed to assess various maladaptive behavioral and emotional problems in children aged 18 months to 18 years (Achenbach 2000, 2001). The preschool version of the measure (CBCL 1.5 to 5), groups behaviors into three broadband scales: externalizing, internalizing, and total problems, as well as seven syndrome-oriented and five DSM-oriented subscales, one of which assesses for “Pervasive Developmental” problems (PDP). Several studies have demonstrated the usefulness of the CBCL PDP subscale in discriminating autism spectrum disorders against the “gold standard” diagnostic measures. Specifically, PDP subscale elevations have been associated with ASD and group classification on the ADOS-G (Hartley, et al., 2008; Sikora, et al, 2008). However, the performance of the CBCL as a screening measure, particularly against other commonly used screening measures, is unclear. As the CBCL is commonly regarded as an efficient method of screening for a variety of childhood concerns, it is important that the validity of the PDP subscale as a screener be assessed, particularly the relationship of this subscale to the MCHAT, SRS, and SCQ, the most commonly used screening tools for discriminating ASD from non-ASD disorders in preschool aged-children.

Objectives:

The focus of this present study is to further evaluate the clinical use of the CBCL 1.5 to 5 PDP subscale as a screening measure for discriminating ASD from non-ASD disorders. of the CBCL. Specifically, the aim of this study is to further evaluate the construct validity of the PDP scale by assessing its relationship to the MCHAT, SCQ, and SRS total score and subscales.

Methods:

Study participants included 67 children (54 male) who were referred to a hospital-based Autism Clinic due to concern of ASD. Children who met the age criteria for the CBCL 1.5 to 5 were selected (i.e., 18 to 71 months of age; Mean = 42.6 months, S.D. = 11.6 months). All children in this sample were given the CBCL as part of their assessment battery, in addition to the MCHAT for children aged 18 months to 47 months of age, and the SCQ and SRS for children aged 48 to 71 months of age. Pearson’s bivariate correlations were used to evaluate the PDP subscale of the CBCL to the MCHAT, SCQ, and SRS.

Results:

The PDP subscale was significantly correlated with the SCQ (r = .82, p = <0.001), as well as the critical items and total items scores on the MCHAT (r = .63, r =.66, p = <0.001, respectively). Comparing the PDP subscale to the subscale scores and total score of the SRS yielded the following significant correlations: Social Communication, r=.45, p=0.034, Social Motivation, r=.71, p=<0.001, Autistic Mannerisms, r=.67, p=<0.001, and Total Score, r=.57, p=<0.001. All other subscale correlations on the SRS were non-significant.

Conclusions:

Results of the present study provide further support for the use of the CBCL PDP subscale as a screening tool for ASDs.

128.091 91 A Study on Audio Patterns of Natural Environment for Children with Autism. D. Xu*, J. Gilkerson and J. A. Richards, *LENA Foundation*

Background: Previous work showed the effectiveness of daylong audio recordings for child vocalization analysis and environment monitoring. The scheme includes a digital recorder worn by a child to collect his/her sound and other sounds in natural environment. Speech processing and pattern recognition technologies are used to automatically detect different sound segments in a recording, including key-child, adult, noise, overlapped-sounds and others, producing a sequence of segment labels. This framework provides rich information about child, environment and how they interact with each other. It can be applied to childhood autism risk estimation, home activity and treatment monitoring. Previous study (presented in 2009 IMFAR) showed the good discriminating capability of child vocalization features for children with autism, children with language delay and children of typical development.

Objectives: In addition to child vocalization, this study investigates other features for autism risk estimation by looking into audio-based environmental and interactive information. It was found that parents and children with autism tend to have more “near-distance-talk” than “far-distance-talk” as it may even more difficult for them to interact from far distance because of the impairment in social interaction and communication. Since loudness of sound is correlated with distance, the dB-level statistics of environment sounds in daylong recordings are investigated as one characterization for environmental and interactive information.

Methods: The segments of adult male, female, noise and overlapped-sound are considered interactive type when they are next to a child segment. The average dB-level and the peak dB-level of these segments are calculated. Since segments can further be categorized into “clear” or “faint”, there are eventually 24 parameters for each recording. These parameters are analyzed by linear discriminant analysis (LDA) and Ada-Boosting analysis (an approximation to logistic regression). These parameters are further combined with child vocalization parameters to exam the joint effect for autism discrimination and risk estimation.

Results: Data set contains 802 recordings for 106 typical children, 333 recordings for 49 children with language delay, 228 recordings for 71 children with autism. No recording is under 9 hours and No recording contains therapy. Equal sensitivity and specificity (ESS) is used as performance measure. With the 24 dB-level parameters, the LDA gives 79.6% ESS for recordings and 85.8% ESS for children, and the Ada-Boosting gives 80.3% ESS for recordings and 83.2% ESS for children. With the 113 parameters of child vocalization reported before, the LDA gives 86.4% ESS for recordings and 90.1% ESS for children, and the Ada-Boosting gives 88.2% ESS for recordings and 89.1% ESS for children. For the combined parameters, the LDA gives 88.9% ESS for recordings and 91.6% ESS for children, and the Ada-Boosting gives 90.6% ESS for recordings and 93.0% ESS for children. All results are obtained with Leave-one-out cross-validation.

Conclusions: This study shows that daylong audio recordings contain rich information for childhood autism risk estimation. The dB-level statistics of sounds surrounding child vocalizations can characterize certain interactive aspects between child and environment, which can significantly improve the autism risk estimation performance, achieving 93% ESS. More detailed investigation is necessary in the future.

128.092 92 The Association Between the Social Responsiveness Scale (SRS) with Measures of Global Intelligence and Adaptive Functioning In the Assessment of Children with ASDs. N. Gjolaj*, C. Wolfe-Christensen, M. Palance, B. Gorka, A. Veenstra and M. E. Behen, *Children's Hospital of Michigan*

Background:

The Social Responsiveness Scale (SRS), a parent-report screening measure of autistic traits in individuals between the ages of 4 and 18, has been widely used in both clinical and research settings to assess the degree of social impairments specific to Autism Spectrum Disorders (ASDs). Early studies of the measure revealed that the SRS total score was independent of global cognitive functioning. However, there has been relatively little research that has examined the relationship of the SRS subscales to overall level of cognitive

functioning. Further, given the difficulties of reliable assessment of children with ASDs, evaluation of the relationship of the SRS subscales to an alternative measure of overall functioning may also be warranted.

Objectives:

The aim of the present study was to evaluate the relationship of global and specific intellectual indices and adaptive behavior functioning to the SRS total score and subscales.

Methods:

One hunderd and seventeen children (24 females; 92 males) between the ages of 48 and 312 months (mean= 93.43 ; sd= 38.80) with diagnoses of ASDs were underwent comprehensive psychological evaluations, including assessment of cognitive functioning (Wechsler Intelligence Scale for Children, Fourth Edition [WISC-IV], Wechsler Preschool and Primary Scale of Intelligence, Third Edition [WPPSI-III]), adaptive functioning (Vineland Adaptive Behavior Scales, Second Edition [Vineland-2]), and caregiver report on the magnitude of autism symptoms (Social Responsiveness Scale [SRS]). Pearson bivariate correlations were used to evaluate the magnitude of relationships between the SRS total score, and subdomains with intellectual indices (VIQ, PIQ, FSIQ) and adaptive behavior domain scores.

Results:

Overall, results indicated that intelligence indices were independent of SRS Total score and subdomains. However, SRS scores were associated with Vineland-2 indices. Total scores on the SRS were significantly correlated with Vineland-2 domains in the areas of Communication (r=-.471, p=.001), Socialization (r=-.634, p=.000), and the Adaptive Behavior Composite (r=-.516, p=.000). Additionally, SRS subscales were significantly inversely related to Vineland-2 domains in all areas with the exception of Motor Skills. In particular, associations were observed between the Vineland-2 Communication composite and three SRS subscales (Social Communication r= - .416, p=.002; SRS Social Motivation r= -.540, p=.000; SRS Autistic Mannerisms r= - .332, p=.034). Daily Functioning Skills according to the Vineland-2 were found to be negatively associated with the SRS Motivation subscale (r= - .469, p=.000). Finally, the Socialization domain of the Vineland-2 was found to be inversely related to four domains of the SRS (Autistic Mannerisms r= -.569, p=.000; Social Cognition r= -321, p=.020; Social Communication r=-.552, p=.000; Social Motivation r= -.469, p=.000).

Conclusions:

In conclusion, results suggest that the SRS, although unrelated to intellectual functioning, is associated with overall level of adaptive behavior functioning, which in children with pervasive developmental disorders, may represent a more psychometrically sound metric of overall level of functioning than global IQ (Perry & Factor, 1989).

128.093 93 *Types of Perseveration In Adults with Autism Spectrum Disorder. T. Arora*, *California State University, Long Beach*

Background:

There is limited research on perseveration in autism spectrum disorder and even more reduced empirically based knowledge in the area of adulthood and ASD exists. Perseveration continues to exist in adults with ASD (Rapin & Katzman, 1998).

Objectives:

There were 2 objectives of this study: 1) To determine the types of perseveration displayed by the adult participants with ASD, and 2) to examine whether the highest frequency of a type of perseveration displayed by an adult related with a particular domain of development that is a core deficit area in ASD.

Methods:

The study examined perseveration in 6 adult participants with a diagnosis of autism spectrum disorder using DSM-IV criteria and ADOS. The participants had an average chronological age of 20 years and included 4 males and 2 females. Data regarding cognitive functioning, social and language skills were collected from Individual Transition Plans, medical and psychological files. Videotaped interactions were analyzed for perseveration using a revised version of The Timed Stereotypies Rating Scale, Revised (Luce, 2003). The scale contains 47 items that measure the frequency of perseveration. Independent coders blind to the objectives obtained an inter-reliability check of 76% using event coding to analyze the types of perseveration displayed. Coding of data is ongoing. Relationships will be examined between the highest frequency of a particular type of perseveration displayed for each participant and any particular domain of development, i.e., social, cognitive and language that is known as a core deficit developmental domain in ASD. Videotapes of perseverations will be presented.

Results:

The participants displayed perseveration that was object related, physical in terms of movements and routines, and verbal such as echolalia and topic related. The highest frequency of perseveration displayed for participants was verbal. Analysis is ongoing for patterns and relationships.

Conclusions:

The adult participants displayed perseveration of all types. Data analyses to address the second objective is ongoing.

128.094 94 Quality Matters: Differences Between Expressive and Receptive Non-Verbal Communication Skills In Children with Autism. R. B. Grossman*[1] and H. Tager-Flusberg[2], (1)*Emerson College*, (2)*Boston University*

Background: Expressive and receptive nonverbal communication skills, such as facial expressions and prosody, are interrelated in typical individuals, but very little is known about the specific relationship between these two modalities in children with autism.

Objectives: To determine patterns of qualitative and quantitative differences for receptive vs. expressive facial and vocal communication skills between children with autism and their TD peers.

Methods: Participants were children with autism (N=7 or 11, depending on task) and typically developing children (N=5 or 6 depending on task) aged 9-18. We consolidated data from nine measures (i-ix) taken from five studies (1-5): 1. Facial expression and prosody productions recorded during a story-retelling task and coded for naturalness of expression. The autism group was found to be more awkward than the TD group in faces (i) and voices (ii). 2. Length of whole-word production in a lexical stress task. The autism group showed abnormally long productions for noun-phrases (iii) (hot dog) and compound nouns (iv) (hotdog). 3. Auditory-visual integration of speech information in an onset-asynchrony detection task. The autism group was as accurate as the TD group at audio delays of 10 (v) and 12 (vi) frames. 4. Accuracy of matching emotional facial expressions to auditory-only emotional sentences. The autism group was less accurate than the TD group when prosodic expressions and face choices were more subtle (vii). 5. Ability to place individual images taken from a facial expression video in their correct dynamic sequence. The autism group was less accurate than the TD group when eyes were visible (viii), the groups were equal when eyes were masked (ix). To conduct a meta-analysis of these results we calculated z-scores for each subject's performance on every measure and produced two aggregate scores, one for the four expressive (i-iv) and one for the five receptive tasks (v-ix).

Results: A Wilcoxon Rank Sums test revealed that the autism group had significantly larger z-scores than the TD group for the expressive aggregate, but not the receptive aggregate ($p<.025$). Within the autism group, a Kruskal-Wallis test showed that the z-scores for expressive tasks were significantly larger than for receptive tasks ($p<.05$). No such difference was found in the TD group.

Conclusions: Our data show that the facial and vocal affective communication skills of individuals with autism have a greater difference from the typical mean for expressive tasks, but not receptive tasks. Based on the significant difference in z-scores for expressive vs. receptive tasks *within* the autism group, we also hypothesize that their expressive skills are potentially more fragile than their receptive skills. Across tasks, receptive skills were measured in objective accuracy scores, while expressive ability was measured by qualitative methods, such as length of whole word production or perceived naturalness of facial and vocal expressions. Taking this distinction into account, our data indicate that individuals with high functioning autism are capable of achieving typical accuracy in a variety of receptive nonverbal communication tasks, but still exhibit significant qualitative differences from their TD peers in the production of those same skills.

128.095 95 Assessment of Play In Toddlers with Autism: An Integrated Perspective and Implications for Intervention. K. Goods*[1], A. Gulsrud[2] and C. Kasari[1], (1)*University of California, Los Angeles*, (2)*UCLA*

Background: A hallmark of early childhood development is the ability to play. Many studies have noted differences in the play skills of children with autism when compared to typically developing children and children with other intellectual disabilities (Baron-Cohen, 1987; Jarrold et al., 1996; Libby et al., 1998; Sigman & Ungerer, 1984). In particular, symbolic play is delayed in children with autism; these play acts are produced less often than their typically developing peers, if at all (Baron-Cohen, 1987; Charman & Baron-Cohen, 1997; Jarrold, 2003; Mundy et al., 1986; Rutherford et al, 2007; Sigman & Ungerer, 1984). This body of evidence provides a striking profile of play in children with autism that is different from typical children and children with other disabilities.

Objectives: This study describes developmental play in 50 toddlers diagnosed with ASD. First, we used a developmental play assessment (Ungerer & Sigman, 1981) to provide a detailed description of all play levels, including levels within functional play, in toddlers with autism. Second, we examined developmental differences in a cross-sectional sample of toddlers with autism.

Methods: A total of 50 toddlers with an autism spectrum disorder (ASD), with an average chronological age of 30.28 months and average mental age of 20.91, participated in the study. The child's play behaviors during the Structured Play Assessment were coded for frequency and types of functional and symbolic spontaneous play acts (Kasari et al., 2006; Lifter et al., 1993; Ungerer & Sigman, 1981). The children were grouped into developmental play profiles based on *mastery*, *emergence* or *absence* of play (Lifter & Bloom,1989).

Results: Most frequently toddlers engaged in functional play that appears to become more diverse and frequent with increasing developmental age. A similar trend does not exist for symbolic play, that remains at low levels despite increasing developmental age. Four distinct play profiles emerged for the toddlers with autism based upon their mastered and emerging levels of play. While children in each profile did not differ in terms of chronological age, they significantly differed in terms of play and mental age. These groupings revealed that over half of the sample had non-sequential play development. That is, they either did not have any mastered play, and/or there were large discrepancies between their mastered and emerging play levels.

Conclusions: Research on the development of the earliest play levels are important to better inform treatment goals for interventions targeting, or utilizing, play in toddlers with autism. The play skills of young children with ASD can best be described as both delayed and discrepant. Their play skills are delayed in timing relative to typical child development. Their play was discrepant in that typical children show mastery in one level of play and emergence in higher levels of play, toddlers with ASD in this study were often not emerging in the next higher levels of play.

128.096 96 The Acquisition of Brown's 14 Grammatical Morphemes In Children with Autism: A New Look. L. Mesite*, S. Tek, D. A. Fein and L. Naigles, *University of Connecticut*

Background: Brown (1973) found a consistent order in the progress of acquisition of fourteen grammatical morphemes in 3 typically developing (TD) children, subsequently replicated by deVilliers and deVilliers (1973). In contrast, Bartolucci, et al. (1980) and Howlin (1984) found that children with autism (ASD) show a different pattern of acquisition, based on verbal samples taken from 8-year-olds and 10-year-olds.

Objectives: Our study investigates the *progress* of acquisition of Brown's grammatical morphemes in children with ASD, as well as the *onset* of their acquisition in very young children with ASD.

Methods: We included 18 TD toddlers (MA = 20.6 months at Visit 1, 16 males), and 17 children with ASD (MA = 32.85 months at Visit 1, 16 males); the groups were matched on the CDI at Visit 1 (ASD = 94.1; TD = 118.77). 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 Brown's 14 morphemes using CLAN (e.g. progressive "-ing," the prepositions *in* and *on*, the articles *a* and *the*). Because Howlin found no differences between coding for "90% use in obligatory contexts" vs. "percent of correct usage," we used the latter method.

Results: Thus far, Visits 1, 3 and 5 have been analyzed. The ASD children were divided into 2 groups based on their joint attention behavior, which was coded separately (Tek et al., 2010). ASD1 children (n = 8) performed close to TD levels on joint attention whereas ASD2 children (n = 9) engaged in very little joint attention. At Visit 1, both the ASD1 and TD groups produced many morphemes at significantly higher rates than the ASD2 group. Because the ASD1 group was chronologically older, they produced more verb types with the progressive and more article types than the TD group (ps < .05); however, the *pattern* of morpheme production (i.e., which morphemes were frequent vs. not) was strikingly similar across the TD and ASD1 groups. Interestingly, plurals were more frequent than predicted, probably because object labels were frequently elicited. At Visits 3 and 5, no statistically significant differences were found between ASD1 and TD; however, both of these groups still produced more morphemes than the ASD2 group. From Visit 3 to Visit 5 the TD group increased in overall morpheme use by an average of 7.69 tokens while the ASD 1 group only increased by 2.81 tokens, which illustrates that although they have a similar pattern at Visit 5, the TD children might surpass the ASD1 group by Visit 6.

Conclusions: Children with ASD who have good joint attention skills do seem to acquire Brown's 14 grammatical morphemes similarly to TD children, in contrast to ASD children with poor joint attention. The non-canonical pattern observed by previous researchers may be traced to their inclusion of ASD children who were (a) older and (b) of a wider range of abilities. Moreover, we conjecture that some differences in Brown's order of acquisition may be traced to contexts of use.

128.097 97 Differences Between Receptive and Expressive Language Abilities In Low Functioning Children with ASD. J. P. W. Maljaars*[1], I. L. J. Noens[2], E. M. Scholte[1]

and I. A. van Berckelaer-Onnes[1], (1)*Leiden University*, (2)*K.U.Leuven*

Background: Receptive and expressive language are often studied separately in ASD, except for some studies in toddlers (e.g. Weismer et al., 2010). Prior research indicated several predictors of early language abilities. Both limited intentionality and symbol formation are considered to be core deficits in the communication development of individuals with ASD (Travis & Sigman, 2001). Several studies identified joint attention as a predictor for language development in ASD (e.g. Dawson et al., 2004), but the role of symbol understanding still remains unclear.

Objectives: 1) to explore differences in receptive and expressive language abilities of low functioning children with autistic disorder compared to children with an intellectual disability and typically developing children; 2) to examine whether and how precursors of language (joint attention and symbol understanding) are related to concurrent receptive and expressive language abilities in these groups.

Methods: In this study, 36 children with autistic disorder and intellectual disability (AD+ID) (confirmed by the ADOS and the DISCO-11) are compared with 26 children with intellectual disability (ID) and 34 typically developing children (TD) with regard to their language abilities. Groups were comparable with respect to non-verbal mental age (NVMA range: 2 to 5 years). Language abilities were assessed using the Reynell test for Dutch language comprehension, the Schlichting test for Dutch language production, and the Dutch Communicative Development Inventories. Joint attention was based on items from the ADOS and symbolic understanding of pictures was measured with a doll house experiment.

Results: Repeated measure ANCOVA, with NVMA as covariate, revealed significant differences between the groups: the AD+ID group obtained lowers scores than the ID-group, and the TD group outperformed the ID group. The language profiles differed significantly among the three groups. The AD+ID group obtained higher scores on expressive than on receptive language, whereas the ID and the TD groups showed the opposite profile. For the AD+ID group, hierarchical regression analyses indicated that symbol understanding and joint attention were most strongly related to language abilities. Symbol understanding was a stronger predictor for receptive language than joint attention. In the ID-group, NVMA and symbol understanding were significant predictors for receptive language, whereas the final model for expressive language only consisted of NVMA. NVMA was also a significant predictor for both receptive and expressive language abilities in TD children.

Conclusions: In contrast with the two control groups, receptive language abilities are significantly weaker than expressive language abilities in children with AD and ID. Consequently, language comprehension in low functioning children with AD may be overestimated. Next to joint attention, symbol understanding contributes to receptive and expressive language abilities in low functioning children with AD. Therefore, symbol understanding should be an important focus in assessment and treatment with respect to communication problems in ASD.

128.098 98 Understanding the Relationship Between Emotion Regulation and Social Skills In Adolescence. L. Berkovits*[1], L. A. Tipton[2], E. A. Laugeson[3] and J. Blacher[2], (1)*University of California, Los Angeles*, (2)*University of California, Riverside*, (3)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background: Poor social skills are a core diagnostic feature among adolescents with autism spectrum disorders (ASD). Adolescents with intellectual disabilities (ID) also often demonstrate impaired social skills, although for this population social impairment could be considered part of a broader adaptive behavior deficit. Research with adolescents with typical development (TD) has shown emotion regulation abilities to be closely linked to social skills. For instance, better regulated children are more actively engaged in positive interactions with their peers (Rydell, Thorell & Bohlin, 2007). Despite our knowledge of this relationship, few studies have investigated the link between emotion regulation and social skills among adolescents with ASD and ID.

Objectives: This study assesses adolescents' social skills and behavioral functioning through parent report, and assesses adolescents' emotion regulation through self-report and coded behavioral observations, to examine the extent to which emotion regulation is related to social functioning among adolescents with ASD, ID, and TD.

Methods: Participants were selected from a longitudinal study of adolescent development and included individuals with TD (n=68), ID (n=20), and ASD (n=12). Social skills were measured using parent report on the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), while emotion regulation was measured using adolescent self-report on the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaij, & Spinhover, 2001), and an observational behavior paradigm designed to elicit emotion dysregulation and

regulation. Additional social and behavioral functioning were measured by parent report on the Child Behavior Checklist (CBCL; Achenbach, 2000).

Results: Preliminary results revealed significant group differences in social skills on the SSRS and social competence on the CBCL ($p < .001$). Post-hoc analyses revealed that adolescents with ID ($M = 86.61$, $SD = 12.35$) exhibited poorer social skills than adolescents with TD ($M = 104.02$, $SD = 15.22$) on the SSRS, and adolescents with ID ($M = 38.55$, $SD = 9.53$) and ASD ($M = 40.42$, $SD = 8.67$) exhibited poorer social competence on the CBCL than adolescents with TD ($M = 50.49$, $SD = 7.73$). Significant differences were also found between the groups on the Blaming Others subscale of the CERQ ($p < .05$), with adolescents with ASD ($M = 10.30$, $SD = 5.06$) scoring higher than adolescents with TD ($M = 7.44$, $SD = 2.44$). Results suggest a significant positive correlation between the Adaptive Emotion Regulation domain on the CERQ and the CBCL Social Competence scale ($r = .268$, $p < .05$). Results also suggest a significant negative correlation between the CERQ Blaming Others scale and the CBCL Social Competence scale ($r = -.251$, $p < .05$).

Conclusions: These findings do demonstrate group differences on social skills and emotion regulation. Preliminary data shows that emotion regulation is also significantly correlated with social competence, supporting our hypothesis that emotion regulation predicts social skills. Ongoing coding of observational data is aimed at demonstrating further predictive capabilities of emotion regulation to social skills in adolescents with ASD and ID. In addition, the size of the ASD sample should double by the time of presentation.

128.099 99 When Peers Matter Most: Adolescent Social Skills Across ASD, ADHD, and ID Symptom Groups. R. Ellingsen*[1], E. A. Laugeson[2] and J. Blacher[3], (1)*University of California, Los Angeles*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*, (3)*University of California, Riverside*

Title: When Peers Matter Most: Adolescent Social Skills Across ASD, ADHD, and ID Symptom Groups

Background: Poor social skills in adolescence are related 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), Attention-Deficit/Hyperactivity Disorder (ADHD), and Intellectual Disabilities (ID), no known research has yet to compare differences in social functioning among these groups.

Objectives: The first objective of this study is to compare the social skills of early adolescents with ASD, ADHD, and ID with adolescents with typical development (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. The third objective is to investigate friendship quality as an outcome variable.

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=43), ADHD (n=14), ID (n=29) and TD (n=67). Data was 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) and the outcome variable of friendship quality were also examined.

Results: Data was analyzed by one-way ANOVAs. Preliminary results suggest 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 and ADHD. Adolescents with TD had higher overall social functioning and higher levels of assertion and self-control as compared to the three symptom groups (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 and ADHD (p<.05). The subscales of cooperation and responsibility also showed a trend for higher functioning among adolescents with ID and TD as compared to adolescents with ASD and ADHD. Results of the predictor variables are forthcoming and are expected to reveal lower social functioning as a result of anxiety, externalizing behavior, and inattention. We also expect social skills scores to be a positive predictor of friendship quality across groups.

Conclusions: Preliminary results suggest that adolescents with TD exhibit better social functioning overall than adolescents with ASD, ADHD, and ID. However, when behavior problems are considered, the TD and ID groups are functioning better than adolescents with ASD and ADHD. This suggests a possible behavioral regulation deficit in adolescents with ASD and ADHD 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.

128.100 100 Aides' and Teachers' Perceptions of Social Skills In Relation to Perceived Relationships In Elementary-Aged Children with Autism Spectrum Disorder. J. J. Locke*[1] and C. Kasari[2], (1)*University of Pennsylvania*, (2)*University of California, Los Angeles*

Background: Little is known about the social skills repertoire of fully-included children with autism spectrum disorder (ASD). Inclusion is an increasingly common practice; many children with ASD now are placed in settings with general education teachers and neurotypical peers (Kasari, et al., 1999). Little is known about the social functioning of these children in this setting. Preliminary research indicates that they have poorer teacher-student relationships than their peers (Robertson, Chamberlin, & Kasari, 2003) and are often on the periphery of their classroom social networks (Chamberlain, Kasari, & Rotheram-Fuller, 2007). This study adds to this small body of literature by examining the social functioning of included children with ASD as measured by classroom aides, teachers, and peers.

Objectives: A newly-developed Social Skills Q-Sort (SSQ) was used to measure classroom aides' and teachers' perceptions of children's social skills. Associations between the SSQ and teacher-student and peer-peer relationships in children with and without ASD were examined.

Methods: Twenty-one children with ASD were recruited from 19 classrooms in six elementary schools in Los Angeles. These children were fully included in regular education classrooms for 80% or more of the school day and averaged 6.7 years old. Another 270 typically developing children (mean age 6.3) from the target children's classrooms participated. A subset of 21 of these children, matched on age, gender (86% male), grade, and classroom were compared with children with ASD. Seventeen classroom aides and 19 teachers participated. Teachers completed the Student Teacher Relationship Scale (Pianta, 2001) for children with ASD and the matched sample; aides and teachers sorted the SSQ for both groups of children; children with ASD and their classmates completed the Friendship Survey.

Results: Children with ASD had significantly poorer teacher-student relationships than their peers ($p<.0001$), marked by more conflict ($p=.004$) and less closeness ($p=.004$) and poorer social network centrality ratings ($p<.0001$). Separate linear regressions were conducted to determine whether aide or teacher-reported SSQs predict children's teacher-student and peer-peer relationships. Aide-reported SSQs predicted children's overall teacher-student relationships ($p=.01$) and dependency ($p= .001$) while teacher-reported SSQs significantly predicted children's overall teacher-student relationships ($p=.01$), conflict ($p=.04$), and dependency ($p=.01$). Teacher-reported SSQs also predicted children's social network centrality ($p=.01$), but aide-reported SSQs did not.

Conclusions: Data from this study were gathered from multiple sources, including children with ASD, his/her peers, classroom aides, and teachers. This study extends our current understanding of social skills in elementary school-aged children with and without ASD and how these social skills affect relationships with teachers and peers. Since the social lives of children with ASD are very complicated, a better understanding of children's abilities is critical in informing developmentally appropriate interventions for this population. Future studies should carefully consider the impact of stable negative teacher-student and peer-peer relationships over time on children's academic and social success and consider intervention programs that include children with ASD, their teachers, and peers.

128.101 101 Early Identification of Autistic Spectrum Disorders: A Retrospective Analysis of Early Social-Emotional and Communicative Indicators. L. Bayrami*, *The Milton and Ethel Harris Research Initiative at York University*

Background: It is imperative to identify children at risk of developing autistic spectrum disorders (ASD) as early as possible, given the evidence that early intervention mitigates the downstream consequences of ASD. This spectrum of complex neurobiological disorders can affect a child's ability to communicate, both verbally and nonverbally, to engage in social interactions and form relationships with others. The screening approaches most widely used for identification do not allow for reliable assessment until the age of 18 months. In fact, a reliable diagnosis generally does not occur prior to 2 years. Despite the age of diagnosis, many parents express serious concerns regarding their infants' level of development within the first year of life.

Objectives: This retrospective study investigated the early emergence of social-emotional and communicative markers associated with ASD in the framework of infant-caregiver interactions as they occurred on home videos.

Methods: Twenty-three children diagnosed with ASD and 22 typically developing (TD) children participated via previously

recorded home videotapes. Infants were engaged in a series of typical daily activities with primary caregivers (e.g., feeding and changing). Videos were analyzed to determine whether deficits in social-emotional and communicative development were evident within the first 13 months of life. The aim of the study was two-fold. One, to investigate the developmental profiles of both groups by observing age of onset pertaining to several developmental milestones (i.e., cooing, reduplicative babbling, variegated babbling, first words, social and pointing) from birth to 13 months. The second objective was to examine communication trends in each group via caregiver-infant interactions, from 1 ½ to 4 months and from 4 to 8 months, with a focus on infant communicative behaviours.

Results: The onset of developmental milestones occurred significantly earlier in the TD group. Infants with ASD did not evidence variegated babbling, first words, and pointing in the first 13 months. In relation to infant communication, between 6 weeks and 4 months of age there were significant differences between the groups with respect to the coordination of eye contact and (1) nonverbal behaviours, and (2) vocalizations and nonverbal behaviours. The ASD group showed a significantly lower proportion of both forms of cross-modal communication. Between 4 to 8 months of age there was a significant difference between groups in relation to coordination of eye contact with (1) vocalizations, and (2) vocalizations and nonverbal behaviours, whereby infants with ASD showed a significantly lower proportion of both forms of cross-modal communication. The ASD group displayed a significantly higher frequency of eye contact as an independent response at the first age point and a significantly lower frequency at the second age point. The frequency of initiations towards the caregiver was higher for the TD group at both age points. Initiations were not evidenced by the ASD group.

Conclusions: The findings suggest that the onsets of significant social-emotional and communicative milestones are delayed in infants with ASD. In relation to dyadic communication, these infants are less likely to implement cross-modal communication but may rely on uni-modal communication, such as gaze, very early on.

128.102 102 Investigating the Validity of the Social Responsiveness Scale In a Clinical Sample of Preschool Children with Autism Spectrum Disorder. E. Duku*[1], T. Vaillancourt[2], P. Szatmari[1], S. Georgiades[1], L. Zwaigenbaum[3], I. M. Smith[4], S. E. Bryson[4], E. Fombonne[5], P. Mirenda[6], J. Volden[3], C. Waddell[7], W. Roberts[8] and A. Thompson[1], (1)*Offord Centre for Child Studies, McMaster University*, (2)*University of Ottawa*, (3)*University of Alberta*, (4)*Dalhousie University/IWK Health Centre*, (5)*Montreal Children's Hospital*, (6)*University of British Columbia*, (7)*Simon Fraser University*, (8)*University of Toronto*

Background: The Social Responsiveness Scale (SRS) is a widely used instrument for distinguishing autism spectrum disorder (ASD) from other developmental disorders and for quantifying the severity of autistic social impairment. The SRS has been validated in children 4 to 18 years of age from clinical and referred samples. However, current understanding of the psychometric properties of the SRS in younger children with ASD is limited.

Objectives: This study examined the validity and psychometric properties of the SRS in a clinical sample of newly-diagnosed preschool children with ASD.

Methods: The data came from a Canadian longitudinal study investigating the development of children with ASD. The study sample consisted of 339 children with an ASD diagnosis (mean age: 40.8 months (SD 9.3 months); 284 males (84.4%)). First, mean scores for the total scale and five SRS subscales were compared between the current sample and the norms. Second, confirmatory factor analysis (CFA) was used to assess the best fitting model for the structure of the SRS in this clinical sample. Third, Rasch analyses were used to evaluate the performance of the overall scale as well as each of the 65 items of the SRS.

Results: Study results indicate that: (a) Children in the current clinical sample score significantly higher than the published scale norms on the total scale and five SRS subscales (all effect sizes > 1.0 SD). Differences were largest for the Social Communication and Autistic Mannerisms subscales. (b) CFA results showed that the 1-, 2-, and 5-factor solutions for the structure of the SRS, previously proposed in the literature, provided an inadequate fit for the data (CFI and TLI varied from 0.46 to 0.50; RMSEA varied from 0.074 to 0.075); the best fit for the data was provided by the Autistic Mannerisms subscale (CFI = 0.85, TLI = 0.82, RMSEA = 0.08). (c) Results from the Rasch analyses confirmed those derived in the CFA; they also indicated that 17 out of the 65 SRS items did not perform as expected.

Conclusions: Study findings show that compared to the published scale norms, preschool children with a diagnosis of ASD have elevated scores on social impairment as measured by the SRS. Furthermore, the data suggest that the structure of the SRS cannot be described as uni-dimensional and that a substantial number of SRS items function poorly and do not discriminate well between children with ASD in this clinical

sample and population norms. Overall, the Autistic Mannerisms subscale performed the best out of the five SRS subscales and provided an adequate fit for the data. Although the SRS has proved to be a useful assessment screening tool , caution is warranted for its use and interpretation in clinical samples of preschool children with ASD.

128.103 103 Do Children and Adolescents with ASDs Who Have Achieved An Optimal Outcome Continue to Exhibit Pragmatic Language Deficits?. K. A. De Yoe*[1], I. M. Eigsti[2], E. Troyb[2], K. E. Tyson[2], A. Orinstein[2], M. Barton[2] and D. A. Fein[2], (1), (2)*University of Connecticut*

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 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 subset of individuals, once diagnosed with ASD, achieves an "optimal outcome" (OO); Sutera et al., 2007, Kelley et al., 2006, and Helt et al., 2008). These prior studies indicate that some residual language deficits, particularly in the domain of pragmatics, may be present in individuals who achieve OO (Kelley et al., 2006; Kelley, Naigles & Fein, 2010).

Objectives: This study examines pragmatic language in individuals with an OO, ages 8 to 21 years, compared to those with high-functioning autism (HFA) and typically developing (TD) peers.

Methods: Participants included individuals with OO (n = 25), HFA (n = 22), and TD (n = 21) with a mean age of 13 years. Groups were matched on age, gender, and non-verbal IQ. Diagnoses were confirmed via the Autism Diagnostic Observation Schedule (ADOS), ADI-R, and expert clinical judgment. Grammatical knowledge was evaluated using the Clinical Evaluation of Language Fundamentals-4, Core Language score (CELF-4). Pragmatic language was evaluated from ADOS videos using the Pragmatics Profile (PP) of the CELF-4; raters were blind to diagnosis. The PP consists of 52 items in three subsections: *Rituals and Conversational Skills* (*"Rituals"*), *Asking For, Giving, and Responding to Information* (*"Information"*), and *Nonverbal Communication Skills* (*"Nonverbal"*). Items are scored on a 1-4 Likert scale; higher scores indicate better pragmatic language.

Results: All groups differed significantly in grammatical language abilities, with TD > OO > HFA, all p's < .01; $M(SD)$ = 108 (16), 101 (14), 119 (7), p < .001, for OO, HFA, and TD groups, respectively. However, all groups were in the average or high average range in grammatical knowledge. A repeated-measures MANCOVA with CELF-4 score as a covariate indicated that the HFA group scored significantly lower than OO and TD groups in pragmatic language (PP) scores, $F(2,63)$ = 16.15, p < .001. Post-hoc analysis indicated that in each PP domain, TD and OO groups did not differ, all p's > .44, and HFA scored lower than both TD and OO, all p's < .001. Across PP domains, scores were significantly correlated with ADOS Social + Communication scores, all r's > -.57, all p's < .001, and with Vineland Social scores, all r's > .35, p's < .01. Only the Nonverbal subscale of the PP was correlated with CELF-4 Core Language, r =.23, p = .04.

Conclusions: Unlike prior studies of children with an OO, performed when participants were ages 5 – 8 years (Kelley et al., 2006) and 10 years (Kelley et al., 2010), an analysis of spontaneous pragmatic language skills found no difference between OO and TD groups, even holding constant grammatical language knowledge. In contrast, pragmatic language skills in HFA group were significantly lower than OO and TD groups.

128.104 104 Sensory Processing and Motor Deficits In Children with ASD. T. Todd*[1] and R. Lytle[2], (1)*California State University*, (2)*California State University, Chico*

Background: Children with Autism Spectrum Disorder (ASD) have deficits in the motor domain (Provost et al., 2007, Staples & Reid, 2010) and exhibit sensory processing difficulties (Kern et al., 2007; Wiggins et al., 2009). Jasmine and colleagues (2009) compared sensory responses, daily living skills, and motor skills in preschoolers and found few significant correlations. The relationship between sensory processing and motor ability is not well understood.

Objectives: To better understand motor and sensory function of school aged children with ASD three questions were posed; 1) is there a difference in gross motor skills and abilities in children with high and low functioning ASD and their neurotypical peers; 2) is there a difference in sensory processing in children with high and low functioning ASD and their neurotypical peers; and 3) is there a correlation between sensory processing and gross motor performance.

Methods: Thirty-three children 5-10 years of age, 12 with a diagnosis of high-functioning autism (HFA), 9 with ASD and poor receptive language, and 12 typically developing children completed two tests of motor development, the Test of Gross Motor Development 2 and the Movement ABC. A receptive language test, the Peabody Picture Vocabulary Test, was

administered to determine receptive language skill, children who scored more than 1.5 SD from the mean were classified as having poor receptive language. Parents completed the Sensory Processing Measure (SPM), a standardized questionnaire regarding their child's sensory preferences. One-way analysis of variance was performed to compare the results of the three groups on the TGMD-II, M-ABC, and SPM. The relationship between motor scores and sensory scores was explored through correlation analysis.

Results: Children with ASD displayed significant motor deficits (TGMD-II $F=17.23$, $p<0.01$; M-ABC $F=44.22$, $p<0.01$) and sensory processing difficulties ($F=47.9$, $p<0.01$) when compared to neurotypical peers. Greater sensory problems were related to motor deficits ($r=0.79$), however when the groups were separated the relationship decreased. Scores on the TGMD-II correlated moderately to the Sensory Processing Measure ($r=0.52$) for the groups with ASD. A social participation component of the SPM, which does not factor into the final score, correlated significantly with motor performance (TGMD-II $r=0.80$; M-ABC $r=0.75$).

Conclusions: Children with ASD had significantly more difficulty in the motor domain and sensory processing than children without ASD. There was no significant difference between the ASD groups on the TGMD-II and SPM. However the children with HFA scored significantly better than children with poor receptive language on the M-ABC. This finding suggests that the scores on the M-ABC may reflect poor comprehension of tasks as well as motor ability. Greater sensory problems were related to motor deficits for the total sample. This decreased when the groups were analyzed separately. All children with ASD had sensory processing difficulties which were moderately related to motor deficits. The small sample size limits generalizability of these findings. One finding of interest is the correlation between motor performance and social participation, this is in agreement with recent data from other studies (ex: McDonald et al., 2010) and should be examined in the future

128.105 105 The Impact of Symptom Severity on Parent-Child Interaction and Relationships Among Children with Autism. N. M. Beurkens*, *Horizons Developmental Remediation Center*

Background: The abilities that constitute deficiencies in autism are known to develop in typical children through interactions and relationships with parents from infancy throughout the childhood years (Hobson, 2004). While it is recognized that parents and children influence each other in a bidirectional process, little has been done to investigate how this occurs in the interactions and relationships between parents and children with autism (Siller & Sigman, 2002). The impact of autism symptoms on the ability to engage in relationships that allow this development has been well documented. What has not received equal attention are the mechanisms by which a child's autism symptoms impact interactions and relationships with parents, therefore impacting the developmental process.

Objectives: To examine the impact of child symptom severity in children ages 4-15 years, as measured by the Autism Diagnostic Observation Schedule (ADOS), on parent-child interaction, as measured by the Dyadic Coding Scale (DCS), and parent-child relationships, as measured by the Parent Child Relationship Inventory (PCRI).

Methods: Demographic information about participants was gathered via questionnaire. Autism symptom severity was measured using the ADOS, including updated scoring algorithms and the newly developed autism severity metric. The severity metric allowed for accurate comparison of symptom severity across the entire sample; taking into account age, communication level, and module utilized during testing. The DCS subscales were used to measure parent-child interaction, and the PCRI to measure parent-child relationships. A convenience sample of 25 participants was acquired from various autism organizations in West Michigan. Multivariate regression was used to analyze data.

Results: Intra-class correlation for coding reliability on the DCS subscales was strong and ranged from .83 to .98. Results of the multivariate regression analysis showed significant relationships between autism symptom severity and parent-child interaction. As autism symptom severity increased, the quality of parent-child interaction decreased. However, a significant relationship between autism symptom severity and parent-child relationship was not found. Autism symptom severity did not predict any of the parent-child relationship subscales. Results indicate that autism symptom severity is related to parent-child interaction, but not to the overall parent-child relationship.

Conclusions: Study results underscore the importance of identifying patterns of parent-child interaction that may impact child functioning in positive or negative ways. In addition, attention must be paid to the impact autism has on parent child interaction and relationships regardless of the child's symptom levels, specifically in the area of parent communication effectiveness. Focusing on the ways in which parents and children interact with one another on a moment-to-moment basis can provide an appropriate starting point for intervention and improved treatment outcomes.

128.106 106 The Developmental Sequence of Social-Communicative Skills In Young Children with Autism: A Longitudinal Study. C. C. Wu*[1] and C. H. Chiang[2], (1)*Kaohsiung Medical University*, (2)*National Chengchi University*

Background: The long-term outcome and adaptation in autism was an important issue but not really known clear. Previous studies suggested that acquisition of spoken language plays an important role. And there were a few early social-communicative skills (i.e. joint attention, imitation and play) prior to the development of expressive language in typically developing infants. Recent research has found a different developmental sequence for preschool children with autism (Carpenter, Pennington, & Rogers, 2002). However, few researches explored the developmental sequence of social-communicative abilities in young children with autism below three years old.

Objectives: The purposes of the longitudinal study were to explore the emergence sequence of social-communicative skills in young children with autism below three years old by comparing to the autism children and the developmental delay children. The children were tested two times, eighteen months apart- first at the about thirty-month-olds.

Methods: The participants were twenty three 29-month-olds (range = 24-36 months) young children with autism, 23 27-month-olds (range = 24-36 months) young children with developmental delay. All participants were recruited from one local hospital in Taiwan and assessed and diagnosed by multidisciplinary team according DSM-IV-TR (APA, 2000). We modified the STAT (Stone, et al., 2000, 2004) to measure social-communicative skills, including initiating joint attention, responding joint attention, object imitation, manual imitation, and doll-directed play.

Results: The results revealed that the emergence sequence of social-communicative skills in young children with developmental delay were RJA, IJA, object imitation, the other/doll directed play, language and manual imitation. However, the developmental sequence of social-communicative abilities in young children with autism performed different pattern. The young autistic children emerged object imitation first, and language was developed before the IJA.

Conclusions: The first three emerged social-communicative abilities in young children with autism were object imitation, RJA, and other/doll play. It indicted that the process of language development in young children with autism relied on salience effects companied by directed language of the caregivers, for example, touching and manipulating object. The atypical developmental sequence and learning strategy could not make them understand the intention of others. This is the reason why autism performed the errors and inappropriate usage of language.

128.107 107 Autism's Pervasive Effect on Early Parent-Child Communication. L. B. Adamson*[1], R. Bakeman[1], P. B. Nelson[1], D. F. Deckner[2] and A. M. Grossniklaus[1], (1)*Georgia State University*, (2)*Clayton State University*

Background: Joint attention deficits may greatly constrain a young child with autism's social interactions. For example, during the developmental period when a child often begins to speak, children with autism are less likely than typically developing (TD) toddlers to sustain periods of coordinated and supported joint engagement when interacting with their parents that in turn may limit their introduction to language and its use.

Objectives: This study uses a newly crafted set of rating scales to document how autism affects early parent-child interactions. In addition to replicating well-documented effects on joint engagement, we sought to gain a wider view of how autism affects other aspects of the child's communication, the parent's communicative actions and the characteristics of shared topics of communication. Moreover, we probed how the relations between joint engagement and aspects of communication varied between groups.

Methods: Children (56 typically-developing children [TD] at 18 months; 23 children with autism [AU] at 30 months) were observed interacting with a parent during six 5-minute Communication Play Protocol scenes that afforded a range of communicative functions including interacting, requesting, and commenting. For each scene, reliable observers rated items related to child joint engagement (4 items), child communication (5 items), parent communication (4 items), and their shared topic (4 items) on a 1–7 scale.

Results: Consistent with prior findings based on moment-by-moment state coding, supported (SJ) and coordinated (CJ) joint engagement were rated lower in the AU group than in the TD group ($p < .001$). In both groups, symbol-infused joint engagement was rated low, (M = 2.2), indicating that most children were not yet integrating language into the interactions. Autism also significantly and negatively affected the child communication items, including responsiveness to and initiation of communication, affective communication, and quality of behavior ($p < .001$). Moreover, topics within the AU group were less sustained and conversations were less fluent and

connected ($p < .001$). The parents' contribution was also affected; scaffolding and following-in were rated lower ($p < .05$) and symbol highlighting higher ($p < .001$) in the AU group. Correlations between the items assessing SJ and CJ and other items indicated that in both groups parent scaffolding and following in was related to SJ but not to CJ. Within the AU group, but not within the TD group, correlations of child communication items and shared topic items with SJ and CJ were often strong (>.50).

Conclusions: Rating scales can help document the pervasiveness of autism's effect on early parent-child communication. In this study, they detail how, during the developmental period when language is emerging, parents interacting with a child with autism may have more difficulty than parents of typically developing children scaffolding communication and following in on the child's focus of attention. Shared topics may also be constrained in scope and relatively difficult to sustain. Furthermore, the level of joint engagement may be tightly associated with aspects of communication, underscoring the relation between children's problems sustaining shared attention and communication difficulties.

128.108 108 Relationships Among Lexical Processing Speed, Autistic Symptomology, and Linguistic Competence. E. Abrigo* and F. Hurewitz, *Drexel University*

Background: Eye movements are closely time-locked to the occurrence of spoken words that refer to contextual objects (Cooper, 1974; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995), implicating saccade speed as an index of spoken lexical information processing speed. Processing speed can be conceptualized as a measure of efficiency in performing basic cognitive operations. When processing is slow, information may be lost, affecting both success on tasks and the amount of information that can be successfully encoded. Several researchers have associated autism with specific disruption in rapid auditory listening and/or processing of spoken language with automaticity (Welsh, Rodrigues & Edgar, 2010; Kuhl et al., 2005). A possible implication of this deficit may be abnormal language development.

Objectives: We utilize a new Lexical Processing Eye-tracking Task (LPET), to test response time to verbally referenced targets, as measured by eye movements. Target words are presented in several conditions (with and without linguistic competitors or Phonemic Cohorts) x 3 environmental Noise conditions, in order to examine individual differences in lexical processing and the relationship between speed, autistic symptomology, and linguistic competence.

Methods: Thirty-five children (mean age = 10.1, range 7.0-11.8) and 34 adult native speakers of English with no history of autism, developmental disorders or sensory impairments were assessed on the LPET as well as standardized language, IQ and social measures. The LPET was conducted using a monitor based eye-tracking system. Participants were asked to find images that map to prerecorded spoken words. Target images were presented on a 2x2 array of photographic images, randomized for position on the screen and controlled for lexical frequency. Saccades to targets were reinforced by animations that were triggered by fixation on the Target. Saccade time to Target was compared to performance on subtests from the Comprehensive Assessment of Spoken Language (CASL), and the child Social Responsiveness Scale, a measure that may be used to assess the continuum of social impairment in the general population.(Constantino & Todd, 2003).

Results: Children and adults showed sensitivity to the cohort conditions, suggesting the LPET is a valid measure of online processing. Results indicate a relationship between response time on the LPET and autistic symptomology, as reflected by children with slower reaction times exhibiting significantly higher parent rated SRS scores. Children, but not adults, showed a relationship between receptive and productive language skills (Synonyms, Grammatical Morphemes and Sentence Completion) and LPET performance, indicating that online lexical processing speed relates to higher level language skills during development.

Conclusions: We introduce a language based processing speed assessment which is an ecologically valid method to determine individual differences in lexical processing. Since referents are fixated on in close temporal proximity to when they are heard, the LPET is a natural task, not confounded by motor or reading skills or compliance with complex task requirements. These LPET results demonstrate the sensitivity of the assessment to autistic traits and linguistic competence in children, consistent with theories that suggest disturbances in auditory attention and speech parsing for children with autism (Constantino et al, 2007; Welsh et al, 2010).

128.109 109 Adolescent Social Competence: No Differences Between Mother and Father Ratings on the Social Responsiveness Scale. L. A. Smith*, M. Murray and A. Pearl, *Penn State Hershey*

Background: Impairment in social interaction is one of the core deficits of autism spectrum disorder (ASD). This symptom is pervasive throughout the spectrum as well as throughout the lifetime. It is particularly evident in adolescence as a great deal of emphasis is placed on social interaction and building

relationships during the teenage years. However, there is a dearth of instruments designed to measure social competence of adolescents with autism; the Social Responsiveness Scale (SRS; 1) is one of few that can be used with individuals during these years.

Objectives: To explore diagnostic sensitivity and specificity of the SRS using parental ratings and to compare differences between mother and father reports of social competence of adolescents with and without autism spectrum disorder.

Methods: Parents of 50 adolescents between the ages of 12 and 17 (mean age=14.74, SD=1.45) completed the SRS as part of a larger clinical trial examining the effectiveness of a social skills training program for individuals with ASD. Twenty-nine adolescents had a confirmed diagnosis of high-functioning autism (mean IQ=106.21, SD=16.57) and 21 were typically developing adolescents. Twenty subjects were male. The SRS was completed independently by each parent prior to the social skills intervention.

Results: Mother ratings on the SRS were able to correctly distinguish, with 100% diagnostic sensitivity and specificity, between individuals with autism and typically developing adolescents. Father ratings displayed 100% diagnostic sensitivity, classifying all those with ASD as in the autism range, and 95% diagnostic specificity with one typically developing individual falling within the autism range. Inter-rater differences were also examined. The standardized difference score was the method used to measure informant discrepancies (2). There were no significant differences between mother's and father's ratings on any of the subscales. Intraclass correlations (ICCs) between mothers and fathers for the SRS subscales and total score were high (ICC range = .80 – .93). The Communication subscale had the highest correlations suggesting that this variable is observed more consistently between mothers and fathers as compared to the other subscales, including the overall score. Although no significant differences were found between mother's and father's ratings, post hoc exploratory moderator analyses were conducted to determine if any variables predicted differences in ratings of behavior between informants. There were larger discrepancies between mother's and father's reports for children diagnosed with ASD than typically developing children.

Conclusions: The SRS demonstrated strong diagnostic ability as well as high inter-rater reliability between parents. These results suggest that the SRS is a valuable tool for researchers to screen for the presence or absence of an autism diagnosis and to obtain a more comprehensive understanding of an individual's social skills deficits. The high inter-rater reliability provides more confidence for the utility of this instrument and further supports obtaining a single parental rating.

References:
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128.110 110 Neuropsychological Profiles In Italian Children with Autism: a Descriptive Study Through NEPSY-II.

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Background: A deep investigation of the neuropsychological impairments in children with autism, may help to the identification of the pathophysiological mechanisms associated with the disorder and to design appropriate interventions aimed to improve cognitive capacities in individuals with autism. NEPSY-II (Korkman et coll. 2007) is one of the most comprehensive instrument designed to assess neuropsychological development in preschool and school-age children. It consists of several tests divided into six content domains: Attention and Executive Functioning, Language, Memory and Learning, Social-Perception, Sensorimotor Functions and Visuospatial Processing. The advantage of the NEPSY-II is the capability to assess the primary and secondary deficits underlying impaired performance both within and across functional domains.

Objectives: To explore the neuropsycological profile of children with autism through NEPSY-II.

Methods: A sample of 22 children (mean age = 9.56 years) with DSM-IV-TR clinical diagnosis of Autistic Disorder or Autistic Disorder NOS confirmed through ADOS and ADI-R was assessed with all the tests of the Italian version of the NEPSY-II. Additional inclusion criteria were: absence of any neurological dysfunction; Wechsler Full Scale IQ greater or equal to 80. A neurotypical sample matched for age and sex was randomly selected from the Italian normative sample (Urgesi, Campanella, Fabbro, in press) for comparison of neuropsychological profiles. Statistic analyses were conducted using t-Test ($p<.001$ was established as significant to correct for multiple comparisons).

Results: Attention and Executive Functioning: The test of inhibition, requiring the ability to suppress automatic responses in a naming task, was impaired in children with autism. In the Animal Sorting task, the autistic sample obtained higher scores than the control one. In Visual and Auditory attentions tests, requiring selective and sustained Attention abilitites, Design Fluency and Statue there was no difference between groups. Language: Comprehension of instruction, Repetitive of nonsense word, Speeding Naming and Word Generation were similar in the two groups whilst Oromotor Sequences and Phonological Processing were impaired in the autistic sample. Memory and Learning: Memory for Designs, Memory for Faces, Memory for Names and Sentence Repetition measures didn't show significant differences between autistic and neurotypical samples. List Memory, Narrative Memory under free and cued recall, and Word List Interference were impaired in autistic sample. Sensorimotor: Autistic sample showed significant deficiency in all tasks (Fingertip Tapping, Imitating Hand Positions, Manual Motor Sequences, and Visuomotor Precision). Social-Perception: Affect Recognition was impaired. Regarding Theory-of-Mind (ToM) measures, verbal tasks were impaired whilst measures in contextual tasks were intact. Visuospatial Processing: Block Designs, Geometric Puzzle, and Picture Puzzle tests showed no statistical differences between groups. Only Design Copying was impaired in autistic sample.

Conclusions: Only Sensorimotor domain appears totally impaired in autistic children. Within other domains, some traditional deficits are confirmed. For example ToM performance appears to be more apparent in verbal tasks and not in the understanding the emotional context of emotions. These findings provide additional support for the phenotypic neuropsychological profile of individuals with autism and suggest that the NEPSY-II can contribute to the neuropsychological description of children with autism.

128.111 111 Profiles of Receptive and Expressive Vocabulary Growth In Toddlers at High Risk for Autism Spectrum Disorders. K. Hudry*[1], R. Bedford[2], S. Chandler[2], G. Pasco[2], T. Gliga[3], M. Elsabbagh[4], C. de Klerk[3], M. H. Johnson[5], T. Charman[2] and .. The BASIS Team[6], (1)*La Trobe University*, (2)*Institute of Education*, (3)*Birkbeck*, (4)*Centre for Brain and Cognitive Development, Birkbeck*, (5)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (6)*BASIS*

Background:

Atypical language development is a key feature of autism spectrum disorders (ASD), with language delay common in the subgroup of children with core autism diagnoses. Delays and differences in the acquisition of both receptive and expressive vocabularies have been demonstrated, with preschoolers with autism often failing to show the usual developmental pattern of comprehension significantly in advance of production.

Objectives:

The current study extended existing findings of atypical receptive and expressive vocabulary profiles in children with ASD by exploring these in toddlers at high genetic risk for ASD (based on having an older sibling with a diagnosis) along with low-risk controls where there is no such family history. The aim was to identify the period in development at which developmental trajectories of vocabulary acquisition began to emerge.

Methods:

Participants were 50 toddlers at high-risk for ASD recruited through the British Autism Study of Infant Siblings (BASIS), and 50 low-risk controls. Profiles of receptive and expressive vocabulary growth were evaluated using the MacArthur Communicative Development Inventory, completed by parents at multiple visits, when children were aged around 6, 12, 24 and 36 months. Diagnostic outcomes of the high-risk group were determined at the final visit, permitting comparison of three groups of children: low-risk controls, children at high-risk with no ASD outcome, and children developing ASD.

Results:

Preliminary analysis comparing all children at high-risk with all low-risk controls suggests a different trajectory for both receptive and expressive vocabulary growth. Overall, vocabulary growth was slower in children at high-risk for ASD compared to low-risk controls. However, growth in receptive vocabulary appeared to slow at an earlier age, with expressive growth initially maintaining typical levels and showing signs of slowing only later. Additional analyses are planned to evaluate these data with respect to final outcome diagnosis of the high-risk group.

Conclusions:

These results expand upon previous research around receptive and expressive vocabulary and language patterns in individuals with diagnosed ASD, to prospectively examine vocabulary growth in a high-risk cohort followed longitudinally. Further

results including diagnostic outcomes at 3 years of age will address the specificity of language atypicalities in receptive vs. expressive domains and the developmental period at which ASD-characteristic profiles emerge.

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128.112 112 Perceptions of Popularity and Social Skills Among Adolescents with ASD: Comparing Adolescent, Parent, and Teacher Reports. A. R. Dillon*[1], E. A. Laugeson[2], A. Gantman[2] and F. Frankel[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 and popularity standing accurately. Consequently, there is often a discrepancy between how individuals with ASD perceive their peer relationships and how others perceive them (Kasari & Rotheram-Fuller, 2007). Koning and Magill-Evans (2001) found that adolescent boys with ASD rated themselves more socially competent than did their parents or teachers. Bauminger and Kasari (2000) noted that parents of children aged 8-14 years reported that many of the friends they identified for their children with autism were “desired” friends, rather than “actual” friendships. Furthermore, when peer social networks among children with ASD were examined, peer nominations indicated that children with ASD perceived themselves as having more friends than they actually did (Rotheram-Fuller, 2005). While discrepancies between self versus other perceptions of social functioning have been examined to some extent, less is known about perception of popularity standing among adolescents with ASD.

Objectives:

This study seeks to examine the relationship between adolescent self-perception of social functioning in comparison to parent and teacher perceptions. Correlations between adolescent self-reported popularity, and parent and teacher perceptions of overall social skills on three standardized measures were investigated.

Methods:

217 adolescents with ASD ranging from 11-18 years of age (*M* = 13.80; *SD* = 1.69) participated in the study. Adolescent participants completed the Piers-Harris Self-Concept Scale 2nd Edition (PHS; Piers, Harris & Herzberg, 2002) to assess for self-perceived popularity, while parents (*n*=187) and teachers (*n*=92) completed the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) to assess for overall social functioning.

Results:

Pearson correlations were conducted to determine whether correlations exist between adolescent self-perceived popularity, parent perceptions of adolescents’ social skills, and teacher perceptions of adolescents’ social skills. Results suggest that adolescent-report of self-perceived popularity was not significantly correlated with parents’ perception of the adolescent’s social skills (r=.138; p<.05), nor the teacher’s perception of the adolescent’s social skills (r=.158; p<.07). However, parent and teacher perceptions of adolescent social skills were significantly correlated (r=.238; p<.05).

Conclusions:

These results reveal that adolescents with ASD do not appear to perceive their level of popularity in accordance with how their parents and teachers perceive their level of social functioning; however, parents and teachers appear to be in agreement. These findings suggest that adolescents with ASD may actually perceive their social standing as greater than their actual social skill abilities might allow.

128.113 113 Exploring the Nature of Joint Attention Difficulties In Young Children with Autism Spectrum Disorder and In Siblings. H. Roeyers*, I. Schietecatte and P. Warreyn, *Ghent University*

Background: It is generally accepted that joint attention is impaired in children with autism spectrum disorder (ASD). As joint attention skills have repeatedly been demonstrated to relate to the development of language, cognition, social skills and behavioural competence (e.g., Charman et al., 2003; Kasari et al., 2008; Vaughan Van Hecke et al, 2007), a better understanding of this impairment may not only have positive implications for early detection but also for intervention and long-term outcome.

Objectives: A first aim of the current study is to compare young children with ASD, children at risk for ASD (siblings) and typically developing children (TD) in their joint attention skills. Secondly, we want to examine the relationship between joint attention and possible underlying processes such as social

preference, understanding of intention and nonsocial attentional skills.

Methods: *Participants.* 95 children participated: 23 children with ASD of 3 years old, and 20 siblings and 52 typically developing controls who were seen at both 24 and 36 months of age. *Instruments.* Attentional skills (e.g., disengaging, shifting) were measured by a visual orienting task and the orientation towards social stimuli was assessed with a visual preference paradigm with social and nonsocial stimuli. Understanding of intentions was studied by observing the behavioural responses of children towards an adult who was either unwilling or unable to give them a toy. Joint attention tasks were partly based on the Early Social Communication Scale (ESCS; Mundy et al., 2003). The Mullen Scales of Early Learning and the ADOS were also administered.

Results: Quality and quantity of joint attention was significantly better in 24 months old siblings and TD children than in 3-year-olds with ASD. Siblings of children with ASD initiated less joint attention than TD children but both groups did not differ on response to joint attention (RJA).
In the ASD group, RJA was significantly related to initiation of joint attention (IJA) while both forms of joint attention skills were not significantly associated in the two other groups. Different associations were found between the possible underlying processes and joint attention skills in the ASD group, compared to the two other groups.

Conclusions: This is the first study that compares joint attention skills and associated processes in young children with ASD and in siblings. The findings indicate that a slightly delayed pathway is characteristic of the broader autism phenotype while no evidence was found for a deviant pathway. Also in children with ASD, a delayed pathway was found, but only for the development of RJA. Concerning IJA skills however, data indicate that children with ASD are not only following a delayed pathway, but also a deviant one compared to that in typical development. Theoretical and clinical implications will be discussed.

128.114 114 SYMPTOMS SEVERITY and VISUAL Attention to the Eyes IN Children with AUTISM: A Correlational STUDY. L. Ferretti*[1], G. S. Doneddu[1], G. Saba[1], S. Marras[1] and R. Fadda[2], (1)*Center for Pervasive Developmental Disorders, AOB*, (2)*University of Cagliari*

Background: The reduced visual attention toward human faces in individuals with Autism Spectrum Disorders (ASDs) has been described in a number of studies (see Jones et al., 2008; Grelotti, Klin, Volkmar et al., 2002). In particular, while eyes are a special kind of stimuli for typically developing individuals (Ristic et al. 2002), this seems not to be true for people with ASDs. Poor attention to social stimuli, corresponds to a great loss of relevant social information and this is likely to have a negative impact on symptoms severity. However, the link between attention to the eyes and symptoms severity has been rarely explored in a systematic way. For the best of our knowledge, to date only one study, investigated whether attention to social elements in complex social scenes predicted symptoms severity in ASDs (Klin, Schults, Volkmar & Cohen, 2002). However, this study used very complex stimuli, in which hand and mouth movements accompanied by language were extremely salient and this might have lowered attention to the eyes.

Objectives: Our study aimed to investigate the possible correlation between fixation behavior to social stimuli and symptoms severity, in children with ASDs, using very simple static stimuli.

Methods: A group of 20 children with ASDs (10 M), aged between 3 and 8 yrs (mean age=4.5 yrs), were evaluated in respect to visual attention for photographs of human faces using an eye-tracker Tobii T60. The stimuli were pictures, depicting a human face with the eyes directed laterally towards one of two coloured objects depicted each on one side of the face, at the eyes level. Time to First Fixation (TFF) and Fixation Count (FC) for the eyes and for the non social elements of the stimuli (i.e. the background) were measured, and correlated with ADOS language scores and with ADOS social interaction scores.

Results: As found in previous studies, the results confirmed the eyes were less relevant compared to the non social stimuli, since the children looked less to them (mean FC eyes=156 (sd=110); mean FC non social stimuli = 347 (sd=253); t=-2.53; df=19; p=0.020) and less faster (mean TFF eyes=1.3 (sd=0.76); mean TFF non social stimuli = 0.76 (sd=0.64); t=2.67; df=19; p=0.015). However, while FC did not correlate with symptoms severity, TFF to the non social stimuli correlated both with ADOS language scores (r= -0.58; p=0.017) and with ADOS social interaction scores (r= -0.60; p=0.013), meaning that the children with more severe symptoms tended to focus more rapidly to non social elements of the stimuli rather than to the social relevant ones.

Conclusions: It seems that, increasingly with their inability to be attuned to the social world, children with ASD tend to be attracted more by the non social elements of the stimuli, rather than by those that might bear a social meaning. This abnormal

tendency already thoroughly documented in the literature (Osterling et al., 2002), needs early intervention, since the low focus on social information reduces opportunities for social learning in ASDs, hampering social and communicative development.

128.115 115 How Attention to Gaze-Direction Is Captured by Static Pictures In Very Young Children with ASDs: a Time-Course Analysis. R. Fadda*[1], G. S. Doneddu[2], T. Striano[3], S. Congiu[2], G. Frigo[2] and A. Salvago[2], (1)*University of Cagliari*, (2)*AOB*, (3)*Department of Psychology, Hunter College*

Background: In our previous study (Fadda, Doneddu, Striano et al., 2010) investigating children with ASDs' sensitivity to the orientation of an adult's eye gaze towards an object located within the child's field of view, in static images, children with autism appeared as successful and as accurate as controls in locating the object although they paid less attention to the eyes and over-explored non relevant areas of the stimulus. This led to the hypothesis that children with ASDs might use compensatory strategies to locate the gaze target rather than understanding the referential meaning of the gaze.

Objectives: Our study aims to extend our previous results, exploring the strategies used by children with ASDs to locate a gaze target by analyzing the time-course of their visual attention, in comparison with a group of chronological age matched controls, and with a group of adults, that represent respectively typical immature and mature patterns of visual attention toward static gaze-direction cues.

Methods: We compared 20 children with ASDs (13 M), mean age=57 mths (range: 36-101; sd=21.37), mean non verbal mental age=39 mths (Leiter-R scale), with a group of 20 typically-developing children, matched for chronological age (7 M) and a group of typically-developing adults (10 M), mean age=22.65 (sd=1.98). The stimuli, presented with a Tobii T60 Eye Tracker, were those used in Fadda et al. 2010: a human face looking right or left at one of two visible target objects positioned next to the head. We defined 5 areas of interest for all the 8 stimulus images: eyes, gaze target, non-gaze target, mouth, not-AOI (that is the area of the screen external to the other AOI). In order to define the strategies used to perform the tasks, we calculated the mean proportion of Fixation Count (FC: the number of fixations to an AOI) for each AOI during 3 different time slots, each lasting one second: 1st , 2nd and 5th second of stimulus presentation.

Results: Paired sample t tests revealed that adults showed a preference to the gaze target versus the non-gaze target at t1 (t=3.35.; df=19; p=0.003), t2 (t=2.54; df=19; p=0.02) and at t3 (t=1.78; df=19; p=0.09). Neither children with ASDs nor typical controls showed such a preference. Adults preferred the eyes rather than not-AOI at t1 (t=5.63; df=19; p=0.000), at t2 (t=4.10; df=19; p=0.001) and at t3 (t=2.15; df=19; p=0.044). The same preference was found in young typical controls but not in children with ASDs.

Conclusions: While adults were quickly and stably oriented by the eye-gaze direction toward the gaze target, both children with ASDs and typical controls were not, meaning that this phenomenon might be due to immature visual orienting patterns rather than being specific to ASDs. Contrary to previous studies (Ristic et al. 2005; Chawarska et al. 2003) we didn't find intact basic gaze cueing in ASDs, indeed children with ASDs showed poor attention to the eyes, suggesting that they generally miss important information conveyed by the eyes and this is also likely to hinder later understanding of the referential value of looking.

128.116 116 Early and Persistent Motor Delay In the Broader Autism Phenotype: Evidence From a Prospective Study. E. L. Hill*[1] and H. C. Leonard[2], (1)*Goldsmiths, University of London*, (2)

Background:

Prospective studies into infants at-risk of developing autism have found motor atypicalities between the ages of 6 and 24 months (e.g., Landa & Garrett-Mayer, 2006). These motor symptoms often precede the problems in social-communicative development associated with autism (Rogers, 2009).

Objectives:

The aim of the analyses was to build a profile of motor development in infant siblings of children diagnosed with autism, determining whether motor atypicalities are part of the endophenotype of autism, and when interventions could be introduced.

Methods:

Participants were 53 infants at high-risk of developing Autism Spectrum Disorder (ASD) and 50 low-risk infants, tested longitudinally at the ages of 6, 12-15 and 24 months. Eighteen of the high-risk infants were flagged for meeting criteria for ASD

at 24 months, and analyses were conducted on the groups with and without these participants. Outcome measures were the gross and fine motor scales on the Mullen Scales of Early Learning (standardized task) and the Vineland Adaptive Behavior Scales (parental report) at the three age points.

Results:

Strong correlations were found between measures of gross motor ability at all three age points (low-risk: *r*s > .5, *p*s < .01; high-risk: *r*s > .4, *p*s < .01), although fine motor skills were less consistent across the two measures over time. High-risk and low-risk groups differed significantly on both gross and fine motor scales at 6 months based on parental report, with high-risk infants still scoring lower on both scales at 12-15 months (all *p*s < .01). Infants only differed significantly on motor skills on the Mullen Scales of Early Learning from the age of 12-15 months.

Conclusions:

Motor atypicalities were found as early as 6 months of age in infants at high-risk of developing ASD, over and above differences in other cognitive areas. These differences between low- and high-risk groups persisted over time, and were not changed substantially when infants who were later flagged for meeting ASD criteria were removed from the analyses. Taken together, these data suggest that motor difficulties may be part of the endophenotype of autism, and that focused intervention could begin as early as 6 months on the basis of motor markers. These interventions would have important effects not only on motor development, but also on other cognitive skills.

128.117 117 Can Autism and Asperger Syndrome Be Distinguished According to Motor Abilities and Perceptual Processing Speed?. E. B. Barbeau*[1], I. Soulières[2], A. A. Meilleur[1] and L. Mottron[1], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Neural Systems Group, Massachussetts General Hospital*

Background: On the autistic spectrum, autism and Asperger syndrome are distinguished with respect to early speech abilities. Speech onset delays and/or certain speech atypicalities are specific to autistics and distinguish them from Asperger individuals. Other reported demarcating features are perceptual and motor skills, with autistics displaying visuo-perceptual peaks and Asperger displaying motor clumsiness.

Objectives: To investigate whether autistic spectrum individuals stratified on the basis of speech development atypicalities also differ on perceptual and motor variables.

Methods: 30 typically developing, 18 autistic and 17 Asperger (based on clinical diagnosis and speech abilities) participants were assessed with a) an intelligence battery including the Wechsler's scale of intelligence and the Raven Progressive Matrices b) a motor battery including the Purdue Pegboard and the Annett Peg Moving tests that measure gross and fine motor skills, dexterity, bi-manual and hand-eye coordination; and c) a task measuring perceptual processing speed (PPS), the computerized Inspection Time task. The groups were matched on age (14-27 years), gender and IQ (range 78-129).

Results: As predicted, the Asperger group did not show any atypicalities in PPS compared to the TD group, while the autistic group was significantly faster than the TD group (p = .028). In the autism group, PPS was correlated with Raven's Progressive Matrices performance (r=-.80, p<.001) but not in the Asperger group (r=-.34, p=.178). In motor abilities, both Asperger and autistic groups were significantly slower than the typical group at the Annett task with the dominant hand but only the autistic group was significantly slower with the non-dominant hand. Autistic and Asperger groups were also slower than their typically developing controls with either hand at the Purdue Pegboard task. Although there was a trend with Asperger individuals being more impaired than autistics for most subtests of the Purdue, the difference between autistic and Asperger groups was non-significant.

Conclusions: The results suggest that a faster PPS is specific to the autistic spectrum subgroup with speech onset delays and/or atypicalities while the subgroup without speech atypicalities displayed typical PPS. PPS could thus play a role in enhanced perception in autistics, and contribute to their strong performance on Raven's Progressive Matrices. Motor abilities did not seem to differ significantly between autistic and Asperger individuals. Although this might be due to a lack of power in the study, it is also possible that this variable cannot distinguish the subgroups, or the tasks used were not measuring the area in which the groups can be differentiated. Appropriate tasks might be ones involving the whole body (ex: balance and whole body coordination) rather than just manual dexterity and coordination.

128.118 118 Parental Help-Seeking Behaviors In Children with High Functioning Autism: The Role of Parental Confidence and Children's Symptomatology. T. A. Hassenfeldt*, N. M. Reyes and A. Scarpa, *Virginia Polytechnic Institute & State University*

Background: Autism Spectrum Disorders (ASD) are characterized by deficits in social interactions, language delays and the presence of stereotypic behaviors (Mastrangelo, 2009). Rogers and Vismara (2008) recommend that children with ASD receive comprehensive and intensive interventions. However, little is known about how, when, or why parents seek services for their children. In parents of children with ASD, research has shown that self-confidence in managing their children's anger and anxiety episodes increased when parents were involved in the treatment process (Sofronoff, Attwood, Hinton, 2005; Sofronoff, Attwood, Hinton, & Levin, 2007).

Objectives: However, to the authors' knowledge, no studies have investigated parental confidence and the potential association with help-seeking behaviors in children with ASD. Because of this lack of research, no hypotheses were predicted. This study sought to examine the associations between parental confidence and child symptomatology with (1) school interventions and (2) medical treatment.

Methods: Participants consisted of 12 children with ASD (83% male) aged 4.5 to 7 years old, recruited to participate in an intervention study for stress and anger management in children with high functioning ASD. Children had 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. Children's social and communication symptoms were measured using the Communication and Social domain sub-scores of the ADOS (Lord et al., 2000; Lord, et al., 1999). Parental confidence in their own and their child's ability to deal with anger/anxiety-related emotions and type of intervention (medical treatment, school services) were measured via parent report.

Results: Because our sample was small, it was considered appropriate to conduct a series of non-parametric comparisons (i.e., Mann-Whitney test). Parents reported significantly lower levels of confidence in their child's ability to deal with anger and anxiety when their child was receiving school services (M=4.63 for anger and M=4.75 for anxiety) than when their child was not receiving such services (M=9.67 for anger and M=9.33 for anxiety, p<0.05). However, children who received or did not receive medical treatment did not significantly differ on parental confidence. Similarly, no differences were found between parental self-confidence and children's services utilization. Finally, children who received or did not receive school services or medical treatment also did not significantly differ on the ADOS social or communication sub-scores.

Conclusions: Although parental perception of their own abilities did not appear to be related to interventions provided to children, parental confidence in their children's abilities did appear to influence the decision to seek for services. Children's ASD symptom severity did not appear to be associated with the services the child was receiving. These findings indicate that in a sample of children with diagnosed ASD, parental help-seeking behaviors seem to be associated with parents' perception of their children's abilities to deal with their emotional states, rather than a child's social or communication deficits. Future research should focus not only on whether children receive interventions, but also what mechanisms are contributing to parental help-seeking behaviors.

128.119 119 Narrative Abilities In Boys with Autism and Fragile X Syndrome. A. H. Brown*[1], D. Mueffelmann[2], G. Martin[3] and M. Losh[1], (1)*Northwestern University*, (2)*University of North Carolina*, (3)*FPG Child Development Institute, UNC Chapel Hill*

Background: Several studies have found that narratives produced by children with autism spectrum disorders (ASDs) do not differ from comparison groups of children with intellectual disability (ID) and typical development (TD) on basic levels of story production such as length and reference to main events (Diehl et al., 2006; Loveland et al., 1990). However, children with ASD exhibit difficulties in other key components of narrative, including evaluative devices (which are used to communicate the narrator's perspective), and the use of causal language in particular (Capps et al., 2000; Diehl et al., 2006; Losh & Capps, 2003; Tager-Flusberg, 1995). They are also more likely to include irrelevant or inappropriate utterances (Diehl et al., 2006; Loveland et al., 1990). Much less research has been conducted on narrative abilities in children with fragile X syndrome (FXS). Keller-Bell & Abbeduto (2007) found that narrative profiles of children with FXS (without comorbid autism) resembled those of TD children more than children with Down syndrome (DS). No research to date has investigated how the narrative abilities of children with ASD, FXS with comorbid autism, and FXS without autism compare to children with ID or TD children.

Objectives: To compare the narrative abilities of children with autism spectrum disorder (ASD), FXS with ASD (FXS-ASD), FXS only (FXS-O), Down syndrome (DS), and typical development (TD).

Methods: Narratives were elicited from 101 boys using the wordless picturebook *Bed Full of Cats* (Keller, 2003). Groups included children with ASD (n=20, mean CA=9.36 years, sd=2.0 years), FXS-ASD (n=21, mean CA=10.6 years, sd=2.7

years), FXS-O (*n*=21, mean CA=9.68 years, *sd*=2.56 years), DS (*n*=19, mean CA=10.85 years, *sd*=2.14 years), and TD (*n*=19, mean CA=4.72 years, *sd*=1.04 years) who were similar on non-verbal mental age, expressive language age, and receptive language age. Narratives were transcribed and coded for length, syntactic complexity, evaluative devices, story structure, and inappropriate and off-topic utterances.

Results: One-way between-group analyses of covariance were conducted to compare narrative variables across groups. After adjusting for non-verbal IQ, and expressive and receptive language ability, significant group differences emerged in the use of evaluative language $F(4, 90) = 2.53$, $p = 0.046$, and the number of story episodes included in narrative $F(4, 90) = 2.80$, $p = 0.031$. In particular, individuals with FXS-O performed most poorly, whereas individuals with FXS-ASD performed more similarly to individuals with ASD-O. Further examination of patterns of evaluative language use revealed that the ASD and FXS groups (both ASD and FXS-O) showed particular difficulty with causal explanations of emotion in particular. Moreover, children with FXS-ASD used no causal language at all when referring to such states.

Conclusions: Findings suggest that children with FXS without autism exhibit more severe narrative impairments than those with ASD. Moreover, the narratives of the FXS-ASD and ASD groups shared many of the same characteristics, including similar use of evaluative devices, and particular difficulties with causal explanations of emotions. Taken together, these findings contribute to existing literature documenting an overlap of autism and FXS.

128.120 120 Strengths and Difficulties of Children with Asperger Syndrome: Parents' Views and Implications for Intervention. S. E. Carr*[1], R. P. Goin- Kochel[2] and B. J. Myers[1], (1)*Virginia Commonwealth University*, (2)*Baylor College of Medicine*

Background:

Children with Asperger syndrome have problems with social, emotional, and communication skills. They are intelligent and have better outcomes in life than those with autism (Cederlund, et al., 2008). However, they have unusual behaviors and interests, and their unique challenges may leave parents feeling either hopeful or disappointed for their child's future (Mackintosh et al, 2005).

Objectives:

This study used qualitative analyses to examine parents' answers to the open-ended question, "What are your child's strengths and difficulties?" The objective was to examine parents' own words regarding their child with Asperger syndrome and to identify themes that describe family's experience of their child. By better understanding what parents face when raising a child with Asperger Syndrome, interventionists can develop support services to address the key areas of concern.

Methods:

Parents of 531 children in the autism spectrum responded to an internet-survey regarding the development of their children. From these, 103 parents of children with Asperger syndrome (76% boys; ages 3 to 22**);** 96% white), provided a written answer to this question. Two coders independently coded the responses and then worked together to refine the codes (Patton, 2010). This resulted in themes that described both positive and negative qualities of the children. Coders came to agreement on the themes and on placement of comments into the themes.

Results:

Parents were both complimentary and critical in describing their children. Themes included personality traits (both positive and negative), cognition (noting both high intelligence and difficulties in learning), talents (this theme was always positive), social deficits (mentioned by virtually every family), aggression, and challenging behavior. Parents most often saw multiple themes in their child. A typical answer was:

"He appears fairly normal, but with a few quirks. He is smart and loves science. He has real talent in art. He has difficulty with reading and writing (dyslexic,dysgraphic). He has difficulty with memorizing math facts. He has difficulty with coordination, playing sports, jumping rope ect. He has difficulty playing with other children, yet he wants to play with them. He does not respond when a classmate calls out his name as he is leaving school. He will not make any response when an adult at church speaks directly to him in the hall. Yet he will make good eye contact when speaking with me much of the time. . . . He will get excited and rambunctious and not behave appropriately for someone his age."

Conclusions:

Parents did not hesitate to describe their children and to name both the positives and the negatives in their child's behavior. They were empathic toward their children but not Pollyanna in their answers. Many of their views went beyond what is measured in school settings and spoke to the challenges

children with Aspergers present to family functioning. Understanding parent's perspectives on their child's strengths and difficulties can lead to insight into developing parental supports as well as tailoring interventions to address the perceived difficulties of children with Asperger Syndrome while utilizing their strengths.

128.121 121 Social Cognition In Williams Syndrome: Relations Between the Social Attribution Task and Parent-Reported Socio-Communicative Functioning. F. van der Fluit*[1], E. K. Erdmann[2], E. C. Bennaton[1], S. L. Schram[1], M. Gaffrey[3] and B. P. Klein-Tasman[1], (1)*University of Wisconsin, Milwaukee*, (2), (3)*University of Washington in St. Louis*

Background: Williams syndrome (WS) is a developmental disorder of genetic origin (Ewart et al, 1993), with characteristic cognitive and personality profiles (Mervis et al, 2000; Klein-Tasman & Mervis, 2003). Studies of WS point to an outgoing and gregarious personality style, often contrasted with autism spectrum disorders (ASDs); however, recent research has uncovered underlying social reciprocity difficulties in this population (Laing et al, 2002; Lincoln et al, 2007; Klein-Tasman et al, 2007, 2009).

Objectives: The objective of this study was to examine relations between social cognition, as measured by the Social Attribution task, cognitive abilities, and parental ratings of social reciprocity in children and young adolescents with WS.

Methods: All children were administered a measure of intellectual functioning (KBIT-II; Kaufman & Kaufman, 2004) and a lab-based measure of social perception and cognition (Social Attribution Task; (SAT; Klin, 2000). Parents completed measures of socio-communicative functioning (Social Communication Questionnaire, SCQ, Rutter, Bailey, & Lord, 2003; Social Responsiveness Scale, SRS, Constantino & Gruber, 2005). SAT responses were coded according to the original scheme (Klin, 2000). Correlations between performance on various indices of the SAT and scores on the KBIT-II and the parent questionnaires were examined.

Results: Participants included 24 children (12 males, 12 females) with WS ages 8-15 years (M = 149.88 months, SD = 32.51 months). All children were administered the SAT and KBIT-II (M = 66.04, SD = 11.93). 21 caregivers completed the SRS (M total score = 70.24, SD = 11.17) and 20 completed the SCQ (7 [35%] met or exceed cutoff). Significant correlations were found between the Salience index and SRS Social Cognition (SCog) ($r(19)=-.615$, $p<.01$), Social Communication (SComm) $r(19)=-.604$, $p<.01$), Social Motivation (SMto) $r(19)=-.443$, $p<.05$), Autistic Mannerisms (AM) $r(19)=-.552$, $p<.01$), and Total scores ($r(19)=-.623$, $p<.01$) as well as the total score on the SCQ ($r(18)=-.458$, $p<.05$). Significant correlations were found between the Problem Solving index and the KBIT IQ Composite ($r(21)=.418$, $p<.05$), SRS Social Awareness (SAware) ($r(19)=-.601$, $p<.01$), SCog ($r(19)=-.521$, $p<.05$), SComm ($r(19)=-.637$, $p<.01$), AM ($r(19)=-.635$, $p<.01$), and Total scores ($r(19)=-.673$, $p<.01$) as well as the total score on the SCQ ($r(18)=-.675$, $p<.01$). Significant correlations were found between the Improvement index and the KBIT-II nonverbal and IQ composite scores ($r(21)=.514$, $p<.01$ and $r(21)=.490$, $p<.05$, respectively), SRS SComm and total scores ($r(19)=-.452$, $p<.05$ and $r(19)=-.449$, $p<.05$, respectively), as well as the SCQ total score ($r(18)=-.513$, $p<.05$). The majority of these relationships remained significant even when IQ was taken into account.

Conclusions: Consistent relations were found between performance on the lab-based measure of social cognition and parent-reported social communication and reciprocity skills, indicating that the SAT is indeed tapping into real-world social perception and cognition. The relationship between the Improvement index and overall IQ supports the hypothesis that children with more delays especially benefit from additional structure to support their interpretation of the stimuli.

128.122 122 Validity of M-CHAT In a Large ASD Mexican Sample. L. Albores-Gallo*[1], O. Roldan Ceballos[2], L. Hernandez-Guzman[3], G. Villarreal-Valdes[1], C. Santos[1] and X. Betanzos-Cruz[1], (1)*Hospital Psiquiatrico Infantil* , (2)*Asociacion Mexicana de Ninos con TDA y trastornos asociados A.C.*, (3)*UNAM*

Background:

Mexican Child Psychiatry Hospitals and Primary Health Services need validated reliable instruments for identifying autism spectrum disorders. The Modified Checklist for Autism in Toddlers (M-CHAT) questionnaire is a brief measure available in Spanish which needs to be tested and validated for use in Mexican population.

Objectives:

To examine suitability of M-CHAT Mexican version, and to analyze reliability, concurrent and construct validity in children from two settings: general population and a group of Autism spectrum disorder (ASD) attending Child Psychiatry Hospital Dr. Juan N. Navarro

Methods:

Parents of Mexican children from two different settings: 1) community with typical development (TD) and 2) Child Psychiatry Hospital outpatient unit completed the CBCL1.5-5 and the Mexican version M-CHAT. The ASD group was diagnosed with ADI-R as part of their routine assessment process.

Results:

The study sample consisted of 456 children with an age range of 1 to 6 years old (M: 4.46 SD 1.12). Of these, 339 (74.34%) were children with typical development (TD) and 117 (26.65%) with ASD. Both groups had very similar for SES, maternal, paternal and children's age. The ASD group had a higher percentage of male compared to the TD group (p=<.001). The CHAT mean score for failed critical items for the ASD group was 6.66 (SD 4.21) and for TD group was 3.27 (SD 2.19) (*p*=<.0001). The results remained significant even after dividing the groups by age from1 to 3 and 4 to 6 years. The internal consistency for the Mexican M-CHAT version was .76 for the total score (23 items) and .70 for the 6 critical items. The M-CHAT correlations were high with two ADI-R dimensions: B (non- verbal) dimension (r=.665, *p*=0.01) and A dimension (r=.61, *p*=0.01). Moderate correlations were obtained for ADI-R dimensions B1 Verbal (r=.23, *p*=ns) and C (r=.36, *p*=0.01). Correlations were also high for the CBCL1.5/PDD (r=.53, *p*=0.01) and the Withdrawn subscale (r=.636, *p*=0.01). Items 10, 11, 14, 17, 18, 21, 22 were identified as critical through discriminant analysis. Item 14 was also identified by the original CHAT, and item 10 was identified in the Chinese study. Items 17 and 21 were similar to the Japanese study.

Conclusions:

M-CHAT could discriminate between ASD and TD group. The instrument show moderate internal consistency. However our results support evidence for cultural differences in items response, making difficult to compare results internationally.

128.123 123 Social Perception Deficits In Children with ASD : An Eye-Tracking Study Using Social Video Clips. A. Saitovitch*[1], A. Bargiacchi[2], N. Chabane[3] and M. Zilbovicius[2], (1)*Research Unit 1000 "Neuroimaging and Psychiatry", CEA – INSERM*, (2)*Research Unit 1000 "Neuroimaging and Psychiatry", CEA - INSERM*, (3)*Hospital Robert Debre*

Background: Autism Spectrum Disorders (ASD) are characterized by important impairments in social interaction. Previous eye-tracking studies have showed that adults with ASD lack preference to social stimuli and have a tendency to look more to non-social features in a social scene, which can be accounted as one possible explanation for their difficulties in social interaction.

Objectives: To use eye-tracking during video clips presentation to study social perception in children with ASD compared to typical developing children.

Methods: ASD diagnosis was based on DSM IV-R and ADI-R criteria. Autism clinical severity was assessed with ADI-R total score. Participants were 22 ASD children (mean age = 11,8 ± 3,1; 20 boys; mean IQ = 81,8 ± 29,3) and 21 typical developing children (mean age = 11,3 ± 2,5; 15 boys). Eye-tracking studies (Tobii T120 Eye Tracker) were performed during presentation of social relevant video clips (film and cartoon versions), non-social control video clip and during presentation of static pictures taken from each video clip. Gaze parameters were measured in areas with strong social contents (eyes, mouth, and face) and in non-social areas.

Results: Children with ASD spent significantly less time examining strong social content areas (eyes, mouth, and face) and more time examining non-social areas when presented with both video clips and static pictures. Such deficits were significantly more prominent in children with severe ASD (global ADI-R > 30). In addition, the differences between the two groups were more substantial in dynamical scenes comparing to static scenes, as well as in film version comparing to cartoon version. There were no significant differences between the two groups in the non-social control video clip.

Conclusions: Children with ASD showed a lack of preference to social information when compared to typically development children, as well as a preference to non-social contents, and the deficits were linked to autistic severity. These results indicate the presence of abnormalities in social perception process in ASD. Social deficits were more prominent in more ecological situations (video clips), suggesting this kind of stimuli is more suitable to study social perception in ASD.

128.124 124 The Importance of Including Mesures of Joint Attention Abilities In the Clinical Assessment of Very Young Children with ASDs. M. Foscoliano*[1], R. Fadda[2], G. S. Doneddu[1], G. Frigo[1] and M. Piu[1], (1)*AOB*, (2)*University of Cagliari*

Background: One of the core social symptoms of Autism Spectrum Disorders (ASDs) involves a marked reduction in the ability to engage in Joint Attention (JA) episodes, in order to share a common perceptual experience of objects and events (Mundy & Newell, 2007). This ability seems to be central for language and social development (Baldwin, 1995; Charman, Baron-Cohen, Sweettenham, Baird, Cox and Drew, 2000).

Moreover, individual differences in JA skills are related to the responsiveness to intervention and to long-term social outcomes in children with ASDs (Mundy et al., 2007). However, despite the centrality of these abilities, individual differences in early JA are rarely assessed in very young children with autism and they are almost never considered in relation to the developmental and cognitive measures necessary to define personalized and effective interventions.

Objectives: This study aimed to investigate the relationship between JA abilities and developmental measures of language and cognitive abilities in very young children with ASDs.

Methods: 30 participants with ASDs (17 M), including 4 PDD-NOS, aged between 1.10yrs and 5.7yrs (mean age=3.6yrs), were evaluated for the following early social communication behaviors with the Early Social Communication Scales – ESCS (Mundy et al., 2003): Initiating Joint Attention (IJA) , Responding to Joint Attention (RJA), Initiating Behavioural Requests (IBR), Responding to Behavioural Requests (RBR), Initiating Social Interaction (ISI) and Responding to Social Interaction (RSI). Developmental functioning was tested with the Bayley Scales for Infant Development Third Edition (Bayley, 1999). The measures of the two scales were correlated and the JA abilities were analyzed as possible predictors of both language and cognitive scores of the Bayley Scales.

Results: The results showed positive and significant correlation between Bayley scores of language development and IJA (r=0.53; p=0.04), RJA (r=0.019; p=0.019), IBR (r=0.63; p=0.001) and RBR (r=0.55; p=0.01), confirming the pivotal role of these abilities in early linguistic and social development. IBR correlated also with the Bayley scores of cognitive development (r=0.40; p=0.03), confirming the important role of cognition in planning and structuring social reciprocal interactions and goal-directed actions. However, while all the socio-communicative behaviors measured by the ESCS predicted the Bayley Language scores (r squared=0.41; F(4;20), p=0.05), none of each single ability was a significant predictor per se.

Conclusions: These results indicate that measures of joint attention abilities may provide an early behavioral indicator of atypical development in very young children with ASDs, due to their high correlation with standardized measures of language and cognitive development. Moreover, the assessment of individual differences in JA abilities in very young children with ASDs may be particularly interesting, if we consider that early intervention on JA seems to have important effects on long-terms outcomes in social-learning and socio-communicative development (Charman, 2004; Kasari et al., 2008; Mundy and Crowson, 1997).

128.125 125 The Contribution of Reciprocal Social Interaction to the Acquisition of Verbs and Spatial Terms In 2-Year-Olds with ASD and Siblings-at-Risk. K. Carter*[1], J. Parish-Morris[2], S. Paterson[1] and I. B. I. S. Network[3], (1)*Children's Hospital of Philadelphia*, (2)*Temple University*, (3)*University of North Carolina at Chapel Hill*

Background: Accumulating evidence suggests that for children with ASD, vocabulary growth is highly dependent on social skills. Understudied, however, is the *nature* of vocabulary that is acquired. Extensive research with typical children suggests that not all words are created equal; rather, some kinds of words are more difficult to learn than others (Hirsh-Pasek & Golinkoff, 2006). The so-called "hard words" label static and dynamic relationships between objects or entities, and include verbs like "run" and prepositions like "on". These words are more difficult to learn in part because their meaning is less perceptually obvious than a concrete noun like "ball". Thus, figuring out the meaning of a relational word often requires children to utilize more than just perceptual cues – they must also integrate knowledge gleaned from social cues. The relationship between social understanding and verb vocabulary in children with ASD has been established (Lopez & Lord, 2009), but the theoretically similar link between social understanding and a different type of relational words – prepositions or spatial terms – has yet to be explored.

Objectives: Explore the link between social understanding and relational vocabulary in children with ASD and siblings-at-risk who did *not* receive a diagnosis. It was hypothesized that social skills would predict *both* types of relational words (verbs and prepositions) in children with ASD, but not in unaffected siblings.

Methods: Ten 2-year-olds with ASD were matched to 10 2-year-old siblings of children with ASD on the non-verbal portion of the Mullen Scales of Early Learning (Mullen, 1995). These children were seen as part of the Infant Brain Imaging Study; a multi-site longitudinal study of brain and cognitive development in infants at risk for ASD. Parents completed the MacArthur-Bates Communicative Development Inventory – Words and Sentences questionnaire (Bates et al., 2007). All children were administered the ADOS-G (DiLavore, Lord, Risi & Rutter, 1999).

Results: Consistent with Lopez and Lord's (2009) finding that expressive verb vocabulary is affected by social affect, linear regressions run separately for each group revealed an effect of

reciprocal social interaction scores on verb vocabulary size after controlling for non-verbal cognitive ability in the ASD group (p<.05), but not the sibling group (all ps=n.s.). Our hypothesis that words labeling *non-dynamic* relations would also be sensitive to social skills was likewise confirmed, as reciprocal social interaction scores predicted preposition vocabulary in the ASD group only (p<.05) after controlling for non-verbal cognitive ability.

Conclusions: Social understanding has been linked to verb development in ASD (Lopez & Lord, 2009), and the present research extends this finding in an important way: rather than arguing that social understanding in children with ASD is important for any particular *word class*, our findings suggest that social cues are crucial to acquiring *relational words in general*, including spatial terms. Data for this study continues to be collected, and future analyses will include participants who are not at genetic risk of developing ASD, thus creating a three-group design.

128.126 126 Spontaneous Syntactic Complexity In Preschool Children with ASD. J. Mayo*[1], I. M. Eigsti[1], Y. Fuerst[2], H. Prentice[3] and R. Paul[4], (1)*University of Connecticut*, (2)*Southern Connecticut State Univeristy*, (3)*Midstate Medical Center*, (4)*Yale Child Study Center*

Background: Abnormalities in language and communication are hallmarks of the Autism Spectrum Disorders (ASD). In addition to well-established weaknesses in language (e.g. early language delays, weaknesses in high-level discourse, and abnormalities in pragmatic abilities), deficits in syntactic ability (combining words into phrases and using morphemes) have also been reported (Eigsti et al., 2007, 2009). Previous studies have offered contradictory results regarding the acquisition of grammatical morphemes in ASD; several reports have concluded that individuals with ASD use grammar commensurate with their cognitive abilities (Fein & Waterhouse, 1979; Tager-Flusberg et al., 1990), while others have noted significant deficits in syntactic development in ASD that go beyond cognitive deficits (Eigsti, Bennetto, Dadlani, 2007; Bartolucci, 1982; Bartolucci, Pierce, & Streiner, 1980).

Objectives: To clarify the debate regarding syntactic development in ASD, we sought to replicate an earlier finding of delayed syntactic development in young children with ASD. In addition, we sought to examine the persistence of any grammatical deficits by examining language in children who are older than those previously studied.

Methods: Language samples were collected from children with ASD (n = 19) and a group of age- and Performance IQ-matched children with typical development (TD; n = 24) ages 4.0 – 7.6 years. The first 100 utterances of language samples were analyzed using the Index of Productive Syntax (IPSyn) to quantify grammatical complexity of four language domains: Nouns, Verbs, Questions/ Negations, and Sentence Structure. Standardized measures of language and cognitive skills were collected for all children.

Results: Preliminary results for 24 children are reported here. Groups did not differ in overall IPSyn score, or subscale scores for Noun phrases; Verb phrases; or Sentence Structures. Interestingly, the ASD group earned significantly higher scores (p = .001) on the Questions/Negations subscale, producing significantly more questions on 6 of 7 items. Correlational analyses of IPSyn data and standardized measures of cognition, language, and autism severity will be presented.

Conclusions: A subset of children with ASD produced language that was similarly syntactically complex as a group of age- and IQ-matched TD peers; further analyses will take into account history of language delay and autism severity. These results differ from a previous study using IPSyn for a younger group of children with ASD (Eigsti et al., 2007). Results could indicate that initial syntactic delays in ASD remediate relatively early. Alternatively, it is noteworthy that the current spontaneous language sample was drawn primarily from the ADOS, which is an adult-directed interaction. As such, results may suggest that the TD group was sensitive to the social context of their interactions, in that they waited passively for adults to lead the interaction. Participants with ASD may have felt less constrained by the social interaction, and felt uninhibited in asking questions.

128.127 127 Using Eye Tracking to Examine Factors Affecting Comprehension In Children with Autism. C. E. Venker*[1], E. R. Eernisse[2], A. Bean[1], J. R. Saffran[1] and S. Ellis Weismer[1], (1)*University of Wisconsin-Madison*, (2)*University of Illinois, Urbana-Champaign*

Background:

Measuring comprehension is a key component of characterizing children's language skills, but traditional measures may not accurately capture the comprehension skills of young children with autism. It is likely that examiner administered standardized tests underestimate these children's receptive language skills because of unfamiliarity with the testing environment and limited on-demand responses. Eye tracking paradigms have emerged as a methodology that may more accurately and implicitly measure comprehension in children with autism (Edelson et al., 2008; Swenson et al.,

2007; Tek et al., 2008). Importantly, these paradigms provide real-time information and allow for more fine-grained analyses of factors that may influence the speed and accuracy of comprehension, such as age of acquisition, word frequency, and phonotactic probability.

Objectives:

The objectives of this exploratory study were to assess comprehension of familiar nouns in young children with autism using the looking-while-listening paradigm (Fernald et al., 2008) and to explore the effect of age of acquisition on comprehension.

Methods:

A subset of ten children with autism (ages 2-5) who were part of a larger longitudinal project participated in the current study. Children were presented with pairs of pictures of familiar words on a screen with accompanying audio stimuli (e.g., child saw a baby and a ball, and heard, "Where's the baby? Do you see it?"). Eight words (*ball, baby, car, doggie, cup, spoon, shoe, book*) were tested twice, for a total of 16 trials. Children's eye movements were coded frame-by-frame from video by trained coders. A measure of age of acquisition was determined based on the percentage of 8-month-old infants reported to understand each target word in the CDI normative database.

Results:

Accuracy and reaction time data were obtained from the majority of participants, meaning that children typically looked at the pictures, not away from the screen. With respect to accuracy, results indicated that the proportion of looking to the target picture increased significantly after the onset of the target word, compared to baseline looking ($p<.05$). The relationship between reaction time and age of acquisition was non-significant; the Spearman correlation between proportion of looking time to each word and that word's age of acquisition was .67 ($p=.069$). This trend toward significance suggests that age of acquisition may relate to comprehension at the preschool age, even for early emerging words.

Conclusions:

Results suggest that examining the eye movements of preschool children with autism provides a window into their comprehension abilities. Children attended to the task, contributed usable accuracy and reaction time data, and demonstrated comprehension of familiar words. An exploratory analysis suggested that children's proportion of looking time trended toward an association with the developmental point at which those words are typically understood. Together, these results support the use of the looking-while-listening paradigm to measure comprehension in young children with autism and other populations that are difficult to test. A strength of this paradigm is that it provides a more nuanced picture of real-time comprehension than traditional measures, allowing for further characterization of factors that affect the receptive language abilities of individuals with autism.

128.128 128 Towards Collaborative Pretence and Collective Intentionality: Metacommunication In the Pretend Play of Children with Autism. L. Stirling* and S. Douglas, *University of Melbourne*

Background:

Impairments in joint attention, social imitation and social-emotional reciprocity mean that children with autism find spontaneous social play very difficult (Jordan 2003; Wolfberg 2009). Carpendale and Lewis (2004) indicate an association between children's false belief recognition and their engagement in metacommunication in pretend play. However social pretend play is by nature a metacommunicative activity: for play to evolve successfully, the players must communicate in the creation, expansion and sustainment of a shared make-believe world (Giffin 1984).

Objectives:

The aim of this exploratory study was to investigate engagement in the social pretend play of children with autism – in particular, the extent to which these children could initiate and sustain a shared pretend scenario and make use of metacommunicative strategies to achieve this. We hypothesized that the children would not seek to engage in collaborative pretend play.

Methods:

The corpus consisted of 30 hours of videotaped free play of child – adult dyads. 5 English-speaking children with autism (ages 3;6 – 7;2) participated in the study, all of whom had undergone a team assessment from a recognised child mental health service. We identified 64 pretend play sequences in the corpus. The data was approached from a conversational interaction perspective involving detailed qualitative examination of the play sequences in their linguistic and non-linguistic context, to determine whether the children sought to recruit the adult into their play. Specifically, we analysed verbal and nonverbal metacommunicative strategies employed by the children, using an adaptation of Giffin's (1984) coding scheme

for typically developing children's play. We also coded the data according to our own continuum of engagement in social play.

Results:

While only one child engaged in true collaborative pretend play, all of the children shared the pretence to varying degrees: some children did not actively seek collaboration in the pretence, but still interacted with the adult play partner, while for others the adult was invited to share in the pretence but actively discouraged from making creative contributions.

All of the children used metacommunicative strategies applicable in both solitary and collaborative play (e.g. sound effects). However, only three children demonstrated the ability to utilize and respond to metacommunicative strategies exclusive to collaborative settings: negotiation of the pretence (within or outside the play frame) and sharing in the creative process. Even the most able children exhibited a lack of flexibility in shifting in and out of the play frame and incorporating proposals by the interlocutor into the play.

Conclusions:

While research shows children with autism are capable of pretend play (e.g. Jarrold, Boucher & Smith 1996), social pretence has received less attention. Our detailed analysis of metacommunication shows children participating in pretend play interactions in a directive fashion, but with varying levels of engagement and collaboration, from positioning the adult as audience to clearer attempts to establish collective intentionality. Crucially, even the most competent children displayed atypical behaviours in metacommunication. The results support a nuanced continuum model of collaborative pretend play ability.

128.129 129 Does the Presence of Symbolic Play Matter In Toddlers with ASD?. N. Tarshis*, D. Meringolo, L. H. Shulman and K. Hottinger, *Albert Einstein College of Medicine*

Background: With the onset of new AAP guidelines for early screening, an earlier diagnosis of autism spectrum disorder (ASD) has become a reality. Toddler screening instruments rely on play as a "critical item" for evaluating risk status and employ it as the medium for assessment. Yet, the presence of symbolic play is rarely utilized in the **final** algorithm for diagnostic decision-making. Does the presence of symbolic play in toddlers with social and communication findings consistent with ASD have the potential for a prognostic role in terms of clinical outcome?

Objectives: To examine symbolic play behavior in young children who received a diagnosis of ASD by age 24 months (mo) and to assess the relationship between symbolic play at the time of original diagnosis and autism severity and cognitive functioning at follow-up.

Methods: Retrospective chart review of 74 children presenting by age 24 mo to a University Affiliated early intervention program from 2003 to 2009 who received an ASD diagnosis based on multidisciplinary evaluation and who had follow-up at least 1 year later. Data from initial evaluation included: age, demographics, cognition, autistic features based on the DSM-IV criteria, Childhood Autism Rating Scale (CARS) and, in some, the Autism Diagnostic Observation Schedule (ADOS). Initial play level was determined based on clinical observations and compared to the criterion-referenced Westby Play Scale (1992). Children were classified as having symbolic play (SP) if they demonstrated short pretend schemas enacting familiar everyday activities using self or a doll as agent and non-symbolic (No-SP) if they lacked pretend play. ASD diagnosis at follow-up was based on CARS, DSM IV, ADOS, and educational classification. Data of children with SP and No-SP were compared. Statistical analysis included chi-square, t-test and nonparametric testing.

Results: At presentation, mean age of the sample was 19.9 mo; 68% male; 64% had a cognitive standard score > 70; 46% exhibited SP. At follow-up, mean age was 54.1 mo. 87% of the sample continued to meet ASD criteria. At follow-up, SP children were more likely to show improvement in autism severity: with a greater likelihood of moving from ASD/Autistic Disorder (AD) to PDD.nos (47% vs. 20%, $p=0.013$) and of having a CARS score <30 (53% vs. 18%, $p=0.009$) than the No-SP group. At follow-up, No-SP children had a higher total CARS score (mean CARS 34.9 ±7.3 vs. 29.9± 5.3, $p=0.001$) and were more likely to meet criteria for AD (68% vs. 17%, $p<0.001$). They were also more likely to have lower cognition (SS <70) both at presentation (62% vs. 30%, $p=0.006$) and follow-up (87% vs. 50%, $p=0.03$) than SP children.

Conclusions: Symbolic play was commonly seen in a cohort of children presenting early with social communicative deficits and given an ASD diagnosis. Children demonstrating symbolic play at presentation showed greater likelihood of improved clinical outcome with decreased autism severity and higher cognition at follow-up than those who did not. Symbolic play in the presence of social communicative deficits represents a potentially meaningful prognostic indicator of positive outcome for children receiving an early ASD diagnosis.

128.130 130 Comparing the Accuracy of Coding Methods for A Low-Incidence Behavior. A. M. Sam*[1], S. S. Reszka[2] and S. Odom[2], (1)*Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill*, (2)*University of North Carolina*

Background: Event coding provides an accurate and reliable method of assessing the occurrence of behaviors (Thompson, Symons, & Felce, 2000). Event coding, however, can be impractical in cases where observers must code multiple variables, or the behavior occurs at a low frequency (Thompson, et al., 2000). Time sampling measures, such as interval coding and momentary time sampling, provide an approximation of the occurrence of behaviors assessed through event coding. While these time sampling measures are useful in providing a sampling of behavioral patterns, they may misrepresent these patterns in low-incidence behaviors (Hartmann & Wood, 1990; Odom & Ogawa, 1992; Sackett, 1978), such as the social behaviors of preschool-aged children with Autism Spectrum Disorder (ASD).

Objectives: The purpose of this study is to compare the data from three observational methodologies (event coding, interval coding, and momentary time sampling) when used to assess the social behaviors of children with ASD towards adults and peers.

Methods: Participants included 100 preschoolers with ASD. Trained research staff collected a 30-minute, videotaped observational sample during center time. Social behavior (defined as any gestural/motor or vocal/verbal behavior) was coded towards adults and peers using three methods: momentary time sampling (coded social behaviors that occurred at the end of each 10-second intervals), interval coding (coded either yes or no for the occurrence of social behaviors within a 10-second interval), and event coding (tallied the number of social behaviors during each 10-second interval). Two trained research assistants obtained 80% IOA across the coding methods, and 20% of videos will be coded by both coders for IOA. For each method, the total number of social behaviors towards adults and peers were converted to the rate of social behaviors per minute.

Results: Participants directed social behavior towards adult at a higher rate per minute (0.32 for momentary; 1.49 for interval, and 2.01 for event) than to peers (0.14, 0.35, and 0.46, respectively). Pearson's correlation was used to determine the association between each coding method. For social behaviors towards adults, interval and event were highly correlated (r = 0.97), followed by event and momentary (r = 0.694) and interval and momentary (r = 0.612). For social behaviors directed towards peers, each method was highly correlated with the strongest correlation between event and interval (r = 0.990), followed by event and momentary (r = 0.941), and finally momentary and interval (r = 0.925). Data is based on 34 videos. The analysis will be completed by March 2011.

Conclusions: Preliminary results indicate a strong correlation between momentary time sampling, interval coding, and event coding for social behavior directed towards peers (Ratner, 2009). The correlation for social behavior directed towards adults is strong between momentary time sampling and interval coding, but only moderate between event and momentary time sampling, and interval and momentary time sampling. While there were differences among the coding methods in the rate of social behaviors per minute, momentary time sampling and partial interval coding provided an accurate approximation of the frequency of low-incidence social behaviors.

128.131 131 There Is Something about ASD: Cognitive, Symptomatic, and Adaptive-Skills In Four Toddlers Who Failed the MCHAT. N. M. Reyes* and A. Scarpa, *Virginia Polytechnic Institute & State University*

Background: Early screening is considered crucial for receiving early intervention in children with Autism Spectrum Disorders (ASD; Kabot, Masi, & Segal, 2003); however, little is known about the differential diagnosis in toddlers who present clinical profiles associated with ASD vs. those who present clinical profiles associated with other psychological symptoms or developmental delays (DD). Few studies have investigated differences in toddlers with ASD and toddlers with other DD (Provost, Lopez, and Heimerl, 2007).

Objectives: The goal of this study is to examine three toddlers who failed the Modified Checklist of Autism in Toddlers (M-CHAT) but did not meet criteria for ASD, and one toddler who failed the M-CHAT and received an ASD diagnosis.

Methods: Four toddlers (Ages: 28, 20, 20, and 19 months), who failed the M-CHAT, were recruited during their 18- and 24-month well-child visit in a rural area of Southwest Virginia. During part 1 of the study, mothers filled out the M-CHAT. During part 2, mothers were interviewed using a follow-up M-CHAT Interview, the Vineland Adaptive Behavior Scales-II (VASB), and the Autism Diagnostic Interview-Revised (ADI-R). Toddlers were administered the Mullen Scales of Early Learning (MSEL) and the Autism Diagnostic Observation Schedule (ADOS).

Results: Several differences were observed between the child who failed the M-CHAT and met criteria for ASD (Child-ASD) and the children who failed the M-CHAT but did not meet

criteria for ASD (Children-A-B-C). First, Children-A-B-C had different psychological and medical histories than Child-ASD. Child-A experienced physical abuse in her first year of life, Child-B was showing behavioral problems, and Child-C was born prematurely. The mother of Child-ASD did not report any history similar to those reported for Children-A-B-C. Second, Children-A-B-C obtained a mixed profile of average and below average scores on the MSEL, whereas Child-ASD obtained below average scores across the MSEL subtests. Similarly, on the VASB, Children-A-B-C received scores that varied from moderately low to adequate, but Child-ASD received scores that varied from moderately low to low on the Social and Communication domains. On the ADOS, Children-A-B-C showed lower scores, indicating fewer deficits, on the social domain only (social domain scores: 6, 2, and 4, respectively) than Child-ASD (social domain score: 9). Similarly, on the ADI-R, Children-A-B-C obtained lower scores, indicating fewer deficits, on both social (scores: 6, 17, and 7, respectively), and communication (scores: 11, 8, and 10, respectively) domains than Child-ASD (social score: 25 and communication score: 14).

Conclusions: Child-ASD showed deficits in social, communication, and cognitive domains and in daily-living skills; Children-A-B-C also presented with remarkable psychological and medical histories. Leckman-Westin, Cohen, and Stueve (2009) argued that research that incorporates a "person-oriented approach," (i.e., includes multiple measures) might create a better picture of factors contributing to child-mother psychological health (i.e., depression, p. 1177). Perhaps, in clinical settings, children who failed the M-CHAT ought to receive a person-orientated evaluation (i.e., examining multiple domains). This practice will identify children who might be experiencing psychological and developmental difficulties that differ from deficits associated with ASD. In turn, this would help children receive appropriate intervention at an early age.

128.132 132 The Effects of Sleep Problems on Communication Skills In Autism Spectrum Disorders. S. M. Munger*[1], C. B. Nilsen[1], M. W. Gower[1], M. K. McCalla[1], T. A. Perez[1], K. C. Guest[1] and S. E. O'Kelley[2], (1)*University of Alabama at Birmingham*, (2)*UAB Civitan-Sparks Clinics*

Background: When compared with children in the typically developing population, children with Autism Spectrum Disorders (ASD) experience increased rates of sleep disturbance due to sleep onset difficulties and frequent night waking. Research has suggested that certain ASD symptoms could be impacted by this heightened occurrence of sleep problems. For example, children in the ASD population who experience sleep disturbances have also been more likely to exhibit social and communication impairments. However, research is limited as few have studied specific sleep quality effects of children with ASD.

Objectives: The purpose of the current study is to determine the effects of sleep problems on communication ability in children with ASD.

Methods: Participants were included if they have an Autism Spectrum diagnosis (based on ADOS, ADI-R, and clinical opinion), were given a language ability test (PLS-3 or PLS-4), and exhibit sleep problems per parent report. For comparison purposes, children with an ASD diagnosis and no reported sleep problems were also included. Communication scores were compared between those children with ASD with reported sleep problems and those without.

Results: Preliminary data was analyzed using a Factorial ANOVA with sleep problems and diagnosis as independent variables. During preliminary analyses, no significance was found between individuals with reported sleep problems (N= 5) and individuals without (N = 18), $F(1, 18)=1.505$, $p = 0.236$. However, results indicate a trend towards significance. Evaluations are ongoing to further clarify these relations.

Conclusions: Children with deficits in communication skills, particularly receptive language skills, may encounter problems understanding daily routines and social cues which could lead to inconsistent sleep patterns. Clarifying these relationships could ultimately lead to improved sleep quality among children with ASD.

128.133 133 Cues to Pronominal Reference Resolution In Children with and without Autism Spectrum Disorders. L. R. Edelson*, A. T. Meyer and H. Tager-Flusberg, *Boston University*

Background:

Children with autism spectrum disorders (ASD) have long been reported to have problems with production of pronouns (Fay, 1979; Lee, Hobson, & Chiat, 1994), but few studies have investigated comprehension of pronouns in this population (e.g., Lee, et al., 1994). This area merits further exploration as misinterpreting pronouns could contribute to more global impairments in comprehension. Third-person pronouns are relatively ambiguous in nature, as they can be used to refer to any individual in the world. In order to determine an appropriate coreferent, the listener needs to incorporate additional information from sources such as the syntax, semantics, and prosody.

Objectives:

By exploring several types of cues in the same group of children, we can determine which cues emerge first in English-speaking children, and which are relatively more difficult for children with ASD.

Methods:

Nineteen children with ASD (mean age: 98 months, range: 60-127) and 19 typically-developing children (mean: 78 mo.; range: 61-105) participated in several experiments to assess pronoun comprehension. Diagnostic status was confirmed using the ADOS and groups were matched for receptive language using the Test for Reception of Grammar (TROG). For each experimental trial, the participant heard sentences played from speakers and used a button-box to select a matching picture from two choices displayed on a computer screen. The first experiment explored children's ability to use the lexical gender (he vs. she) of a pronoun (1a) and gender- and age-based stereotypes about people (1b) to disambiguate pronouns. Experiment 2 used the context of a previous phrase (2a) or sentence (2b) to disambiguate a pronominal referent. In Experiment 3, prosodic cues were manipulated to shift a referent.

Results:

In the typically-developing group, the highest "passing" rate (defined as scoring at least 75% correct on a task) was on the task using age stereotypes (child-biased vs. adult-like activities) to disambiguate the referent, followed by the semantic tasks, then using lexical gender, and finally using prosodic cues. In contrast, the group with ASD performed best on the lexical gender task, followed by age stereotypes, semantics, and prosody. The unexpectedly low success rate on the lexical gender task by the typically-developing group may be attributed to use of gender stereotypes overriding the lexical gender of the pronoun, possibly an artifact of the younger age of this group.

Conclusions:

Overall, when children with and without ASD are matched for receptive grammar abilities, their scores on tests of pronominal reference resolution are comparable; however, age differences between the groups may explain superior performance on some tasks by the ASD group. Further, different factors may impact performance on individual tasks within each group. Explorations of which participant characteristics are associated with success on these tasks will be discussed and may give us insight into how these different types of cues are learned.

128.134 134 Social Communication Skills, Cognitive Ability, and Language Development of Young Children at Risk for Autism. L. Huynh* and A. Fuller, *UCLA*

Background: Many studies have shown that children with autism are able to use protoimperative gestures (i.e. gestures to request objects) but show deficits in protodeclarative gestures (i.e. gestures to share objects with people) (Baron-Cohen, 1989; Mundy et al., 1986). Previous research has demonstrated that children at risk for autism and children with autism initiate less joint attention, and display fewer gestures compared to typically developing children. In addition, joint attention has been found to be associated with language development (Mundy, Sigman, & Kasari, 1990; Mundy and Gomes, 1998) and cognitive ability (Mundy, Sigman, and Kasari, 1994).

Objectives: The purpose of this study is to examine the relationships between social communication skills, cognitive ability, and improvements in language in young children at risk for autism.

Methods: The sample is comprised of 36 children (29 boys, 7 girls) between 15-30 months of age at entry (CA: *M* =21.5, *SD* =3.8, MA: *M* =14.5, *SD* =5.2). Participants were recruited from the community in the Los Angeles area and were enrolled if they showed high risk for autism on the: 1) Modified Checklist for Autism in Toddlers (MCHAT, Robins & Dumont-Mathieu, 2006), 2) MCHAT: Follow-Up Telephone Interview, and 3) Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP, Wetherby & Prizant, 2002).

Measures

The *Early Social-Communication Scales* (ESCS, Mundy et al, 1986; Seibert, Hogan, & Mundy, 1982) is a social-communication assessment. It assesses joint attention behaviors, behavioral requests and social interaction behaviors.

The Mullen Scales of Early Learning (MSEL) (Mullen, 1989) assesses general cognitive ability. The Mullen yields age-equivalent scores for young children in four domains: Visual Reception, Fine Motor, Receptive and Expressive Language.

Results: Of the 36 children identified with concern for autism, 91.6% had concern in the emotion and eye gaze cluster, 97% had concern in the communication cluster, and 100% had concern in the gesture cluster within the social domain of the

CSBS. The amount of concern was not associated with initial social, language or cognitive abilities. However, greater joint attention and requesting behaviors were associated with better language outcomes 3 months later. Pearson's correlation analysis revealed that more behavioral regulation points at entry were associated with greater improvements in receptive language from entry to exit, ($r = 0.44$, $p < 0.008$), and more joint attention gives at entry were associated with greater improvements in expressive language from entry to exit ($r = 0.35$, $p < 0.04$). In addition, higher developmental quotients at entry were associated with greater frequencies of behavioral regulation points ($r = 0.46$, $p < 0.01$) and joint attention points at exit ($r = 0.5$, $p < 0.005$).

Conclusions: Results from this study contribute to the autism literature by exploring the links between social communication skills, cognitive ability and language development in young children at risk for autism. These data are consistent with data for children with clear diagnoses of autism (Mundy, et al., 1986; Mundy & Gomez, 1998; Mundy, Sigman, and Kasari, 1994).

128.135 135 Gesture Production Across Multiple Input Modalities In ASD. H. Stieglitz Ham*[1], A. Bartolo[2], M. Corley[1], G. Rajendran[3] and S. Swanson[4], (1)*University of Edinburgh*, (2)*Universite' de Lille Nord de France*, (3)*University of Strathclyde*, (4)*Medical College of Wisconsin*

Background: Imitation deficits are a robust finding in individuals with autism spectrum disorders (ASD), and previous findings suggest that imitation performance in ASD appears to be task dependent (Hamilton, 2008; Mostofsky et al., 2006; Smith & Bryson, 2007). However, modality-specific effects on gesture production are not well understood in ASD. Gestural production deficits affect the ability to produce signs and gestures necessary for social communication in children with autism. Further, the neurocognitive mechanisms affecting gestural processing in ASD are not well established.

Objectives: 1) To explore modality-specific effects on gesture production in a group of individuals with ASD using three tasks of meaningful gestures (transitive gestures, intransitive gestures, and pantomimes) across verbal, visual, and tactile modalities to compare their performance to a matched group of typically developing peers and 2) to investigate the role of underlying cognitive mechanisms including visuomotor integration (VMI), working memory (WM), and visuoperceptual processing (VP) on gestural production performance in ASD.

Methods: 19 individuals with ASD and 23 TD controls (mean age of 12.0 and 12.1 respectively) were tested on five tasks of gesture production comprising intransitive gestures in verbal and visual modality; pantomimes in verbal, visual, tactile, and imitation modalities; and transitive gestures in spontaneous object use and imitation of object use. All gestures were videotaped, coded, and analyzed. Here we report analyses of the gesture production tasks across all modalities.

Results: Binomial regression models were fitted to determine whether there was an effect of autism and/or an effect of modality in the production performance of transitive gestures, intransitive gestures, and pantomimes in the ASD and control groups. Results revealed that the odds of successful gesture performance among typically developing children were 9.34 fold higher than among autistic children. Transitive gesture production was performed better than imitation; intransitive gesture imitation was performed better than visual or verbal modalities; and pantomime imitation was performed the worst followed by tactile, visual, and verbal modalities. After controlling for the underlying cognitive mechanisms, the ASD group continued to show significantly poorer production performance than the TD group. Higher VP and listening recall were associated with higher odds of success [OR=1.06 and OR=1.02 respectively]. An additive model measuring the effect of ADOS and SCQ on gesture production in each modality was fitted. The results indicated that lower ADOS scores were associated with higher success but the effect of SCQ did not reach statistical significance. Gesture production performance was a significant predictor of the characteristic features of autism as measured by the ADOS.

Conclusions: Our results indicate that individuals with ASD demonstrated impairments across gesture types and modalities and that these findings suggest that transitive, intransitive gestures and pantomimes were performed differently across the tested modalities. These results may inform future therapeutic interventions that include the use of multiple modality communication strategies, especially in nonverbal children with autism. Production performance was a significant predictor of the characteristic features of autism as measured by the ADOS, suggesting that disorders of praxis processing may be a defining feature of ASD.

128.136 136 Profiles of Language and Reading Impairment In a Family Study of Autism Spectrum Disorders and Specific Language Impairment. A. Hare*[1], J. Flax[1], Z. Fermano[1], S. Buyske[1], L. Hou[2], C. Bartlett[2] and L. Brzustowicz[1], (1)*Rutgers University*, (2)*The Research Institute at Nationwide Children's Hospital & The Ohio State University*

Background:

Over the past 10 years there have been several studies comparing patterns of language impairment observed in individuals who meet criteria for an Autism Spectrum Disorder (ASD) and those meeting criteria for Specific Language Impairment (SLI). While ASD may include individuals who have significant dysfunction in communication, social interactions, and repetitive and restrictive behaviors, SLI refers to individuals who have no other obvious behavioral, cognitive or neurological issues other than deficient language. From a genetic standpoint it has been postulated that perhaps these two disorders share partial genetic etiology. The approach has been to compare language functioning in subjects with SLI with subgroups of subjects with autism in the areas of semantics, syntax, and phonological short-term memory. Conflicting results have been reported. The New Jersey Language and Autism Genetics Study (NJLAGS) is studying families who have at least one individual with a diagnosis of Autism and at least one other individual with SLI, with the goal of identifying language phenotypes to serve as behavioral biomarkers for linkage and association studies.

Objectives:

The object of this study is to examine specific language constructs in family members who meet criteria for language-learning impairment, and compare their patterns of language abilities to those family members who meet criteria for ASD. This study is unique in that not only are the segmental aspects of oral language examined, but reading and higher order language constructs (i.e. abstraction, inference, idiomatic language) are compared between the two groups.

Methods:

All individuals (including the ASD probands able to receive the measures) received a comprehensive neuropsychological battery including several standardized measures of oral and written language. Language measures included vocabulary, language structure, phonology, verbal short term memory, higher order oral language and reading measures. Individual family members were categorized in terms of language impairment (LI) and reading impairments (RI) based upon their scores on each respective assessment. ASD probands were compared to other sample individuals (LI, RI, and unaffected). Additionally, each family contributed a blood or saliva sample for genetic analyses.

Results:

When compared to the entire sample, ASD probands had significantly lower scores on all assessments except for a phonological awareness task. In comparison to those affected for LI, ASD probands scored significantly higher on phonological tasks, reading assessments and Ambiguous Sentences, a higher order language tests. The ASD probands did not have significantly different scores for vocabulary and other higher order language assessments. However, when compared to those affected for RI, ASD probands scored significantly lower on higher order language tests and vocabulary with no significant differences in phonological and reading measures. Similar results were observed when ASD probands were compared to individuals affected for both LI and RI.

Conclusions:

Although previous research has been divided as to whether there is sufficient language evidence of shared genetic etiology among individuals with language disorders and individuals with ASD, this study suggests that in addition to segmental language constructs such as structure and phonology, shared language behaviors might occur on the suprasegmental level and will be investigated further.

128.137 137 Repetitive Behaviors In Young Children with Autism: Specificity and Stability. L. Joseph*[1], S. Shumway[2] and A. Thurm[2], (1)*National Institute of Mental Health*, (2)*National Institutes of Health - National Institute of Mental Health*

Background:

Research indicates that the type and severity of restricted and repetitive behaviors and interests (RRBs) is one area of symptoms that differentiates autism spectrum disorders (ASD) from other developmental disorders (Bodfish, Symons, Parker, & Lewis, 2000; Richler, Bishop, Kleinke, & Lord, 2007; Richler, Huerta, Bishop, & Lord, 2010). The Repetitive Behavior Scale, Revised (RBS-R, Bodfish et al., 2000) has been used to examine RRBs in children with autism; however, few studies have used this tool to examine differences in RRBs among children with ASD compared with other developmental disorders and typical development. Studies have also not used this measure to examine repetitive behaviors over time in young children with autism.

Objectives:

This study examined 1) differences in RRBs among children with an ASD, nonspectrum developmental delay (DD), and

typical development (TD) and 2) RRBs over time in children with autism.

Methods:

Participants included age-matched groups of 106 children with autism (mean age = 4.03 years, +/-1.10), 39 PDD-NOS (mean age = 3.86 years, +/- 1.18), 23 nonspectrum DD (nonverbal developmental quotient below 80, mean age = 3.89 years, +/- .86), and 44 TD (mean age = 3.55 years, +/-1.13). To date, 56 children in the autism group (mean age =5.45 years, +/-1.22) have Time 2 data (mean time = 1.26 years, +/-.26 years). All participants completed a cognitive measure, from which a nonverbal development quotient (NVDQ) was calculated, and the Autism Diagnostic Observation Schedule (with the Social Affect "new" algorithm score used for this study). RRBs were examined using the RBS-R, a parent report measure that includes 5 subscale scores: Stereotypic Behavior, Self-Injurious Behavior, Compulsive Behavior, Rituals/Sameness Behavior, and Restricted Interests. Measures were repeated at Time 2 in the autism group.

Results:

Preliminary results of ANCOVA (controlling for NVDQ) revealed that children with autism and PDD-NOS scored significantly higher than TD on the RBS-R total score and all subscales except Self Injurious Behavior; and significantly higher than DD on the total score and 3 of 5 subscales (stereotypic behavior, compulsive behavior, restricted interests). No significant differences were found between autism and PDD-NOS. In the autism group (N=56), repeat measure t-tests revealed no significant differences between Time 1 and Time 2 RBS-R total and subscale scores. Hierarchical regression analyses found that RRBs at Time 1 significantly predicted RRBs at Time 2, and age, NVDQ, and Social Affect at Time 1 did not contribute significantly to the model.

Conclusions:

Preliminary analyses found the RBS-R to be a useful measure in finding that certain types of RRBs differentiate children with ASD compared to DD, and almost all RRBs are more common in ASD compared to TD. Additionally, results indicated that over a one year timeframe, RRBs overall were highly stable in children with autism. This study provides information about the types of RRBs that may be specifically associated with ASD as well as the stability of RRBs in young children with autism.

128.138 138 Differences In Items and Summary Scales of the Autism Diagnostic Interview-Revised Between Latino and Non-Latino White Adolescents and Adults with ASD. S. Magana*[1] and L. E. Smith[2], (1)*University of Wisconsin-Madison*, (2)*University of Wisconsin*

Background: Recent research documents that Latinos are less likely to be diagnosed with autism than their non-Latino counterparts. One factor that may contribute to these differences in diagnostic rates is that autism diagnostic instruments have not been adapted for the Latino population; therefore, whether these instruments measure the same constructs across cultures has not been determined. The focus of this study is on the use of the Autism Diagnostic Interview-Revised (ADI-R) among Latinos with an ASD diagnosis compared to non-Latino Whites. Because the ADI-R is based on parent report, cultural perceptions about normative language, social, and behavioral development may influence parental responses. Some research shows that Latina mothers place more emphasis on social development and may have a lower threshold for behavioral presentations in their children.

Objectives: The goal of this analysis was to compare ADI item and summary scores between Latino and non-Latino White children with an ASD. We hypothesized that: 1) Latina mothers will report more social impairments in their children with ASD, 2) similar levels of impairment in nonverbal communication, and 3) fewer restrictive and repetitive behaviors than non-Latina White mothers.

Methods: We created a matched sample consisting of 48 Latina mothers and 96 non-Latina White mothers of adolescents and adults with an ASD from a larger study of adolescents and adults with autism across the lifespan. The sample was matched on verbal fluency, whether the person with ASD had an intellectual disability and age of person with ASD. In the Latino sample, 85% of the mothers were foreign born and 69% were interviewed in Spanish. All participants were interviewed in their homes by interviewers trained by researchers certified in the use of the ADI-R. The interviews included the 37 ADI-R items that comprise the diagnostic algorithm. Separate analyses of variance (ANOVA) were conducted for individual items and summary scores in the three domains of the ADI-R: impairments in social reciprocity, nonverbal communication and repetitive behaviors and restrictive interests.

Results: There were no differences in level of total social reciprocity impairments between the two groups; However, Latina mothers reported a higher level of impairment in direct gaze among their children than non-Latina white mothers. Both groups reported similar levels of impairments in nonverbal communication. The Latina mothers reported lower levels of

restrictive and repetitive behaviors among their children than non-Latina White mothers. Specific items that were significantly different in this category included circumscribed interests, unusual preoccupations and compulsions or rituals.

Conclusions: Findings suggest that social and communication items may work similarly across the two groups; however, whether there is cultural equivalency for the restrictive and repetitive behavior items warrants further exploration.

128.139 139 Understanding Intentions Predicts Relational Vocabulary In Preschoolers with ASD. J. Parish-Morris*[1], K. Hirsh-Pasek[1], R. Pulverman[2], R. T. Schultz[3] and S. Paterson[3], (1)*Temple University*, (2)*Delaware State University*, (3)*Children's Hospital of Philadelphia*

Background: The ability to infer the intentions underlying people's behavior helps children learn language, especially when words label ambiguous referents. For example, when a word labels a dynamic referent (e.g., *run*), inferences about what the speaker *intends* to label narrows the list of possible meanings for the word (Behrend & Scofield, 2006). Theoretically, social understanding should predict relational vocabulary in typical children, but lack of variability in social skills in the typical population has made this connection difficult to pinpoint. Children with ASD, by definition, have variable social skills, and recent research suggests that children with ASD have special difficulty learning at least one type of relational word: verbs (Lopez & Lord, 2009). The linguistic and social variability of this group provides an opportunity to probe the connection between intention understanding and relational language more generally.

Objectives: Explore the link between understanding the social intentions of another person, and relational vocabulary size.

Methods: Thirteen children with ASD (9 boys, mean age 5:4) were matched to 13 control children (12 boys, mean age 4:7) on non-verbal cognitive ability, and were administered the Test of Relational Concepts (a measure of receptive relational vocabulary). Children participated in a modified version of a classic behavioral reenactment task (Meltzoff, 1995), which consisted of two conditions. In the *canonical* condition, the experimenter repeatedly tried (and failed) to perform actions that were in line with the toys' affordances (e.g., stack a ring on a post). In the *non-canonical* condition, the experimenter's intended actions 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 given a score of 1 if it completed the experimenter's intention, and a score of 0 if it did not. It was hypothesized that children with ASD would be able to complete the failed intention in the *canonical* condition only, and that the rate of intentional responses in the ASD group would correlate with relational vocabulary as measured by the TRC.

Results: A repeated-measures ANOVA revealed a condition by group interaction, $F=3.75$, $p=.065$. Planned independent-samples t-tests revealed that the ASD group completed the experimenter's intention as often as the TYP group in the canonical condition ($p>.10$) but were less consistent in the non-canonical condition, $t(24)=2.02$, $p=.06$. The sample was split by group to test the hypothesis that social intentional understanding predicts relational vocabulary size. A positive correlation between the rate of completed intentions and scores on the TRC emerged in the ASD group, $r(13)=.56$, $p<.05$, but not the TYP group, $r(13)=.24$, p=n.s.

Conclusions: The present results suggest a relationship between social intention understanding and relational language development, and shed light on what could be the driving force behind reported verb differences in children with PDD-NOS vs. autism (Lopez & Lord, 2009). Future research could clarify the causal direction of this effect by testing whether interventions that improve social intention understanding also increase relational word vocabulary.

128.140 140 Maternal Input Predicts Wh-Question Production In Young Children with Autism. A. Goodwin* and L. Naigles, *University of Connecticut*

Background: Wh-questions play a central role in many early social interactions (e.g., Brown, 1968; Ervin-Tripp, 1970). However, these forms are often absent from the speech of young children with autism (ASD). Correlations have been found between the speech that children with ASD produce and the maternal input that they receive (Swensen et al., 2006). However, it is not known if mothers' speech predicts children's wh-question production, specifically. The current research is part of a longitudinal study in which young children with ASD are visited every four months across a 3-year time span to investigate their language development. This report includes maternal input data from visits 1 and 2, and children's production data from visits 3 and 4.

Objectives: We investigated which features of maternal speech predicted subsequent features of wh-question production in 3-year-old children with autism.

Methods: Mothers and children participated in 30-minute semi-structured play sessions at each visit. At onset, children averaged 32.8 months-of-age and had a mean Mullen Early

Learning Composite score of 75.9 (*SD* = 26.8). Transcripts of the sessions were coded for maternal input features, including: number of utterances, number and proportion of wh-questions, number of different wh-words (e.g., 'what', 'where', 'whose') and verb diversity. Children's productions were coded for the same features. Additionally, a series of standardized tests (e.g., MacArthur CDI) were administered at each visit, to assess children's development.

Results: The number of wh-questions produced by children was predicted by concurrent CDI scores at visit 3 (R^2 = .313, p = .037) and visit 4 (R^2 = .689, p < .001). The proportion of mothers' earlier utterances that were wh-questions did not account for a significant amount of additional variance (ΔR^2 = .006, p = ns), but the number of different verbs used by mothers at visit 2 was a significant predictor of the number of wh-questions produced by children at visit 4 (ΔR^2 = .103, p = .047). Similarly, the number of different wh-words produced by children was predicted by concurrent CDI scores at visit 3 (R^2 = .623, p = .001) and visit 4 (R^2 = .637, p = .001), and the number of different verbs produced by mothers at visit 2 accounted for a significant amount of additional variance in the number of different wh-words produced by children at visit 3 (ΔR^2 = .139, p = .028). Lastly, the number of wh-word types produced by mothers at visit 1 predicted the number of different wh-words produced by children at visit 4 (ΔR^2 = .137, p = .025).

Conclusions: ASD children with larger vocabularies tend to produce more wh-questions and more types of wh-words than their peers with smaller vocabularies. However, maternal input also influenced the wh-question production of children with ASD. Mothers who produced a greater variety of wh-words and verbs had children who produced more, and more varied, wh-questions; even after controlling for children's vocabulary. More diverse input may help children with ASD produce more wh-questions by modeling the use of wh-questions in a variety of forms and situations.

128.141 141 Differences In the Activity Experiences of Children with Intellectual Disability with or without Autism Spectrum Disorders. M. A. Viecili*[1], S. M. Brown[1], J. A. Weiss[1], A. Perry[1], J. M. Bebko[1] and P. Minnes[2], (1)*York University*, (2)*Queen's University*

Background: For children with severe developmental disabilities, participation in recreational and social activities facilitates the development and generalization of social skills and adaptive behaviours. For children with intellectual disabilities (ID) and with autism spectrum disorders (ASD), leisure activities have been found to have emotional, psychological, and educative benefits and social integration has been suggested to have positive influences on overall well-being. Engaging in social and recreational activities provides opportunities for friendships, the development of social skills and adaptive behaviours, and functions to prevent loneliness, which is a common problem for children with disabilities.

Objectives: The study aims to examine differences in the experiences of social and recreational activities between children with ID and children with both ASD and ID (ASD+ID). It was hypothesized that due to the social deficits that are inherent in a diagnosis of ASD, children with ASD + ID will participate in fewer social and recreational activities than peers with only ID. It was also hypothesized that activities in both groups will be similar in terms of the support person that is present, but that children with ID will be more likely to engage in recreational activities with typically developing peers.

Methods: Data for this study were collected as part of the GO4KIDDS: Great Outcomes for Kids Impacted by Severe Developmental Disabilities. Data collection is ongoing. Parents were recruited to participate through community agencies and online advertising. The measures utilized in this study were from a larger on-line survey, which included the Scales of Independent Behavior–Revised (SIB-R; Bruininks et al., 1996) and a brief questionnaire on social and recreational activities (Solish et al., 2010). Groups (ASD+ID and ID) did not differ on age, gender, and overall adaptive and maladaptive behavior as measured by the SIB-R. Thus far, 54 parents have participated, with 34 having a child with a diagnosis of ASD+ID, and 20 having a child with a diagnosis of only ID. Children ranged in age from 7 to 19 years (*M* = 12.02, *SD* = 2.92).

Results: Preliminary results suggest that a similar percentage of children with ID and with ASD+ID spend unstructured time with peers (36% vs. 32% respectively), go on social outings (21% vs. 32%), and take part in community activities (42% vs. 24%). However, a greater percentage of children with only ID played on a sport team (42% vs. 6%, p = .001), and took lessons in a leisure activity (68% vs. 35%, p = .02). The poster will further examine differences between groups on types of peers with whom they are interacting, and who is providing support during these activities.

Conclusions: Evaluation of social inclusion programs should take into account the current findings when examining the level of child participation with peers. Researchers and program developers need to be aware of the different needs of children with ID who have comorbid ASDs.

128.142 142 Characteristics of Joint Attention Episodes In Autism: Initiation, Duration and Termination. H. M.

Marwick* and M. E. Dimopoulou, *University of Strathclyde*

Background: Joint attention in young children is important to later developmental outcomes. Differences in engagement in joint attention are reported for young children with autism, with less joint attention initiating and response behaviours found in staged research situations. Greater understanding of entry into joint attention, and duration and termination characteristics of joint attention in young children with autism in naturalistic situations could inform early intervention and support for individuals on the autism spectrum.

Objectives: This study analysed early joint attention characteristics in two monozygotic twins, one of whom has a diagnosis of autism, in videoed family situations in the first two years of the children's life. By comparing the joint attention episodes of the two twins in naturalistic situations, the study aimed to reveal possible differences in successful initiation characteristics as well as duration and termination patterns for the twins.

Methods: Home videotapes of first and second birthday events for the two siblings were analysed retrospectively using specialised software for recording, coding and analysing sequences, frequencies and durations of observed events. Characteristics of initiation, duration and termination of joint attention episodes between the mother and each child were coded and examined.

Results: A greater number of joint attention bids per minute were made by the mother to the twin with autism in the first year events, although a higher proportion of initiation bids were successful with the child without autism. The most successful types of initiation with the twin with autism were tapping and showing, however, the most successful types of initiation with the twin without autism were verbalization and giving. Overall, a greater number of joint attention episodes were established between the mother and the twin with autism, however, these were of markedly shorter duration than the episodes between the mother and child without autism, with the duration of joint attention episodes for the mother and child with autism being half of that found for the mother and twin without autism. Noticeably, in the first year events, joint attention was always terminated by the child with autism and not the mother, whereas both the mother and the child without autism terminated their joint attention episodes. By the second birthday the mother terminated joint attention with both twins and both twins also terminated their joint attention episodes.

Conclusions: The frequency, duration, and termination of joint attention episodes were found to be different for the two twins in this small study, one of whom has a diagnosis of autism. This develops the findings of previous studies, by highlighting that joint attention in natural situations can be frequently engaged in by a child with autism, but that the characteristics of these joint attention episodes differ from those with a child without autism, being initiated differently, considerably shorter and terminated by the child. It is argued that understanding of the differences in characteristics of the successful initiation, duration and termination patterns of joint attention episodes for these infants will help in informing supportive approaches to engaging and sustaining joint attention with young children with autism.

128.143 143 Endorsement of Social Items on the M-CHAT Does Not Predict the Presence of Parental Concern about Toddler's Social Functioning. M. G. Arroyo*[1], D. L. Robins[1] and D. A. Fein[2], (1)*Georgia State University*, (2)*University of Connecticut*

Background:

Studies show that prior to diagnosis, many parents of children with an autism spectrum disorder (ASD) report speech delay as a primary concern about their child's development. Social concerns are reported infrequently and, if reported, are often secondary to language concerns. The current study investigates whether the number of social deficits endorsed on the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 1999) predicts parental endorsement of social concern.

Objectives:

It is predicted that parents who endorse a higher number of social deficits on the M-CHAT will be more likely to report social impairment on free response questions regarding concerns about their child's development prior to a diagnostic evaluation.

Methods:

Children who screened positive on the M-CHAT and received a diagnostic evaluation were recruited from a larger study (n=174). Of these children, 118 were diagnosed with an ASD (97 males; mean age at evaluation=26.48 months, SD=4.56, mean M-CHAT score=10.03, SD=4.01) and 56 children were diagnosed with another developmental delay, no diagnosis, or typically developing (44 males; mean age at evaluation=25.62 months, SD=4.21, mean M-CHAT score=7.70, SD=3.70). Age at evaluation was not significantly different between groups, $t(172)=-1.177$, $p=.241$, but M-CHAT score was significantly

greater for the ASD group than the nonASD group, $t(172)=-3.67$, $p<.001$.

Prior to the diagnostic evaluation, all caregivers filled out a history questionnaire. Three open-ended items evaluated parent concern; parent responses were coded for the presence or absence of a social concern, such as "doesn't look at me" or "ignores other children" (inter-rater reliability: Kappa=.82, $p<.05$).

Participants all received a score (maximum of 11) based on the number of M-CHAT social items endorsed (M-CHAT-Social); social items were determined by group consensus if they mapped onto DSM-IV social symptoms.

Results:

Of the parents indicating concern for their child's development ($n=139$), 49 parents endorsed social delays. ROC analysis did not indicate an optimum cutoff point for M-CHAT-Social (AUC=.558), indicating that M-CHAT-Social score is not predictive of social concerns. Excluding parents who did not indicate any concerns, ROC analysis still failed to indicate an optimum cutoff point for M-CHAT-Social (AUC=.612). In addition, report of social deficits was not more likely for children diagnosed with ASD, $\chi^2(1, n=139)=1.189$, $p=.275$, although overall M-CHAT-Social was higher for children with ASD, $t(172)=-3.98$, $p<.001$. Discriminant function analysis indicated that social concerns were more likely to be indicated if the parent endorsed the items "does your child respond to his/her name when you call" and "does your child take an interest in other children."

Conclusions:

A higher M-CHAT-Social score did not predict parent report of social impairment, indicating that these deficits may not be as salient to parents as language delay. Parents should be educated about social milestones for children so that when social deficits are present, parents bring them to the attention of healthcare providers, which would aid early detection. Future research could investigate the impact of various family factors such as birth order, parent age, and education on parent report of social concerns.

128.144 144 Standardized Severity Scores for the Autism Diagnostic Observation Schedule-Toddler Module. A. N. Esler*[1], V. Hus[2], S. Ellis Weismer[3] and C. Lord[4], (1)*University of Minnesota*, (2)*University of Michigan Autism and Communication Disorders Center*, (3)*University of Wisconsin-Madison*, (4)*University of Michigan*

Background: Calibrated severity scores have been created for modules 1-3 of the ADOS as a measure of the construct of "autism" as it is measured on this instrument (Gotham, Lord, & Pickles, 2008). Calibrated severity scores had more uniform distributions across age and developmental level and were less influenced by demographic variables than ADOS raw totals. For modules 1-3, severity scores have demonstrated usefulness creating more homogeneous groups for clinical, genetic, and neurobiological research. Calibrated severity scores are needed for the ADOS-T to expand comparisons of ASD behaviors over time.

Objectives: Standardize ADOS-T raw scores to approximate a metric of ASD-related symptom severity that is less influenced by chronological age, language level and nonverbal IQ.

Methods: Data from participants in three independent samples from Michigan, Wisconsin, and Minnesota were combined for these analyses. Analyses were conducted using ADOS-T and psychometric data for 220 children age 12 to 30 months, some with repeated assessments for a total of 488 cases. Following procedures informed by Gotham and colleagues (2008), the ASD sample (N=198) was divided into groups based on chronological age and language level. Within each group, raw scores were mapped onto a severity metric, using percentiles of raw totals corresponding to ADOS-T classifications.

Results: Comparisons across age and language groups suggest Toddler calibrated scores were more uniform and less related to developmental and demographic variables. Preliminary findings indicate calibrated severity scores will be useful for comparison of assessments across raters, modules, and time.

Conclusions: ADOS-T calibrated scores demonstrated reduced associations with age and developmental level. ADOS-T calibrated scores may facilitate longitudinal studies by allowing comparisons to be made starting at 12 months, expanding the ability to identify trajectories of ASD symptoms potentially at the first signs of concern. Calibrated severity scores for the ADOS-T should be replicated in large independent samples. Toddler severity scores should be tested for validity in predicting outcomes (eventual ASD diagnosis, response to intervention).

128.145 145 Regression and Autism: The Answer Depends on the Question. J. Foley*[1], A. Diehl[1], T. Smith[1], S. L. Hyman[2] and T. Musa[1], (1)*University of Rochester*, (2)*University of Rochester School of Medicine*

Background:

Estimates of the rates of regression in autism spectrum disorder (ASD) are typically based on retrospective parent reports. However, the reliability of such reports is currently unknown and may be affected by factors such as the assessment method. For example, although questionnaires allow greater standardization, interviews are more flexible and give more opportunities to clarify parent responses. Because of these differences, the two assessment methods may yield differing results.

Objectives:

We compared parents' retrospective report of regression on a self-administered questionnaire and a clinician-administered interview given during consecutive study visits.

Methods:

A chart review was conducted looking at parent reports of regression in their children (ages 2-17.5 years, n=161) who participated in the Rochester site of the Autism Treatment Network (ATN). Responses to regression questions in the Autism Diagnostic Interview–Revised (ADI-R, questions # 11-28) and the loss of skill question on the ATN Developmental and Medical History form were compared using descriptive statistics. Associations between reports of regression and child variables (age, IQ) were also analyzed.

Results:

Overall, parents were significantly more likely to report regression on the ATN questionnaire (n = 65) than on the ADI-R (n = 39), $z = 2.98$, $p < .01$. Similar patterns were observed in individual developmental domains, with 60 parents reporting loss of language on the ATN questionnaire compared to 30 parents on the ADI-R, $z = 3.55$, $p < 0.01$, and 30 reporting loss of motor skills on the ATN questionnaire compared to 11 on the ADI-R, $z = 3.01$, $p < 0.01$. The rate of intellectual disability (IQ < 70 or untestable) among children whose parents reported regression on both the ATN questionnaire and ADI-R (16 of 36, 44%) was not significantly different from the rate of intellectual disability in the rest of the sample (46 of 125, 37%), $z = 0.64$, NS.

Conclusions:

Parent reporting is the basis for much clinical research, including the search for biomarkers and other biologic investigations that may be related to regression. Parents in this study were significantly more likely to report regression on a parent questionnaire than a clinical interview. Reports of regression were not associated with whether or not children had an intellectual disability. Only prospective studies can determine the accuracy of questionnaires and interviews for validly identifying regression in children with ASD.

128.146 146 Language, Communication, and Self-Awareness Among Individuals with Autism. D. M. Williams*[1], D. M. Bowler[2] and A. Whitehouse[3], (1)*Durham University*, (2)*City University London*, (3)*University of Western Australia*

Background: Individuals with Asperger's syndrome/high-functioning autism (HFA) have clinically significant difficulties with communication despite (by definition) normal structural language abilities. However, recent studies suggest that sub-clinical abnormalities in structural language that are difficult to detect using standardised language tests may be present among people with Asperger's (e.g., Eigsti et al., 2007). Individuals with HFA also have diminished self-awareness in at least some respects (e.g., Williams & Happé, 2010).

Objectives: To assess self- and other-reported estimates of language and communication skills among adults with HFA and matched comparison participants, using the "Communication Checklist – Self-report" (Bishop et al., 2009) and "Communication Checklist-Adult" (Whitehouse & Bishop, 2009), respectively.

Methods: Forty five adults with HFA, as well as 45 typically developed comparison adults, matched for age, VIQ, and PIQ, will take part. Ethical approval for the study has been granted and data collection has just started. Participants are recruited from a database of participants who have taken part in our previous studies (and therefore have intelligence and diagnostic information already collected), ensuring recruitment will not be a barrier to the success of the study.

Participants will complete the Communication Checklist – Self-report (CC-SR), a 70-item questionnaire that assesses three domains of functioning: Structural language, pragmatic language, and social engagement. A friend/relative of each participant will provide a report on the skills of the participant in each of these domains, using the Communication Checklist-Adult (CC-A).

Results: We make two specific predictions about the results of the study:

Firstly, we predict that, relative to comparison participants, adults with HFA will achieve significantly lower scores on the Structural Language subscale on both the CC-SR and the CC-

A. This will provide direct evidence of sub-clinical structural language anomalies among individuals who have otherwise normal verbal intelligence (all verbal IQs > 100).

Secondly, there will be a significantly weaker association between self-reports of social-communication skills (on the CC-SR) and other-person reports of social-communication skills (on the CC-A) among individuals with ASD than among comparison participants. Specifically, we predict that adults with ASD will consistently underestimate their difficulties with social-communication, as reflected by significantly lower scores on the Social Engagement and Pragmatic Language subscales of the CC-SR than on the equivalent subscales of the CC-A. If confirmed, this would provide further evidence for a diminished self-awareness among individuals with ASD.

Conclusions: This study has the potential to inform our understanding of language, communication, and self-awareness among people with autism, topics of which are currently the focus of sustained research attention (see, for example, Hobson & Bowler, 2010)

128.147 147 Joint Engagement and Joint Attention Skills During Mother-Child and Preschool Teacher-Child Play.
A. Kaale*[1], L. Smith[2], E. Sponheim[1] and A. J. Nordahl Hansen[3], (1)*Oslo University Hospital*, (2)*Centre for Child and Adolescent Mental Health*, (3)*University of Oslo*

Background: Children with autism have problems sustaining joint focus with others around an object or event (Adamson, Bakeman, Deckner, & Romski, 2009). However, little is known about the patterns of joint engagement and joint attention when the children are playing with their mothers compared to their preschool teachers. More knowledge about this area could contribute to higher quality interaction in both dyads.

Objectives: This study compares the pattern of interaction during play between young children with autism and their mothers and their preschool teachers with a focus on a) duration of joint engagement and b) frequency of joint attention skills.

Methods: Fifty-eight children (46 males) with a diagnosis of autistic disorder (age M = 49 months, SD = 8, range 29-60/developmental age M = 28 months, SD = 12, range 9-59) participated. Dyads of mother-child and preschool teacher-child were provided with a standard set of toys and instructed to play as they would do in a natural setting, and then video taped for 10 minutes. First each play session was coded for duration of six mutually exclusive engagement states (unengaged, on-looking, person engagement, object engagement, supported joint engagement and coordinated joint engagement) (Bakeman & Adamson, 1984). Duration of *mother/preschool teacher-child JE* was calculated from percentage of total time (subtracting time out of camera) in supported and coordinated JE, combined. Subsequently, frequency of *child initiation of joint attention* (alternate gaze, show, point and give) was coded.

Results: Preschool teacher-child dyads spent significantly more time in joint engagement (mean 56 %, SD = 24, range = 10-98) compared to mother-child dyads (mean 47 %, SD = 22, range = 2-91) ($t = 2.47$, $p = .016$). In contrast, the children showed significantly more joint attention skills during play with mothers (mean 1.2, SD = 1.8, range = 0-8) compared to play with preschool teachers (mean .5, SD = 1.2, range = 0-5) ($t = 2.77$, $p = .008$). Most of the time the mother-child and preschool teacher-child dyads were in joint engagement was due to mothers (95%)/preschool teachers (98%) joining the children's focus of interest, while only a small percentage of the time was spent in coordinated joint engagement (mothers 5%, preschool teachers 2%).

Conclusions: The difference in joint engagement and joint attention in mother-child and preschool teacher-child dyads suggests that the closeness of the relationship between the child and the adult is more important for the quality of the interaction than child characteristics. Further, it is noteworthy that although the preschool teachers were longer in joint engagement with the children, compared to mothers, they still experienced less child initiated joint attention. Altogether these findings point to the importance of the emotional connection in joint attention. Maybe also well established play routines are of importance. Further, the results suggest that the association between joint attention and joint engagement is weaker than previously thought. More studies investigating the relation between joint engagement and joint attention in different contexts are needed.

128.148 148 Dimensions of Autism Based on the CARS In Different Age and Ability Groups.
F. Budhani*[1], A. Perry[2], K. Wells[2], N. L. Freeman[3], J. D. Geier[4] and A. Levy[2], (1)*Thistletown Regional Center*, (2)*York University*, (3)*Toronto Partnership for Autism Services*, (4)*Children's Hospital of Eastern Ontario*

Background: Recently factor analytic studies have contributed substantially to the conceptualization of autism. These have often been based on the ADI-R items (e.g. Snow et al., 2009) or domains (e.g., Georgiades et al., 2007), but occasionally other measures, such as the CARS (e.g., Magyar & Pandolfi,

2007). There is growing consensus that symptom profiles may vary among individuals of different ages and ability/language levels (Ben Itzchak, Lahat, Burgin, & Zachor, 2008; Dyck, Piek, Hay, & Hallmayer, 2007; McGovern & Sigman, 2005).

The Childhood Autism Rating Scale (CARS; Schopler, Reichler & Renner, 1988; Schopler, Bourgondien, Wellman, & Love, 2010) is a behaviour observation scale rating 15 symptoms of autism. This measure has important clinical and research utility and is widely used in the diagnosis, treatment planning and evaluation of children with ASD. However, only three studies in the literature report on the underlying factor structure of the CARS (DiLalla & Rogers, 1994; Magyar & Pandolfi, 2007; Stella et al., 1999) with 3 to 5 factors being described. The inconsistent factor compositions and mixed results may be accounted for by sample characteristics, including: small sample size, differences in ages, developmental levels, and diagnoses. Our research team reported a pilot study (Levy et al., 2009) which suggested different symptom factors in younger and older individuals.

Objectives: The underlying factor structure of the CARS was investigated in a large sample (1000+ individuals) with an ASD from several different settings. This analysis was intended to determine whether, according to the CARS, there is symptom coherence across individuals with autism or whether there are distinct and independent groups of symptoms based on age and cognitive level.

Methods: This is an ongoing file review study involving multiple settings across Ontario, Canada. The CARS was administered to participants within the context of routine clinical assessments by a team of trained clinicians. Further analyses by age, diagnoses, and cognitive level will be conducted with the larger sample.

Results: Preliminary results suggest that for the older group (*N*= 130) the 15 items of the CARS load onto four factors ("Repetitive Behaviour", "Social/Communication", "Emotion Regulation", "Cognitive level"), while results from the younger group (*N*= 828) load onto only two factors ("Autism", "Emotional Regulation"). Analyses with a larger sample and with subsamples broken down by age group (2-6 years; 7-12; 13-18, over 18) and ability level (severe-profound, mild-moderate, borderline-average) are presently being conducted.

Conclusions: Results to date suggest that the characteristics of autism, as measured by the CARS, may be different in adolescents and young adults than in younger children and we speculate that analyses will reveal different factor structure in individuals of different cognitive levels as well. In view of the forthcoming transition to the DSM-V and the widespread recognition of a broader group of individuals with ASD, these results may help define symptom constellations that clinicians should look for in different subgroups of people on the autism spectrum.

128.149 149 Sibling Relationship Quality and the Social Skills of Children with Autism. B. B. Thomas*[1], R. Stoddart[1], A. K. Nuttall[2] and J. J. Diehl[2], (1)*Saint Mary's College*, (2)*University of Notre Dame*

Background: In typically-developing children, siblings can play an important role in the development of social skills. Although there is considerable literature on sibling relationships among typically-developing children, there is a paucity of research examining the sibling relationship and its effect on children with ASD. Moreover, research on the sibling relationships of children with ASD has primarily focused on the adjustment of typically-developing siblings and not the effect of the relationship on the social skills of children with ASD.

Objectives: We examined the relationship between the sibling relationship quality, the total number of siblings a child has, and the social skills level of children with ASD.

Methods: Participants in this preliminary study were 20 families of children diagnosed with an ASD (ages 3-15). We hope to recruit a total of 50 families for the final study. Of the 20 families, five of the children with ASD had no siblings and 15 had one or more siblings. The ages of the siblings ranged from 1-21 years-old, with 10 being older and five being younger than the child with ASD. To assess the sibling relationship, parents completed the Sibling Relationship Questionnaire (Furman & Buhrmester, 1985), which gives information on sibling warmth/closeness, status/power, conflict, and rivalry. To assess the social skills of the child with ASD, the parents completed the Bellini Social Skills Profile (Bellini & Hopf, 2007). To assess the sibling's perception of the relationship, siblings completed the child portion of the Sibling Relationship Questionnaire.

Results: For children with ASD who had a sibling, parent report of sibling warmth/closeness was the primary predictor of social skills in children with ASD. Using a stepwise regression, we found that warmth and closeness was uniquely related to social skills, $p<.05$. We then examined the role of the age of the sibling relative to the child with ASD. We found that parents perceived higher levels of rivalry in the relationship when the child with ASD was younger than when the child with ASD was older, $t(13)=3.02$, $p<.01$, but there were no significant differences in the other Social Relationship Questionnaire

measures. Rivalry was inversely correlated with the number of siblings a child with ASD had, r=-.64, p<.01, suggesting the number of siblings decreased the amount of rivalry between a child with ASD and their sibling.

Conclusions: This preliminary study suggests that children with ASD score higher on social skills assessments when the parent perceives high levels of warmth and closeness in the sibling relationship. Additionally, the total number of siblings seems to decrease the perceived rivalry between a child with ASD and their sibling. Further research is needed to determine whether the level of social skills increases closeness to the sibling, or whether level of closeness increases as a result of higher social skills of the child with ASD.

128.150 150 Look at This, Mommy! Profiles of Spontaneous Social Communication In Toddlers with ASD, DD, and TD During Solitary Object Exploration. M. Meltvedt*, S. Macari, F. Shic, M. Coffman and K. Chawarska, *Yale University School of Medicine*

Background: Both eye contact and joint attention are key elements of social communication. Deficits in these areas in toddlers with ASD have been studied primarily in a context of parent-child interaction or adult-mediated tasks. Solitary object exploration tasks, however, can potentially probe for spontaneous rather than elicited social communication behaviors. A recent study of object exploration, (Ozonoff, Macari, et al., 2008), has suggested that infants with ASD explore toys differently than their typically developing (TD) and developmentally delayed (DD) counterparts, but this study did not examine social communication behaviors exhibited during these tasks.

Objectives: To examine spontaneous social communication behaviors in the context of a solitary object exploration session in toddlers with ASD, TD, and DD.

Methods: Participants included 15 toddlers with ASD, 16 with TD, and 11 with DD. All groups were matched on age (M=19.9 months) and gender. The ASD and DD groups were matched on non-verbal mental age (M=15.1 months, SD=3.5) and expressive language level (M=9.3 months, SD=4.4). The toddlers were given an opportunity to play with a standard set of objects during a 9-minute object exploration session. Videos were coded offline for episodes of joint attention, looking at an adult's face, showing objects, and giving objects. Joint attention consisted of either 3-point coordinated or 2-point gaze shifts.

Results: ANOVA followed by Bonferroni post-hoc comparisons showed that toddlers with ASD spent less time looking at an adult's face ($F(2,39)=12.2$, $p<.001$) and less 2-point gaze shifts ($F(2,39)=7.6$, $p<.005$) than both TD and DD toddlers. Toddlers with ASD also engaged in fewer coordinated joint attention bids ($F(2,39)=10.9$, $p<.001$), less showing ($F(2,39)=4.9$, $p<.01$) and less giving ($F(2,39)=5.0$, $p<.01$) than TD children, but this performance was comparable to that of the DD group. Furthermore, toddlers with DD engaged in similar amounts of 2-point gaze shifts as TD toddlers alongside less coordinated joint attention, suggesting they lag behind their typical peers in their use of 3-point gaze, but not in 2-point gaze or looking at an adult's face.

Conclusions: In the second year of life, social communication impairments differentiate toddlers with ASD from toddlers with global developmental delays and typically developing toddlers. Deficits in elementary social behaviors, such as looking at an adult's face and 2-point gaze were more likely in toddlers with ASD, despite being matched developmentally to the DD group. Other more advanced behaviors such as coordinated joint attention, giving, and showing, were equally impoverished in both the ASD and DD groups. These results suggest that, while toddlers with ASD and DD were similarly impaired on coordinated joint attention and social communicative behaviors, the toddlers with ASD were much less likely to check in with, or reference, an adult during their solitary play than toddlers with DD or TD. The context of a solitary exploration task with adults present provides an opportunity to observe children's intrinsically motivated spontaneous social communication skills along with their atypical exploration patterns, offering complementary measures which may provide increased specificity in understanding the behavioral phenotypes of children with ASD early in development.

128.151 151 Lèvy Flights Search Patterns In Children with ASDs Exploring Social Stimuli. A. Liberati*[1], M. Javarone[2], G. Frigo[3], A. Salvago[3], G. S. Doneddu[3], R. Fadda[1], T. Striano[4] and A. Chessa[1], (1)*University of Cagliari*, (2)*Linkalab*, (3)*AOB*, (4)*Department of Psychology, Hunter College*

Background: It is known that, in order to efficiently scan a visual scene, humans employ a 'scale free' jump strategy that is geometrically similar to a class of random walks known as Lévy flights (Brockmann et al, 2000), for which the distribution tails are power-laws. This 'scale free' strategy results also in a particular distribution of the clusters of fixation points, that are typically concentrated in the relevant zones of the salience field. Since individuals with Autism Spectrum Disorders (ASDs) seem to be characterized by atypical visual attention toward complex social scenes (Klin et al., 2002), in which the salience of social cues is reduced for them compared to the controls, it might be of interest to investigate if abnormalities of Lèvy flights

patterns of fixation points might underlie their atypical focus of visual attention.

Objectives: Investigate the Lèvy flights patterns and the clustering patterns of visual attention of children with ASDs exploring static images of human faces looking objects.

Methods: We looked at the scanpath patterns of 27 children with ASD (18 M; 9 F), aged between 1-8 yrs (mean= 4; SD=1,9), IQ Leiter-R=65 (sd=24), and 70 TDs controls (34 M; 36 F), aged between 1-8 yrs (mean = 3; SD=1,7). The stimuli were presented with a Tobii T60 Eye Tracker and were those used in Fadda et al, 2010: an adult face gazing at one of two objects located laterally on eye level, next to the head. The scene develops a narrow horizontal salience field that generates an x Vs y asymmetry. We measured the absolute jumps distribution both in the x and the y direction. In order to characterize the clustering patterns we performed a k-means analysis. In particular we studied the distortion parameter, a quality parameter for the convergence of the cluster structure, versus the number k of centroids.

Results: The results showed that children with ASDs had qualitatively the same Lévy flight behaviour as the TDs, but with a different slope in the distribution tails (2.08+-0.03 for the ASD vs 1.76+-0.06 for TD, x axis and 2.24+-0.04 for the ASD vs 1.97+-0.04 for TD, y axis). After a crossover region, we found that the ASDs had always on average an higher probability to perform long jumps. The cluster analysis revealed a decay with the number of centroids k, in which systematically the ASDs had a greater value of k for the same distortion, signaling on average a much higher number of clusters covering the scene for them.

Conclusions: In summary, the fundamental mechanism of visual exploration of a static social scene seems to be a Lèvy flight process both for ASDs and TDs, but with different values in the parameter that determines the probability of jumps. Indeed, the pattern of the clusters distribution for the ASDs is much more spreaded, especially in the zone far from the salience field. This latter characteristic points to an over exploratory behavior, even in empty zones, and to a more spotted strategy in probing the salience space.

128.152 152 Eye Tracking as a Measure of Responsiveness to Joint Attention In Infants at Risk for Autism. A. Navab*[1], K. Gillespie[1], G. Park[1], M. Sigman[1], S. P. Johnson[1] and T. Hutman[2], (1)*University of California, Los Angeles*, (2)*UCLA Center for Autism Research and Treatment*

Background: Response to joint attention (RJA), as assessed by socially interactive measures like the Early Social Communication Scales (ESCS), is a key predictor of language skills in typically developing children and those with autism (Sigman & Ruskin, 1999). Reduced RJA in infancy is also predictive of an autism diagnosis (Rozga et al., 2010). Therefore, accurate measurement of RJA during infancy may facilitate early detection of autism. Because the ESCS yields a relatively blunt measure of RJA, eye-tracking assessments of RJA have recently been developed to assess the microstructure of eye movements associated with RJA (Senju & Csibra, 2008). Because most eye tracking assessments of RJA utilize pre-recorded video of a model turning towards objects, they are more consistent across administrations than the ESCS and thus potentially useful as standardized prognostic measures. However, opportunities for RJA that children typically experience are highly interactive. Do eye tracking assessments of RJA measure the same construct as RJA as assessed by the ESCS?

Objectives: The current study aimed to assess the ecological validity of an eye-tracking assessment of RJA by administering the ESCS and eye-tracking RJA to 39 eighteen-month infant siblings of autistic children, a sample therefore at heightened risk for diagnosis (Bailey et al., 1993). Relationships between both RJA measures and concurrent language scores were assessed. We predicted that both assessments of RJA would be correlated, and would be related to language skills.

Methods: During eye-tracking RJA, each infant watched a video of a model fixating 1 of 2 objects with direction of turn counterbalanced across trials. Eye movements were recorded with a Tobii 1750 eye tracker. Each trial consisted of a baseline phase, an infant-directed greeting and smile, and the model turning and fixating an object for 5 seconds. RJA was calculated by summing the duration of all looks from the model's face to the correct object relative to the duration of looks from the face to either object. The ESCS yields two measures of RJA: a distal task wherein the examiner visually orients and points towards a poster and a proximal task wherein the experimenter points to pictures in a book directly in front of the infant. Language was assessed with the Mullen Scales of Early Learning. Total scores on the Autism Diagnostic Observation Schedule were used as an index of symptomatology

Results: The eye-tracking RJA was correlated with RJA during the distal ESCS task ($p(39)=0.33$, $p<0.05$) but not the proximal task. Only RJA during the proximal ESCS task was positively correlated with expressive ($p(36)=0.51$, $p<0.01$) and receptive language scores ($p(36)=0.37$, $p<0.05$). When we controlled for autistic symptomatology, eye-tracking RJA and RJA–ESCS-

distal remained correlated (r(31)=0.49, p<0.01); and RJA-ESCS-proximal was correlated with eye-tracking RJA (r(31)=0.45, p<0.01) and expressive language (r(31)=0.57, p<0.01).

Conclusions: While eye-tracking RJA and ESCS RJA appear to measure a similar construct, only proximal ESCS RJA related to language. The current study establishes the construct validity of eye-tracking RJA and suggests that it may provide a useful prognostic tool for assessing autism risk.

128.153 153 A New Joint Attention Eye Tracking Measure for Children with Autism: a Pilot Study with Neurotypical Adults. M. R. Swanson*[1], V. Erstenyuk[2], G. Serlin[1] and M. J. Siller[3], (1)*Graduate Center at the City University of New York*, (2)*Hunter College, City University of New York*, (3)*Hunter College of the City University of New York*

Background: Joint attention is a deficit typically described in young children with autism, but current research suggests that adults with autism attend to social-attentional cues differently than neurotypical adults (Fletcher-Watson et al., 2009). Williams and colleagues (2005) developed an fMRI paradigm that successfully tested brain activation during moments of joint attention and non-joint attention in adult males. The current paradigm adapts Williams' for school-aged children with autism. Pupillary response is controlled by the autonomic nervous system, and has been linked to emotional arousal and cognitive load.

Objectives: The current study aims to validate a new joint attention eye tracking paradigm on a population of adults by evaluating difference in attention and pupil reactivity during congruent and incongruent videos.

Methods: 35 neurotypical adults aged 18-50 (M=23.41, SD=7.28; 65% male) completed a background questionnaire, medical questionnaire, and the Broader Autism Phenotype Questionnaire, which measures subtle traits that resemble the characteristic features of autism, including pragmatic language (Hurley et al., 2007). Participants that scored above cutoff did not differ from participants that scored below cutoff on the following descriptive variables: age, gender, or education. Each participant's eye gaze behavior and pupil size were recorded using a Tobii T-60 eye tracker. The stimuli presented are dynamic, social videos where an adult model shifts her gaze to different corners of the screen. In the congruent condition, the model's gaze follows a Pokémon character. In the incongruent condition, the model gazes to a non-Pokémon corner. Mean pupil diameter was calculated for five 500-ms intervals time locked to the presentation of the Pokémon. In the first interval the Pokémon appears, but the model does not switch her gaze. Relative change in pupil size was calculated and standardized for each additional time interval. To avoid the pupillary response to changes in luminance (appearance of Pokémon), data analysis included intervals 3 and 4.

Results: RM-ANOVA reveals that adults spend a significantly longer time viewing the Pokémon during congruent videos when compared to incongruent videos, F(1,34)=30.87, p<.01. This finding indicates that adults were more likely to follow the model's gaze and focus their attention to the Pokémon character during the congruent videos when compared to incongruent videos. A separate RM-ANOVA reveals that change in pupil size is larger in the congruent condition during intervals 3 and 4 when compared to the incongruent condition (F(1,19)=4.11, p=.057; F(1,19)=6.32, p<.05), indicating that cognitive load or emotional response was greater during the congruent condition (which is designed to be social in nature) when compared to the incongruent condition. Finally, participants that scored above cutoff on the pragmatic language subscale of the BAPQ demonstrated a larger change in pupil size during intervals 3, 4 when compared to individuals that scored below cutoff (t=2.06, p=.051; t=2.08, p<.05) during incongruent videos. Meaning, individuals with more BAP traits demonstrated greater pupil reactivity during incongruent clips when compared to individuals showing fewer BAP traits.

Conclusions: Results indicated that congruent and incongruent videos elicit different visual attention and pupil reactivity. We are currently extending this work to typically developing children and children with autism.

128.154 154 The Interrelationship Between Adaptative Receptive Language and Behavior In Children with ASD: Exploration for Inform Pivotal Interventions. K. Lierheimer*[1], N. A. Gage[1] and S. M. Kanne[2], (1)*University of Missouri*, (2)*Thompson Center for Autism and Neurodevelopmental Disorders*

Background: Researchers have found that targeting pivotal skills, such as self-initiation and self-management, has resulted in successful interventions and increased skills for children with autism spectrum disorders (ASD). Research has also shown a strong connection between language skills and different aspects of the child's behavior, including both externalizing and internalizing behaviors. However, less is known about the relationship between adaptive language skills and behaviors in ASD. Given the importance of adaptive language in ASD, examining these relationships may provide guidance and direct

identification of pivotal skills to target for intervention, especially adaptive language skills.

Objectives: This exploratory study examines the interrelationship between adaptive language ability and behavioral performance to identify whether or not targeted language-based intervention research should be further explored. In addition to language and behavioral performance, we include (1) cognitive ability to examine direct and indirect linkages between IQ and language, and (2) a calibrated Autism Diagnostic Observation Schedule (ADOS) score to explore both adaptive language ability, and IQ's relationship with autism symptomatology.

Methods: The sample included 130 subjects from the Autism Treatment Network (ATN) database at the Thompson Center for Autism and Neurodevelopmental Disorders. ATN is a collaborative network of clinics and physicians dedicated to developing better ways to identify, manage and treat children with autism. Subscales of The Vineland Adaptive Behavior Scales (VABS) were utilized as measures of adaptive receptive language, adaptive expressive language, and social skills. The Child Behavior Checklist was used for a measure of internalizing and externalizing behavior. The calibrated severity score from the ADOS was utilized for a measure of autism symptomatology, and various IQ tests were used for a measure of cognitive ability. A path analysis modeling procedure was utilized to empirically examine the interrelationship among the constructs.

Results: Results indicated there was a significant relationship among adaptive receptive language and all behavioral performance measures, specifically externalizing behavior (β = -.428), internalizing behavior (β = -.376), and social skills (β = .257), suggesting an increase in one's adaptive receptive language ability is associated with an increase in social skill performance, and decreases in externalizing and internalizing behavior. There was also a significant relationship between adaptive expressive language and social skills that suggests increased expressive language is associated with increased social skill performance (β = .631).

Conclusions: The results point to adaptive receptive language as a potential pivotal intervention point. Unlike adaptive expressive language, the receptive construct was significantly related to all the behavioral performance measures. Increased adaptive receptive language abilities has implications for targeting language interventions in children with ASD that could result in decreased levels of externalizing and internalizing behaviors, and improved social skill performance. Significant differences were identified for cognitive abilitity and its association with social skills, autism symptomatology, and internalizing behavior, suggesting IQ may be an important component for further analysis. We hope that the results of this exploratory study lead to further interest and research into language interventions and potential distal behavioral outcomes for children with ASD.

128.155 155 Emotion Recognition Through Nonverbal Channels In Children with Autism Spectrum Disorder. J. Emmons-Garzarek*[1], M. R. Klinger[2], T. N. Holtzclaw[2], N. Broka[2] and L. G. Klinger[2], (1)*Yale University School of Medicine*, (2)*University of Alabama*

Background: Sensitivity to nonverbal cues is crucial for successful social and communicative functioning. It is estimated that more than 60% of a message is expressed nonverbally (Philipott, 1983), suggesting listeners must rely on nonverbal cues, including facial expression, body posture and gesture, and vocal prosody to understand an intended message (Lieberman & Rosenthal, 2001). Although there is substantial evidence that individuals with ASD have atypical face processing abilities, we know comparatively little about the processing of other nonverbal cues in ASD. Thus, the understanding of emotions through these less studied nonverbal cues warrants further investigation.

Objectives: The current study had two objectives: 1) to assess group differences in accuracy of detecting emotional states through the nonverbal channels of gestures and vocal prosody, and 2) to evaluate the relationship between nonverbal emotion perception accuracy and cognitive ability.

Methods: Participants included 15 children with high-functioning ASD and 15 typically developing controls, matched on chronological age (M=10 years, 0 months; SD=1 year, 2 months) and IQ (M= 107, SD= 18), as measured by the WASI (Wechsler, 1999). Participants completed two emotion recognition tasks that required them to make a forced judgment about the emotional state (happy, sad, angry, or afraid) depicted in each stimulus. Task 1 used affective prosody using the Child Paralanguage subtest of the DANVA-2 (Nowicki & Duke, 1994). Stimuli were 24 audio clips of an actor saying the sentence: "I'm going out of the room now, but I'll be back later," with varying intonation to depict one of the four emotions. Task 2 used affective gestures using stimuli from Pohlig (2007). Stimuli were 24, 3-second silent video clips of an actor depicting one of the four emotions. Facial features were concealed so gesture and body posture were the only information provided.

Results: Group differences were examined utilizing a 2 (diagnosis; ASD or TD) x 2 (channel; gesture or prosody) analysis of variance (ANOVA). An overall effect of diagnosis was obtained, $F(1,28)= 9.08$, $p = .005$. Follow up analyses indicated that children with ASD were impaired on both gesture, $t(28)= 2.01$, $p=.05$, and prosody, $t(28)= 2.08$, $p<.05$. Regression analyses indicated that nonverbal ability (matrix reasoning) was related to understanding of gesture ($r= .86$, $p= .001$) and prosody ($r= .43$, $p= .11$) for children with typical development. However, nonverbal reasoning was not related to understanding of gesture ($r= -.39$, $p= .15$) or prosody ($r= -.06$, $p= .83$) for children with ASD.

Conclusions: This study provides evidence that emotion understanding difficulties in ASD extend beyond understanding of faces to include understanding of gestures and vocal prosody. Additionally, the results of this study suggest that children with ASD may not recruit nonverbal reasoning skills to help them recognize gestures and vocal prosody. These results suggest the importance of teaching children with ASD to understand both gestures and prosody when targeting emotion recognition during social skills and language therapies.

128.156 156 ASD-Sibs Show Differences In Initiating Behavioral Requests at 12 Months. C. J. Grantz*[1], L. V. Ibanez[2], W. L. Stone[3] and D. S. Messinger[1], (1)*University of Miami*, (2)*University of Washington Autism Center*, (3)*University of Washington*

Background: Children with Autism Spectrum Disorders (ASDs) demonstrate difficulties with nonverbal referential communication, or communication with a social partner about their environment. Two aspects of nonverbal referential communication, initiating joint attention (IJA; sharing enjoyment with another about an object or event) and initiating behavioral requests (IBR; eliciting help from another) are lower in the younger siblings of children diagnosed with ASDs (ASD-Sibs) than in the infant siblings of children with no ASD (COMP-Sibs). The current study examined IJA and IBR in ASD-Sibs compared to COMP-sibs at 12 months of age, an age at which behavioral markers of ASD-related difficulties may become more observable (Rogers, 2009), with both an examiner and the infant's caregiver. This may help us better understand early nonverbal communication abilities across different social contexts in infants at-risk for developing an ASD.

Objectives: 1) Examine associations of referential communication (IJA and IBR) between a semi-structured examiner-administered and a relatively naturalistic parent-child measure). 2) Examine group differences in IJA and IBR on both measures.

Methods: Two measures of nonverbal referential communication were administered to 53 infants (ASD-Sibs n=37, COMP-Sibs n=16). The Early Social Communication Scales (ESCS; Mundy et al., 2003) is a 15-20 minute semi-structured interaction between an infant and an examiner in which the examiner presents objects individually to the infant. The Assessment of Referential Communication (ARC) is a 6 minute semi-naturalistic floor play between the infant and caregiver in which toys are placed within reach of the infant and the caregiver is instructed to respond briefly to their infants' referential bids and refrain from initiating any interaction with their infant. The ARC provides a measure of infant-initiated nonverbal referential communication with a caregiver, furthering our understanding of the impact of social environment on infant referential communication. IBR during the ARC was dichotomized, such that a score of zero indicated no IBR during the ARC, and a score of one indicated at least one instance of IBR during the ARC.

Results: Both IJA, $r(53)=.29$, $p<.05$, and IBR, $r(53)=.35$, $p<.05$, were positively associated between the ESCS and ARC. Significantly fewer ASD-Sibs (16%; 6 of 37) demonstrated IBR during the ARC than COMP-Sibs (44%; 7 of 16), $\chi^2(1, n = 53) = 4.57$, $p < .05$. While all infants initiated at least one behavioral request during the ESCS, ASD-Sibs engaged in IBR significantly less frequently (rate-per-minute M=.94, SD=.70) than COMP-Sibs (rate-per-minute M=1.47, SD=.85), $F(1, 53)=5.87$, $p<.05$. No significant group difference was found in frequency of IJA demonstrated during the ARC or the ESCS.

Conclusions: There were robust differences in IBR across two measures of referential communication that employed different adult partners and levels of adult structuring. This replicates previous studies' findings of IBR differences at 12 months of age in ASD-Sibs, and expands the finding to different social contexts, suggesting that differences in behavioral requesting may be a robust early signal of a differing developmental trajectory within this at-risk group.

128.157 157 How Narrative Difficulties Build Peer Rejection: The Case Study of A Girl with Asperger's Syndrome and Her Female Peers. G. F. Adams*[1], M. C. Dean[2] and C. Kasari[2], (1)*UCLA*, (2)*University of California, Los Angeles*

Background: Little is known about the social experiences of school-aged girls with Asperger's Syndrome (AS) (Faherty, 2006). Recounting personal experiences presents significant challenges for children with AS (Solomon, 2004; Capps et al, 2000; Capps et al, 1998), and gender compounds the issue. Children typically segregate into same-sex groups, and, to be

perceived as socially competent, girls with AS must align with gender norms of their female peers (Adler et, 1992). One feature of female bonding is co-participation in story telling, which in part determines social hierarchies (Goodwin, 2006). As a result, narratives told by girls with AS have the potential to yield negative peer evaluations and social marginalization.

Objectives: This analysis examines how AS characteristics impact a 7-year-old girl's ("Cindy's") ability to interact with her female peers and identifies the relationship between narrative difficulties and peer rejection. Moreover, it examines how peer responses to social violations distinguish acts of accommodation from exclusion and elucidate the power asymmetries.

Methods: In this case study, conversation/talk-in-interaction analysis of 16 hours of naturalistic video data was used to investigate Cindy's co-participation in storytelling (Nosfinger, 1991/Goodwin & Duranti, 1992) during 16 classroom lunches with three female peers. All instances of Cindy's narratives were identified. Fine-grained transcripts of non-verbal/verbal behavior were created for randomly-selected narratives from each session. Analyses of story preface sequences, recipient design/uptake, and repairs as well as related multi-modal/paralinguistic features of all four participants enabled the creation of detailed descriptions of Cindy's narrative difficulties.

Results: The analysis demonstrates a link between narrative difficulties and the social construction of peer rejection. Cindy's difficulties include: affective (laughter, stress, volume), linguistic (literal word meaning, phrasal repetition), interactional (norms for being polite/ exchanging eye gaze/ clarifying/ negotiating/ repairing/ turn taking) and narrative (embodied delivery, causal connections, launching story) actions. During early sessions, peers use subtle non-verbal behaviors, such as averting their gaze, turning their bodies away from Cindy and toward one another as they disengage from Cindy's storytelling. They also withhold expected sequential responses and second-stories. During later sessions, peers verbalize that they are no longer interested in the content and the telling of her stories. Cindy's eye gaze and utterances indicate that she notices these behaviors; however, she does not make adjustments, nor does she reduce the number of stories she tells. In part, her difficulties with conversational/interaction norms of storytelling systematically build her social rejection.

Conclusions: This research identified a positive relation between communicative deficits and peer rejection. The student with AS is stranded in her attempt to tell stories and be engaged in the group. Additionally, her group perceives her as someone who consistently violates social norms. As a result, her peers form alliances to collectively sanction her undesired behavior and reject her as a friend. These findings highlight the need to consider gender and narrative in terms of how girls with AS build and sustain social relationships.

128.158 158 Semantic and Syntactic Language Skills In Individuals with Optimal Outcomes. K. E. Tyson*[1], E. Troyb[1], A. Orinstein[1], M. Helt[1], I. M. Eigsti[1], M. Barton[1], L. Naigles[1], E. A. Kelley[2], M. A. Rosenthal[1], M. C. Stevens[3], R. T. Schultz[4] and D. A. Fein[1], (1)*University of Connecticut*, (2)*Queen's University*, (3)*Institute of Living, Hartford Hospital / Yale University*, (4)*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" (Sutera et al., 2007; Helt et al., 2008; Kelley, Naigles, & Fein, 2010). Kelley, Naigles, & Fein (2010) reported small differences in language scores in OO compared to typically developing adolescents.

Objectives: The current study examines semantic and syntactic language skills as measured on the Comprehensive Evaluation of Language Fundamentals (CELF-IV) in a small cohort of individuals once diagnosed with an ASD who have since lost their diagnosis, known as the "optimal outcome" (OO) group. The study compares performance in the OO group to performance of a group of individuals with high-functioning autism (HFA) and a group of typically developing (TD) individuals.

Methods: Participants included 28 OO individuals, 30 HFA individuals, and 24 TD individuals. Participants were matched on sex (85% males), age (*M* (OO) = 12.98, *SD* = 3.46; *M* (HFA) = 13.26, *SD* = 2.23; *M* (TD) = 14.30, *SD* = 3.00), and PIQ (*M* (OO) = 113.43, *SD* = 14.37; *M* (HFA) = 112.47, *SD* = 14.59; (*M* (TD) = 115.29, *SD* = 12.24). VIQ scores, although within the average range, differed significantly across the groups (*M* (OO) = 113.57, *SD* = 13.28; *M* (HFA) = 104.63, *SD* = 14.22; *M* (TD) = 112.75, *SD* = 12.69, $p < .05$). We compared the three groups' performance on the CELF-IV core language subtests (Formulated Sentences, Recalling Sentences, and Word Classes), as well as the Composite Score, using ANCOVA, with VIQ as a covariate.

Results: The OO group's performance was significantly poorer than TD on Recalling Sentences ($p < .05$), but not on the other subtests or the composite. The OO group scored higher than the HFA group on Word Classes ($p < .01$), and the TD group scored higher than the HFA group on Formulated Sentences, Word Classes, and the composite score ($p < .01$ for all three). However, all group means were well within the normal range; furthermore, all OO participants scored within the normal range on Word Classes and Formulated Sentences, with two participants scoring below average (SS<7) on Recalling Sentences.

Conclusions: These results suggest that OO individuals are performing similarly to their TD peers on the core language skills measured by the CELF. Although most of the OO group is still well within normal range on verbal recall, the groups' performance was lower than would be consistent with their VIQ, suggesting a subtle residual deficit in immediately recalling and reproducing orally presented sentences.

128.159 159 Symbolic Play Skills and Parental Object Labelling During Free Play: Preliminary Findings with Preschoolers with ASD and Typical Development. J. Burns* and A. Nadig, *McGill University*

Background:

Child and parent variables that may affect language acquisition in both typically-developing (TD) children and children with autism spectrum disorders (ASD) are observable during parent-child play interactions. Symbolic play skills are associated with expressive and receptive language abilities in TD preschoolers (Lewis et al., 2000), and children with ASD are known to have deficits in symbolic play (e.g., Baron-Cohen, 1987). The link between play skills and language development in children with ASD, however, may be mediated by parental behaviours (Lewis, 2003). In a sample of children with ASD, Siller and Sigman (2008) found that better language outcomes over time were associated with a greater proportion of parental utterances that were contingent upon their child's focus of attention during play. Further exploration of the links between child play skills, parent-child interaction variables, and language acquisition will inform future intervention strategies for children with ASD.

Objectives:

To evaluate how language acquisition in TD preschoolers and children with ASD is affected by child symbolic play skills and parental follow-in object labelling.

Methods:

TD preschoolers and children with ASD, along with one of their parents, were enrolled in a 1-year study carried out over 3 visits. The full sample in this study will include 15 Anglophone and 15 Francophone parent-child dyads within each of the TD and ASD groups (total sample size of 60). The present analysis includes 5 Anglophone dyads from each group matched on the children's expressive language scores from the Mullen Scales of Early Learning (MSEL; Mullen, 1995). At the first visit, the mean chronological ages were 26 months (TD group) and 57 months (ASD group). Participants were administered the MSEL and the MacArthur-Bates Communication Development Inventory (CDI-2; Fenson et al., 2004) at the first visit. During the second visit, 6 months later, the parent-child dyads were recorded during a 10-minute free play session. Video of the interaction was coded for the proportion of child play acts that involved symbolic use of objects and for the proportion of parental object labels that followed the child's focus of attention. The MSEL and CDI-2 were administered again during the third visit, 6 months after the second visit.

Results:

Preliminary data appear to reflect emerging group differences. The proportion of child play acts that included symbolic object manipulation is lower for the ASD group (M=.30, SD=.17) than the TD group (M=.55, SD=.38). The ASD group was also lower on the proportion of parent object labels that followed the child's focus of attention (M=.53, SD=.12) than the TD group (M=.76, SD=.15).

Conclusions:

The data thus far are consistent with previous reports (Baron-Cohen, 1987) that children with ASD use fewer symbolic play acts. The greater proportion of parental labels that followed the child's focus of attention in the TD group may reflect more attempts by the parents of the children with ASD to re-direct their children's attention. The child and parent variables reported in this analysis will be used to predict differences in expressive language and vocabulary growth over the 1-year span of the study.

128.160 160 The Effects of Motor Abilities on Language Acquisition and Use In Autism. A. N. Harris*[1], M. W. Gower[2], S. E. O'Kelley[3] and K. C. Guest[2], (1)*The University of Alabama at Birmingham*, (2)*University of Alabama at Birmingham*, (3)*UAB Civitan-Sparks Clinics*

Background: One of the first symptoms parents report in their children with a question of ASD is problems with language acquisition and use. In fact, one of the criteria for Autism Spectrum Disorder (ASD) is a delay in or complete lack of the

development of language (spoken or otherwise). Additionally, motor problems are also common in children with ASD (Noterdaeme, Wriedt, & Hohne, 2010). 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 certain motor skills to be significant predictors of language difficulties in the same population. The use of gestures was a significant predictor of receptive language and the use of gestures and imitation significantly predicted expressive language.

Objectives:

- To examine the receptive and expressive language profiles in children with ASD compared to a group of children without ASD
- To examine the fine and gross motor profiles in children with ASD compared to a group of children without ASD
- To determine the relationship, if any, between the receptive and expressive language abilities and the fine and gross motor abilities in children with ASD.

Methods: Children are referred to an interdisciplinary tertiary clinic to be evaluated for Autism 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) will be included in the analyses. Predicted sample sizes are approximately 30 children in the ASD group and 30 children in the non-ASD group.

Results: Examination of pilot data suggests that compared to a non-ASD group, the expressive language abilities of children with ASD surpass their receptive language abilities. This pattern is opposite that which is found in the control group and the typical population. It is believed that fine motor skills will be related to this language pattern of children with ASD.

Conclusions: These results have potential to greatly impact the treatment and therapy of children with ASD. Specifically, language abilities may be improved with improved motor functioning. Indeed, Gernsbacher, Sauer, Geye, Schweigert, & Goldsmith (2007) found that the oral-motor skills of children with ASD were directly related to their language abilities. Those with higher fluency were able to perform more skills aptly than those with lower fluency. Thus, if improvement in oral-motor skills can potentially influence language, the same is possible for the improvement of fine motor abilities influencing language (particularly receptive language).

128.161 161 A Preliminary Analysis of In Home Parent-Child Communication Interaction In Families with Toddlers with Autism and the Influence of a Parent Training Program. S. Patterson*[1], V. Smith[1] and E. Sliwkanich[2], (1)*University of Alberta*, (2)

Background: Researchers have demonstrated that the style and frequency of parents' engagement with their children impacts language development (e.g. Hart & Risley, 1995). In contrast to families of typically developing children, families of children with autism spectrum disorder (ASD) demonstrate differences in the style (Wilder, Axelsson & Granlund, 2004) and decreases in the frequency (Konstantareas & Homatidis, 1992) of interaction. As such, various intervention programs have been designed to help parents learn to initiate and sustain interactions with their child, to support the child's language development. The purpose of this study was to explore the nature of in home communicative interactions between parents and their toddlers with ASD and the influence of a parent education intervention program on those interactions, using both video and new audio capture technology, the digital language processor (DLP) (Gilkerson & Richards, 2008).

Objectives: Specific questions addressed in this pilot study include: (1) what is base duration of child engagement and parent-child interaction in the home of toddlers with ASD? and (2) does the duration of these interactions and frequency of child engagement change after parent participation in the *More Than Words (MTW)* program?

Methods: Ten families and their toddlers with ASD (age 29-39m) were recruited from a local agency providing the *MTW* program (Sussman, 1999). Parent-child interaction data were collected over a three month period including measures prior to and immediately after participation in MTW. Video was utilized to capture engagement in interactions and examined using criteria by Bakeman & Adamson (1984) while the DLP designed for use in unstructured environments, was utilized to capture audio data. Computer software was used to examine the duration of parent-child interaction defined as communicative turns between parent and child separated by less than 5 second of silence.

Results: Video data indicated children both significantly decreased their object only engagement ($t(9)=3.12$, $p=0.012$,

d=1.348) and increased their coordinated joint engagement (t(9)=-2.67, p=0.028, d=.957) post intervention. Audio data indicated few communicative interactions were taking place between parents and toddlers. Parents engaged in communicative turns with their child for an average total of 146.52 seconds/hour where the mean duration of interaction was 19.67 seconds. Post intervention, mean score differences indicated an increase of 3.92 seconds in duration of interaction, a 19.88% increase over baseline. This preliminary trend suggests that parents may be maintaining their children's engagement in dyadic interaction for longer instances during a 10 minute video play situation after intervention however, the duration of in home interactions was not significantly different.

Conclusions: Little is understood about the home language environments of toddlers with ASD or the supports necessary to effect change in this setting. Further, what can be considered meaningful change in this environment when so few interactions are taking place is also relatively unknown. Although the data suggest that children may be more engaged in dyadic interaction post intervention, this change may not be transferring to daily home interactions where only a small fraction of the child's day is spent engaged in communicative interaction with a parent.

128.162 162 Operationalizing the Construct of Social Communication In Children with Autism Spectrum Disorder: A Scoping Review. B. M. Di Rezze*[1], A. Curtis[2], B. Reed[2], M. J. Cooley Hidecker[2], B. Ross[2], L. Zwaigenbaum[3] and P. Rosenbaum[1], (1)*McMaster University*, (2)*University of Central Arkansas*, (3)*University of Alberta*

Background: Social skill deficits distinguish children with autism spectrum disorder (ASD) from children with other disabilities. Proposed changes to the DSM-IV may combine the categories of social and communication deficits into 'social communication'. However, there is no universally accepted meaning for these abilities and challenges for children with ASD. Furthermore, 'social communication' may not be synonymous with 'social responsiveness', 'social interactions', or 'social impairments'. This scoping review maps how people operationalize 'social communication' for children with ASD.

Objectives: To **e**xamine the ASD literature to operationalize the characteristics of social communication in children with ASD.

Methods: The research question guiding this review asks: "How is social communication defined and operationalized for children with ASD?" An iterative search strategy will be conducted by first searching electronic bibliographic databases such as, CINAHL, ERIC, PsychInfo, and MEDLINE. For each database, ASD is the major subject heading and "social communication" is the keyword to be identified in the work's abstract or title. Relevant search hits are those that define and/or operationalize "social communication." Two reviewers independently assess search results for definitions of social communication and ensure agreement of selected works. Data will be charted using a matrix where definitions of "social communication" are listed by source. These are being extracted according to key concepts and the investigators' professional backgrounds. A second search is then conducted, using a similar search procedure to identify additional "social" terms arising from the literature to understand their relationship with "social communication". Other content sources will be examined in this review include publications of measurement tools/checklists, ASD textbooks/clinical materials and internet sites of key ASD stakeholders. All concepts identified from this review will be examined across variables such as the age of the child and DSM-IV diagnosis (i.e., Asperger, autistic disorder) and collated across sources. We expect that common themes will be generated.

Results: Early results of the first search identified an initial yield of 460 articles. Currently approximately one quarter of these articles have been reviewed, where half are relevant search hits. As articles undergo review, additional search terms for social deficits have accumulated for the second search (e.g., social responsiveness, social interactions, social impairments). Concurrently, the important data from internet sources, books and measurement tools published are being retrieved and further examined for relevance. An early analysis of the selected works describes social communication as the ability to engage and maintain joint attention with communication partners. Other articles define social communication more broadly to include a set of skills in nonverbal (e.g., eye gaze, appropriate physical distance, gestures), speech (e.g., appropriate pitch, prosody, stress), and language (e.g., appropriate speaker and listener tasks) performance.

Conclusions: This scoping review will provide a conceptual map of the construct of social communication. The poster will discuss the results of these analyses as they relate to our understanding of the development of social communication in children with ASD. We will discuss future applications of this work to support the development of a functional classification tool based on social communication patterns in children with ASD.

128.163 163 Stability of Early Diagnoses and Symptom Presentation In Toddlers Referred for Autism Evaluation. W. Guthrie*, L. B. Swineford, C. E. Nottke

and A. M. Wetherby, *Florida State University Autism Institute*

Background: The impact of early intervention on toddlers with ASD and emergence of developmentally appropriate, evidence-based methods (Dawson et al., 2010; Wetherby et al., 2006) have led to increased priority of early identification. Some research has shown diagnoses of very young children to be largely stable (Chawarska et al., 2009; Kleinman et al., 2008; Lord et al., 2005) while other research indicates that symptoms change across the toddler and preschool years (Landa et al., 2006; Gamliel et al., 2009). However, these studies have primarily included children at high-risk and overrepresented low-functioning children.

Objectives: In order to address the need for research utilizing representative samples, the present study examined the short-term stability of diagnosis made by 24 months for toddlers referred for possible ASD in a prospectively identified sample. Secondly, this study examined child characteristics associated with change or stability of diagnosis.

Methods: A preliminary study of 37 toddlers selected from the FIRST WORDS® Project, a screening of a general population sample, was conducted. Additional analyses will include 77 children with ASD or nonspectrum diagnoses. Children participated in two autism diagnostic evaluations before 42 months (preliminary sample: initial evaluation, M=19.35 months, SD=2.08; follow-up, M=34.71, SD=4.44). Best-estimate diagnosis was made by experienced clinicians using the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999; Lord, Luyster, Gotham, & Guthrie, in press), standardized measures of developmental level and adaptive behavior, parent checklists, and home observation. A consensus clinical diagnosis was made by the one of three experienced diagnosticians using all information available, including initial best estimate diagnosis (made by the evaluating clinician and a licensed SLP), ADOS algorithm total, diagnostic report, and ADOS and home observation tapes. Diagnostic certainty was rated on a scale measuring certainty of current and predicted diagnostic symptom presentation.

Results: The preliminary study of 37 toddlers indicated 100% stability for ASD diagnoses made at Time 1 (T1), as all 37 children were diagnosed with ASD at follow-up. Change in diagnostic symptoms was measured using ADOS classifications. The ADOS provides three classifications which reflect the number and intensity of symptoms. Classifications were stable for 68% of children, while classification worsened for 19%, and improved for 13%. Results indicated that age at T1, time between evaluations, and developmental skills as measured by the Mullen Scales of Early Learning (Mullen, 1995) at T1 did not differentiate between the stable, worsening, and improving groups. These groups were differentiated by clinician certainty at T1 in that clinicians were more certain about the stable group than

Conclusions: Findings support the increasing practice of diagnosing ASD in toddlers, as very young children were assigned diagnoses that remained stable from the second to the fourth year of life. Further, for some children, symptom presentation changed substantially indicating that marked improvement or worsening may occur within diagnostic stability. There is a clear need for increased understanding of factors associated with this change, in order to tailor intervention to a child's likely developmental trajectory.

Medical Co-Morbid Conditions Program
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128.164 164 Sensory Sensitivity and Oral Care in the Dental Office in Children with Autism Spectrum Disorders. S. A. Cermak* and L. Stein, *University of Southern California*

Background:

Children with autism spectrum disorders (ASD) often have challenges with oral care, both in the home and dental office, which can negatively impact their oral health and increase risk for oral caries and disease (Brickhouse et al., 2009; Marshall et al., 2010; Pilebro & Backman, 2005). Difficulties processing sensory stimuli in children with ASD are common (Baranek et al., 2007; Ben-Sasson et al., 2009), but although sensory over-responsiveness has been mentioned as a factor contributing to challenges in oral care, it has rarely been empirically studied.

Objectives:

1. To investigate the differences between children with ASD and their typically developing counterparts in regards to prevalence and magnitude of sensory over-responsivity across different sensory domains, as related to oral care.

2. To examine possible relationships between over-responsivity to sensory stimuli and difficulty with dental cleanings and uncooperative behaviors during oral care.

Methods:

The research design consisted of a correlational assessment of the relationship between ASD, sensory processing difficulties, and oral care problems. Data were based on parental responses to a 37-item survey about oral care in the home and dental office A total of 398 English- and Spanish-speaking parents of children ages 2-18 years were recruited from California (n=196 ASD, n=202 typical).

Results:

Parents of children with ASD reported their child to be "moderately to very" oversensitive to sensory stimuli significantly more than parents of typically-developing children across all sensory modalities (touch, oral, taste, smell, sound, vibration, movement, light; p<.0001 for all modalities). Significantly more parents of children with ASD reported difficulty with routine dental cleanings compared to parents of typically-developing children (60%:13%, p<.0001). Additionally, significantly more parents of children with ASD, as compared to typical children, reported that their child's uncooperative behaviors increased in the dental office (49%: 5%, p<.0001). Cut scores of sensory responsivity were created based on the distribution of scores in the typical group. Children whose parents reported "moderate to extreme" sensitivity on three or more of the eight sensory variables were categorized as "sensory over-responders" while children whose parents reported moderate to extreme sensitivity on two or fewer variables were placed in the "typical-responder" group. Significantly more children in the ASD group were over-responders than typically-developing children (74%: 15%, p<.0001). With both groups (ASD and typical) combined, 62% of parents of over-responders reported moderate to extreme difficulty with routine cleanings, as compared to 16% of parents of typical-responders (p<.0001). Likewise, of the combined over-responder group, significantly more parents reported that their child exhibited an increase in uncooperative behaviors in the dental office as compared to parents of typical-responders (45%: 12%, p<.0001).

Conclusions:

Results indicate that according to parental report children with ASD, as compared to their typically-developing counterparts, exhibit a greater prevalence and magnitude of sensory over-responsivity across touch, oral, taste, smell, sound, vibration, movement and light sensory domains, and that over-responsivity is significantly associated with both difficulty with dental cleanings as well as increased uncooperative behaviors during dental care.

128.165 165 Streptococcal Antibodies In Autism Spectrum Disorders with Catatonia. S. Kile*[1], M. Chez[2], C. Parise[1], A. Hankins[3], T. Donnel[1], R. Low[4], S. Caffery[4] and C. Lepage[4], (1), (2)*Sutter Neuroscience Institute, Sacramento; UC Davis Medical Center*, (3)*Sutter Institute for Medical Research*, (4)*Sutter Neuroscience Medical Group*

Background: Catatonia has been described for centuries yet the etiology of this disabling illness has remained elusive and it is often regarded as an idiopathic psycho-motor complication of psychiatric illness. Recently, catatonia has become recognized as having an increased prevalence (12-17%) in young adults with autism spectrum disorders (Wing and Shah, 2000; Billstedt et al., 2005). Laboratory abnormalities have been reported in some cases of catatonia (eg, elevated CPK, low iron, elevated CSF HVA); however, to our knowledge, this is the first report of abnormal streptococcal antibodies in catatonia.

Objectives: To evaluate clinical features and diagnostic studies in catatonia in young adults with autism spectrum disorders.

Methods: A record review of 78 patients who presented to the Sutter Transition for Autism and Neurodevelopmental Disorders (S.T.A.N.D.) Clinic, a transition clinic for young adults with neurodevelopmental disorders, over 18-months since inception.

Results: Five cases (age range 16-29) out of 78 of teens and adults (age range 16-60) with autism spectrum disorders presented with catatonia. Laboratory screening revealed an elevated anti-DNase Ab (avg. 544 [340-1360]; nl <85) in all five subjects with catatonia and an elevated ASOT (avg 437.8 [105-1210]; nl <200) in three of the five with catatonia. No clear recent streptococcal infections were identified in these five subjects. Three subjects demonstrated a positive clinical response to immunotherapy (the other two patients are still being assessed and are likely going to start immunotherapy soon).

Conclusions: We hypothesize that the streptococcal antibodies may point to a neuro-autoimmunologic etiology of catatonia in autism spectrum disorders. Similar neuro-immunologic mechanisms have been proposed in other neurological disorders associated with streptococcal antibodies (PANDAS, Sydenham's chorea, and post-streptococcal dystonia). Further investigation is important as this could represent a biomarker for catatonic patients who may respond to immunological treatment strategies.

128.166 166 Autoantibodies to Cerebellum IN Children with AUTISM Associate with Behavior. P. E. Goines*[1], L. Haapanen[1], R. Boyce[1], P. Duncanson[1], D.

Braunschweig[1], L. Delwiche[1], R. L. Hansen[2], I. Hertz-Picciotto[3], P. Ashwood[2] and J. Van de Water[1], (1)*University of California, Davis*, (2)*University of California, Davis, MIND Institute*, (3)*University of California Davis*

Background: Autism is a heterogeneous disorder with a poorly understood biological basis. Some children with autism harbor plasma autoantibodies that target brain proteins. Similarly, some mothers of children with autism produce autoantibodies that target fetal brain proteins. It is unknown whether the presence of brain-directed autoantibodies in children relates to specific behavioral traits, or if there is a familial relationship for autoantibody production.

Objectives: Explore the relationship between the presence of brain-specific autoantibodies in children and several behavioral characteristics of autism. Investigate potential familial relationships for the production of brain-directed autoantibodies using maternal autoantibody data

Methods: The incidence of plasma antibodies directed towards Rhesus macaque cerebellum proteins was determined in children with autism (AU, n=207), the broader diagnosis of autism spectrum disorder (ASD, n=70), and typically developing age-matched controls (n=189) via Western blot. Plasma from the respective mothers of the child subjects was previously analyzed using western blot for IgG reactivity to fetal brain proteins. The presence of cerebellum-specific IgG was considered with respect to 1) the child's diagnosis, 2) scores on the ADOS, ADI-R, Aberrant Behavior Checklist (ABC), the Vineland Adaptive Behavioral Scales (VABS), and the Mullen Scales of Early Learning (MSEL), and 3) to the occurrence of maternal anti-fetal brain IgG in their respective mothers.

Results: We demonstrated that autoantibodies specific for a 45kDa cerebellum protein in children were associated with a diagnosis of AU (p=0.017) while autoantibodies directed towards a 62kDa protein were associated with the broader diagnosis of ASD (p=0.043). Children with such autoantibodies had lower adaptive (p=0.0008) and cognitive function (p=0.005), as well as increased aberrant behaviors (p<0.05) compared to children without these antibodies. In many cases, this was true regardless of the child's diagnosis. No correlation was noted for those mothers with the most autism-specific pattern of anti-fetal brain autoantibodies and children with the autoantibodies to either the 45 or 62 kDa proteins.

Conclusions: These data suggest that antibodies towards brain proteins in children are linked to lower adaptive and cognitive function as well as core behaviors associated with autism. The presence of these antibodies may relate to certain behavioral features associated with the disorder rather than autism specifically. It is unclear whether these antibodies have direct pathologic significance, or if they are merely a marker of a previous event. Future studies are needed to determine the identities of the protein targets and explore their significance in autism.

128.167 167 Biochemical Screening for Mitochondrial Dysfunction In Children with Autism Spectrum Disorders. D. U. Menon*[1], R. Kelley[2] and R. Kern[3], (1)*Kennedy Krieger Institute -Center for Autism & Related Disorders.*, (2)*Kennedy Krieger Institute*, (3)*Kennedy Krieger Institute*

Background:

Mitochondrial disease has been recognized as a recurrent but still apparently rare cause of ASD. Oliveira et al, (2005), in population-based studies, found that between 5 and 7% of patients with ASD had abnormal, persistent lactic acidemia. A more recent study from this group found conclusive evidence of a mitochondrial disease in 5 of 69 patients tested (Oliveria et al., 2007). Biochemical markers identification will lead to treatment of ASD children presenting with mitochondrial dysfunction .

Objectives:

Despite many advances in molecular techniques, the diagnosis of mitochondrial disorders remains a major challenge, especially in the evaluation of children with autism spectrum disorders (ASD). Because muscle biopsy diagnosis of mitochondrial disease is not practical in the large ASD patient population, we developed an outpatient protocol for diagnosing mitochondrial disease using basic metabolic profiling but adhering to strict timing of sample collection. Our purpose here is to report results of this testing in 20 recently evaluated patients with regressive ASD.

Methods:

The protocol incorporates metabolic profiling under three conditions: **A)** morning fasting (patient's overnight fasting period + 3 h), **B)** 4-5 h after a regular breakfast, and **C)** 90-120 min after lunch. Tests include urine organic acids (**A, C**), plasma amino acids (**A, B**), blood lactate (**A, B, C**), CMP (**A, B**), and CK (**A**). Patients with regressive ASD were referred to our clinic for metabolic testing by physician's expert in ASD, who diagnosed ASD by one of several recognized ASD diagnostic inventories. Because the testing reported herein was undertaken as a standard diagnostic service for patients with

clinical signs of metabolic disease, such as developmental regression, we have not routinely tested patients with non-regressive ASD.

Results:

All 20 patients with regressive ASD had biochemical signs of mitochondrial disease, including, in most, increased levels of blood lactate, urine 2-ketoglutarate, and CK, and absolutely or relatively increased levels of glycine and alanine. The combined increase in alanine and glycine ($p < 0.0001$ vs. control for both) occurs in many types of mitochondrial complex I deficiency, which was found on muscle biopsy in all of several patients who underwent more invasive testing. No patient was found to have a mtDNA mutation. Plasma amino acids obtained at 4h fasting was diagnostically abnormal in almost all patients.

Conclusions:

Developmental regression is a hallmark of many metabolic disorders, especially of mitochondrial disease in children who show acute or subacute cognitive decline after a period of normal development, as typically occurs in regressive ASD. Although, for many years, enzymatic testing of biopsy-obtained muscle tissue was considered the "gold standard" for diagnosis a mitochondrial disease, there is increasing recognition of the scientific limitations of this diagnostic approach and of the impracticability of requiring muscle biopsy for diagnosis of mitochondrial disease among large numbers of at-risk patients, such as those with regressive ASD. We have found our non-invasive diagnostic protocol with an emphasis on careful timing of sampling in relation to nutritional state to be useful in establishing that most patients with regressive ASD have a primary mitochondrial disorder.

128.168 168 Nutritional and Metabolic Status of Children with Autism. J. Adams*,

Background:

There is growing evidence of multiple metabolic problems in children with autism, including oxidative stress, methylation problems, sulfation deficits, and nutritional insufficiencies.

Objectives:

1) Compare the nutritional and metabolic status of children with autism with that of neurotypical children

2) Investigates the possible association of autism severity with biomarkers of nutritional and metabolic status.

Methods:

Participants were children ages 5-16 years in Arizona with Autistic Spectrum Disorder (n=55) compared with non-sibling, neurotypical controls (n=44) of similar age, gender and geographical distribution. Neither group had taken any vitamin/mineral supplements in the two months prior to sample collection. Autism severity was assessed using the Pervasive Development Disorder Behavior Inventory (PDD-BI), Autism Treatment Evaluation Checklist (ATEC), and Severity of Autism Scale (SAS). Study measurements included: vitamins, biomarkers of vitamin status, minerals, plasma amino acids, plasma glutathione, and biomarkers of oxidative stress, methylation, sulfation and energy production.

Results:

Biomarkers of children with autism compared to those of controls using a t-test or Wilcoxon test found the following statistically significant differences ($p<0.001$): Low levels of biotin, plasma glutathione, RBC SAM, plasma uridine, plasma ATP, RBC NADH, RBC NADPH, plasma sulfate (free and total), and plasma tryptophan; also high levels of oxidative stress markers and plasma glutamate. Levels of biomarkers for the neurotypical controls were in good agreement with accessed published reference ranges. In the Autism group, mean levels of vitamins, minerals, and most amino acids commonly measured in clinical care were within published reference ranges.

A stepwise, multiple linear regression analysis demonstrated significant associations between several groups of biomarkers with all three autism severity scales, including vitamins (adjusted R^2 of 0.25-0.57), minerals (adj. R^2 of 0.22-0.38), and plasma amino acids (adj. R^2 of 0.22-0.39).

Conclusions:

The autism group had many statistically significant differences in their nutritional and metabolic status, including biomarkers indicative of vitamin insufficiency, increased oxidative stress, reduced capacity for energy transport, sulfation and detoxification. Several of the biomarker groups were significantly associated with variations in the severity of autism. These nutritional and metabolic differences are generally in agreement with other published results and are likely amenable to nutritional supplementation. Research investigating treatment and its relationship to the co-morbidities and etiology of autism is warranted.

128.169 169 Hypocholesterolemia In Children and Adolescents with Autism: A Clinical Sample From

Turkey. A. Herguner* and S. Herguner, *Meram Faculty of Medicine*

Background:

Autism is defined as abnormalities in reciprocal social interaction and communication, and by the presence of restrictive or stereotyped interests and behaviors. A number of factors are being investigated including genetic, infectious, metabolic and environmental, with specific causes known in less than 10% to 12% of cases. Recent findings suggest the role of abnormal lipid metabolism in autism (Tierney et al, 2006; Aneja and Tierney, 2008; Kim et al, 2010).

Objectives:

The aim of this study was to investigate the incidence of cholesterol deficiency in a group of subjects with autistic disorder (AD).

Methods:

Study group included 88 children and adolescents (74 male / 14 female) with a mean age of 8.3 ± 3.5 (2.8 – 16.6) years who met DSM-IV diagnostic criteria for AD (APA, 1994) by clinical assessment. All patients were recruited from Bakýrköy State Hospital for Mental Health and Neurological Disorders, Child Psychiatry Outpatient Clinic during May 2008 - April 2009. Children with any diagnosed genetic, metabolic, or neurological disorders were excluded from the study. Children with dietary restrictions and on psychopharmacotherapy also were excluded.

Results:

The mean cholesterol level was 150.5 ± 28.7 (81.0 – 230.0) mg / dl. Sixteen subjects (18.2 %) had a cholesterol level lower than 100 mg/dl, which is below the 5th centile. The mean age of 16 participants with cholesterol levels below 100 mg/dl (10.1 ± 0.8 years) were higher than the other 72 subjects (7.9 ± 3.4 years). Five of 14 girls (35.7 %) and 11 of 74 boys (14.9 %) had low cholesterol levels. Pearson correlation analysis revealed that there was a relation between low cholesterol levels and age (p=.024) and a relation close to significance between low cholesterol levels and gender (p=.065).

Conclusions:

Tierney et al (2006) reported that 19 % of children with autistic spectrum disorders had total cholesterol levels lower than 100 mg/dl. Our findings confirmed the high prevalence of abnormally low cholesterol levels in AD and support clinical significance regarding the possible role of cholesterol deficit in the etiology. Cholesterol is essential for brain development and myelination. Also cholesterol functions as a modulator of 5-HT1A and oxytocin receptors, and is a precursor for steroid hormones. It is likely that in some forms of ASD, the symptoms may be due to interaction of components that are sterol dependent.

Low serum cholesterol values are associated with increased violent behavior, suicide, depression, anxiety, and bipolar disease. As subjects with autism have high rate of comorbid psychiatric conditions, further studies are needed to investigate the relation between cholesterol levels and psychiatric problems.

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128.170 170 Lead Poisoning In Children with Autism Spectrum Disorders. J. Roesser*, *University of Rochester Medical Center*

Background:

Although the prevalence of lead poisoning has steadily decreased since 1988, it remains a public health problem affecting 1.4% of children (Jones, 2009) with known medical and neurodevelopmental consequences. The medical effects include constipation, growth failure, anemia, encephalopathy, hearing loss, seizures, and even death (Chandra,1980). The neurodevelopmental effects include hyperactivity, school failure, aggression, and delinquent behaviors (Chandra, 1980) Elevated lead levels may be seen at older ages and have a more protracted course in children with autism and other developmental disorders who have persistent pica (Shannon, 1996). In the recent past this was a common finding; lead poisoning was reported in 44% of one group of 34 children with developmental differences. (Cohen, 1976) . While the AAP Clinical Report of 2007 recommends consideration of lead testing in the evaluation of children with autism, there is no data

regarding the prevalence of elevated lead levels in this population.

Objectives: To explore elevated lead levels in children with autism spectrum disorders.

Methods: Children seen at the University of Rochester in 2006 or 2007 for diagnosis or treatment of Autism, Asperger's Syndrome and Pervasive Developmental Disorder, not otherwise specified were identified using ICD-9 codes. Charts of 1088 patients were reviewed for age, diagnostic category, DSM IV criteria, cognitive level, GI diagnoses, seizures, sleep problems, pica, picky eating and parent report or other evidence of lead testing . Laboratory data in the electronic medical record was abstracted including lead level.

Results:

Laboratory results of lead measurement were present in 174/1088 records reviewed. The medical history recalled by the caregiver included report of a normal lead level at or below 2 years of age in another 458 children. Of these children, 9 had elevated lead levels (> 10 mcg/dL). Normal lead levels were recorded for 4 children at < 2 years of age who were later documented to have elevated levels at older ages. Overall 0.8% of the total charts reviewed and 1.4% (9 out of 632) of those with any report of lead had an elevated lead levels. There was no association between elevated lead levels and autism spectrum diagnosis, GI symptoms or seizures. Children with lower cognitive levels or a history of pica were significantly more likely to have documented elevated lead levels.

Conclusions: A minority of children with ASD seen in a tertiary care clinic serving a mixed urban/suburban/rural region have had elevated lead levels. However, 9/17 children who had lead levels drawn for pica that persisted beyond 2 years of age demonstrated clinically significant elevation. While a history of environmental risk may allow for targeted lead screening in general pediatric populations, the presence of pica needs to be considered in determining the need for lead screening in children and youth with autism.

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128.171 171 Expressive Language Profiles of Children with Idiopathic Autism and Fragile X. J. Klusek*[1], M. Losh[2] and G. Martin[3], (1)*FPG Child Development Institute*, (2)*Northwestern University*, (3)*FPG Child Development Institute, UNC Chapel Hill*

Background: Fragile X syndrome (FXS) is associated with significant genetic risk for autism, with 67-74% of males with FXS meeting criteria for ASD (Harris et al., 2008). The study of autism in FXS (a single gene disorder) provides a paradigm for examining phenotypic variation within a simplified genetic context, potentially informing genetic and neural mechanisms in autism. Both children with ASD and FXS show impaired performance on standardized expressive language assessments (Kjelgaard & Tager-Flusberg, 2001; Roberts et al., 2001). This study aimed to define potentially overlapping language phenotypes in ASD and FXS, and to build on previous findings by examining expressive language in spontaneous, naturalistic language samples, which may compliment findings from standardized assessments (Evans, 1996).

Objectives: To compare intelligibility, fluency, rate, and pragmatic skills within a semi-naturalistic conversational sample among boys with ASD, FXS with ASD (FXS-ASD), FXS-only (FXS-O) and typical development (TD), in order to define syndrome-specific expressive language profiles.

Methods: Participants included boys with ASD (*n*=21), FXS-ASD (*n*=34), FXS-O (*n*=21) and TD (*n*=19), aged 3-12. Groups were similar according to nonverbal mental age (Leiter-R) and receptive/expressive language (EVT-2 and PPVT-4 composite). The ADOS was administered to determine ASD status, and served to elicit the semi-naturalistic conversational language. The first 150 conversational turns were transcribed using SALT conventions (Miller & Chapman, 2000). Overall intelligibility was measured as the percent of intelligible utterances. Fluency was assessed via the number of reformulations that included word repetitions, and the number that included word revisions. Rate was measured as the number of words spoken by the child or examiner divided by the total minutes elapsed. Pragmatic variables included the number of exact repetitions of the examiner's utterance (echolalia), and the percent of questions to which the child responded. MANCOVA was conducted to test for group performance on the six variables, co-varying for mean length of utterance in morphemes.

Results: Results indicated a significant overall effect for group. Bonferoni-corrected group comparisons revealed that ASD and TD groups responded to significantly fewer questions than FXS-O (*M*=-.095; *M*=-.107, respectively) and FXS-ASD (*M*=-.092; *M*=-.104). Children with FXS-ASD were less intelligible than controls (*M*=-.051) and produced more reformulations with repetitions than children with ASD (*M*=7.10). Both FXS groups used more words per minute than ASD (*M*=-19.12; *M*=-19.02)

and TD (*M*= 14.49; *M*=14.38) groups. Groups did not differ on imitations or reformulations with revisions.

Conclusions: Children with FXS, regardless of autism status, were more responsive to questions and showed faster rates of speech than children with ASD and TD. The FXS-ASD and FXS-O groups did not differ on any of the variables measured. However, children with FXS-ASD were less intelligible than those with TD and produced more repetitious reformulations than children with ASD, while these differences did not reach significance in FXS-O. Findings provide evidence of a FXS-specific expressive language profile that presents regardless of ASD status, and may differ from that seen in ASD.

128.172 172 Autism Spectrum Disorders In Children with Duschen Musculer Dystrophy. S. Herguner* and A. Herguner, *Meram Faculty of Medicine*

Background:

Duchenne muscular dystrophy (DMD) is an X-linked recessive degenerative neuromuscular disorder characterized by deficient dystrophin. The gene that encodes for dystrophin has been mapped to chromosome Xq21. DMD has a prevalence of 1 in 35,000 males and its symptoms include delayed motor milestones and weakness of the proximal muscles, usually identified by age 5 years.

Autism is characterized by impairments in social interaction and verbal and nonverbal communication, and restricted and repetitive patterns of behaviors. In addition to their behavioural deficits, up to 70% of individuals with AD have an intellectual disability. Previous studies on comorbidity of autism spectrum disorders (ASD) in subjects with DMD reported a frequency rate between 3.1 – 5.4 % (1, 2, 3).

Objectives:

The aim of this study is to investigate the coexistence of ASD and DMD in a sample from Turkey.

Methods:

The study involved 46 children and adolescent males with a diagnosis of DMD (mean age 7.4 ± 3.8). All subjects recruited from Istanbul Medical Faculty Pediatric Neurology Department between September – December 2010. A psychiatric assessment in a one-hour session was done based on DSM-IV Autistic Disorder Criteria. Additionally autistic symptoms were scored on the Childhood Autism Rating Scale.

Results:

Three cases were diagnosed with ASD; two with autistic disorder and one with pervasive developmental disorder – not otherwise specified (PDD-NOS). Additionally two cases had mental retardation.

Conclusions:

In this study the rate of coocurrance of ASD in DMD was 6.5 % that is significantly greater than expected by chance. And our finding confirms previous studies on association of DMD with ASD.

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128.173 173 Prosopagnosia In Children with High Functioning Autism: An Exploratory Study. X. Qian*, S. L. Corrow and A. Yonas, *University of Minnesota*

Background:

A number of studies have demonstrated that children with ASD showed pronounced deficits in face recognition (FR) (Langdell, 1978; Klin et al., 1999). Klin and colleagues found significant difference in FR performance between children with autism and the non-PDD group.

Another condition related to FR is known as prosopagnosia, a selective deficit in learning and recognizing faces (Duchaine & Nakayama, 2006). It is thought that prosopagnosia may be linked with ASD because the lack of social interest in children with ASD may prevent them from opportunities of learning about faces (Grüter, Grüter, & Carbon, 2008). To date, few studies have been conducted to examine FR in children with high functioning autism (HFA) using measures designed to identify prosopagnosia.

Objectives:

The purpose of this study is to assess FR ability in children with HFA (a) using the Cambridge Face Memory test (CFMT) (Duchaine & Nakayama, 2006) and Reading the Mind in the Eyes (child version, Baron-Cohen, et al., 2001) and (b) including HFA group (n=8) and a group of typically developing children (n=48) matched on chronological age and IQ.

Methods:

Participants

Group 1 Consisted of 8 participants with an average age of 8.7 years old (*sd* = 0.49). These participants were recruited from an autism clinic and all met ADOS autism cutoffs with average or above average IQ.

Group 2 Consisted of 48 typically developing children (*M*= 8.29, *sd* = 0.12) who were matched on chronological age and IQ.

Measures

*Cambridge Face Memory Test***.** In this task, participants were introduced to 6 faces and then tested with forced-choice items consisting of three test faces, one face being the target face. Duchaine and Nakayama reported that CFMT could classify 75% adults with prosopagnosia correctly.

Reading the Mind in the Eyes. In this task, participants were asked to look at photographs of the eye region of a face, and select one of the four words that best describes what the person in the photograph might be thinking or feeling. Baron and Cohen reported that that children with ASD scored significantly lower compared to the control group.

Results:

Children in the non-HFA group scored 79 on average on CFMT (*sd* = 18.9). The range of CFMT scores of HFA group is 52-75(*M* = 67.1, *sd* = 9.2). On the Reading the Mind in the Eyes test, most participants in HFA group (*M* = 15, *sd* = 9.2) scored within average range of the mean CFMT score (*M* = 18.9, *sd* = 3.2) obtained from the non-HFA group. Also, when parents were asked if their child has problems in face recognition, 6 out of 8 parents reported yes.

Conclusions:

This study provides preliminary evidence that it is likely some children with autism may also suffer from prosopagnosia. Further, the results suggest that eye test alone is not sufficient to differentiate HFA and prosopagnosia. More assessments need to be developed to discriminate these two disorders in children.

128.174 174 Relations Between Caregiver Perceptions of Problematic Mealtime Behaviors and Caregiver Feeding Practices. S. L. Johnson*[1], H. Austin[2], N. A. Withrow[1], E. Hsueh[1], A. Waggoner[1] and A. M. Reynolds[2], (1)*UC Denver*, (2)*University of Colorado Denver*

Background: Problematic eating behaviors are often reported in children with Autism Spectrum Disorders (ASD). Limited data exist regarding eating behaviors of children with ASD and even fewer findings characterizing caregiver feeding practices have been reported.

Objectives: We report on a substudy of a multi-center study investigating the nutritional intake of children with ASD participating in the Autism Treatment Network (ATN). The aims of the substudy are to explore caregivers' perceptions regarding eating behaviors of their children with ASD and relate them to feeding practices that caregivers use to facilitate eating for children with ASD.

Methods: Children 2 - 11 y enrolled in the ATN within the past year were eligible for this study. Participants were diagnosed with Autism, Pervasive Developmental Disorder- Not Otherwise Specified, or Asperger Disorder per DSM IV criteria and supported by the Autism Diagnostic Observation Schedule. Caregivers completed a demographics survey, The Brief Autism Mealtime Behavior Inventory (BAMBI) to measure caregiver perceptions of mealtime behavior problems (Lukens & Linscheid, 2007), and The Child Feeding Questionnaire (CFQ), to capture caregiver feeding strategies (Birch et al. 2001).

Results: Thirty-six caregivers of children with ASD (10 girls, 26 boys; 24 white, 1 black, 1 Asian, 10 unknown; mean age 62.7 ± 4.8 mo; median caregiver education = college degree; median income = $50,000 - $74,999;) have participated to date. Scores from the BAMBI (see table below) compare favorably with reported means from previous studies (Lukens & Linsheid, 2007). In general, caregiver CFQ scores are similar to previously reported findings for parents of typically developing children (Birch et al. 2001) however Perceived Responsibility and Monitoring of children's food intake were higher for caregivers of children with ASD. No differences in caregiver responses were noted across gender or demographic categories. Child age was associated with Mastery of Eating (r=.56, p<.01).

Child Food Refusal was negatively associated with Offering of New Foods and Urging of New Foods (r=-0.44 & r=-0.51,

p<.01) and similarly robust associations were noted between child Limited Variety and caregiver Offering and Urging of New Foods. Higher scores for Disruptive Mealtime Behaviors were associated with lower scores for Urging New Foods (r=-.49, p<.01).

Parameter	Construct Score (X + s.d.)
BAMBI (Range)	11.2 + 2.5
• Disruptive Mealtime Behaviors (5-25)	10.3 + 3.1
• Food Refusal (5-25)	23.3 + 6.7
• Limited Variety (8-40)	44.8 + 11.1
• Total Score (18-90)	
Child Feeding Questionnaire (Range 1 – 5)	4.6 + 0.4
• Perceived Responsibility	3.6 + 0.5
• Restriction	4.0 + 1.0
• Monitoring	2.4 + 0.8
• Pressure to Eat	3.4 + 0.6
• Mastery of Eating	4.2 + 0.5
• Structure & Routine	3.1 + 0.5
• Offering New Foods	3.3 + 0.7
• Urging New Foods	

Conclusions: Higher rates of food refusal and limitations in food acceptance are related to less frequent offering of and urging to try new foods. While the causality of this relationship cannot be determined, these data underscore the need to develop methods for caregivers to successfully expose their children with ASD to new foods.

128.175 175 Food and Other Allergies In Autism Spectrum Disorders. T. A. Perez*[1], M. W. Gower[1], K. C. Guest[1] and S. E. O'Kelley[2], (1)*University of Alabama at Birmingham*, (2)*UAB Civitan-Sparks Clinics*

Background:

Allergies are a common occurrence in the lives of children and adults. However, 26% of children with ASD have respiratory allergies compared to 15% of children without ASD. Food allergies also occur in approximately 14% of the population of children with ASD compared to 3% in children without (Altarac, 2008). Adams and Conn (1997) suggest that allergies, particularly food allergies contribute to the neurological symptoms apparent in ASD, including reduced concentration, difficulty sleeping, irritability, and decreased immune system functioning. Gurney, McPheeters, and Davis (2006) noted that parents of children with ASD report a higher incidence of allergies and an increased number of visits to healthcare professionals, such as pediatricians and emergency rooms.

Objectives:

To evaluate the relationship between allergies and diagnosis in children with autism spectrum disorders and children with other developmental disabilities in a tertiary care setting.

Methods:

Approximately 124 children were evaluated through the Autism Clinics. Of these a percentage reported using medication and having allergies. The participants data were entered into a database and 2 separate chi square analyses will be conducted to decipher whether or not children with ASD exhibit different patterns of food, seasonal and environmental allergies.

Results:

The researchers expect to find significant results after running both 2x2 Chi-square tests. Specifically, it is reasonable to expect that children on the spectrum will show higher frequencies of food and other allergies when compared to their typically developing peers.

Conclusions:

Based on the previous literature, it is anticipated that children with ASD will show an increased rate of allergies as compared to children with developmental disabilities. Given the public health implications of allergies in addition to the high medical costs associated with ASD, it is important t determine ways to prevent and treat allergies in ASD.

128.176 176 Childhood Vaccinations and ASD: No Relationship Between Number or Schedule of Vaccinations and Diagnostic Outcome or Severity. A. Margolis*[1], J. D. Jones[2], A. Trubanova[2], W. Jones[2], K. Chawarska[1] and A. Klin[2], (1)*Yale University School of*

Medicine, (2)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: Recent increases in the number of recommended childhood vaccines have raised public concerns about the potential side effects of immunizations on children's health. Because of the increasing prevalence of autism diagnoses over the last 15 years, this disorder, in particular, has become the focus of much of the attention and concern surrounding childhood vaccines. As a consequence of this debate, the use of childhood vaccines, especially the measles-mumps-rubella vaccine (MMR), has decreased significantly, and this decrease has led to numerous outbreaks in diseases previously prevented by vaccines. Furthermore, research addressing the relationship between vaccines and autism has relied primarily on retrospective population studies, with little power to determine the role of immunizations in individual outcomes.

Objectives: The primary goal of this study is to examine the relationship between the frequency and number of childhood immunizations and the subsequent likelihood of developing autism. In addition, this study aims to investigate the relationship between childhood vaccines and disorder severity in children who do go on to develop autism.

Methods: Immunization data were collected for 91 children divided among the following three groups: (1) siblings of children with an autism spectrum disorder diagnosis, (N =48; gender = 37M); (2) children at risk for developmental delays (N = 7; gender = 5M); and (3) children expected to develop typically (N = 36; gender = 19M). All children were at least 2 years of age when their immunization records were collected. Individual immunization data were recorded and then compared with diagnostic outcome and behavioral data.

Results: Tests of association and linear multiple regressions revealed that neither a greater number of childhood vaccines nor a higher rate of vaccination had a positive relationship with subsequent autism spectrum diagnosis (N=8; gender=7M) or disorder severity, which was assessed in all participants. In addition, comparison of immunization data to behavioral indicators at 2 years of age did not reveal any relationship between either higher frequency or greater number of childhood vaccines and subsequent negative behavioral outcomes. Likewise, neither vaccination with MMR nor the age of MMR vaccination was significantly related to outcome. Instead, because siblings of children with autism were less likely to be vaccinated according to the recommended schedule, both correlations and multiple regressions revealed a significant relationship between higher rates of vaccination and non-ASD behavioral outcomes.

Conclusions: These results suggest that childhood vaccines do not increase children's risk of developing autism and do not exacerbate the disorder severity in children who are later diagnosed with autism. Children who receive a greater number of vaccines overall, who receive the MMR vaccine, or who receive immunizations at a higher rate, do not differ significantly on subsequent behavioral measures from children who receive vaccines on an alternative schedule or children who do not receive vaccines. Instead, the results of this study emphasize heritability in risk for autism, and also indicate that siblings of children with an autism diagnosis are less likely to be vaccinated, which actually increases their risk for contracting other illnesses.

128.177 177 Examining the Relationship Between Otitis Media Occurrence and Autism Severity Among School Aged Children with Autism Spectrum Disorders Between the Ages of 7-9. B. Reilly*, M. Clow, A. D. Stevens, J. R. Wenegrat and R. A. Bernier, *University of Washington*

Background: Otitis Media (OM) is a commonly diagnosed condition among children. OM has been identified as a significant factor in combinations of neuropsychological and neurobehavioral developmental difficulties such as increased severity in comorbid learning disorders and Attention Deficit Hyperactivity Disorder (Padolsky, 2008). Further, typically developing children with a history of chronic OM also evidence lower scores on measures of phonological awareness, rhyme and non-word reading, semantic skills of expressive vocabulary, word definitions, reading, language development, and literacy development (Winskel 2006). Frequencies of OM in early development have not been identified as more prevalent among children with ASD than in neurotypical populations (Rosen, Yoshida, & Croen, 2007); however, given the relationship between OM and symptom severity and language, the examination of OM in ASD is warranted. Recent cluster analyses of expressive phonology and word comprehension among children with ASD between the ages of 7-9 point to different subtypes of language disorder among the age group (Rapin et al., 2009). This suggests the possibility that for children of this age group with ASD, OM occurrence could exist as a factor in aspects of symptom severity and deficits during critical stages of development and learning.

Objectives: The objective of the current study was to investigate the relationship of Otitis Media occurrence in childhood and autism severity and language ability among 7-9 year old children with ASD. Results may inform potential factors involved in the development of deficits and symptom presentation within an identified critical age range.

Methods: Using individuals ascertained through the Simon's Simplex Collection (distribution 8.2; http://SFARI.org), we investigated the occurrence of parent-reported occurrences of Otitis Media among 394 (348M; 46F) 7-9 year old children with ADI and ADOS-confirmed ASD diagnoses in relation to their autism severity scores and performance on the Peabody Picture Vocabulary Test (PPVT). Children were divided into two occurrence groups identified as having either no occurrence of Otitis Media or at least once occurrence (and up to more than 8 occurrences). Autism severity scores based on the ADOS Calibrated Severity Score as well as standard scores on the PPVT were examined between Otitis Media groups

Results: A significant main effect for Otitis Media was found for the sample in relation to autism severity score. Children with at least once occurrence of Otitis Media during their development had significantly higher autism severity scores compared to those without an occurrence (F (5,1) = 4.659, p < .05). Main effects for OM were not found for PPVT performance, although age group showed a significant main effect (F (5,2) = 6.108, p, < .05) with ASD nine-year-olds performing significantly higher than both eight-year-olds and seven-year-olds on the test.

Conclusions: The current study suggests that the occurrence of Otitis Media during development could play an important role in autism severity and symptom expression among children in a critical age range for skill development. Importantly, the present effects observed coincide with other language, processing, and behavioral deficits in ASD populations specific to this particular age group.

128.178 178 Frequencies of Myringotomy Procedures Among ASD Populations Compared to National Samples and the Role of Developmental Morphology (Low Set Ears).

M. K. Clow*[1], B. Reilly[2] and R. A. Bernier[2], (1), (2)*University of Washington*

Background: Findings from early studies in children with Autism Spectrum Disorders (ASD) have suggested ear abnormalities to be a discriminating factor between ASD and normal controls (Rodier et al., 1997). Previous investigations have suggested that low-set ears may be associated with chronic and problematic otitis media in children with ASD (Konstantareas & Homatidis,1987). The examination of frequency of myringotomy procedures for the treatment of chronic and severe otitis media in children with ASD could provide further information into the nature of chronic OM in ASD populations. Furthermore, examining ear placement in children with ASD in relation to controls in the context of myringotomy procedure may be utilized to serve as a clinical marker for ASD symptomology or aid in identifying specific subgroups.

Objectives: The objectives of the current study are twofold. The first aim is to investigate frequency of myringotomy procedures among ASD populations compared to a verified normative sample to identify potential fit-related differences that could be indicative of specific aspects of ASD populations. The second aim is to compare ear position of ASD children in the sample to their unaffected siblings to examine the hypothesis that children with ASD will have higher incidence of low-set ears that may contribute to difficulties with chronic otitis media and myringotomy procedures.

Methods: To address aim 1, we investigated the occurrence of myringotomy procedures among 1650 (1429M; 221F) children with ADI and ADOS-confirmed ASD diagnoses between the ages of 3 and 18 years ascertained through the Simons Simplex Collection (distribution 8.2; http://SFARI.org). Frequencies were then compared to myringotomy tube placement procedures from the National Hospital Ambulatory Medical Care and National Ambulatory Medical Care Surveys for 2003– 2005 and the 2003 Kids' Inpatient Database (KID). To address aim 2, analyses are ongoing and include the comparison of ear placement in 40 children with ASD (both with and without myringotomy procedures) to their same age closest age siblings. Measurements are conducted on 2D side view photographs that capture both sides of the head to ensure landmarks of the nose, eyebrow ridge, and eyes are visible and measureable.

Results: A chi-square test of goodness-of-fit test was performed to compare myringotomy procedure frequencies between the two groups. Myringotomy procedure for both groups was not equally distributed in the population. ASD children had significantly more myringotomy procedures than their typically developing peers, χ^2 (1, N = 1650) = 1679.17, p < .001. The difference was also present when rates were examined individually for males (χ^2 (1, N = 1429) = 1556.44, p < .001) and females (χ^2 (1, N = 221) = 135.68, p < .001). Data collection and analysis of ear placement in children with ASD both with and without myringotomy procedures are ongoing.

Conclusions: Results from the current study suggest that myringotomy procedures occur with significantly greater frequency in ASD populations compared to that of normative populations. Better understanding of the factors underlying this increased rate could enhance early identification and screening methods used to assess children with developmental deficits associated with ASD and OM.

128.179 179 The Relationship of Abnormal Sensory Responses to Self-Regulatory Deficits In 265 Children with and without Autism. L. M. Silva* and M. Schalock, *Western Oregon University*

Background:

In developmentally delayed (DD) children, abnormal sensory responses characterized by hyper and hypo-reactivity, are commonly reported. They are of varying severity/frequency, and may involve one or more senses. In autism, they are more severe than other disabilities, and are classified as co-morbid symptoms of unknown etiology. Recently two RCTs of a massage methodology based on Chinese medicine (Qigong Sensory Training, or QST) designed to improve sensory nervous system function in children with ASD under age six, demonstrated robust improvement of abnormal sensory responses following a five-month course of treatment, as well as improvement in measures of self-regulation and autism. Chinese medicine asserts that timely achievement of self-regulatory milestones is dependent upon normal function of the senses. To further evaluate the relationship between sensory and self-regulatory impairment in young children under age 6, the Sense and Self-Regulation Checklist (SSC) was developed and validated.

Objectives:

To explore the relationship between abnormal sensory responses and self-regulatory difficulties in 265 children under age six, with and without developmental delay.

Methods:

SSC data from three groups under age six are compared: children with autism, children with other reasons for DD, and typically developing children.

Results:

A strong and linear relationship between abnormal sensory responses and self-regulatory difficulties was found in all groups of children ($B = .801$, $p < .001$). The typically developing group was differentiated by mild, single-sense findings; the other DD group was differentiated by moderate multi-sensory findings; and the autism group was differentiated by severe, multi-sensory findings and a diffuse tactile abnormality with hypo and hyperesthesia ($F < 122$, $p<.001$). The mean SSC score for the group with autism was twice as high as the mean score for the typical group, and on the scatterplot, there was a sharp line of demarcation between the two groups.

Conclusions:

Abnormal sensory responses occur in a spectrum of severity/frequency and uni/multi-sensority that appears directly, linearly related to difficulties achieving self-regulatory milestones. Furthermore, in autism, they are treatable, and with treatment, self-regulatory abilities improve. Given that self-regulatory abilities are foundational for social, emotional and cognitive development, this elevates the importance of early identification and treatment of abnormal sensory responses in children with developmental delay. It appears that moderately and severely abnormal sensory responses are as clinically relevant to the developmental trajectory actual loss of hearing and vision.

128.180 180 Preliminary data validating a qualitative assessment of core and co-morbid autism symptoms: The Sense and Self-Regulation Checklist. L. M. Silva*,

Background: In developmentally delayed (DD) children, abnormal sensory responses characterized by hyper and hypo-reactivity, are commonly reported. They are of varying severity/frequency, and may involve one or more senses. In autism, they are more severe than other disabilities, and are classified as co-morbid symptoms of unknown etiology. Recently two RCTs of a massage methodology based on Chinese medicine (Qigong Sensory Training, or QST) designed to improve sensory nervous system function in children with ASD under age six, demonstrated robust improvement of abnormal sensory responses following a five-month course of treatment, as well as improvement in measures of self-regulation and autism. Chinese medicine asserts that timely achievement of self-regulatory milestones is dependent upon normal function of the senses. To further evaluate the relationship between sensory and self-regulatory impairment in young children under age 6, the Sense and Self-Regulation Checklist (SSC) was developed and validated.

Objectives: To explore the relationship between abnormal sensory responses and self-regulatory difficulties in 265 children under age six, with and without developmental delay; and to see how the scores changed for the autism group following QST treatment.

Methods: SSC data from three groups under age six are compared: children with autism, children with other reasons for DD, and typically developing children. Children with autism received the five-month QST treatment methodology.

Results: A strong, linear relationship between abnormal sensory responses and self-regulatory difficulties was found in all groups of children (B = .801, p < .001). The typically developing group was differentiated by mild, single-sense findings; the other DD group was differentiated by moderate multi-sensory findings; and the autism group was differentiated by severe, multi-sensory findings and a diffuse tactile abnormality with hypo and hyperesthesia (F < 122, p<.001). The mean SSC score for the group with autism was twice as high as the mean score for the typical group, and on the scatter plot, there was a sharp line of demarcation between the two groups. Following five months of treatment for the autism group, scores moved in the direction of the typical group with mean sensory scores decreasing by 22 %, and mean self-regulatory scores improving by 18%.

Conclusions: Abnormal sensory responses occur in a spectrum of severity/frequency and uni/multi-sensority that appears directly, linearly related to difficulties achieving self-regulatory milestones. Furthermore they are treatable, and with treatment, self-regulatory abilities improve. Given that self-regulatory abilities are foundational for social, emotional and cognitive development, this elevates the importance of early identification and treatment of abnormal sensory responses in children with developmental delay. It appears that moderately and severely abnormal sensory responses may be as clinically relevant to the developmental trajectory as actual loss of hearing and vision.

128.181 181 Health Symptoms of Mothers of Adolescents and Adults with ASD. L. E. Smith*[1], M. M. Seltzer[2] and J. S. Greenberg[1], (1)*University of Wisconsin*, (2)*Waisman Center, University of Wisconsin-Madison*

Background:

Parents of children with ASD consistently report poorer psychological well-being in comparison to parents of children with other developmental disorders such as Down syndrome, fragile X syndrome, cerebral palsy, and undifferentiated developmental disability (Abbeduto et al., 2004; Blacher & McIntyre, 2006; Eisenhower, Baker, & Blacher, 2005). Less is known, however, regarding the *physical* health of mothers of individuals with ASD.

Objectives:

The goal of the present study was to examine the daily health symptoms of mothers of adolescent and adult children with ASD. Health symptoms of mothers of a son or daughter with ASD were compared to a nationally representative sample of mothers of similarly-aged children without disabilities as well as to a sample of mothers of adolescents and adults with fragile X syndrome (FXS). Specifically, we compared the three groups of mothers on daily symptoms including pain, dizziness, menstrual-related symptoms, and mood.

Methods:

Participants were drawn from three longitudinal datasets: (1) Adolescents and Adults with Autism (n = 96), (2) the study on Family Adaptation to FXS (n = 112) and (3) the National Survey of Midlife in the US (n = 230). One component of each of these studies was a Daily Diary; respondents were interviewed by telephone each evening for 8 consecutive days. The daily telephone interview included questions about daily experiences in the previous 24 hours. Daily health symptoms were measured using an adapted version of Larsen and Kasimatis' (1991) symptoms checklist. The following symptoms were included in the present analysis: headache, backache, muscle soreness, fatigue, joint pain, muscle weakness, dizziness, menstrual-related symptoms, and hot flashes. Positive and negative emotions were measured using a shortened version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988).

Results:

Both mothers of a son or daughter with ASD and mothers of a son or daughter with FXS reported a higher proportion of days with headaches, backaches, muscle soreness, fatigue, and hot flashes than mothers of children without disabilities. Additionally, mothers of a son or daughter with ASD indicated more days with joint pain, muscle weakness, and menstrual-related symptoms than mothers in either the FXS group or the non-caregiving comparison group. Findings also indicated that mothers of adolescents and adults with ASD reported higher levels of negative affect and lower levels of positive affect than mothers of adolescents and adults with FXS or mothers of similarly-aged children without disabilities.

Conclusions:

The present study demonstrated that mothers of adolescent and adult children with disabilities experience a greater proportion of days with health symptoms compared to mothers of similarly-aged children without disabilities. Mothers of a son or daughter with ASD appear to be at particular risk for health problems, highlighting a need for comprehensive services and supports for families across the lifecourse.

128.182 182 Medical Conditions and Neurogenetic Syndromes IN Venezuelan Children with ASD. C. Montiel-Nava*, J. Pena and J. A. Chacin, *La Universidad del Zulia*

Background:

It has been established by different studies that additional medical problems are often present in children with Autism Spectrum Disorders (ASD). ASD could also be part of wider neurogenetic entities such as fragile X syndrome, tuberous sclerosis complex, among others. There are few studies that have examined the distribution and frequency of neurogenetic syndromes and medical condition in Hispanic children.

Objectives:

This study aims to investigate the medical conditions and neurogenetic syndromes in Venezuelan children with ASD attending an outpatient pediatric facility.

Methods:

154 children with ages aged 3 through 7 with a confirmed diagnosis of autism spectrum disorders, underwent a neurogenetic evaluation to identify medical conditions and/ or genetic syndromes comorbid to the ASD. In order to identify dysmorphic features, neurological abnormalities, and signs of neurocutaneous disorders, a translation of the neurogenetic evaluation form used for AGRE was used. Each child had a complete physical examination, including a neurological examination, an assessment for dsymorphic features, overt physical abnormalities, neurological or motor abnormalities, and a skin examination by Wood's lamp for signs of tuberous sclerosis. Karyotyping was performed, and also tests for other genetic syndromes (including Fragile X). During the interviews a detailed medical and developmental history was also obtained, which questioned specifically for non-psychiatric medical illnesses, neurological disorders, medications taken, and treatment responses.

Results:

36 of the children with ASD (23.38%) also had another medical condition. These entities included Fragile-X (3 children, all boys), epilepsy (19 children), tuberous sclerosis complex (2 children), blindness (2 children), Williams syndrome (1 children), Sotos syndrome (1 children), LHON (1 children), Warbenburg syndrome (1 children), Down syndrome (3 children), and other genetic syndromes (3 children). All the genetic syndromes were present in the autism group, while the epilepsy was more frequent in the PDD group. There were no cases of epilepsy or genetic syndromes in the Asperger´s syndrome children. The medical and genetic conditions were more prevalent in males than females.

In this study, 23.38% of the children had an additional medical condition. 13.34% of the autistic children also had a diagnosis of epilepsy. Rates of epilepsy are high in autistic samples, with higher rates in those samples with lower cognitive functioning. However, being our sample of younger children and due to the increased incidence of seizures during adolescence among autistic individuals, these proportions should be regarded as underestimation of the lifetime risk of epilepsy in autism. Fragile X has also been reported to be prevalent among autistic individuals, and we found that 1.94% of our children with autism also have this genetic abnormality. The rate of 1.29% of autistic children with associated TS is close to the 1% rate reported by other studies.

Conclusions:

Results of this study reveal once again the association between some medical conditions and ASD. The findings suggest the need to be vigilant about the possible development of comorbid medical and neurogenetic conditions in children with ASD. Our results imply that for children seen in outpatient pediatric settings in Venezuela, comorbid neurogenetic conditions are an expected occurrence.

128.183 183 Health Status and Medical Co-Morbidities of Non-Verbal/Low-Verbal Children with ASD: Data From the Autism Treatment Network. N. Jones*[1], T. Katz[2] and T. Clemons[3], (1)*Autism Speaks*, (2)*University of Colorado*, (3)*EMMES Corp*

HEALTH STATUS AND MEDICAL CO-MORBIDITIES OF NON-VERBAL/LOW-VERBAL CHILDREN WITH ASD: DATA FROM THE AUTISM TREATMENT NETWORK

Background:

Current research estimates that 9-25% of children with ASD remain non-verbal into early childhood (Thurm et al. 2007; Hus et al., 2007), yet little research has focused on this subset of children. This represents a gap in addressing the needs of children with ASD particularly as language outcomes are a strong predictor of overall outcome (Kobayashi, Murata, & Yoshinaga, 1992). One frequently cited barrier to good medical care for children with ASD is difficulty communicating symptoms appropriately (Kraus et al. 2003; Filipek et al. 1999). Notwithstanding, little research characterizes the healthcare needs of non-verbal/low-verbal children with ASD.

Objectives:

The objective of this study is to characterize the behavioral and medical issues of non-verbal/low-verbal children with ASD as compared to those of verbal children.

Methods:

The study compares non-verbal/low-verbal and verbal children with an autism spectrum diagnosis (autism, Asperger disorder or PDD-NOS) ages 2-17 who are enrolled in the Autism Treatment Network (ATN) Registry. The ATN has enrolled 3073 children at 14 sites across the US and Canada. Children will be assigned to non-verbal/low-verbal or verbal groups based on age and performance on the ADOS: 1) Non-verbal/low-verbal: no words or some words on Module 1 or five years and above on Module 2; 2) Verbal: Module 3 or 4. The study will compare rates of neurological, physical, and genetic abnormalities, medication use, rates of reported GI and sleep disorders (Child Sleep Habits Questionnaire), problem behaviors (Child Behavior Checklist), adaptive functioning (Vineland Adaptive Behavior Scales, Second Edition), Pediatric Quality of Life (Peds QL), and sensory issues (Short Sensory Profile) for both groups.

Results:

Preliminary data from 2460 children in the ATN Registry showed that parental report of problems with language use and understanding were related to exposure to special diets (p=.0001). Children with parent-reported language regression were also more likely to be exposed to special diets (p=.0001) and complementary and alternative medicine (p=.0053). These children (n=2508) also have significantly higher repetitive movement problems (p=0.0002), abnormalities in stance and gait (p=.0001), and muscle tone abnormalities (p=.0001). Low cognitive ability (IQ < 70) was linked to a higher incidence of repetitive movements (p=0.0001) and stance and gait abnormalities (p=0.0001). A descriptive analysis of medical and behavioral characteristics of non-verbal/low-verbal children compared to verbal children will be presented.

Conclusions:

Factors related to language performance are associated with physical health concerns. This study will provide a description of the behavioral and medical characteristics of non-verbal/low-verbal children with ASD addressing previously unanswered questions regarding their medical issues, behavioral concerns, overall quality of life, and adaptive functioning relative to children with ASD who are verbal.

Acknowledgement

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128.184 184 Identification of Subclinical Seizures In Children with Autism and Their Association with the Vineland Adaptive Behavioral Scales.

S. J. Asghar*[1], M. L. Griebel[1], S. J. Blossom[2], R. Williamson[1], S. A. Maham[1], H. Gomez-Acevedo[1] and S. J. James[3], (1)*UAMS, Arkansas Childrens Hospital*, (2)*Arkansas Chidlren Hospital Research Institute*, (3)*University of Arkansas for Medical Sciences*

Background:

Autism is a devastating neurological disorder with marked impairment in social skills, behavior, cognitive functions and verbal communication. Frequent co morbidities include seizure disorders, mental retardation, mood and sleep disorders. In Arkansas, the prevalence of autism is 1 in 145 children with higher incidence in boys than girls (odds 1.78 to 1). Recent studies suggest that one third of children in the autistic spectrum disorders (ASD) will develop seizures with onset prior to age 5 years (infancy) or after age 10 years (adolescence). Most children with seizures and ASD are likely to have an abnormal EEG reading. Moreover, in children with ASD without seizures, approximately 15-20% has an epileptiform EEG. About 68% of children with ASD with episodes of sudden or unprovoked crying, holding of the hands to the ears, unusual blinking patterns and brief staring spells had epileptiform activity in simultaneous EEG recording. These clinical findings suggest that subclinical seizures may be misdiagnosed in this population. Since the overt seizures are not usually evident until many years after the onset of autistic features, an early detection of subclinical seizures may improve the neurodevelopment of autistic children.

Objectives:

Our specific aim was designed to rigorously characterize this subgroup of autistic children in terms of specific behaviors and subclinical seizures and to determine the feasibility of early intervention strategies to avoid the progression into overt seizure activity.

Methods:

Twenty children with Autistic Disorder or PDD-NOS using DSM-IV criteria, Childhood Autism Rating Scales (CARS) and the ADOS (Autism Diagnostic Observatory Scale) were recruited.

Ten children had a history of subclinical seizures whereas the other ten were not diagnosed with subclinical seizure activity, thus this latter group was considered the control group. The population consisted of girls and boys with ages ranging between 18 months and 6 years. Informed consent was obtained and each child was subjected up to 2 hours of EEG recording including one hour of sleep and behavior testing using Vineland Adaptive Scales.

All children had computerized digital EEG recording utilizing 20 scalp electrodes with the standard 10-20 electrode placement and a channel of EKG recording in total 24 leads with montage reformatting capabilities. Interical epileptiform abnormalities specifically focal or multifocal with frontal, occipital or centro-parietal spikes were identified as abnormal. All EEGs were read by the PI, and two additional readers to reduce bias.

Results:

5 children had abnormal EEGs and all were identified with the initial symptoms of subclinical seizures. Logistic regression was used to determine the relevance of different factors to determine the likelihood of detecting changes in EEG readings. Few dimensions were moderately significant to determine the outcome of EEG readings, namely adaptive score (OR=0.75, $p<0.1$), personal dimension (OR=1.8, $p<0.19$), and previously diagnosed subclinical seizures (OR=20.9, $p< 0.1$).

Conclusions:

We were unable to confirm the utility of Vineland Behavior Scales to determine EEG changes in autistic children, thereby limiting the use of this scale as a marker for subclinical seizures for this population.

128.185 185 The Social and Behavioral Phenotype of Children with Autism Spectrum Disorders and Comorbid Gastrointestinal Dysfunction. P. Gorrindo*[1], E. B. Lee[1], K. C. Williams[1], L. Tilson[1], S. G. McGrew[1] and P. Levitt[2], (1)*Vanderbilt University*, (2)*Keck School of Medicine, University of Southern California*

Background: The clinical manifestation of Autism Spectrum Disorder (ASD) is heterogeneous, with multiple medical and behavioral comorbidities of varying prevalence. Gastrointestinal dysfunction (GID) in ASD has been noted in multiple studies, but little information has been reported regarding differences in social functioning or behaviors associated with comorbid GID in children with ASDs.

Objectives: The aim of this study is to characterize severity of autism symptoms, expressive language level, and social impairment in children with ASDs and comorbid GID, compared to children with ASDs without GID and to children without ASDs but with GID.

Methods: Children aged 5-18 years old were enrolled into one of three study groups: ASD and GID (+ASD/+GID), ASD without GID (+ASD/-GID), and no ASD but GID (-ASD/+GID). Children in the two +ASD groups were evaluated with the Autism Diagnostic Observation Schedule (ADOS). Children in the two +GID groups were evaluated by a gastroenterologist. Parents completed the Social Responsiveness Scale (SRS) for children in all three study groups. Enrollment of study participants is ongoing.

Results: Enrollment to-date is as follows: +ASD/+GID, n=39, mean age 11.7 years (SD=3.5), 77% male; +ASD/-GID, n=49, 12.2 years (3.7), 86% male; -ASD/+GID, n=29, 12.1 years (3.4), 45% male. ADOS classification (using revised scoring algorithms): +ASD/+GID, 95% autism, 5% autism spectrum; +ASD/-GID, 92% autism, 8% autism spectrum. A severity score of autism symptoms, based on ADOS score relative to age and language level, was not significantly different between ASD groups: +ASD/+GID mean score 7.9 (SD=1.7), +ASD/-GID mean score 8.0 (1.7), Independent Samples t-Test. Non-verbal children were significantly more prevalent in the +GID group: +ASD/+GID 31% non-verbal, +ASD/-GID 8% non-verbal, $p=0.006$ by Chi-Square Test. Stanford-Binet Abbreviated Battery IQ (ABIQ) scores were available for a subset of children, and showed no significant difference between groups: +ASD/+GID mean score 67.3 (n=13, SD=26.3), +ASD/-GID mean score 75.4 (n=27, SD=20.7), not significant by Independent Samples t-Test. SRS total T scores were significantly elevated in +ASD/+GID compared to +ASD/-GID and to -ASD/+GID children: +ASD/+GID mean score 90.8 (n=33, SD=13.2), +ASD/-GID 78.9 (n=30, SD=16.8), -ASD/+GID 51.0 (n=24, SD=12.3), $p<0.01$ by one-way ANOVA with Tukey HSD post hoc comparisons.

Conclusions: Parents report increased social impairment (based on SRS scores) in children with ASDs and comorbid GID, compared to children with ASDs but without GID. In our sample, children with ASDs and comorbid GID have lower expressive language skills compared to children without comorbid GID. For a subset of the children in this study, those with ASDs and comorbid GID do not show significantly different cognitive functioning compared to children with ASDs but without GID.

128.186 186 Gene Expression Analysis to Evaluate Gastrointestinal Tissue In Symptomatic Autism Spectrum Disorder Children: A Pilot Study. S. J.

Walker*[1], J. Fortunato[2], L. Hewitson[3] and A. Krigsman[4], (1)*Wake Forest Institute for Regenerative Medicine*, (2)*Wake Forest University Health Sciences*, (3)*Thoughtful House Center for Children*, (4)*Pediatric Gastroenterology Resources of New York*

Background: Gastrointestinal (GI) symptoms occur frequently in children with an autism spectrum disorder (ASD). GI symptoms suggestive of inflammatory bowel disease often necessitate confirmatory diagnosis via upper endoscopy, colonoscopy, and biopsy. Although histologic evaluation of intestinal biopsy tissue remains the gold standard for diagnosis of inflammatory bowel disease, there exists a clinical need for additional diagnostic tools to characterize the molecular features unique to this population of children.

Objectives: The goal of this pilot study was to evaluate gene expression profiles in gastrointestinal tissue biopsy specimens from ASD children presenting with chronic GI symptoms, and to compare them to gene expression profiles in GI tissue from neurotypical children with no gastrointestinal symptoms. The gene expression profiles in GI tissue from symptomatic ASD children may then be used to describe the molecular aspects that underlie the symptoms, and thereby provide additional information for diagnosis and treatment.

Methods: GI biopsy tissue from children with an autism spectrum disorder who underwent colonoscopy, clinically indicated based on chronicity and severity of their gastrointestinal symptoms, was used in this study. Control GI tissue consisted of pathology-free cadaveric specimens obtained from neurotypical children. All case and control tissue was collected under appropriate IRB approval. Briefly, total RNA was isolated from the individual tissue biopsy specimens, reverse-transcribed, labeled, and used to query whole genome DNA microarrays. Following data normalization, standard statistical analyses were used to generate a list of genes differentially-expressed between the cases and controls. Additional data mining included pathway analysis, using both public and private databases, as well as comparisons of these data with other relevant published datasets from molecular studies that were designed to distinguish IBD subtypes.

Results: At a fold change ≥ 1.5 ($p \leq 0.05$) there were approximately 1800 genes differentially expressed between the ASD-GI samples and controls, with nearly two thirds (~1100) being down-regulated in the ASD-GI tissue. Further analysis indicated significant involvement of numerous pathways including: primary immunodeficiency, B cell and T cell receptor signaling, chemokine signaling, and p53 signaling (all significantly up-regulated); and also focal adhesion, extracellular matrix-receptor interaction, drug and xenobiotic metabolism (cytochrome p450 mediated), Wnt signaling, and glutathione metabolism (all significantly down-regulated). Moreover, when these data were compared with a published biomarker study reporting a 7-gene panel for distinguishing two IBD subtypes, Crohn's and ulcerative colitis, 4 of those 7 biomarkers were present and differentially-expressed in this dataset.

Conclusions: In this pilot study we have identified numerous gene expression changes in GI tissue from ASD children with GI symptoms that correlate with similar gene expression changes that have previously been reported for both Crohn's disease and ulcerative colitis in other study populations. By significantly expanding our sample size in a follow-up study we expect to be able to identify a gene expression signature specific and/or diagnostic for GI pathology in this unique patient population.

128.187 187 Relationship Between Gastrointestinal Disorder and GSR Indicators of Stress In Autism Spectrum Disorders. B. J. Ferguson*[1], J. R. Day[1], B. R. Wexler[1], J. M. Constance[2], P. S. Foster[3] and D. Q. Beversdorf[1], (1)*University of Missouri*, (2)*Truman State University*, (3)*Middle Tennessee State University*

Background: There appears to be a high prevalence of gastrointestinal (GI) problems 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). Additionally, an association exists between stress and GI disorders (e.g., Suarez et al., 2010). However, despite this knowledge, the relationship between stress indices and GI disturbances 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. 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. Galvanic skin response (GSR), a measurement of eccrine gland activity, was used as an indicator of sympathetic nervous system activation for a baseline condition as well as in response to auditory and vibrotactile stimulation as well as cold temperature.

Methods: Children and adolescents with an ASD diagnosis with a comorbid GI disorder or significant GI symptomatology, as assessed by the Autism Treatment Network Gastrointestinal

Questionnaire, and those with ASD without a GI diagnosis or significant GI symptomatology had GSR data recorded from the distal phalanxes of their index and middle fingers for a baseline condition as well as independent conditions of auditory, vibrotactile, and cold temperature stimulation.

Results: Mean GSR was significantly higher for the ASD GI group for the cold pressor task, and maximum amplitude GSR was significantly higher for the ASD GI group for the cold pressor task. Trends toward significance were noted for the baseline and vibrotactile conditions.

Conclusions: Preliminary results from our pilot study suggest that physiological response to sensory stimuli in the domain of cold temperature stimulation may differ in those with ASD with a GI disorder or significant GI symptomatology relative to those with ASD alone. 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.

128.188 188 Association Between Gastrointestinal Disorder and Cardiovascular Responses to Stress In Autism Spectrum Disorders. P. M. Hecht*[1], B. J. Ferguson[1], J. R. Day[1], B. R. Wexler[1], J. M. Constance[2], P. S. Foster[3] and D. Q. Beversdorf[1], (1)*University of Missouri*, (2)*Truman State University*, (3)*Middle Tennessee State University*

Background: Gastrointestinal (GI) problems appear to be prevalent in children suffering from Autism Spectrum Disorders (ASD) (e.g., Williams et al., 2010), and evidence suggests that ASD patients have a heightened response to stress (Corbett et al., 2008). Moreover, an association exists between stress and GI disorders (Suarez et al., 2010). However, despite this knowledge, the relationship between stress indices and GI disturbances has not been fully explored in ASD.

Objectives: As a marker for stress, we examined the relationship between cardiovascular reactivity in children with ASD both with and without gastrointestinal disorders or significant GI symptomatology. We hypothesized that the cardiovascular reactivity in children and adolescents with ASD with a GI disorder or significant GI symptomatology would be higher than those with ASD alone. Heart rate and blood pressure were used as indicators of sympathetic nervous system activation in response to auditory and vibrotactile stimulation as well as cold temperature.

Methods: GI symptomatology was assessed and quantified using the Autism Treatment Network Registry GI Symptoms Inventory. Children and adolescents with an ASD diagnosis with a comorbid GI disorder or significant GI symptomatology and those with ASD without a GI diagnosis or significant GI symptomatology had their heart rate and blood pressure taken immediately after a baseline condition as well as during conditions of auditory, vibrotactile, and cold temperature stimulation.

Results: Preliminary results indicated that heart rate and blood pressure were significantly higher for the ASD group with GI disturbances for the cold pressor condition when compared to children with ASD alone.

Conclusions: Preliminary results from our pilot study suggest that cardiovascular reactivity to sensory stimulation in the domain of cold temperature may differ in those with ASD with a GI disorder or significant GI symptomatology relative to those with ASD alone. 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.

128.189 189 The Relationship Between Sensory Processing, Physiological Stress, and Sleep Quality In Children with Autism Spectrum Disorder. S. E. Reynolds* and S. J. Lane, *Virginia Commonwealth University*

Background: Many children with ASD experience sleep disorders such as frequent night wakening, difficulty getting to sleep[1]. They also demonstrate physiological and behavioral responses to sensory stimulation that are different from typical children (TYP)[2]. Atypical sensory processing, specifically sensory sensitivity, has been suggested as a contributing factor to sleep problems in some children[3]. Both sleep and sensory processing have been linked to overall arousal and the stress hormone cortisol[4,5]. Here, we posited that hypersensitivity, high physiological arousal, and high nighttime salivary cortisol would predict sleep problems identified in children with and without ASD.

Objectives: 1) Elucidate the relationship(s) between responses to sensory stimuli and problem sleep behaviors in children with ASD; 2)identify which behavioral, neuroendocrine, and physiological variables best predict good sleepers and poor sleepers.

Methods: Participants were fifty five children, 6-12 years of age (ASD=27, TYP=28). All children were screened for normal intelligence using the Leiter-R non-verbal scale of intelligence. ASD diagnosis was made by using the ADOS or ADI-R and confirmed through proof of documentation. A cross sectional

repeated measures design was used. Statistical analysis included bivariate correlations, multiple analysis of variance (MANCOVA) models, and logistic regression.

The Sensory Challenge Protocol (SCP)[6], a series of eight sensory stimuli in six sensory domains presented in a laboratory setting while physiological data is collected, was administered. Tonic arousal was measured using baseline electrodermal activity (EDA) and baseline/diurnal salivary cortisol. Electrodermal response magnitude (EDR) and post-challenge salivary cortisol reflected response to SCP. Sensory Profile (SP) quadrant scores (Sensory Sensitivity/SS, Sensory Avoiding/SA, Sensation Seeking/SSk, Low Registration/LR) reflected sensory processing abilities. A sleep index was calculated from questions related to sleep behaviors (*nightmares, overtired, sleeps less than most kids, sleeps more than most kids, talks or walks in sleep,* and *trouble sleeping*) on the Child Behavior Checklist.

Results: Children with ASD had a higher prevalence of atypical sensory responses and sleep disturbances. SA correlated most strongly with sleep problems in children with ASD; SS and SSk behaviors correlated most strongly with sleep difficulties in TYP children. Looking across groups, poor sleepers demonstrated higher afternoon salivary cortisol, greater EDR magnitude, and higher cortisol post-sensory challenge. Cortisol, EDR, and SP measures predicted good sleepers from poor sleepers with 85.7% accuracy.

Conclusions: Sleep constitutes an area of concern for ASD. This research documents specific sensory processing behaviors linked to sleep disturbances in ASD and TYP, and characterizes poor sleep physiologically. Further examination of a sleep/sensory processing link may inform both intervention and future studies.

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128.190 190 Psychological Correlates of Sleep Problems In Children with High-Functioning Autism Spectrum Disorder and Typically Developing Children.

A. L. Richdale*[1] and C. L. Michaels[2], (1)*La Trobe University*, (2)*RMIT University*

Background: Sleep problems are common in children with neurodevelopmental disorders such as autism. It is believed that multiple biological, psychological, and environmental factors may be associated with an increased risk for sleep disturbance in children with autism spectrum disorder (ASD). Children with ASD also have a wide range of co-morbid psychiatric disorders, including ADHD, anxiety, and depression and these may be associated with sleep problems; however these relationships have not been well explored.

Objectives: The present study examined the psychological correlates (ADHD, anxiety, and depression) of sleep problems in children with high functioning ASD (HFASD) as compared to typically developing (TD) children, using both the children and their caregivers as informants.

Methods: Thirty-three children aged 8-12 years (HFASD, 18; TD, 15) and their primary caregivers completed questionnaires that investigated the child's sleep and psychological wellbeing. Caregivers completed demographics, including questions about the presence of common sleep problems; the Family Inventory of Sleep Habits (FISH); the Children's Sleep Habits Questionnaire (CSHQ); and the Child Behavior Checklist (CBCL). Children completed the Sleep Self Report Questionnaire (SSRQ), the Screen for Childhood Anxiety Related Emotional Disorders (SCARED) and the Children's Depression Inventory-short form (CDI)

Results: TD children slept significantly longer than the HFASD children. Caregiver reports of child sleep problems and psychopathology were significantly higher in children with HFASD, compared to TD controls, but the groups did not differ on the FISH. On child report the HFASD group had significantly higher SSRQ scores but the two groups did not differ on self-reported anxiety or depression. Sleep problems were associated with some measures of psychopathology on both parent and child report measures. Significant relationships were observed between specific types of sleeping difficulties and different dimensions of psychopathology for both groups of children. In particular SCARED total score and some SCARED subscales were associated with both CSHQ and SSRQ scores in both groups. The CDI was associated with the SSRQ for the TD children while the CBCL-Affective score was associated with the SSRQ for the HFASD group. There were some associations between CHSQ subscales and CBCL-ADHD score

for the TD but not the HFASD group. While medication was not associated with the presence of sleep problems or psychopathology, when the 8 children who were on medication in the HFASD group were removed the pattern of sleep and psychopathology measures changed for the remaining 10 children

Conclusions: Using both caregiver and child self-report, this study illustrates that significant, yet complex relationships exist between sleep disturbance and psychological wellbeing in children with and without HFASD. However, further research is required in order to gain a greater insight into the aetiology of sleep problems in HFASD, and the degree to which child development, daytime behaviour, and psychopathology is impacted. Clinical intervention research is also recommended in order to ascertain the effect that pharmacological and behavioural sleep interventions may have on children's co-morbid psychopathology. It is possible that interventions designed to reduce children's problematic sleep may result in overall improvements in their mood, anxiety, and ADHD symptomatology.

128.191 191 How Often Do Physicians at a Multidisciplinary Autism Center Address Sleep Problems In Children with Autism Spectrum Disorders?. J. A. Accardo*[1], B. H. Freedman[1], L. Kalb[1], R. G. Vaurio[1], S. E. Goldman[2] and B. A. Malow[2], (1)*Kennedy Krieger Institute*, (2)*Vanderbilt Medical Center*

Background:

Sleep problems are highly prevalent among children with Autism Spectrum Disorders (ASDs), particularly difficulty initiating and maintaining sleep. This can lead to disrupted sleep for families as well. Pediatric sleep problems are often overlooked by primary care providers, but it is unknown how they are addressed in children with ASDs.

Objectives:

To quantify how often children with an ASD and parentally-identified sleep problems had their sleep related concerns addressed by their medical provider.

To test for differences between children whose sleep problems were addressed versus not addressed. It was hypothesized that children with observed apnea would be more likely to be referred for evaluations by sleep specialists and that those with difficulty initiating and maintaining sleep would not consistently receive guidance about sleep problems.

Methods:

This retrospective cross-sectional cohort consisted of 122 subjects with ASDs from a single center, ages 2-17.5 years, 85% male and 79% white, seen for initial medical evaluation. Parents were assessed using the Children's Sleep Habits Questionnaire (CSHQ), which queries parentally-reported symptoms of common pediatric sleep disorders. Problem sleep was defined by a parent questionnaire item that asked the extent to which sleep disturbance has been a problem within the past month, with choices of "no problem", mild, moderate, or severe used to dichotomize children into good or poor sleepers (good sleepers had no or mild sleep problems). Whether discussion occurred was based on clinician response to an item documenting whether sleep problems had been discussed. Whether referral to subspecialty clinic occurred was based on clinician response to an item documenting a sleep-related referral. Logistic regression models were performed to examine the association between sleep symptoms (sleep disordered breathing and insomnia) and discussion/referral of sleep problems.

Results:

Twenty-six (21%) of subjects were categorized as problem sleepers. Twelve (46%) of these problem sleepers had discussion (8), referral (3), or both (1). CSHQ Sleep Disordered Breathing Subscale score was not associated with increased problem sleep (p=0.1), but was associated with increased odds ratio (OR) for discussion or subspecialty referral (OR=1.7, confidence interval [CI]=1.1-2.8, P=0.03). Sleeping too little and waking during the night were associated with problem sleep (P<0.001), and also with increased OR for discussion and referral (sleeping too little: OR=3.5, CI=1.6-7.6, P=0.001; waking: OR=2.2, CI=1.1-4.4, P=0.03). Sleeping in a parent's bed or taking more than 20 minutes to fall asleep were not associated with problem sleep being discussed or referred.

Conclusions:

Sleep issues in children with autism may not be consistently addressed, even by experienced autism clinicians. In larger multicenter studies, factors which affect whether children with ASDs have their sleep problems addressed should be further explored.

128.192 192 Sleep Patterns In Adolescents with High-Functioning Autism Spectrum Disorder and Typically Developing Adolescents. E. Baker*[1], A. L. Richdale[1], M. Short[2] and M. Gradisar[2], (1)*La Trobe University*, (2)*Flinders University*

Background: While sleep problems are commonly reported in typically developing (TD) children the prevalence in children

with a developmental disability such as high functioning autistic spectrum disorder (HFASD) is at least twice the rate. Both subjective and objective measures of sleep have indicated that sleep initiation and sleep maintenance are problematic for these individuals. Literature on the sleep patterns of TD adolescents consistently shows that significant physiological, psychological, and social changes in the sleep pattern occur at the onset of puberty. However, no research to date has focussed exclusively on the sleep patterns of adolescents with HFASD and the impact sleep problems may have on their daytime functioning.

Objectives: This study investigates and describes the sleep patterns of adolescents with HFASD; examines the prevalence of insomnia as defined by the International Classification of Sleep Disorders (2nd ed.) (ICSD-2) in HFASD as compared with TD adolescents; and examines the impact of poor sleep on daytime functioning in both groups of adolescents.

Methods: 27 adolescents aged 13-17 years with a diagnosis of HFASD have been recruited and returned data; data entry is ongoing. TD adolescents' data from a similar, larger sleep study conducted at Flinders University, South Australia have been matched on age and sex with HFASD participants. Currently data have been analysed for 19 adolescents aged 13 to 17 years diagnosed with HFASD and 19 matched TD adolescents. The adolescents completed questionnaires about sleep, puberty stage and daytime fatigue and a 7-day sleep/wake dairy; Actigraphy data were also collected for 16 participants over the 7-day diary period.

Results: Preliminary analyses indicate that adolescents with HFASD have significantly shorter total sleep time (TST) and decreased sleep efficiency compared to TD adolescents. Both groups of adolescents showed a delayed sleep-phase, reporting later bedtimes and wake times on weekends in comparison to schooldays; however, this appears more pronounced in TD adolescents. Additionally sleep phase was related to puberty stage in the TD adolescents but this relationship was not found for HFASD adolescents. Although insomnia similarly occurred in both groups, adolescents with HFASD were more likely to experience two or all three complaints of ICSD-2-defined insomnia whereas TD adolescents only experienced one insomnia complaint. A significant negative correlation between daytime fatigue and sleep efficiency was shown across both groups of adolescents. Data on all 27 participants with HFASD will be available at the time of presentation.

Conclusions: This is the first study to describe the sleep problems self-reported by high-functioning adolescents with HFASD. Preliminary analyses indicate several key findings, which suggest that adolescents with HFASD show the same sleep atypicalities as reported for children with an ASD that is reduced total sleep, poorer sleep efficiency and significant symptoms of insomnia. In addition sleep phase appears to be not clearly associated with puberty in HFASD adolescents. Our results indicate that sleep continues to be problematic in ASD during adolescence, and adds further weight to the need to understand the aetiology of these prevalent sleep problems and to develop effective prevention and treatment programs.

128.193 193 A Good Night Sleep: An Examination of the Relationship Between Sleep and Neuropsychological Profiles In School-Aged Children with Autism Spectrum Disorders. J. L. Sokoloff*[1], L. Kenworthy[1], G. L. Wallace[2], C. Caldwell[3], J. F. Strang[1] and B. Yerys[1], (1)*Children's National Medical Center*, (2)*NIMH*, (3)*Walter Reed*

Background: Children with autism spectrum disorders (ASD) exhibit increased sleep disturbances as compared to their typically developing peers. Literature suggests that disturbances in sleep are likely multifactorial and associated with developmental, genetic, environmental, and/or neuroanatomic and physiologic dysfunction. Previous ASD studies have primarily focused on associations between sleep disturbance and daytime behaviors. However, research examining the relationship between sleep profiles in high-functioning children with ASD and everyday neuropsychological functioning is currently limited.

Objectives: The present study seeks to expand on research of sleep profiles in ASD by investigating the relationship between sleep behaviors and executive, adaptive and emotional functioning in everyday settings in an exclusively high-functioning, pre-adolescent sample with ASD. We predicted that sleep disturbance would be more severe in the ASD group, and that they would relate to problems with the aforementioned areas of functioning.

Methods: 73 school-aged children (TD, N=20, FSIQ=117; ASD, N=53, FSIQ=107), matched on age (6.73-12.98yrs), sex-ratio and SES, were recruited for research studies conducted at Children's National Medical Center. Children in the ASD group were diagnosed using DSM-IV criteria, ADI and ADOS and had no significant medical history of mood disorders and seizures. Participants completed an extensive diagnostic battery and parents reported on sleep behavior, executive, adaptive and emotional functioning. Administered parent reports included:

Children's Sleep Habits Questionnaire (CSHQ; comprehensive sleep behavior questionnaire); Behavior Rating Inventory of Executive Function (BRIEF; measure of everyday executive function [EF]); Child Behavior Checklist (CBCL; scale of childhood behaviors and emotions); Vineland Adaptive Behavior Scales -1st and 2nd Editions (VABS; comprehensive measure of adaptive functioning skills); and DSM-IV ADHD Parent Rating Scale.

Results: Analyses revealed significant group differences on CSHQ dimensions of Sleep Anxiety (TD=4.38;ASD=5.37), Excessive Daytime Sleepiness (EDS) (TD=8.66;ASD=12.64) and Total Sleep Disturbances (TD=28.73;ASD=35.63). Relative to the TD group, the ASD group reportedly had more sleep disturbance within these domains (p-values range from .001-.025). Correlation analyses within the ASD group revealed significant positive relationships between increased sleep anxiety and behavioral symptoms including Anxiety and Depression (r(53)=.52, p=.001), Somatic Complaints (r(53)=.34, p=.01) and Attention Problems (r(53)=.36, p=.01). EDS was correlated with behavioral symptoms including Withdrawn and Depressed (r(53)=.40, p=.003), Somatic Complaints (r(53)=.31, p=.03), and Attention Problems (r(53)=.38, p=.01); increased ADHD Inattention Symptoms (r(52)=.33, p=.02); Metacognitive EF deficits (r(53)=.45, p=.001); and impaired Socialization Skills (r(52)=-.35, p=.01).

Conclusions: Preliminary results from this ongoing study outline a possible sleep profile characterized by increased sleep anxiety, EDS and overall greater sleep disturbances in high-functioning children with ASD as compared to TD peers. Our findings within ASD, suggest a positive association between sleep disturbance and behavioral symptoms (e.g., anxiety, depression, inattention & somatic complaints) associated with common co-morbid disorders. Furthermore, EDS was related to deficits in executive functioning (e.g. working memory, planning & organization) and adaptive behavior (e.g., socialization skills). These findings indicate a need to further examine sleep profiles as a factor in the clinical presentation of core adaptive and executive impairments in ASD. Additionally, results provide support for sleep intervention and its potential impact on neuropsychological functioning in children with ASD.

128.194 194 Comparison of Caregiver Perception of Sleep Behaviors of Infants at High and Low Risk for Autism Spectrum Disorders. M. C. Souders*[1], N. M. Kurtz[2], S. Paterson[3] and I. B. I. S. Network[4], (1)*University of Pennsylvania/The Children's Hospital of Philadelphia*, (2), (3)*Children's Hospital of Philadelphia*, (4)*University of North Carolina at Chapel Hill*

Background: Autism Spectrum Disorder (ASD) represents one of the most devastating neurobiological disorders of pre and postnatal brain development, with a prevalence of 1 in 110 children. The recurrence rate in families with one child with ASD is estimated at 10-20%. One of the most common medical conditions in children with ASD is chronic severe insomnia, with a prevalence of 60-80%. This is a 2-3 fold increase over typically developing children. Inadequate sleep has been shown to have detrimental effects on cognition, behavior, mood and quality of life. Moreover, disruptive sleep in children has been shown to severely alter parents' sleep quality and they report great stress and decreased family functioning. Disturbed sleep emerges early in very young children and when left untreated can often become a chronic medical condition Very little is known about the natural history of sleep in young children with ASD.

Objectives: The purpose of this longitudinal study is to describe the caregiver perceptions of night sleep behaviors of infants at high and low risk for ASD at 6, 12 and 24 months. The secondary aim is to describe the relationship between sleep behaviors and cognitive, social and adaptive behaviors of infants at high and low risk for ASD.

Methods: The Infant Brain Imaging Study (IBIS) Network is an NIH funded Autism Center of Excellence and consists of a consortium of 7 universities in the U.S. and Canada. The study involves the national recruitment of infants at high-risk for autism (having an older sibling diagnosed with ASD and a control group of typically-developing infants. Measures include a battery of behavioral and developmental tests and structural brain imaging. To date data has been collected on 40 infants at high risk for ASD and 20 infants at low risk for ASD at the Center for Autism Research, The Children's Hospital of Philadelphia (CHOP). Infant Behavior Questionnaire – Revised (IBQ-R) was completed by the primary caregiver at each visit. Five questions addressed night time sleep behaviors, likert scale 1-7, 1 being " never "and 7 being "always".

Results: No statistical differences between the mean scores of caregiver perception of sleep behaviors in the low risk and high risk infants at 6 months, (p=0. 51) or 12 months (p=0. 146) of age. Using a cutoff of mean score of 3.5, 56% of the high risk infants (n=40) at 6 months had sleep problems compared to 50% of the low risk infants (n=20). At 12 months of age, 41% of the high risk infants (n=40) and 10% of the low risk infants (n=10) had sleep problems. Effect size was found to be 0.58 demonstrating that we are under powered at this point in the study to find a significant difference.

Conclusions: The Brief Infant Sleep Questionnaire was added to the battery of measures at CHOP. Caregiver perceptions of sleep behaviors in infants at 6, 12, and 24 months of age at high and low risk for ASD could provide insights into the sleep behaviors and the development of sleep problems in ASD.

128.195 195 Sleep Architecture and Phenotype In Children with Autism. A. Lambert*[1], S. Tessier[1], A. C. Rochette[2], E. Chevrier[2], P. B. Scherzer[1], L. Mottron[3] and R. Godbout[4], (1)*Université du Québec à Montréal*, (2)*Hôpital Rivière-des-Prairies*, (3)*Université de Montréal*, (4)*Universite de Montreal*

Background: Disrupted sleep in children is associated to behavioral problems during daytime. Children with autism present with high prevalence of sleep disorders as reported by parents, including long sleep latency and nocturnal awakenings. Laboratory polysomnographic recordings support these observations. Poor sleep in children with autism may thus be associated with disturbances in daytime functioning and modulate core symptoms of autism.

Objectives: 1- To compare sleep characteristics of children with autism, as measured with questionnaires filled by parents and laboratory polysomnography; 2- To evaluate the relationship between sleep characteristics in children with autism and core symptoms of autism.

Methods: Thirteen boys diagnosed with autism according to DSM-IV criteria (ASD: 10.7 ± 1.9 years) and 21 typically-developing boys (10.7 ±1.7) spent 2 consecutive nights in a sleep laboratory. All had a normal IQ and were free of psychiatric or neurologic conditions. None reported difficulties with sleep. Sleep was evaluated in two ways: 1) The Children's Sleep Habits Questionnaire (CSHQ), filled by parents; 2) Polysomnographic recordings. The ADI-R (current scores) measured daytime functioning. Groups were compared using t-tests for independent samples. Pearson's correlation coefficients evaluated the association between sleep and daytime functioning.

Results: The CSHQ showed that ASD children have more problems than TD children with sleep onset delay and sleep duration. Compared to the TD group, polysomnographic recordings of ASD children showed a longer sleep latency (30.4 ± 7.2 min, vs. 13.5 ± 4.6; p=0,006), more awakenings (15.54 ± 2.47 min, vs. 13.97 ± 2.31; p=0.055), less slow-wave sleep (18.4 ± 0.8 %, vs. 24.0 ± 1.3 %; p=0.002), but the same amount of REM sleep (18,9 ± 0,9 %, vs. 17,0 ± 1,0; p=0,186). The density of EEG sleep spindles per hour of stage 2 was the same over the central electrodes (294.4 ± 32.0, vs. 288.4 ± 26.7; p= p=0.70) but inferior over the frontal electrodes (147.1 ± 19.6 vs. 213.0 ± 26.9; p= p=0.08). In the ASD group, CSHQ sleep latency showed a positive correlation with ADI-R on the communication (r=0.72; p=0.008) and the repetitive behavior scale (r=0.665; p= 0.018) sum scores; CSHQ daytime sleepiness showed a positive correlation with the ADI-R socialization sum score (r= 0.590; p=0.043); PSG sleep efficiency showed a negative correlation with the ADI-R on the communication sum score (r= -0.742, p=0.006).

Conclusions: Objective and subjective measures show signs and symptoms of alterated sleep in children with autism. Sleep atypicalities in children with autism is associated with prototypicality of the autism phenotype: the more the sleep is modified in comparison to typical individuals, the higher are the scores indexing the atypicality of the autism phenotype.

128.196 196 EEG Markers of Alterated Sleep In Adults with Autism: Stage 2 K-Complexes. S. M. Duplan*[1], J. Dufresne Bastien[1], E. Chevrier[1], L. Mottron[1] and R. Godbout[2], (1)*Hôpital Rivière-des-Prairies*, (2)*Universite de Montreal*

Background: Objective measures of sleep in adults with Autism Spectrum Disorders (ASD) show signs of alterated sleep, including a delayed sleep onset and increased time after sleep onset. K-complexes are sleep EEG phasic events mainly prevalent during stage 2 and generated by cortico-cortical loops. K-complexes are thought to reflect brain mechanisms involved in sleep protection by inhibiting access of incoming messages to the cortex. K-complexes can be used as EEG markers to quantify sleep maintenance capacity.

Objectives: To evaluate the sleep maintenance capacity of autistic adults through the quantification and scalp distribution of K-complexes, using a full EEG montage.

Methods: Sixteen autistic adults (ASD: 14 M, 2 F; 22.1 ± 1.3 years) and normal IQ and a comparison group of 18 typically developed participants (TD: 17 M, 1 F; 21.1 ± 1.0 years) were recorded for two consecutive nights in a sleep laboratory. Sleep stage 2 K-complexes were visually identified and quantified for 14 recording electrodes (Fp1, Fp2, F3, F4, F7, F8, C3, C4, P3, P4, P7, P8, O1, O2) according to the following criteria: a negative-going biphasic wave 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), sigma (11.5-14.5 Hz) and beta (13.0-30.0 Hz) frequency bands.

Results: The ASD group generated less K-complexes per hour of stage 2 over all recording sites compared to the TD group but a significant difference was reached only over parietal cortex bilaterally (P3 electrode: ASD = 49.6±6.5 vs. TD = 75.9±10.2, p<.05; P4 electrode: ASD = 44.8±6.0 vs. TD = 78.8±9.8, p<.01). The analysis of ASD sub-groups suggested that high functioning autism (HFA: n = 9) contributed more than Asperger Syndrome (n = 7) to this effect. Preliminary analysis of EEG spectral power showed a significant increase in relative delta activity after vs. before K-complexes in TD participants.

Conclusions: **:** 1) The decrease density of K-complexes in ASD suggest that neural substrates of sleep stage 2 K-complexes, particularly cortico-cortical loops, are atypical in adults with ASD. 2) Impairment of this cortical sleep protective mechanism may be responsible for fragmented sleep in ASD. 3) The analysis of EEG activity in the TD group shows that K-complexes are indeed followed by cortical hyperpolarization, a sleep protective mechanism that will be assessed in further analyses in the ASD group.

128.197 197 Cardiac Activity Before and After Nocturnal Sleep In Adults with Autism. M. Pelletier*[1], B. D'Antono[2], T. Chevrette[1], L. Mottron[3] and R. Godbout[4], (1)*Fernand-Seguin Research Center*, (2)*Montreal Health Institute*, (3)*Hôpital Rivière-des-Prairies*, (4)*Universite de Montreal*

Background: Poor sleep is a frequent finding in autism and it has been shown to interfere with daytime functioning, using either behavioral (Limoges et al., 2005) or EEG measures (Daoust et al. 2004). Literature in typically developing individuals (TD) shows that sleep also influences the regulation of the autonomic nervous system so that the sympathovagal tone is normally higher in the morning compared to evening values. Studies of electrocardiographic (ECG) recordings suggest that there might be disequilibrium between sympathetic and parasympathetic activity in autism (Ming et al., 2005) but it is not known whether this observation is related to sleep or not.

Objectives: Analyze ECG recordings at bedtime and rise time to evaluate the sympathovagal tone before and after nocturnal sleep in autistic and TD individuals. We expected to see in TD as well as in autistic groups an increased sympathetic and an increased parasympathetic tone in morning values relative to evening values. We also expected to find a higher sympathetic tone in autistic participants compared to the TD group both in the evening and the morning recordings.

Methods: Fifteen men with ASD (seven with high functioning autism, HFA: 21.1 ± 4.0 years; eight with Asperger Syndrome, ASP: 23.9 ± 2.1 years) and 18 typically developing individuals (TD: 21.0 ± 4.2 years) were evaluated over two consecutive nights in a sleep laboratory. All participants were free from medication and all had a normal IQ. Sleep was monitored with standard EEG-EOG-EMG measures and ECG was recorded from evening to morning using bipolar sub-clavicular electrodes. ECG samples were taken for 5 minutes at bedtime and just before final rise time in the morning. Spectral analysis of the ECG signal was performed using a commercial software and the following four variables were extracted: total spectral power, low frequency power (LF: sympathetic tone), absolute values of high frequency spectral power (HF: parasympathetic tone), normalized values of high frequency spectral power (HFnu). Groups were compared with Student's t-tests.

Results: Significant differences between evening and morning values were found only in the TD group, with lower evening values for total spectral power (p=0.008), LF (p=0.007) and HF (p=0.040) were all lower in the evening compared to morning. In the morning, significantly lower HF (p=0.043) and HFnu (p=0.027) values were found in ASD vs. TD groups. When the HFA and ASP subgroups were separately compared to the TD group, the latter showed significantly higher HFnu values in the evening compared to ASP (p=0.043) and HFA (p=0.038). In the morning, results showed that HF values were significantly lower in HFA (p=0.033) compared to TD group and HFnu values were significantly lower in ASP (p=0.034) than TD group.

Conclusions: These results suggest that the effect of nocturnal sleep differs in TD and ASD individuals and that the parasympathetic tone may be lower in ASD. Further analyses will focus on ECG activity during sleep, for each of the sleep stages.

Keynote Address Program

129 Using Induced Pluripotent Stem Cells to Study Autism

Speaker: R. E. Dolmetsch *Stanford University*

Autism Spectrum Disorders (ASDs) are a complex group of neurodevelopmental diseases many of which have a genetic basis. While we are starting to identify some of the mutations that confer susceptibility to ASDs, we known little about how these mutations alter the development and function of the human brain. The ability to generate induced pluripotent stem (iPS) cells from the skin of patients with ASDs, combined with our ability to differentiation of these cells into cortical neurons, allows us to establish cellular models of ASDs in the lab. We have generated iPS cells from the skin of patients with

syndromic forms of autism and have differentiated these cells into neurons. We have identified cellular phenotypes in neurons from some of these patients that provide novel insights into the underlying cellular basis of autism. I will describe our results and discuss some of the challenges of using iPS cells to study ASDs. This strategy is allowing us to study the development of patient-derived neurons for the first time and is helping us identify therapeutic targets for the development of new pharmaceuticals to treat ASDs and other neurodevelopmental disorders.

129.001 Using Induced Pluripotent Stem Cells to Study Autism. R. E. Dolmetsch*, *Stanford University*

Autism Spectrum Disorders (ASDs) are a complex group of neurodevelopmental diseases many of which have a genetic basis. While we are starting to identify some of the mutations that confer susceptibility to ASDs, we known little about how these mutations alter the development and function of the human brain. The ability to generate induced pluripotent stem (iPS) cells from the skin of patients with ASDs, combined with our ability to differentiation of these cells into cortical neurons, allows us to establish cellular models of ASDs in the lab. We have generated iPS cells from the skin of patients with syndromic forms of autism and have differentiated these cells into neurons. We have identified cellular phenotypes in neurons from some of these patients that provide novel insights into the underlying cellular basis of autism. I will describe our results and discuss some of the challenges of using iPS cells to study ASDs. This strategy is allowing us to study the development of patient-derived neurons for the first time and is helping us identify therapeutic targets for the development of new pharmaceuticals to treat ASDs and other neurodevelopmental disorders.

Invited Educational Symposium Program
130 Bridging the Gaps In Knowledge of Social Interventions for HFASD: Where We Are Now and Where We Need to Go
Moderator: N. Bauminger *Bar Ilan university*

Social impairment has been identified as the most enduring core deficit facing children with autism. Several have identified developing interventions to address this impairment as a very high priority. At issue is whether our current models are effective enough to give benefit to children in their natural environments of school and community. In this session, we highlight social interventions that address a number of pressing issues for children with ASD, including feeling connected to others at school, of developing friendships, and of reducing their social anxiety enough to engage with others. Models will be described that use different delivery models from parent to peer to therapist mediated, and from focused and targeted treatments to ecologically and multi pronged approaches. Individual differences are considered, including age and functioning. Finally we suggest ways forward in considering how to enhance treatment efficacy for affected individuals.

130.001 Does Anxiety Reduction Through Treatment Lead to Better Social Functioning In Youth with. J. J. Wood*, *University of California, Los Angeles*

Clinical anxiety is a commonly experienced challenge for youth with ASD that appears to exacerbate social maladjustment and related autism symptoms. Cognitive-behavioral (CBT) approaches have been of increasing interest for use with individuals on the autism spectrum, in part due to the success of such programs for ameliorating clinical anxiety in typically developing youth. CBT programs have recently been modified for use with youth on the autism spectrum, 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 yield improvements in social functioning in youth will be discussed. Important areas for further treatment refinement and evaluation will also be reviewed.

130.002 Parent Mediated Approaches In Social Intervention for Adolescents and Young Adults with HFASD. E. A. Laugeson*, *UCLA Semel Institute for Neuroscience & Human Behavior*

Impairment in social functioning is a hallmark feature among adolescents and young adults with HFASD, contributing to poor adjustment across multiple domains. Parent-mediated approaches are quickly gaining evidence-base to support the use of caregiver involvement in social skills treatment. An overview of evidence-based parent-mediated treatments to improve social functioning for adolescents and young adults with ASD will be summarized. Current methodological approaches will be reviewed to include existing benefits and limitations, while research gaps and targets for future investigation will be highlighted.

130.003 Individual Differences In School Based CBT Approaches—Focus On Emotion Cognitions and Social Interaction: Study Synthesis and Future Directions. N. Bauminger*, *Bar Ilan university*

School is the setting in which individuals with HFASD are facing most of their social challenges in development: they have to interact efficiently with their peers as well as understand their peers' social and emotional behavior. As such, school-based social interventions are considered advantageous for the enhancement of social functioning in these children. However, using an ecological/multifaceted school based intervention that will be implemented by the teacher, and will include the child's peers and parents, can be challenging to implement. In this presentation, evidenced-based, multifaceted CBT-approaches for social intervention implemented at school, using teachers as intervention leaders and combining both peer and parent mediation, will be presented with an emphasis on individual differences in social curriculum and intervention modalities (such as dyadic versus group treatment). Current methodological issues will be considered as well future research directions.

130.004 Peer Mediated Approaches: Evidence and New Trends. C. Kasari*, *University of California, Los Angeles*

Using peers as models for children with ASD is the most widespread approach used in schools. Research on peer mediated models have shown good outcomes and generalization for preschool children, but have not been rigorously tested among school-aged children. Other approaches rely on child- assisted methods, focusing on an individualized one-on-one approach that is adult mediated. Both child assisted and peer mediated approaches in schools will be reviewed, and our current evidence evaluated. Research gaps and new research trends will be discussed.

Epidemiology Program
131 Epidemiology, Biological Risk Factors
Moderator: L. A. Croen *Kaiser Permanente, Division of Research*

131.001 Prenatal Influenza or Fever and Risk of Autism/Autism Spectrum Disorders. O. Zerbo*[1], I. Hertz-Picciotto[2], A. M. Iosif[3], R. L. Hansen[4] and C. K. Walker[4], (1), (2)*University of California, Davis*, (3)*UC Davis*, (4)*University of California at Davis*

Background:

Maternal infections during pregnancy have been suggested to be associated with autism. However, to what extent prenatal influenza plays a role has not been well-investigated in epidemiological studies.

Objectives:

To determine if maternal influenza infection or fever during pregnancy is associated with increased risk of autism/autism spectrum disorders.

Methods:

The analysis is part of a large population-based case control study known as the Childhood Autism Risk from Genetics and Environment (CHARGE) Study. 462 children with autism/autism spectrum disorders, 136 with developmental disorders but not autism, and 265 typically developed children born in California age between 2 and 5 years at the time of recruitment were included. Diagnostic category for all participants was determined by standardized clinical assessments. The two main exposures, maternal influenza and fever during pregnancy, were both assessed by telephone interviews. We conducted two types of analyses. One set of analysis was performed applying sampling weights and another without. The weights were determined based on the probabilities of participating in the study taking into account both the three case group sampling strata and a set of socio-demographic variables. Multivariate logistic regression models were fitted to the data to obtain odds ratios (ORs) with their 95% confidence intervals (CI) as measures of association and precision between the main exposures and autism.

Results:

We did not find a strong association between maternal influenza during pregnancy and autism (OR 1.52, 95% CI 0.81 – 2.85) or developmental delay (2.32, 95% CI 0.72 - 7.42) after applying the sampling weights in the analysis. The unweighted analysis showed similar results.

More mothers of children with autism reported having fever during pregnancy than those of children with typical development in the analysis where the sampling weights were applied (OR = 1.86 95% CI 1.14 - 3.02). Second trimester showed the strongest association (OR=2.13 95% CI 1.00 - 4.52). However, in the analysis where we did not apply the sampling weights, the OR of the association between fever and autism did not reach statistical significance (1.25, 95% CI 0.81 – 1.92).

Conclusions:

In our analyses, maternal influenza showed no association with autism or developmental delay, but fever during pregnancy was associated with autism in our weighted analysis, which corrects

for selection bias to some degree. We consider these results to be preliminary and more analyses will be performed.

131.002 Autism Spectrum Disorders In Relation to Parental Occupational Exposures During Pregnancy. G. Windham*[1], J. K. Grether[1], A. Sumner[2], S. Li[3], E. Katz[4] and L. A. Croen[5], (1)*California Department of Public Health*, (2)*Vermont Department of Health*, (3)*Kaiser Permanente Divison of Research*, (4)*CA Department of Public Health*, (5)*Kaiser Permanente Division of Research*

Background: To attempt to understand and explain the continuing rise in the number of children reported with autism spectrum disorders (ASD), it is important to examine the role of exposures to environmental chemicals. However, reliably ascertaining exposure during the critical period of development, thought to be in utero, can be difficult because affected children are not identified until several years later. Chemical exposures that occur on the job have traditionally been at higher levels than in the general population; thus examining parental occupation as reported at birth of the child provides several advantages for studying exposure.

Objectives: To explore whether mothers of children with ASD are more likely to work in occupations with potential neuro- or repro-toxic exposures during pregnancy, in a population-based sample.

Methods: Subjects included 284 children with ASD who were identified through records-based systematic surveillance and 659 gender-matched controls, born in 1994 in the San Francisco Bay Area of California. Parental occupation and industry were abstracted from birth certificates and potential exposure to toxic chemicals was identified by a physician certified in Occupational Medicine and checked by an industrial hygienist. Up to three exposures to any of seven chemical groups were also coded for each parent (exhaust/combustion, solvents, pesticides, heavy metals, cooling fluids, disinfectants, and auto paint), as well as higher likelihood of electro-magnetic field (EMF) exposure. Limiting analyses to parents with a usual occupation and industry indicating employment outside of the home or school, odds ratios (AORs) were calculated by logistic regression, adjusting for maternal age, education, and child race.

Results: Among the 60% of mothers who were employed, 11.3% of case mothers worked in chemically-exposed occupations compared to 4.3% of controls (AOR 2.8; 95% CI 1.4-5.5). The exposure categories with the highest and statistically significant AORs were exhaust and disinfectants, but metals and solvents had slightly elevated AORs as well. Including these four in the same model did not substantially alter the AORs for each specific exposure category, except for metals, which was no longer elevated. EMF exposure was not related to ASD in these data and none of the mothers were exposed to cooling fluids or auto paint. Maternal occupation in the medical/dental field was highly related to ASD in offspring, but based on small numbers (AOR 11.3; 95% CI 1.3—99). Work in laboratories or as chemists was also three times more likely in mothers of cases than controls, but was not statistically significant. Fathers of cases were not more likely than those of controls to work in exposed occupations.

Conclusions: Although exposure assessment was rudimentary, use of birth certificates allows ascertainment of occupation before a child is diagnosed with ASD, which may affect subsequent maternal employment, and avoids issues of recall bias. These descriptive data suggest that maternal occupational exposure may be associated with increased risk of ASD and indicate areas for additional study. The findings will be discussed in relation to other literature on environmental exposures.

131.003 Traffic Exposure From Freeways as a Risk Factor for Autism. H. E. Volk*[1], I. Hertz-Picciotto[2], F. Lurmann[3] and R. McConnell[1], (1)*University of Southern California*, (2)*University of California, Davis*, (3)*Sonoma Technology, Inc.*

Background: The prevalence of autism spectrum disorders (ASDs) has increased over the last 10 years. The ASDs are heterogenous with many genetic and environmental factors likely contributing to their origins. Examination of regional pollutants has suggested the importance of air toxics in autism etiology, yet little research has examined local level air pollution exposure beyond measures of roadway proximity. Specifically, living near a freeway has been associated with increased autism risk.

Objectives: In this study we investigate the relationship between traffic related air pollution (TRP) exposure and autism.

Methods: This study analyzed data on 303 autism cases and 259 typically developing controls enrolled in the Childhood Autism Risks from Genetics and the Environment (CHARGE) Study. Autism diagnosis was confirmed based on evaluations conducted at the M.I.N.D. Institute using 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 and trimester specific addresses derived from a residential history questionnaire were geo-coded and TRP estimates assigned to each location using the CALINE4 line-source air-quality dispersion model. Logistic regression models were fit comparing estimated trimester- and birth-specific pollutant levels for cases with autism vs. typically developing controls. Analyses included adjustment for pertinent covariates including child's gender, maternal age, and other demographic and socio-economic related characteristics.

Results: Cases were more likely to live at residences with the highest TRP exposure during the first year of life, as compared to controls (OR 2.02, 95%CI 1.25-3.28). Exposure during the third trimester was associated with increased autism risk even after adjusting for exposure during other trimesters.

Conclusions: Exposure to traffic related air pollution during the third trimester of pregnancy and early life was associated with increased autism risk. Further examination of specific air pollution measures is needed to better understand this association.

131.004 Prenatal and Neonatal Peripheral Blood Mercury Levels and Autism Spectrum Disorders. L. A. Croen*[1], M. A. Lutsky[1], C. Yoshida[1], C. P. Alaimo[2], M. Kharrazi[3], J. K. Grether[3] and P. Green[2], (1)*Kaiser Permanente Division of Research*, (2)*Univ. of California Davis*, (3)*California Department of Public Health*

Background: Prenatal and early-life exposures to mercury via vaccination, diet, and other sources have been hypothesized to be associated with increased risk of autism spectrum disorders (ASD).

Objectives: We investigated the association between ASD and levels of total mercury measured in maternal serum from mid-pregnancy and infant dried bloodspots from the newborn period.

Methods: The study sample was drawn from the Early Markers for Autism (EMA) Study, a population-based case-control study designed to evaluate biomarkers for ASD. Cases were children with ASD (n=84), identified from the California Department of Developmental Services (DDS). General population controls (GP) (n=160) were randomly sampled from birth certificate files and frequency matched to cases by gender, birth month, and birth year. A second group of controls included children with mental retardation or developmental delay (DD) (n=49) identified from DDS. Maternal serum specimens and newborn bloodspots were retrieved from the California Department of Public Health prenatal and newborn screening specimen archives. Serum levels of total mercury were measured in ng/mL by the Agilent 7500 Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Logistic regression was used to estimate risk of ASD associated with log-transformed maternal serum and infant blood mercury levels.

Results: Maternal serum and infant blood mercury levels were significantly correlated among both cases and controls (R~0.4, P<0.05). In maternal serum, the geometric mean mercury levels were similar for ASD cases (0.46 ng/mL), GP controls (0.30 ng/mL) and DD controls (0.33 ng/mL) and case-control comparisons were unchanged after adjustment for maternal age, race/ethnicity, place of birth, gestational age, and mother's weight prior to blood draw (ASD vs. GP: Adj. Odds Ratio (AOR)= 0.99, 95% Confidence Interval (CI) 0.75, 1.29); ASD vs. DD: AOR=1.33, 95% CI 0.81, 2.20). Likewise, in newborn blood, no differences in geometric mean mercury levels were detected for ASD cases vs. GP controls (3.37 ng/mL vs. 2.61 ng/mL, p=0.33), and adjustment for maternal age, maternal race/ethnicity, place of birth, infant age at blood collection, gestational age at birth, and plate number did not alter results (AOR=1.11, 95% CI 0.89, 1.37). While newborn blood mercury levels were somewhat higher for ASD cases vs. DD controls (3.37 ng/mL vs. 2.16 ng/mL, p=0.049), this difference did not persist after adjustment for covariates (AOR = 1.26, 95% CI 0.80, 1.99).

Conclusions: Levels of total mercury in serum collected from mothers during mid-pregnancy and in blood collected from infants at birth were not associated with risk of ASD.

131.005 Cytokine Levels In Amniotic Fluid : a Marker of Maternal Immune Activation In Autism?. M. W. Abdallah*[1], N. Larsen[2], J. Grove[3], B. Nørgaard-Pedersen[2], E. L. Mortensen[4] and D. M. Hougaard[2], (1)*Institute of Public Health, Aarhus University*, (2)*Statens Serum Institut*, (3)*Faculty of Health Sciences, Aarhus University*, (4)*Institute of Public Health and Center for Healthy Aging, University of Copenhagen*

Background:

Converging evidence sheds the light on the important role of immunologic dysfunction in Autism Spectrum Disorders (ASD), and many studies have repeatedly reported abnormal cytokines profiles in ASD patients. To our knowledge, no investigations have been carried out using amniotic fluid samples combined with clinical data regarding maternal immune activation (MIA) during pregnancy.

Objectives:

To assess differences between children with ASD and controls in their amniotic fluid levels of seven MIA associated inflammatory cytokines (Interleukins 1ß, 6, 8 and 18, Interleukin 6 receptor alpha, Tumor Necrosis Factor alpha and Triggering receptor expressed on myeloid cells 1) and the potential role of MIA in the development of ASD.

Methods:

We adopted a case-control study design including all singleton offspring born in Denmark from January 1, 1982 through December 31, 2000 with a reported diagnosis of ASD (ICD-8 codes 299, ICD-10 codes F84) in the Danish Psychiatric Central Register and with a corresponding amniotic fluid sample in a historic birth cohort (HBC) kept and maintained at Statens Serum Institute (SSI) in Copenhagen . Controls were randomly selected from the HBC and frequency matched to cases by sex and year of birth. Perinatal data were retrieved from the Medical Birth Register and The Danish National Hospital Register (DNHR). Amniotic fluid samples from 414 singleton cases and 820 singleton controls were analyzed for seven cytokines using Luminex xMAP technology. Case-control differences in biomarker levels were assessed as continuous measures (Tobit censored regression model) or dichotomized at below the 10th percentile or above the 90th percentile cutpoints derived from control biomarker distributions (logistic regression). MIA was assessed through utilizing the DNHR for different intrauterine maternal infection/inflammation diagnoses.

Results:

There was a significantly increased risk for ASD overall with elevated TNFα [elevated 90th percentile OR=1.63 (95% CI 1.13 - 2.36)]. This pattern was mainly seen for TNFα in girls [2.85(1.28-6.35)]. TNFα was still significantly different in cases compared to controls when controlling for any intrauterine maternal infections diagnoses. We found no significant association between ASD and maternal intrauterine infections/inflammation retrieved from the DNHR in our study population.

Conclusions:

Children later diagnosed with ASD are more likely to have levels of TNFα falling in the upper centile of the distribution of this biomarker in children without ASD. This pattern of TNFα may reflect either a response to an adverse environmental stimulus, specifically MIA, which is possibly contributing to the development of ASD or an inherent dysregulation of this immune biomarker later diagnosed with ASD.

131.006 Prenatal and Neonatal Thyroid Stimulating Hormone Levels and Autism Spectrum Disorder. M. A. Lutsky*[1], C. Yoshida[1], B. Lasley[2], M. Kharrazi[3], J. K. Grether[3], G. Windham[3] and L. A. Croen[1], (1)*Kaiser Permanente Division of Research*, (2)*UC Davis*, (3)*California Department of Public Health*

Background: Thyroid hormones are critical for normal brain development. Intrauterine thyroid dysfunction has been linked to neurologic deficits and has been hypothesized to contribute to autism spectrum disorders (ASD).

Objectives: We investigated the association between ASD and levels of thyroid stimulating hormone (TSH) measured in maternal serum from mid-pregnancy and in infant dried bloodspots from the newborn period.

Methods: The study sample was drawn from the Early Markers for Autism (EMA) Study, a population-based case-control study designed to evaluate early biomarkers for ASD. Cases were children with ASD (n=84), identified from the California Department of Developmental Services. Controls (n=160) were randomly sampled from birth certificate files and frequency matched to cases by gender, birth month, and birth year. Maternal serum specimens from 15-19 weeks gestation were retrieved from the California Department of Public Health prenatal screening specimen archives. TSH was measured in maternal serum using immunoradiometric assay (IRMA). TSH levels were obtained from routine newborn screening by state regional labs, using solid-phase, time-resolved fluoroimmunoassay (AutoDELFIA). Multivariable logistic regression was used to estimate adjusted odds ratios (AORs) of ASD associated with a one $\log_{10}$- unit increase (1 µIU/ml) in maternal and infant TSH levels.

Results: Maternal and neonatal levels of TSH were marginally lower for children with ASD compared to controls [maternal AOR = 0.65, 95% CI: 0.42-1.00; neonatal AOR = 0.72, 95% CI: 0.42-1.25], after adjustment for maternal age, race/ethnicity, place of birth, maternal weight at blood draw, and gestational age at blood draw in the maternal model, and for maternal age, race/ethnicity, place of birth, infant age at blood draw, gestational age at birth in the newborn model. Looking at subgroups among cases, no differences were observed in maternal and neonatal levels of TSH between ASD cases with or without mental retardation, or ASD with regression, compared to controls. However, maternal TSH levels were

significantly lower for children with early onset ASD compared to controls [AOR = 0.59, 95% CI (0.37, 0.96)].

Conclusions: Future studies with larger sample sizes are needed to confirm these findings and to identify factors that might contribute to altered hormonal status during pregnancy.

131.007 The Role of Maternal Diabetes and Related Conditions In Autism and Other Developmental Delays. P. Krakowiak*, A. A. Bremer, A. S. Baker, C. K. Walker, R. L. Hansen and I. Hertz-Picciotto, *University of California, Davis*

Background: Recent trends indicate a rising prevalence of diabetes as well as obesity and hypertension, conditions indicative of elevated insulin resistance. These trends parallel the increasing rates of autism. Although the etiology of this disorder is unknown, studies suggest that its pathogenesis begins *in utero*.

Objectives: This study examined whether prenatal exposure to maternal gestational or type 2 diabetes, hypertension, and/or obesity was associated with (1) an increased risk of having a child with autism or autism spectrum disorders (AU/ASD) or other developmental delays (DD) and (2) greater impairments in cognitive development.

Methods: Data came from 1001 children (508 AU/ASD, 178 DD, and 315 typical controls [TD]) enrolled in The CHARGE (CHildhood Autism Risks from Genetics and the Environment) Study, an ongoing population-based case-control study. Maternal conditions were ascertained from medical records or telephone interview with parent. Maternal diabetes and hypertension were considered to be present if these conditions were recorded in the prenatal medical record or self-reported in a telephone interview. Obesity was defined as body mass index (BMI) ≥30.0, calculated using height and pre-pregnancy weight recorded in the prenatal medical record or via interview. Models were adjusted for mother's education, delivery payer, calendar time, and frequency-matching variables child's age and sex, and Regional Center catchment area.

Results: Women with diabetes, hypertension, and/or obesity had a nearly two-fold increased risk of having a child with AU/ASD or DD compared to women without these conditions (odds ratio [OR] 1.84, 95% confidence interval [CI] 1.30-2.62; OR 2.13, 95% CI: 1.37-3.30, respectively). Among children with ASD, Mullen Scales of Early Learning (MSEL) expressive language scores were significantly lower for children of mothers with diabetes compared to those whose mothers did not have diabetes (Least Squares [LS] mean 22.29, standard error [SE] 1.15 vs. LS mean 26.06, SE 0.54; $P = 0.0025$); no significant differences in MSEL scores were observed with other maternal conditions in the ASD group. Among children with no ASD (DD + TD), children of mothers with hypertension, compared to children of mothers without hypertension, had significantly lower MSEL fine motor (LS mean 32.52, SE 2.96 vs. LS mean 42.79, SE 0.82; $P = 0.0008$), receptive language (LS mean 33.89, SE 2.79 vs. LS mean 41.59, SE 0.74; $P = 0.0072$), and expressive language (LS mean 35.48, SE 2.50 vs. LS mean 41.55, SE 0.74; $P = 0.0190$). Similarly, compared to children of mothers with no conditions of interest, children of mothers with one or more conditions had significantly lower fine motor (LS mean 39.09, SE 1.52 vs. LS mean 43.47, SE 0.92; $P = 0.0128$), receptive language (LS mean 37.67, SE 1.37 vs. LS mean 42.50, SE 0.83; $P = 0.0020$), and expressive language scores (LS mean 37.61, SE 1.31 vs. 42.56, SE 0.84; $P = 0.0011$).

Conclusions: Our findings suggest that diabetes and other conditions indicative of elevated insulin resistance, such as hypertension and obesity, may play a role in the pathogenesis of developmental disorders.

131.008 Common Analytic Pitfalls In Studies of Autism Risk Factors or Phenotypic Characteristics. I. Hertz-Picciotto*, *University of California, Davis*

Background: Studies of risk factors for, or phenotypic characteristics of, autism have commonly fallen short of rigorous methodology, instead applying inappropriate analytic strategies even when the study design was of high quality. Pitfalls include: incorrect adjustment for intermediate outcomes, and lack of control for case-group in evaluating quantitative traits. Additionally, standard reasoning regarding attribution of causal components has generally not accounted for multifactorial causation within individuals.

Objectives: To apply rigorous methodologic principles to analyses evaluating autism risk factors or quantitative traits and to thereby determine validity of previously reported associations and their interpretations.

Methods: This project evaluated commonly employed analytic strategies that (a) derived correlations between a continuous exposure measurement and scores on specific behavioral scales; (b) examined the association between a periconceptional exposure and risk for autism; and (c) calculated heritability without accounting for the role of combined effects of genes and environmental factors. The underlying incorrect assumptions will be highlighted.

Results: In the first example, scores on various quantitative scales such as the Aberrant Behavior Checklist (ABC), or Systematizing or Externalizing scales, were correlated with several biomarkers in a case-control design, but without control for case status. Nine possible scenarios are identified that involve the relationships between biomarker and the ABC or other scale score in the two groups. It is shown that when cases and controls differ markedly on the scale scores, only one of these nine possible scenarios would be consistent with the conclusions drawn from an analysis combining cases with controls. Eight scenarios do not permit a correct description of within group associations between the biomarker and the behavioral score. In the second example, the association between fertility treatments and autism were adjusted for multiple births and other conditions such as gestational age that would be downstream of the exposure. This strategy is demonstrated to result in biased estimates of effects. Conditions when it would lead to an unbiased estimate can be demonstrated. Finally, variance components analysis is applied to the problem of genes and environment, and the underlying assumptions behind interpretation of monozygotic vs. dizygotic concordance are critiqued.

Conclusions: The complexity of the etiology and phenotypic heterogeneity in autism provides for multivariate relationships that may require more sensitive methods than are commonly used in this field. Use of Directed Acyclic Graphs can facilitate the choice of variables to be used in multivariable analysis. The study of biomarkers and behaviors demands an appreciation of heterogeneity of effect measures, especially when comparing children with and without autism; thus, caution is advised prior to grouping typically and atypically developing children. Finally, attribution of causes under simplistic assumptions may have led to systematic underestimation of the role of certain types of etiologic factors. A multifactorial model of variance components predicated on interactions can lead to more realistic estimates of etiologic fractions.

Cognition and Behavior Program
132 Restricted and Repetitive Behaviors and Sensory Issues
Moderator: L. Wing *National Autistic Society*

132.001 Exploring the Relationship BETWEEN LANGUAGE and Repetitive Behavior IN SCHOOL AGE Children with ASD. A. B. Barber*[1], L. G. Klinger[1], S. E. O'Kelley[2], T. N. Holtzclaw[1] and M. R. Klinger[1], (1)*University of Alabama*, (2)*UAB Civitan-Sparks Clinics*

Background:
Repetitive behavior in children with autism spectrum disorder (ASD) is associated with developmental age and communication abilities (Lam et al., 2008). It has been hypothesized that the relation between development and repetitive behavior may be a result of the changing nature of repetitive behaviors with more motor stereotypies seen in lower functioning children (Bishop et al., 2006, Lewis & Bodfish, 1998,). However, it is possible that changes in specific developmental abilities may predict declines in repetitive behavior. Increased repetitive behavior has been observed in linguistically complex environments such as classrooms and unfamiliar social situations. Therefore, it is logical to question whether specific language abilities are related to repetitive behavior in children with ASD.

Objectives:

1. To examine whether general language ability is related to repetitive behavior in children with ASD.

2. To examine whether one aspect of language, specifically grammar understanding, is related to repetitive behavior and mediates the relation between general language ability and repetitive behavior.

Methods:
Verbal ability and repetitive behaviors were assessed in 47 children with high functioning ASD (mean age = 10 years, 9 months) and 55 children with typical development (mean age = 9 years, 8 months). General language ability was measured by the raw score on the verbal subtest of Kaufman Brief Intelligence Test – 2 (KBIT-2). Groups were matched on general language ability. Grammar understanding was measured by the Test of Receptive Grammar (TROG; Bishop, 1989). The TROG measures understanding of grammar including morphological and lexical structure. Repetitive and compulsive behaviors were measured by The Childhood Routines Inventory (CRI; Evans, 1997).

Results:
K-BIT verbal raw score was correlated with the CRI total score (r = -.30; p < .05) indicating that poorer general verbal ability was linked to higher levels of repetitive behavior. Additionally, the TROG total number correct was negatively correlated with the CRI (r = -.41; p < .001) indicating that poorer understanding of linguistic structure was related to higher levels of repetitive behavior. Unsurprisingly, the two language measures, the KBIT-2 and TROG were highly related (r = .70; p < .001). To examine whether grammar understanding independently contributed to repetitive behavior, a mediation analysis was

conducted. To test for mediation, both the KBIT-2 and the TROG were used as predictors of the total score on the CRI. A Sobel test was conducted and indicated that the TROG fully mediated the relation between KBIT-2 verbal raw score and the CRI. However, when verbal raw score was treated as a mediator of the relation between the TROG and the CRI, it had no mediating effect.

Conclusions:
Results suggest that grammar understanding is specifically related to repetitive behaviors in children with ASD. Independently of overall verbal ability, poor grammar understanding was related to increased repetitive behavior. Results suggest that the inability to understand and integrate complex linguistic information may drive the need for repetition and routine in one's environment. These results offer an intriguing notion that improved interpretation of linguistic structures early in life may lead to decreased repetitive behavior in autism.

132.002 What Role Do Sensory Processing Impairments Play In the Core Features of ASD?. R. G. Kent*[1], S. R. Leekam[1], J. Gould[2], A. Le Couteur[3] and L. Wing[2], (1)*Cardiff University*, (2)*National Autistic Society*, (3)

Background: The diagnosis of ASD according to current international diagnostic criteria relies on impairments in social interaction, communication and restricted and/or repetitive behaviours. Recent research, however, has highlighted the high prevalence of sensory processing deficits in individuals with ASD and the detrimental impact such deficits have on individuals' functioning. What is yet to be explored is the relationship these sensory impairments have with the core diagnostic features of ASD.

Objectives: This study will explore the role sensory processing deficits may have in the expression of social, communicative and repetitive behaviours by looking for associations between them. One diagnostic tool that allows separate measures of sensory processing deficits as well as the core features is the Diagnostic Interview for Social and Communication Disorders (DISCO, Wing et al., 2002). Detailed knowledge about these relationships will be attained using the DISCO measures for both an overall measure of sensory processing and modality scores (vision, touch, audition, smell/taste, other oral, kinaesthetic and pain). It is predicted that the core features will have differential relationships with different modalities.

Methods: The DISCO is a semi-structured interview, which was developed through clinical experience and as such measures a broad range of items including all the core features of ASD as well as associated features such as 25 items on sensory processing. The DISCO was completed by a parent/caregiver of 200 individuals (32-456 months) who all received an ICD-10 diagnosis of a Pervasive Developmental Disorder. Total scores for the core features, sensory and modalities were created using the number of items rated as a 'marked abnormality.'

Results: Multiple regression analyses revealed social interaction and repetitive behaviours scores to be significant predictors of overall sensory score. It was also found that the three core features had different associations with the different modalities. Social interaction was a significant predictor of vision, touch, other oral, kinaesthetic and pain. Communication and repetitive behaviours significantly predicted smell/taste and audition and the repetitive behaviour score was also a significant predictor of vision, kinaesthetic.

Conclusions: These preliminary results indicate sensory processing deficits may play an integral role in the expression of the 'core' features of ASD. Furthermore, the core features appear to differentially predict the different modalities. These associations cannot tell us the direction between these behaviours but by incorporating sensory items into diagnostic measures more can be learnt about the developmental direction. It is important to note the sensory items measured by the DISCO are purely sensory in nature and do not overlap with items measuring core features. The vision items, for example, measure 'interest in shiny objects or bright lights', which has no overt connection to social interaction, indicating the significant relationship is due to an underlying association between managing sensory input and autistic behaviours. This could lead to improved sensory interventions which should not only alleviate the distress but could potentially improve social-communicative functioning. This study promotes the use of the DISCO as it allows measurement of associated items as well as specific ASD behaviours all within one tool.

132.003 Sensory Features In Nonverbal Children with Autism. E. Gay*[1], K. K. Ausderau[2], L. R. Watson[1] and G. T. Baranek[1], (1)*University of North Carolina at Chapel Hill*, (2)*University of North Carolina*

Background: Roughly 30% of children with autism remain nonverbal into their school years (Lord et al., 2006). This population of children is poorly understood and no published studies have directly investigated severity or patterns of sensory features in this subgroup. In the general autism population, sensory phenotypes can be characterized by three patterns: hyper and hyporesponsiveness and sensory seeking (Baranek et al., 2006; Liss et al., 2006), with hyporesponsiveness being more characteristic of autism

compared to other developmental disabilities. Hyporesponsiveness and seeking are consistently associated with more impaired social-communication; evidence for hyporesponsiveness is mixed. This study aims to characterize the type and severity of sensory patterns in nonverbal ASD and their predictive utility in a cross-sectional as well as longitudinal sample.

Objectives: To determine a) sensory features of nonverbal (fewer than five words; ADOS module 1 item A1.) children with autism, and b) indicators of change in nonverbal status over time.

Methods: Extant data from two grants including parent and observational sensory measures were analyzed. A total of 72 participants provided cross-sectional data (27 nonverbal CA 42.0 (14.5) mos.; 45 verbal, CA 57.6 (16.2) mos.) and a subset of 15 of these participants provided longitudinal data (7 nonverbal, CA 34.8 (4.5) mos.; 8 verbal, CA 35.4 (4.1) mos.). Factor scores for three sensory patterns (hyper, hypo, seeking), were generated using structural equation modeling and were used to determine group (verbal / nonverbal) differences and change in verbal status over time. Also, groups were analyzed for differences based on cognition, adaptive skills, and demographics.

Results: Cross-sectional analyses indicated that nonverbal children have significantly more hyporesponsive (p=.019) and sensory seeking behaviors (p=.001). Demographic data revealed significant group differences with nonverbal children having mothers with lower education (p=.029) and lower household incomes (p=.016). IQ (proxy) (nonverbal m=34.6, sd=12.7; verbal m=72.7, sd=26.3) was also significantly lower (p=.001). Longitudinal analysis indicated children who remained nonverbal at time 2 were significantly more hyporesponsive (t=3.38; p=.005) and had significantly lower mental ages (p<.05) and poorer adaptive skills (p<.05) at time 1 compared to children who were verbal at time 2. Group differences between hyperresponsiveness and seeking patterns were not significant.

Conclusions: Both cross-sectional and longitudinal data support higher levels of hyporesponsiveness, and cross-sectional data support sensory seeking behaviors being associated with nonverbal status in children with autism. This is consistent with findings regarding social-communication skills and hyporesponsiveness and sensory seeking patterns in the general autism population. Hyporesponsiveness could indicate the child is not participating in early learning opportunities and may indicate decreased attention to environmental stimuli overall. Sensory seeking may yield overfocused attention to idiosyncratic interests to the exclusion of social and communicative opportunities. An interesting finding was that nonverbal status is also associated with lower household income and lower maternal education. These variables associated with lower SES may yield fewer intervention resources and a less rich language environment. These findings have implications for assessment and intervention.

132.004 Visual and Auditory Sensitivity In Autism Spectrum Disorders. T. Holtzclaw*, L. G. Klinger, M. R. Klinger, J. Emmons-Garzarek and N. Broka, *University of Alabama*

Background: The Enhanced Perceptual Functioning theory posits that individuals with ASD have enhanced auditory and visual perceptual abilities (Mottron et al., 2006). Previous studies in support of this theory found that individuals with ASD have demonstrated an enhanced ability to detect differences in pitch, discriminate changes in visual stimuli and detect novel targets in visual arrays. The response type and task demands differed greatly among these studies, making it difficult to draw firm conclusions. Furthermore, no studies have compared visual and auditory perception directly.

Objectives: The current study sought to fill these gaps in the literature by examining visual and auditory perception in the same participants. A simple same/different discrimination task was used. It was predicted that individuals with ASD would show increased sensitivity in both auditory and visual domains.

Methods: 13 children with ASD and 11 children with typical development were included in this study (data collection is ongoing). All participants were 8-12 years old and had an IQ above 70. Groups were matched on verbal and nonverbal ability (raw scores on the WASI). Participants completed two same/different discrimination tasks, a brief IQ test, and hearing and vision screening. In the auditory task, participants discriminated tones with three levels of difficulty for pitch and volume. In the visual task, participants discriminated shapes with three levels of difficulty for hue and luminance.

Results: Using a signal detection analysis comparing hits and false alarm rates (d-prime), children with ASD showed enhanced perception in the auditory domain but not the visual domain. For the auditory task, there was a significant two-way interaction between dimension (pitch vs. volume) and diagnosis, $F(1,22)=8.68$, $p<.01$. Follow-up analyses revealed that the ASD group demonstrated higher auditory sensitivity than the group of children with typical development in pitch but not volume. For the visual task, there was a significant two-way interaction between dimension (hue vs. luminance) and

difficulty, $F(1, 22)=86.98$, $p<.001$, which indicates that both groups were more sensitive to differences in luminance than hue, particularly for more difficult discriminations. In the visual task, there was no main effect of diagnosis, $F(1,22)=0.22$, $p=.65$.

Conclusions: Results supported the Enhanced Perceptual Functioning theory for auditory perception. Specifically, children with ASD showed enhanced perception of pitch. The Enhanced Perceptual Functioning theory was not supported for visual perception. The lack of significant group differences in the visual domain suggest that the enhanced featural discrimination that has been reported previously may be due to other visual aspects than luminance or color saturation. These results have clinical significance for understanding children with ASD. While in some cases, auditory sensitivity may be adaptive (e.g., for a person with musical interests), hyper-sensitivity may be experienced as painful. It is possible that auditory hyper-sensitivity may underlie the development of some difficulties with social-communication and lead to sensory or repetitive behaviors in an effort to manage the environment.

132.005 Visual Sensitivity In Adolescents with Autism Spectrum Disorders: Faces, Objects, and Contrast Sensitivity. P. M. Pallett*[1], S. J. Cohen[2] and K. R. Dobkins[2], (1), (2)*University of California, San Diego*

Background: Children, adolescents and adults diagnosed with Autism Spectrum Disorders (ASD) generally display impaired face processing, both in perceptual and neural imaging studies (see Schultz, 2005 for review). Whether individuals with ASD exhibit typical face inversion effects is controversial (Teunisse & de Gelder, 2003, Webb et al., 2009). In addition, there has been speculation that subcortical Magnocellular (M) vs. Parvocellular (P) pathways may be atypical in ASD (see Koldewyn and Rivera, 2005). Recent research from our laboratory looking at these pathways in adolescents with ASD suggested heightened P pathway functioning in unaffected siblings as a possible protective factor for this group (Koh, Milne, & Dobkins, 2010).

Objectives: In the current study, we 1) collected discrimination thresholds for faces vs. non-face objects (cars), and 2) measured M vs. P pathway sensitivities, to determine whether they could account for group differences in face vs. object discrimination.

Methods: Our study included 20 typically developed adolescents (TD), 7 unaffected adolescent siblings of individuals with ASD (SIBS), and 12 adolescents with ASD. We obtained discrimination thresholds for upright and inverted faces and non-face objects (cars) by asking participants to match a test morph to one of two images (A vs. B), while an adaptive staircase varied the percent of A vs. B in the test morph. We also obtained contrast sensitivities for luminance (light/dark, M pathway) and chromatic (red/green, P pathway) sinusoidal gratings (0.27 cycles/degree, 4.2 Hz), by using an adaptive staircase. The diagnosis of ASD was confirmed with the ADOS, SRS and SCQ.

Results: A two-factor ANOVA including just the TD and ASD groups showed a main effect of subject group in the face/object discrimination task (the ASD group underperformed the TD group, $p = 0.008$), but this was driven by a significant difference between TD and ASD for face discrimination only (TD vs. ASD: faces, $p = 0.003$; objects, $p = 0.308$; subject group x stimulus type interaction, $p = 0.042$). On the luminance/chromatic contrast sensitivity task, the ASD group underperformed the TD group ($p = 0.044$). However, there was no interaction between subject group and stimulus type, indicating that the group difference was the same for luminance and chromatic stimuli. In both experiments, there were no significant differences between SIBS and TD or SIBS and ASD.

Conclusions: gTo our knowledge, this is the first well-controlled demonstration of deficits in face discrimination in adolescents with ASD. Because this deficit was selective for faces, and not objects, we believe the effect cannot be accounted for by the overall deficient contrast sensitivity in the ASD group (which would have predicted impairments in *both* face and object discrimination), and thus we believe the face deficit represents atypical functioning in face processing regions of the brain. Although we found no evidence of a protective factor for the P pathway in SIBS (i.e. no superiority in chromatic sensitivity, as in Koh et al., 2010), our sample size (n=7) was quite small. Thus we may lack the power necessary to detect an effect at this time.

132.006 A Stimulating Play Situation (SPS) Designed to Trigger Restricted Interests and Repetitive Behaviors In Young Autistic Children. C. Jacques*, S. Mineau, S. Ferguson, D. Cousineau and L. Mottron, *Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: The assessment of restricted interests and repetitive behaviors (RIRBs) in autism is based on direct observation combined with retrospective questionnaires and/or parental reports. Despite being a defining element of the autistic phenotype, RIRBs are allotted a lower diagnostic weight by currently used clinical instruments when compared to other behaviors, such as socio-communicative signs. Moreover,

these instruments lead to the common conviction that RIRBs are not specific to autism, despite their important role in expert clinical judgments. We are presently developing and evaluating the effectiveness of a novel stimulating play situation (SPS) as an alternative method for documenting RIRBs by observation, which when validated, could be used as part of diagnostic for younger autistic children.

Objectives: 1- To evaluate the effectiveness of using the SPS for discriminating between autistic and non-autistic participants based on RIRBs. 2- To document the presence and frequency of RIRBs within the context of SPS in groups of autistic and non autistic preschool-aged children.

Methods: 21 autistic and 24 non-autistic children, aged from 2 through 6 years, matched for chronological and non verbal developmental age (Mullen Scales of Early Learning), were exposed to the SPS, which consisted of three periods of free play, semi-free play, and semi-structured play (30 minutes in total). 35 objects triggering RIRBs and one object from the child's home were displayed in a room. The presence and frequency of behaviors manifested during the SPS were coded on a grid that included 32 RIRBs (previously consented upon by 61 autism professionals; see Jacques et al, IMFAR 2009).

Results: A greater proportion of autistic children presented 26 of the 32 RIRBs compared to non-autistic children, 5 of these RIRBs reaching statistical significance [*hand flapping, hand or finger posturing, hopping, looking for the same objects, putting fingers in the mouth*]. When present,28 RIRBs were manifested more frequently by autistic than non-autistic children, 8 of these RIRBs being statistically significant (the aforementioned 5 RIRBs, *putting object in mouth*, *visual exploration* and *putting object in movement*). ROC analyses demonstrated that the presence of more than 2 among these 8 RIRBs differentiated autistic from non-autistic children with a specificity of 82% and a sensitivity of 87%. Regarding which objects were explored, a greater proportion of autistic participants played with certain objects [*hammer and balls toy* [p<0,05], *letters and numbers*, *action-reaction toy*, *mirror*, *sound blocks*], and did so more frequently than non-autistics.

Conclusions: The effectiveness of the SPS for differentiating between preschool-aged autistic and non-autistic children based on RIRBs is supported by the larger proportion of autistic children who displayed some RIRBs in the SPS, and the increased frequency of these RIRBs within each participant. In addition, the SPS is the only of its kind to identify real objects of interests for young autistic children. In conclusion, the SPS instrument is a useful measure for detecting RIRBs in young autistic children that can eventually be used as part of diagnostic assessment process with this population.

132.007 The Relationship Between Sensory Abnormailities and Repetitive Behaviors In Children with Autism. K. L. Berquist*[1], G. Y. Lee[2], K. J. Parker[3] and A. Y. Hardan[1], (1)*Stanford University School of Medicine/Lucile Packard Children's Hospital*, (2)*Stanford University*, (3)*Stanford University*

Background: Restricted, repetitive, and stereotypical behaviors are one of the main core features of autism spectrum disorders (ASD) and are required for the diagnosis of autistic and Asperger's disorders. Sensory abnormalities are frequently reported in ASD but are not a required criteria for the diagnosis of ASD using DSM-IV. Previous studies have reported a relationship between sensory abnormalities and repetitive behaviors in children with autism, but these studies had limited sample sizes and did not examine the associations with the different repetitive behavior symptoms domains.

Objectives: The purpose of the current study was to further investigate the relationship between specific sensory abnormalities and repetitive behaviors in children with ASD. Additionally, correlations between specific patterns of sensory responses (e.g., hypersensitivity, hypo-underreactive, sensory seeking, and sensory avoiding) and the different domains of repetitive behaviors in children with ASD were examined.

Methods**:** This investigation included 119 children with ASD. Diagnosis was based on the Autism Diagnostic Instrument-Revised, the Autism Diagnostic Observation Schedule, and expert clinical opinion. Primary measures included the Sensory Profile Questionnaire (SPQ) and the Repetitive Behavior Scale-Revised (RBS-R). Correlation analyses were conducted to assess the association between repetitive behaviors as measured by the RBS-R and the different factors of the SPQ. Additionally, relationships between RBS-R and its subscales with specific sensory constructs, as measured by factors from the SPQ that are associated with hypersensitivity, hyposensitvity, sensory seeking, and sensory avoiding, were also assessed.

Results: Several associations between sensory deficits and repetitive behaviors were observed. Relationships between total score of the RBS-R and several sensory factors were found including sensory seeking ($P < 0.0001$), emotional/reactive ($p<0.0001$) and oral sensitivity ($p<0.0001$). Correlations between total RBS-R scores and all sensory constructs were found including hypo-underreactive ($p= 0.001$) and hypersensitivity ($p < 0.0001$). Interestingly, associations

were observed between all sensory constructs and RBS-R subscales with the strongest being between hypo-underreactive and the sameness behavior scale ($p<0.0001$) and between hypersensitive and ritualistic behavior subscale ($p<0.0001$).

Conclusions: Preliminary findings from this investigation suggest the existence of a strong relationship between different types of sensory abnormalities and a variety of repetitive behaviors in children with autism. However, these associations do not shed light on the possible existence of a causal relationship between these two clinical domains. Future cross-sectional and longitudinal investigations should attempt to test these associations by examining the effect of age and cognitive functioning on their development of sensory deficits and repetitive behaviors.

132.008 Object-Selection Processes In Infant Siblings: Differences Between Typical and Atypical Development. K. Libertus* and R. J. Landa, *Kennedy Krieger Institute*

Background: Play and self-guided object exploration are fundamental activities throughout development. Through their own actions, children learn about objects, physical properties, their own skills and abilities (Needham & Libertus, 2010). At the same time, manual-exploration behaviors offer unique clinical observation opportunities to detect repetitive behaviors, sensory interests, and use of functional play. Atypical exploration choices or patterns may be predictive of developmental disorders or delays.

Objectives: To investigate play and object-exploration behavior in a prospective study of infants at-risk for autism.

Methods: Participants were fifteen 6-month-olds, nineteen 10-month-olds, twenty-three 14-month-olds, and twenty 18-month-old infants who had an older sibling with autism. Based on clinical impressions (including administration of Mullen Scales of Early Learning and ADOS) 39 infants were classified as "No Concern" and 38 were classified as "Autism Suspected". Object exploration was assessed during 3 minutes of independent engagement with three toys (6-month-olds: nubby ball; slinky; teething toy) or three sets of toys (10-18-month-olds: shape sorter; slinky and net pair; nesting cars). A computer-based coding method was used to score exploration of each object/set during the first, second, and third minute of the assessment.

Results: A repeated measures ANOVA on the number of gaze-shifts from object to adult with Toy (3) as within-subject factor and Age (4) and Concern (2) as between-subject factors revealed a significant Toy x Concern interaction ($F(2, 68) = 4.58$, $p < .02$). Separate analyses for each toy/set revealed more gaze-shifts in the "No Concern" compared to the "Autism Suspected" group for the slinky toy ($F(1,75) = 7.35$, $p < .01$). Therefore, subsequent analyses focused on simultaneous manual-visual exploration of the slinky toy only. Separate ANOVAs for the 1st, 2nd, and 3rd minute of exploration revealed significantly more manual-visual exploration of the slinky toy during the 1st minute of exploration in the "No Concern" compared to the "Autism Suspected" group ($F(1,75) = 7.52$, $p < .01$).

Conclusions: Our results show surprising differences in toy exploration and preferences between infant siblings in whom autism was suspected and infant siblings about whom there was no clinical concern. Compared to infants who were suspected to develop autism during clinical evaluations, infants who raised no concerns for autism showed relatively more exploration of the slinky toy and more social referencing during engagement with this toy. Our results suggest that different object properties may guide initial object selection and engagement in typical and atypical development. Typically developing infants may consider factors such as novelty, affordances, or visual appeal when selecting a toy for closer exploration. Of the toys used here, the slinky toy was relatively novel for infants, easy to grasp and manipulate with one hand, brightly colored, and offered interesting affordances (e.g., pulling, banging). Infants in the "Autism Suspected" group seemed to have weighted these factors differently or less consistently than infants in the "No Concern" group when making their initial toy selection. Which objects are chosen for closer exploration has implications on the possible actions available to the infant, the visual-tactile simulation experienced, and may influence developmental trajectories.

4th Oral Brain Imaging in ASD temporary Program
133 Structural and Functional Brain Imaging In Older Children, Adolescents and Adults with ASD Session #2
Moderator: D. G. Murphy *Institute of Psychiatry, King's College London*

133.001 The Relationship Between White Matter Integrity and Attentional Efficiency In Children with Autism Spectrum Disorder. J. Spradling*[1], D. K. Shukla[2], B. Keehn[3], J. Treiber[2], J. Townsend[4] and R. A. Muller[2], (1), (2)*San Diego State University*, (3)*San Diego State University / University of California, San Diego*, (4)*University of California, San Diego*

Background:

Individuals with autism spectrum disorder (ASD) exhibit early and lifelong abnormalities in adaptive allocation of visual attention. Previous studies have shown white matter compromise in children and adults with ASD, which may relate to impaired function in distributed networks.

Objectives:

The goals of the present study were to 1) investigate whether white matter integrity in regions-of-interest (ROIs) associated with attention networks differ between children with ASD and typically developing (TD) children, and 2) to examine the relationship between attention network efficiency and white matter integrity in ASD and TD children.

Methods:

Diffusion tensor imaging (DTI) data of 17 children with ASD and 14 TD children were acquired from a 3T MRI scanner. Six ROIs were placed on white matter tracts based on previous literature associating these areas with attention. These ROIs were derived from Johns Hopkins University atlas for uncinate fasciculus, inferior longitudinal fasciculus, genu of the corpus callosum, anterior corona radiata, cingulum bundle, and superior longitudinal fasciculus. Fractional anisotropy (FA) was calculated for each ROI and was averaged over all ROIs for a global measure of white matter integrity of attentional networks. Participants also completed three 96-trial blocks of the Attention Network Test. Alerting, orienting, and executive attention network scores for each participant were calculated.

Results:

FA of white matter associated with the attentional networks was significantly reduced in the ASD group compared to the TD group (0.32 ± 0.04 for ASD versus 0.35 ± 0.02 for TD ($p=0.04$)). FA was positively correlated with orienting scores in the TD group ($r=0.51$, $p=0.05$); however, this correlation was absent in the ASD group ($r=0.11$, $p=0.67$).

Conclusions:

Our findings suggest that white matter compromise may contribute to attentional inefficiency in ASD. Absence of typical relationships between integrity of crucial white matter tracts and attention scores may indicate atypical network organization for attention. This was specifically observed for orienting, which was also found to be the attentional network of primary impairment in ASD in a behavioral study (Keehn et al., *J Child Psychol Psychiatry,* 2010).

133.002 Differences In Brain Anatomy In Male Adults with High-Functioning Autism Versus Asperger's Syndrome.

M. C. Lai*[1], M. V. Lombardo[2], C. Ecker[3], J. Suckling[4], B. Chakrabarti[5], E. T. Bullmore[4], D. G. Murphy[3], U. K. MRC AIMS Consortium[6] and S. Baron-Cohen[2], (1)*Autism Research Centre, Department of Psychiatry, University of Cambridge*, (2)*University of Cambridge*, (3)*Institute of Psychiatry, King's College London*, (4)*Brain Mapping Unit, University of Cambridge*, (5)*University of Reading*, (6)*Institute of Psychiatry, King's College London; University of Cambridge; University of Oxford*

Background: The new DSM-5 proposal is to remove the category of Asperger's disorder/syndrome as a diagnosis. However, it is still not clear at the neurobiological level whether the absence of developmental language delay, which is characteristic of the current diagnosis of Asperger's disorder/syndrome, contributes to a distinct subtype. To date, no study has investigated this in adults with autism spectrum conditions (ASC), which are now increasingly recognized.

Objectives: To investigate if there are differences in brain anatomy in male adults with high-functioning ASC with and without developmental language delay, particularly in language areas in the brain.

Methods: Ninety-one male adults, who were clinically diagnosed with ASC, and whose diagnoses were confirmed by the Autism Diagnostic Interview-Revised (ADI-R), were re-classified as having high-functioning autism (HFA) or Asperger's syndrome (AS) according to the presence or absence of developmental language delay. They received brain scanning using high-resolution structural magnetic resonance imaging (sMRI). Voxel-based morphometry (VBM) on the segmented and modulated grey matter images, which were registered to a custom template image specific to this study sample, were performed on an age- and IQ-matched subsample composed of 38 subjects with (HFA group) and 42 without developmental language delay (AS group), who showed comparable levels of autistic symptoms and empathizing-systemizing profile. Region-of-interest (ROI) approach was further employed to investigate into the language-related brain structures.

Results: From VBM, the HFA group showed greater grey matter volume than the AS group in a range of regions, including Broca's area, left primary sensory-motor cortices, inferior parietal lobule, dorsal medial prefrontal cortex, right visual cortex, bilateral dorsal lateral prefrontal cortices, fusiform and parahippocampal gyri, supplementary motor area, cerebellum, and medulla oblongata. The ROI approach further

revealed that in left Heschl's gyrus, the AS group had a larger volume compared to the HFA group.

Conclusions: There were brain volumetric differences in male adults with ASC with (HFA) or without (AS) developmental language delay. The difference could reflect a primary characteristic or a compensatory change. Either way, the history of language delay plays a role in brain anatomy in autism, which may be informative for possible subtyping. This data may inform the debate over whether to remove the diagnostic subgroup of Asperger's disorder/syndrome.

133.003 Social Perception Deficits In Children with ASD : Correlations with STS Anatomical Connectivity. A. Bargiacchi*[1], A. Saitovitch[1], N. Boddaert[2], N. Chabane[3] and M. Zilbovicius[1], (1)*Research Unit 1000 "Neuroimaging and Psychiatry", CEA - INSERM*, (2)*Hospital Necker*, (3)*Hospital Robert Debre*

Background: Social perception deficits in ASD have recently been quantified with eye-tacking methodology. Results have shown that children with ASD have a reduced preference for viewing social stimuli and spend a smaller percentage of time examining the core features of the face (Saitovitch et al., IMFAR 2011). In addition, anatomo-functional abnormalities in the social brain (superior temporal sulcus, orbito-frontal cortex, amygdala and fusiform gyrus) have been previously described in ASD. More recently, diffusion neuroimaging techniques have also suggested that ASD is associated with white matter abnormalities, suggesting anatomical connectivity disruptions in this disorder.

Objectives: To correlate social perception eye-tracking data in children with ASD with diffusion tensor imaging MRI data.

Methods: ASD diagnosis was based on DSM IV-R and ADI-R criteria. Participants were 9 ASD boys (mean age : 12,3 ± 3,7 years; mean IQ : 69,2 ± 32,4). Eye-tracking studies (Tobii T120 Eye Tracker) were performed during presentation of social relevant video clips (film and cartoon versions), non-social control video clip and during presentation of static pictures, taken from each video clip. Gaze parameters were measured in areas with strong social contents (eyes, mouth, and face) and in non-social areas. White matter integrity was voxel-wise assessed over the whole brain using high-angular resolution diffusion tensor imaging (DTI). High angular resolution diffusion images (HARDI) were acquired on a GE-Signa 1.5 T using an echoplanar sequence (41 directions, TE=70 ms; TR=9000 ms; 2*1.8*1.8 mm3; b=1500 s/mm2). Fractional anisotropy (FA) maps were estimated with Brainvisa software (http://brainvisa.info) and then non linearly spatially normalized on study-specific FA template and spatially smoothed (8mm) using SPM5 software (http://www.fil.ion.ucl.ac.uk/spm/). Correlation analysis between FA and eye-tracking data were performed with SPM5.

Results: Significant correlations were observed between gaze parameters and FA values: the less children with ASD looked to social content areas in the scene (eyes, mouth, face), the more FA values were reduced in "social brain" areas (posterior and anterior arcuate fasciculi). In addition, the longer children with ASD looked at non-social features of the scene, the more FA values were reduced in same "social brain" areas.

Conclusions: The present results obtained through direct comparison between imaging data and gaze parameters show a correlation between structural abnormalities and behavioural patterns. These preliminary results suggest that social perception deficits in ASD children are related with abnormal anatomical connectivity in regions of the social brain.

133.004 An fMRI Study of Cooperative and Competitive Play In Autism. B. A. Corbett*[1], C. Schupp[2], N. Ryan[2] and C. S. Carter[3], (1)*Vanderbilt University*, (2)*University of California, Davis*, (3)*UC Davis Department of Psychiatry and Behavioral Sciences, Imaging Research Center*

Background: Children with autism exhibit impairment in reciprocal social interactions. Yet, relatively few studies have explored the dynamic social cognitive processes using neuroeconomic paradigms. The psychobiological investigation of play provides a unique opportunity for identifying underlying brain networks involved in the complex competencies of social behaviors.

Objectives: We used a game playing paradigm adapted from social cognitive neuroscience to increase our understanding of the cognitive and neural mechanisms underlying these deficits. The paradigm permits assessment of social and nonsocial factors within the same game to evaluate the influence of peer exchanges on neural and behavioral responses.

Methods: We collected behavioral data and functional MRI (fMRI) images from male children 8-to-12 years with either high functioning autism (15) or typical development (17). A modified Prisoner's Dilemma game was employed that required the participant to cooperate or compete with both a putative human and a computer partner with the potential to earn money. Based on previous studies, we hypothesized that boys with autism would cooperate more than neurotypical boys and show a pattern of activation that was similar regardless of whether they were playing with a human or computer partner. We

further speculated that children with autism would show reduced activation of limbic striatal regions often recruited during affective and reward learning.

Results: Behaviorally, the children with autism cooperated more than the neurotypical children who engaged in more competitive play. The autism group endorsed more negative emotional responses, especially to partner defection. Based on both response strategy and partner type differential recruitment of social evaluation and reward brain regions were revealed between the groups. The autism group demonstrated less brain activation overall in response to human partners whereas the neurotypical group recruited many prototypical affective learning brain regions. Strikingly the children with autism showed more robust activation of socioemotional brain regions, such as the amygdala and cingulate, to nonsocial stimuli than to the social stimuli and differential caudate response to negative social interactions.

Conclusions: Our results show that children with autism cooperate more, and this is associated with decreased activity in brain circuitry supporting competitive play and a reduced response in the caudate to partner defection. The increased activity to a computer rather than a child partner supports a fundamental disturbance of social engagement and affective learning in children with autism. Atypical recruitment of limbic and reward systems during reciprocated and unreciprocated play suggests a failure to provide appropriate social relevance and reward value in autism.

133.005 The Neural Bases of Joint Attention In Autism Spectrum Disorders. E. Redcay*[1], D. Dodell-Feder[2], P. L. Mavros[3], J. D. E. Gabrieli[3] and R. Saxe[3], (1)*University of Maryland*, (2)*Harvard*, (3)*Massachusetts Institute of Technology*

Background: Joint attention is the process by which two people actively coordinate their attention on an object. One member of a dyad initiates joint attention on an object while the other person responds to joint attention. This powerful social learning tool is impaired in individuals with autism and is predictive of later language and social developments. Only recently have the neural bases of this pivotal skill been examined and no prior study has explicitly examined the neural bases of initiating and responding to joint attention in individuals with autism using functional MRI.

Objectives: To identify the neural bases of initiating and responding to joint attention in typical adults and to examine how these differ in adults with high-functioning autism and Asperger's disorder.

Methods: For Experiment 1, functional magnetic resonance imaging (fMRI) data were collected from 22 typical adults with no known neurological impairments during a real-time face-to-face interactive game designed to elicit joint attention behaviors. During the responding to joint attention condition, the subject followed the experimenter's gaze to find a hidden target. In the initiating joint attention condition the experimenter followed the subject's gaze to find the hidden target. In the non-joint attention control condition, the subject searched for the target while the experimenter signaled that she was not playing the game by closing her eyes. Data from this experiment were used to identify the regions of interest (ROI) in both responding to and initiating joint attention as compared to the nonjoint attention control for Experiment 2. For Experiment 2, fMRI data were collected during the same joint attention game from 15 adults with autism spectrum disorder and 15 age- and sex-matched typical controls. Region of interest and whole-brain analyses were conducted to identify commonalities and differences in regions recruited for joint attention between the autism and typical control groups.

Results: In Experiment 1, both initiating and responding to joint attention recruited regions associated with mentalizing and attention systems [mentalizing: bilateral posterior superior temporal sulcus (pSTS), dorsal medial prefrontal cortex (dMPFC); and attention: left intraparietal cortex (LIPL), right inferior frontal gyrus (R IFG)]. In Experiment 2, percent signal change was extracted from these regions from both the autism and matched controls. Repeated measures ANOVAs revealed a significant interaction (group x condition) in the left posterior STS and dorsal medial prefrontal cortex. Furthermore, whole-brain between group analyses of responding to joint attention (RJA) revealed greater recruitment of right posterior STS and dorsal medial prefrontal cortex in controls as compared to autism.

Conclusions: Joint attention recruits both mentalizing and attention systems. Adults with high-functioning ASD show reduced activation within primarily mentalizing systems suggesting this system may underlie the pervasive impairments seen in joint attention in ASD individuals.

133.006 Decoding Emotions From Body Postures: Altered Mirror Neuron Response In Children with Autism. L. E. Libero* and R. K. Kana, *University of Alabama at Birmingham*

Background: The ability to interpret others' body language is a vital skill that helps us infer and understand their thoughts and emotions. However, individuals with autism have been found to have difficulty in deciphering the body postures and

movements of others, perhaps leading to their overarching deficit in processing emotions (Moore et al., 1997; Hubert et al., 2007; Atkinson, 2009; Philip et al., 2010). The present study investigated the neural mechanisms of inferring emotions from body postures. To our knowledge, this is the first neuroimaging study examining body language processing in children with autism, although a previous study examined processing of fearful body language in adults with autism (Hadjikhani et al., 2009).

Objectives: The primary aim of this functional MRI study was to investigate the neural correlates of emotion and action, in the context of processing body language, in high-functioning children with autism.

Methods: fMRI data was acquired from 5 high-functioning children with autism and 7 typically developing controls (data collection in progress) while they made emotion and action judgments about a series of static stick figure characters. The participants' task was to view a character's posture and choose the option, from three alternatives, that best described the action (e.g., pushing) or emotion (e.g., sad) the character was portraying. The stimuli were presented in a blocked design format and data was acquired on a Siemens 3T scanner and analyzed using SPM8.

Results: The main results are as follows: 1) A between-group comparison of brain activation showed participants with autism recruiting the right inferior frontal gyrus (IFG) and left inferior parietal lobule (IPL) significantly lesser, relative to controls, while inferring emotions from body postures; 2) In an analysis of brain activation for body language in general (emotion and action conditions combined), participants with autism activated bilateral middle temporal and right IFG significantly less than controls. However, they showed significantly greater activation in left cuneus; and 3) A 2 Group (autism vs. control) x 2 Condition (action vs. emotion) mixed ANOVA on the behavioral data showed a significant effect of condition on accuracy, $F(1,10)=9.38$, $p<0.05$ with all participants having greater accuracy in the action condition than in the emotion condition. Although there was no significant group effect, we found a significant group x condition interaction for reaction time, $F(1,10)=5.93$, $p<0.05$, with the control group being faster in the action condition relative to the emotion condition.

Conclusions: The IFG and IPL are two main components of the human mirror neuron system (MNS) associated with the understanding of motor actions (Rizzolatti et al., 1996; Iacoboni et al., 1999). That our participants with autism showed reduced response in these regions while inferring emotions from body postures indicates a possible use of an alternate cortical route in children with autism in decoding body language. It is possible that the control participants may rely more on motor simulation to infer emotions (activation in IFG and IPL), whereas the participants with autism may be more visuospatial (greater cuneus activation) in their approach.

133.007 Sustained Attention In Children and Adolescents with Autistic Spectrum Disorder and Attention Deficit Hyperactivity Disorder: An fMRI Investigation. C. M. Murphy*[1], A. Christakou[2], K. Chantiluke[3], A. Smith[4], A. Cubillo[1], E. Daly[2], V. Giampetro[1], C. Ecker[5], D. G. Murphy[5], M. Aims[6] and K. Rubia[2], (1)*King's College London, Institute of Psychiatry*, (2)*King's College London, Institute of Psychiatry,*, (3)*kings college london Institute of Psychiatry*, (4)*King's College London, Institute of Psychiatry*, (5)*Institute of Psychiatry, King's College London*, (6)*Institute of Psychiatry, London; University of Oxford; University of Cambridge, United Kingdom*

Background:

Individuals with autistic spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) share behavioural and cognitive deficits in sustained attention. It is unclear, however, whether these deficits are related to shared underlying neuro-functional deficits or arise from a different underlying pathophysiology.

Objectives:

We used functional magnetic resonance imaging (fMRI) to compare brain activation in boys with ASD, ADHD and healthy controls to investigate disorder-specific brain dysfunctions during a parametrically modulated sustained attention/vigilance task where the load on sustained attention was progressively increased.

Methods:

29 boys (11-18 years old) with ASD, 24 age and IQ matched healthy boys and 28 age-matched ADHD boys completed an event-related parametric vigilance task on a 3T magnetic resonance imaging scanner. All participants were right-handed, with an IQ >70. All ASD children met ADI and ADOS cut-offs for autism and had no ADHD diagnosis. All ADHD children met DSM-IV ADHD criteria, but had no ASD diagnosis. The 12 min vigilance task requires subjects to respond as quickly as possible to a visual stimulus (timer counting ms) that appears under two different delay conditions: 1) short, frequent,

predictable delays of 500ms (synchronisation) 2) randomly interspersed long, unpredictable delays of 2s, 5s, or 8s. Long unpredictable delays place a higher load on sustained attention (parametrically modulated with increasing delays), while short predictable delays place a higher load on sensorimotor timing. Data analysis used non-parametric image analysis (XBAM).

Results:

Performance: All children had slower reaction times (RT) with increasing delays. ASD and ADHD boys relative to controls both had slower RT to all delays. ADHD children had significantly enhanced response variability relative to boys with ASD and Controls.

fMRI analysis: Several brain regions differed between groups; post-hoc analyses showed significant delay and group by delay interaction effects in these regions. Activation in right inferior parietal lobe, right midcingulate and bilateral supplementary motor area (SMA) increased with increasing delay in all subjects, with activation more pronounced in controls relative to both patient groups. In midbrain, bilateral ventrolateral prefrontal cortices, thalamus and basal ganglia, controls showed enhanced activation with increasing delays during sustained attention, but both ASD and ADHD boys showed progressively more activation during synchronisation. Disorder-specific dysfunctions were not observed for ASD boys, but only for ADHD, in 3 brain regions: cerebellum and left inferior/dorsolateral prefrontal activation was increased in controls and in ASD with increasing delays, while ADHD showed progressively more activation during synchronisation. In anterior cingulate, however, ADHD boys showed progressively enhanced activation with increasing delays, while ASD boys and controls activated this region progressively more during synchronisation.

Conclusions:

Children with ASD and ADHD share poorer performance and reduced activation compared to controls in a sustained attention network comprising bilateral inferior fronto-striato-thalamic, SMA, parietal and cerebellar regions. ADHD boys, however, showed more severe and disorder-specific underactivation in L inferior fronto-cerebellar regions that correlated with increased response variability. Findings show that children with ASD and ADHD share neurofunctional abnormalities during sustained attention, but ADHD boys have additional disorder-specific inferior fronto-cerebellar dysfunctions in ADHD, presumably reflecting greater attention-related dysfunctions.

133.008 Functional Connectivity of BA 44 During Language Processing In ASD and TD Subjects. L. Moore*[1], J. A. Brown[2], D. Shirinyan[3], A. A. Scott-Van Zeeland[4], J. D. Rudie[2], M. Dapretto[5] and S. Y. Bookheimer[4], (1)*Interdepartmental Neuroscience Program, UCLA*, (2)*UCLA*, (3)*UCLA, Center for Autism Research and Treatment*, (4)*University of California, Los Angeles*, (5) *UCLA*

Background: Delayed language acquisition and marked deficits in communication skills are hallmark features of autism (Bailey et al., 1996). Converging evidence suggests that Autism Spectrum Disorder (ASD) is characterized by deficient long-range connectivity and excessive local connectivity (Belmonte et al., 2004). Just examined connectivity during sentence comprehension (2004) and proposed that social and behavioral deficits in ASD are related to cortical underconnectivity, in a variety of brain systems. Previous fMRI and functional connectivity studies have implicated dysfunction of the left inferior frontal gyrus (Broca's area) and left superior temporal gyrus (Wernicke's area) in ASD (Just et al., 2004).

Objectives: We sought to further test the hypothesis that individuals with ASD have diminished language-related modulation of functional connectivity in language-relevant networks. Specifically, we examined functional connectivity with the pars opercularis in the left inferior frontal gyrus (LIFGpo), in children and adolescents with ASD using psychophysiological interaction (PPI) functional connectivity analysis.

Methods: 14 typically-developing (TD) and 14 ASD subjects underwent functional magnetic resonance imaging (fMRI) while listening to a stream of artifical syllables (see Scott-Van Zeeland et al., 2010). Prior to analysis, we subjected fMRI data to ICA denoising and regression of nuisance parameters. Time-series from the LIFGpo (Harvard Oxford atlas, 40% probability) were extracted for each subject and multiplied by a hrf-convolved task regressor to create a PPI term. This was then correlated with every voxel in the brain to generate whole brain positive and negative connectivity maps. We have previously presented results using an anatomically-defined seed ROI in LIFGpo (Moore et al., SFN, 2010), which showed deficient connectivity with bilateral superior temporal gyrus. In order to avoid possible confounds based on differential group activation in the LIFG, we verified that both groups had overlapping peaks of activation within our anatomical ROI region. Here we report PPI results using a functionally-based spherical seed ROI, 12mm in diameter, centered on overlapping clusters of activity ($Z > 2.0$, corrected) in the LIFGpo for ASD and TD subjects.

Results: Between-group analyses found that ASD subjects showed no significant task-related changes in LIFGpo connectivity, while TD subjects showed a wide pattern of task-related increased connectivity with left superior temporal gyrus, left caudate, left amygdala, and posterior and anterior cingulate cortex.

Conclusions: These results suggest that delayed and abnormal language processing in ASD may reflect deficits in long-range connectivity between areas associated with comprehension and production of speech. In addition, deficient connectivity with areas associated with emotional processing and social cognition may underlie additional deficits in processing social and emotional content.

Cognition and Behavior Program
134 Adults with Autism; Girls with Autism; Developmental Psychopathology; Methodological Issues

134.001 1 A questionnaire measuring six adult autism spectrum problem domains by self- and other-report. E. Horwitz*[1], R. Schoevers[1], R. B. Minderaa[2] and C. A. Hartman[2], (1)*Groningen University Medical Center*, (2)*University of Groningen and University Medical Center Groningen*

Background: Psychometrically sound questionnaires measuring adult autism spectrum spectrum problems are scarce but much-needed for 1) epidemiological research, 2) measurement of subthreshold ASD problems, and for 3) profiling scores on different ASD problem domains in patients with a formal ASD diagnosis.

Objectives: To develop a questionnaire measuring AS problems as they are seen in adults on the spectrum. We aimed for a multidimensional questionnaire in correspondence with the heterogeneous nature of the disorder and the multiple problem domains that can be discerned. Our aim was further to measure both the patient's perspective and that of an important other (a parent or a spouse) for a comprehensive picture of the AS problems. Without compromising on psychometric quality, we additionally aimed for a brief questionnaire for practical usefulness.

Methods: We built on our previous work on the Children's Social Behavior Questionnaire which we developed for children and adolescents (CSBQ; Hartman et al. 2006). We used a top-down rational approach of item writing, taking the CSBQ core problem domains and corresponding items as a starting point (for lifespan continuity) but expanding on this by formulating multiple adult (developmentally appropriate) equivalents of the CSBQ behaviors. A comprehensive item pool of 90 items was subjected to principal component analysis. Items were selected with a factor loading >.3 on its main factor and a minimum difference of .2 with a possible secondary factor. These requirements had to apply to both the self- and other-report data. Findings are based on 1143 self-report and 644 other-report questionnaires from 6 outpatient clinics in the Netherlands.

Results: We started analyzing per ASD domain: social, communication, and stereotypic behavior, respectively, in order to make a first selection of adequate items. Results were highly similar for self- and other report. For the social domain the data indicated a two factor structure capturing amount of social contact and quality of social contact. For the communication domain we were able to distinguish between the understanding of social exchanges and acts that are at odds with social rules and conventions. For the stereotypies domain we could differentiate between sensory stimulation and motor stereotypies on the one hand and multiple aspects of rigidity and insistence on sameness on the other hand. Items with aforementioned pattern of factor loadings on both the self- and other-report versions were retained for a second set of analyses across the three domains. This yielded the expected six factor structure in both the self- and other-report version where a total of 38 items (6-7 item per factor) fulfilled aforementioned criteria. Further work on the psychometric qualities of these scales is underway.

Conclusions: We developed a self- and other-report questionnaire of adult AS problems which differentiates between the following domains: reduced contact, reduced empathy, reduced interpersonal insight, violation of social conventions, insistence of sameness, and sensory stimulation/motor stereotypies. The instrument is short and easy to apply and yields a score profile among these six problem domains both from the perspective of the patient and from someone close.

134.002 2 Elderly with autism: A cognitive profile. H. M. Geurts*, *University of Amsterdam*

Background: Cognitive research regarding autism is mainly focusing on children and young adults even though we know that autism is a life-long disorder and that healthy aging has a strong impact on cognitive functioning. Therefore, this study focuses on cognitive functioning in elderly with autism.

Objectives: To determine which cognitive deficits are present in elderly with autism and to explore whether cognitive functions

in elderly with autism remain stable, become more severe, or abate.

Methods: We compared the neuropsychological profile of 23 individuals with autism and 23 age and gender matched healthy controls aged between 51 and 83 years. A broad range of neuropsychological tasks were administered, with a focus on executive functioning and memory.

Results: In most cognitive domains, no deficits were present in elderly with autism. Deficits were only observed in attention, working memory, and fluency. Aging had differential effects for fluency and visual memory. Aging had a smaller impact on fluency performance in the autism group than in the control group, while it had a more profound effect on visual memory performance in the autism group.

Conclusions: We provide novel evidence that elderly with autism have subtle neuropsychological deficits. Moreover, it seems that developmental trajectories are different between elderly with and without autism in particular cognitive domains. While parallel development has been observed in the majority of cognitive domains, there is also evidence for a safeguard hypothesis (abating deficits) and a double jeopardy hypothesis (increasing severity of deficits) of aging in autism depending on the cognitive domain under study. The current findings show that knowledge regarding autism based on studies in childhood and adulthood cannot be translated directly to elderly with autism as different deficits are present depending of the age of individual with autism.

134.003 3 Adults with and without Autism Differ In Their Emotional Responses to Non-Social Images Related to Circumscribed Interests. N. J. Sasson*[1], G. S. Dichter[2], D. Beaton[1] and J. W. Bodfish[3], (1)*University of Texas at Dallas*, (2)*University of North Carolina*, (3)*University of North Carolina - Chapel Hill*

Background: Both preschool and school-aged children with autism spectrum disorders (ASDs) exhibit restrictive and perseverative patterns of visual attention to objects related to circumscribed interests (CI; e.g., trains; Sasson et al, 2008; Sasson et al 2010). Similarly, recent fMRI findings demonstrate that adults with ASD, but not matched controls, are characterized by hypoactivation in neural reward circuits in response to monetary incentives but hyperactivation to images related to CI (Dichter et al, in press), a finding that reveals a potential neurobiological mechanism of restricted interests in ASD. While taken together these studies suggest that objects related to CI are disproportionately rewarding for ASD children and adults, a need remains for better understanding the subjective experience underlying heightened salience and reward value of CI in ASD.

Objectives: To determine whether adults with ASD differ from Typically Developing (TD) adults in their emotional ratings of CI, non-CI, and social images.

Methods: A series of 40 “High Autism Interest” (HAI), 34 “Low Autism Interest” (LAI) and 40 social images were developed based upon previous studies of CI (South et al, 2005, Sasson et al 2008). 214 TD Adults and 51 adults with ASD provided arousal and valence ratings (Lang, 1995) for each image using 9-point Likert scales.

Results: A mixed model ANOVA with stimulus type (HAI vs. LAI vs. social) and emotion rating (arousal vs valence) as the within group factors and group (TD vs ASD) as the between group factor produced a significant three way interaction between stimulus, rating and group ($F(2, 262) = 14.59$, $p < .01$, $h_p^2 = .10$). Follow-up tests revealed that this interaction was driven by similar arousal ratings by both groups across the three stimulus types, but group differences in valence ratings: ASD adults provided higher valence ratings for HAI objects than TD adults, while the reverse pattern was found for social images and LAI objects. Next, correspondence analysis was used to examine the relationship between ratings levels (e.g., middle, high, low) by each group on all stimuli. For the ASD group, “very positive” ratings were assigned almost exclusively to specific subcategories of HAI objects (e.g., video game and electronic equipment), while the TD group more evenly assigned high valence ratings across the three stimulus categories.

Conclusions: The present study reports differences in subjective emotional ratings of CI, non-CI and social images in ASD. While the groups did not differ in how emotionally arousing they found the three image categories, the ASD group rated CI images as more pleasant and other object types and social images as less pleasant than TD individuals. These findings provide additional evidence that certain categories of non-social objects are preferred in ASD and provide support for the development and dissemination of a standardized set of non-social images related to CI in autism that are suitable for studies of incentive motivation salience in ASD.

134.004 4 Cognitive Styles In High-Functioning Adults with An Autism Spectrum Disorder. A. A. Spek*, *Mental Health Institution Eindhoven*

Background:

Research showed that features of ASD can change over the course of development. Only a limited number of studies assessed cognitive strengths and impairments in high-functioning adults with ASD and results were contradictory. Therefore, it is not clear whether the three characterizing cognitive theories are still appropriate when individuals with ASD reach adulthood.

Objectives:

To examine the intelligence profiles, theory of mind, central coherence and executive functioning in adults with the autistic disorder, Asperger syndrome and a neurotypical adult group.

Methods:

The research project encompassed four studies in which the intelligence profile and the three cognitive theories were examined in adults with autistic impairment and in a healthy control group. Neuropsychological instruments and self-report questionnaires were used. In each study, the research groups were matched in age and gender. The mean age of the ASD population varied between 38 and 43 years. The diagnoses were based on ADI-R and structured DSM-IV interviews, differentiation between autism and Asperger syndrome was based on criteria of Gillberg & Gillberg and ICD-10.

Results:

The HFA group was impaired in the speed of processing information, compared to the Asperger and neurotypical groups. The two disorder groups were impaired in advanced theory of mind and reported a detailed information processing style. Furthermore, they reported more use of systemizing strategies than the neurotypical group. No specific impairment has been found in working memory and verbal fluency in any of the groups.

In the areas of theory of mind and central coherence, the self-reports appeared more predictable for the presence of ASD than the neuropsychological tasks.

Conclusions:

In high-functioning adults with ASD, the theories of 'impaired theory of mind' and a 'detailed information processing style' are still relevant. However, there is less evidence for impairment in executive functioning in these individuals.

The impairment in speed of processing information should be taken into account when interpreting performance on cognitive tasks that aim to measure certain cognitive areas.

Based on our studies we want to emphasize the usefulness of self-reports in high-functioning adults with ASD. Apparently, compensating strategies, related to relatively high intelligence enables these individuals to recognize their strengths and weaknesses relatively adequate.

134.005 5 Cognitive Profiles of Adults with HFA or Asperger Syndrome. A. A. Spek*[1], E. M. Scholte[2] and I. A. Berckelaer-Onnes[3], (1)*Mental Health Institution Eindhoven*, (2)*Leiden University, Social and Behavioral Sciences*, (3)*Leiden university*

Background:

Research showed that features of ASD can change over the course of development. Only a limited number of studies assessed cognitive strengths and impairments in high-functioning adults with ASD and results were contradictory. Therefore, it is not clear whether the three characterizing cognitive theories are still appropriate when individuals with ASD reach adulthood.

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The research project encompassed four studies in which the intelligence profile and the three cognitive theories were examined in adults with autistic impairment and in a healthy control group. Neuropsychological instruments and self-report questionnaires were used. In each study, the research groups were matched in age and gender. The mean age of the ASD population varied between 38 and 43 years. The diagnoses were based on ADI-R and structured DSM-IV interviews, differentiation between autism and Asperger syndrome was based on criteria of Gillberg & Gillberg and ICD-10.

Results:

The HFA group was impaired in the speed of processing information, compared to the Asperger and neurotypical groups. The two disorder groups were impaired in advanced theory of mind and reported a detailed information processing style. Furthermore, they reported more use of systemizing strategies than the neurotypical group. No specific impairment

has been found in working memory and in switching and using strategies in any of the groups.

In the areas of theory of mind and central coherence, the self-reports appeared more predictable for the presence of ASD than the neuropsychological tasks.

Conclusions:

In high-functioning adults with ASD, the theories of 'impaired theory of mind' and a 'detailed information processing style' are still relevant. However, there is less evidence for impairment in executive functioning in these individuals.

The impairment in speed of processing information should be taken into account when interpreting performance on cognitive tasks that aim to measure certain cognitive areas.

Based on our studies we want to emphasize the usefulness of self-reports in high-functioning adults with ASD. Apparently, compensating strategies, possibly related to relatively high intelligence, enables these individuals to recognize their strengths and weaknesses relatively adequate.

134.006 6 The Multisensory Attention Assessment Protocol (MAAP): Indices of Attention Predict Diagnostic Status and Symptom Severity In Children with Autism Spectrum Disorders. L. E. Bahrick*, J. T. Todd and J. Vasquez, *Florida International University*

Background: Children with autism spectrum disorder (ASD) show impairments in social orienting, disengaging attention, and intersensory processing; skills typically well-established during infancy (Ames & Fletcher-Wilson, 2010; Bahrick & Todd, in press, Dawson et al., 2004). These impairments impact subsequent developments in joint attention/communication (Bahrick, 2010; Mundy & Burnette, 2005). A new measure, the Multisensory Attention Assessment Protocol (MAAP), assesses basic indices of attention (disengagement, orienting, maintenance, and intersensory processing) to dynamic audiovisual social and nonsocial events in a single protocol. Preliminary findings (Newell et al., 2007) reveal impairments in disengaging and maintaining attention to social (but not nonsocial) events, and impairments detecting audiovisual synchrony.

Objectives: To develop the MAAP as an instrument for assessing core attention impairments in ASD, we assessed interrelations among three indices of attention. We then investigated which attention indices were most predictive of diagnostic status (TD, ASD) and of joint attention initiation (IJA; index of symptom severity) in ASD.

Methods: Thirteen TD children and 13 children with ASD, 1.5-5 years of age, were roughly matched on Mullen composite mental age (ASD=2.30 yrs; TD=2.89 yrs., p=.18). In the MAAP, trials of a central visual event (13s) were followed 3 s later by two side-by-side peripheral events (10s), with the natural soundtrack synchronized with one of the two events. Blocks (20 trials each) of social (affectively positive speech) and nonsocial events (objects striking a surface) were presented. Intersensory matching (to sound-synchronous events), attention maintenance, and disengagement (latency to shift attention to a peripheral event) were assessed. Finally, children participated in the Early Social Communication Scales (Mundy et al., 2003) and number of IJA instances was observed.

Results: Significant correlations among the three indices of attention (maintenance, disengagement, and intersensory processing), as well as among attention maintenance, diagnostic status, and IJA were found (Pearson rs>.40,ps<.05). Two structural models were consistent with the data, for social, $\chi^2(2)<.50$,$p>.79$, but not nonsocial events. For both models, higher levels of intersensory matching and lower latencies to disengage predicted higher levels of attention maintenance to social events, which in turn influenced diagnostic status (TD, ASD) and IJA performance (ASD only). Further, each 1% decrease in attention maintenance predicted a 1% increase in the probability of having a diagnosis of ASD. Also, each 1% increase in attention maintenance predicted a .15 increase in the number of IJAs exhibited by ASDs (all ps<.05).

Conclusions: These analyses reflect the first attempt to assess relations among multiple indices of attention, diagnostic status, and IJA performance in ASD. Findings indicate that greater intersensory processing and lower latencies to disengage from a competing stimulus predict increased attention to social speech events. Further, greater attention maintenance is associated with a decreased probability of having a diagnosis of ASD and, in turn, is predictive of increased IJA in ASD (i.e., decreased symptom severity). These findings demonstrate the feasibility of assessing fundamental aspects of attention to naturalistic audiovisual events in a single protocol, and using the child's performance to predict diagnostic status and symptom severity in ASD.

134.007 7 A Comparison of Basic Attentional Shifting Between Adults and Children with High Functioning Autism. G. Goldstein*[1], D. L. Williams[2] and N. J. J. Minshew[3], (1)*VA Pittsburgh Healthcare System*, (2)*Duquesne University*, (3)*University of Pittsburgh*

Background: The debate continues as to whether individuals with autism have a fundamental deficit in attentional shifting and whether this deficit contributes to their poor performance in executive function tasks (Kleinhans et al., *Developmental Neuropsychology,* 2010). Attention shifting in autism has been studied with a variety of tasks, including simple measures using shifting between perceptual modalities and other measures that require complex conceptual reasoning, with a range of results. Differences in attentional shifting between children and adults with autism have received less attention.

Objectives: This study evaluated whether there is a difference between children and adults with high-functioning autism (HFA) in basic attentional shifting using a simple task, the modality shift reaction time experiment, that involves minimal reasoning, decision-making, or related information processing components.

Methods: Participants were 33 children and 42 older adolescents and adults with HFA and comparison groups of equal numbers of typically developing individuals matched on age, gender, and IQ. Stimuli were a red light, a green light, a high tone, and a low tone presented in ipsimodal (light-light; sound-sound) and contramodal (light-sound; sound-light) sequences responded to by a button press. Normal individuals respond more slowly to the second member of contramodal than to the ipsimodal sequences reflecting a deficit in attention to a changed modality or a modality shift effect (MSE), but individuals with psychopathology produce an exaggerated delay. The measure of specific interest is, therefore, the relationship between contramodal pairs and ipsimodal pairs or the MSE.

Results: The adults with autism exhibited slower reaction times to lights and sounds than the typical controls. The children with autism exhibited slower reaction times to light. There were no significant modality interactions in the adults with HFA, indicating the absence of a significant exaggerated MSE in this group. This finding in the adults with HFA may be the consequence of their slower reaction times to sound and light. There were two significant interactions in the child comparison, both in the condition involving reaction time to a sound followed by a light, indicating an exaggerated MSE in children with HFA.

Conclusions: A significant MSE for a sound followed by a light was found in children but not adults with HFA. Therefore, the MSE appears to be a developmental phenomenon found in children but not adults in this population. In adults with HFA, the MSE appears to merge into a more generalized psychomotor slowness.

134.008 8 Attention Networks In Children with ADHD and High-Functioning ASD. C. M. Freitag*[1] and S. Haenig[2], (1)*Johann Wolfgang Goethe-University*, (2)*Saarland University Hospital*

Background: Clincial attention problems are often reported in children with attention-deficit/hyperactivity disorder (ADHD) and high-functioning autism spectrum disorder (HF-ASD). In addition, differential executive function deficits have been described, but previous studies reported contradictory findings.

Objectives: In this study we compared attentional function according to the multi-component model of attention by can Zomeren & Brouwer (1994) between age, sex, and IQ-matched children with ADHD, HFASD and controls. We expected the children with ADHD to show difficulties with selectivity and cognitive inhibition, whereas for HFASD we expected difficulties with selectivity and cognitive flexibility.

Methods: 90 children with ADHD, 40 children with HFASD, and 60 control children were assessed by the neuropsychological test battery TAP (http://www.psytest.net/). The target parameters were error rates, dichotomised by the median into high and low, compared between the three groups. IQ, age, and gender were controlled for during logistic regression analyses.

Results: Children with ADHD showed impairments in the subtests phasic alertness, vigilance, go-nogo, attentional shifting, and incompatibility. Children with HFASD without ADHD did not show any impairments compared to controls.

Conclusions: Multi-component attention problems are found predominantly in children with ADHD who showed impairments in attentional intensity and selectivity as well as with regard to cognitive inhibition.

134.009 9 Assessing the Allocation of Visual Attention In Adults with Autism Using a Change Detection Paradigm. F. Laine*[1], J. A. Burack[1], S. Rishikof[1], L. Mottron[2] and A. Bertone[3], (1)*McGill University*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (3)*Perceptual Neuroscience Laboratory for Autism and Development, CETEDUM*

Background: Change detection, the ability to detect changes in the environment, can be affected by the type of information that is prioritized. Among typically developing (TD) adults, 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. One question is whether adults with autism present the same spontaneously-biased attention allocation to foreground information. Another question is how perceptual characteristics of the visual scene, such as configurality (generally not prioritized among autistic individuals) and dynamicity (used as an external attentional cue) interact with higher-level attentional processes solicited by a change detection task.

Objectives: The objectives of this study were to assess (1) whether the typically-manifested attention bias for foreground information is displayed by individuals with autism, and (2) to what extent, if any, manipulating the configurality or dynamicity of foreground information differentially influences visual attention allocation among autistic as compared to TD adults.

Methods: Fifteen adults with autism (18-35 years) with average IQs and 15 gender- age- and IQ-matched TD adults were administered an adapted version of the change blindness paradigm from Mazza et al. (2005). The background consisted of 20 columns (alternating between light and dark grey) comprising ten vertically-oriented rectangles (1.81 ^{o} x 1.24 ^{o}). The foreground consisted of 6 horizontally-oriented rectangles (3 light grey and 3 dark grey) arranged in either a circular (configural) or random (non-configural) manner. On a given trial, either a foreground change (horizontal rectangles changed shades of grey), a background change (vertical rectangles changed shades), 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: For the static condition, both groups were more efficient at detecting foreground relative to background change. Moreover, the TD adults were more likely to detect the background changes than the participants with autism. In addition, the TD participants were better able to use dynamic information as a cue to detect changes (either background or foreground). However, only the participants with autism were influenced by the configurality of the elements, as they detected more changes when the foreground rectangles were randomly organized compared to when they were presented configurally.

Conclusions: Different patterns of prioritization of visual attention were found between adults with autism and TD adults on a change detection paradigm when perceptual attributes such as the configurality of the foreground elements were manipulated. As compared to the TD participants, the participants with autism processed information more locally and were less likely to orient their attention to the dynamic elements of a scene. This suggests that atypical perceptual information processing in autism may influence higher-level cognitive functions, such as visual attention.

134.010 10 Managing Missing Data In Autism Research: The Use of Multiple Imputation. J. F. Strang*[1], D. Luckenbaugh[2], L. Kenworthy[1], G. L. Wallace[3], J. L. Sokoloff[1] and D. O. Black[3], (1)*Children's National Medical Center*, (2)*National Institute of Mental Health*, (3)*NIMH*

Background: Missing data is a challenge for much clinical research and is often managed by listwise deletion (dropping incomplete cases). Listwise deletion can result in reduced power, and when data is not missing at random, biased results. Previous studies have shown that dropping cases with incomplete data can in fact lead to overestimates of the relationships between variables (Janseen et al., 2009). Multiple imputation is a statistical technique that generates plausible values for missing data based on observed data (Rubin, 1987). This technique has been shown to produce less biased predictions in medical research than listwise deletion. Very few studies have used multiple imputation in autism-related datasets, and no studies have investigated the impact of the method in autism research where variability is a hallmark.

Objectives: Compare multiple imputation with listwise deletion in a sample of typically developing children and children with autism spectrum disorders and no intellectual disability.

Methods: Gender, Adaptive Behavior (Vineland Adaptive Composite), and Executive Function (BRIEF GEC) data from 120 children without intellectual disability (85 ASD; 35 Typically Developing controls) was used to predict group membership (ASD vs. Typically Developing) under the following conditions: 1. Complete data, 2. Multiple imputation after removal of 33% and 66% of the data for one variable, and 3. Listwise deletion after removal of 33% and 66% of the data for one variable. Multiple imputation was performed using default settings of SPSS 17, where imputation replaced each missing value with 5 values drawn from an estimated distribution, resulting in 5 imputed datasets. Multinomial logistic regression was used to predict group membership. Nagelkerke's r-square values/ranges are reported for each method. Removal of data was intentionally biased to create a missing at random (MAR) condition using a covariate.

Results: In the model with complete data, a Nagelkerke's r-square of .78 was obtained. In the imputed data with 33% of one variable removed, the r-squares ranged from .74 to .78; a similar pattern was observed with the imputed data sets with 66% of data removed (r-squares ranged from .72-.77). By contrast, listwise deletion at 33% and 66% resulted in models that overestimated the relationship among the variables (r-square = .86 for both models).

Conclusions: Results in this clinical autism dataset are consistent with previous findings in the statistical literature that multiple imputation yields estimates which more accurately reflect the complete data than listwise deletion, which may over-estimate relationships among variables. This suggests the potential value of multiple imputation procedures for managing missing data in clinical autism research.

134.011 11 Developmental Profiles of Infants and Toddlers with Autism Spectrum Disorders Prospectively Identified In a Community-Based Setting. J. Barbaro*[1] and C. Dissanayake[2], (1)*La Trobe University*, (2)*Olga Tennison Autism Research Centre*

Background: To date, no study has focused on the cognitive profiles of young children identified prospectively in a community-based sample. The findings from high-risk sibling studies and studies using clinic-referred children may not be applicable to those children identified via developmental surveillance or primary level screening. It is therefore important to ascertain whether the findings from these studies are generalizable to children identified from community-based samples.

Objectives: The objective in the current longitudinal study was to investigate the developmental profiles of children with Autism Spectrum Disorders (ASD) from 12- to 24-months, who had been prospectively identified through developmental surveillance in a community-based sample.

Methods: A total of 110 children with Autistic Disorder (AD), 'broader' ASD, and developmental and/or language delays (DD/LD) were assessed using the Mullen Scales of Early Learning (MSEL; Mullen, 1995) at 12-, 18-, and 24-months of age. These children were drawn from a larger sample of 20, 770 children, monitored as part of the Social Attention and Communication Study (SACS).

Results: Children with both AD and 'broader' ASD performed below age-appropriate norms on the MSEL, with the exception of Fine Motor skills at 12- and 18-months of age, which was an area of strength. Furthermore, those in the AD group performed more poorly, overall, than the ASD and DD/LD groups on the MSEL. The children with autism (AD and ASD) were seen to display an uneven cognitive profile, with poorer performance on verbal skills (particularly Receptive Language) relative to nonverbal skills. The children with broader ASD displayed a similar developmental profile to children with DD/LD, with their profiles only differing in their Receptive Language abilities at 24-months of age. In addition, overall performance on the MSEL was seen to decline across time in the children with AD and ASD due to developmental stagnation.

Conclusions: This is the first prospective, longitudinal study of the developmental profiles of children with autism from a community-based sample. The study's findings suggest that a severe deficit in Receptive Language may be the core cognitive impairment that determines whether a child will develop autism or continue to show developmental or language problems without autism. The findings also highlight the urgency of identifying children with autism and intervening as early as possible. Timely intervention may affect crucial changes during the critical period of development between 12- to 24-months, where developmental stagnation is all but too apparent in young children with autism.

134.012 12 Family Predictors of Quality of Life and Child Problem Behavior In Families of Young Children with Autism Spectrum Disorders. S. P. Tetenbaum*[1], S. Nichols[1] and L. Adamek[2], (1)*ASPIRE Center for Learning and Development*, (2)*Stony Brook University*

Background: Previous research related to problem behavior in young children with Autism Spectrum Disorders (ASD) has primarily focused on the affected child, while often overlooking the family of the child with ASD. Multiple child-related variables have been linked with quality of life and problem behavior; however the role of family variables has not yet been evaluated in a systematic way. Research in other child clinical populations supports the influence of family variables on problem behavior and family quality of life (Reyno & McGrath, 2006; Webster-Stratton & Hammond, 1990).

Objectives: The aim of the present study was to evaluate the association between (a) variables within the family system (i.e. relationship discord, social isolation, parental depression, and elevated parental stress) and (b) quality of life and child problem behavior.

Methods: One hundred and one mothers of 2-8 year old children with ASD participated. Measures included parent report of (a) child problem behavior, (b) overall quality of life, (c) maternal depression, (d) relationship discord, (e) parental stress, and (f) social support. Bivariate correlations and multiple

regression analyses were used to evaluate the association among these variables.

Results: Participants reported significant levels of stress, relationship dissatisfaction, and depression. Bivariate correlations revealed significant moderate to high correlations between overall quality of life and relationship satisfaction (r = .64, p <.001), parental depression (r = .61, p <.001), and parental stress (r = -.55, p <.001) as well as significant moderate correlations between problem behavior and parental depression (r = .25, p <.01) and parental stress (r = .49, p <.001). Two separate multiple regression analyses were conducted for overall family quality of life and problem behavior as criterion variables. For family quality of life, the overall R^2 was .63, $F(4, 96) = 40.06$, $p < .001$. The standardized regression coefficients (betas) were .39 for relationship satisfaction, -.23 for parental depression, .20 for social support, and -.29 for parental stress. For problem behavior, the overall R^2 was .26, $F(4, 96) = 8.34$, $p < .001$. The standardized regression coefficients (betas) were -.09 for relationship satisfaction, .02 for depression, .09 for social support, and .48 for parental stress.

Conclusions: Findings highlight the importance of recognizing the role of the family in ASDs. Relationship discord, maternal depression, and parental stress were associated with (a) high levels of problem behavior in young children with ASDs and (b) poor quality of life for both the child and the family. The role of the family in ASDs and implications for future intervention research will be discussed.

134.013 13 Empathy and Emotion Recognition In People with Autism and Their First-Degree Relatives. E. P. Sucksmith*[1], C. Allison[2], S. Baron-Cohen[2], B. Chakrabarti[3] and R. A. Hoekstra[1], (1)*Open University*, (2)*Autism Research Centre, University of Cambridge*, (3)*University of Reading*

Background:

Impairments in empathy are an important characteristic feature of Autism Spectrum Conditions (ASC) (Baron-Cohen, 2002). Difficulties in identifying other people's thoughts and feelings and problems responding to these mental states appropriately has an adverse impact on the formation of social relationships. Studies indicate that the first-degree relatives of individuals with ASC display higher rates of mild social and communication impairments compared to the general population (Wheelwright et al, 2010; Constantino et al. 2006).

The Empathy Quotient (EQ) is a self-report questionnaire designed to quantify empathy (Baron-Cohen and Wheelwright, 2004). We also designed a basic emotion recognition task using stimuli from the Karolinska Directed Emotional Faces (KDEF; Lundqvist et al. 1998) database. Basic emotion recognition is a fundamental component of social understanding and a core building block in the development of empathy.

Objectives:

To assess whether (i) adults with ASC and (ii) first-degree relatives (parents) of a child with ASC show difficulties on a self-report measure of empathy (the EQ) and a performance measure of emotion recognition compared to a control group with no psychiatric diagnoses.

Methods:

338 adults with ASC (167 male, 171 female), 317 parents of a child with ASC (279 mothers, 38 fathers) and 193 controls (96 male, 97 female) participated in this study. All data were collected using an online test interface and groups were matched on non-verbal IQ. Total EQ scores were calculated; basic emotion recognition performance was measured using accuracy-adjusted response time.

Results:

A Group* Sex analysis of covariance (ANCOVA) with non-verbal IQ as a covariate revealed a significant main effect of Group ($p < 0.001$) and Sex ($p < 0.001$) on total EQ score, with males obtaining lower scores than females. There was a significant interaction effect between Group and Sex ($p < 0.001$). Planned contrasts revealed that fathers, but not mothers of a child with autism, scored significantly lower ($p < 0.05$) than same-sex controls. Both males and females with ASC scored significantly lower ($p < 0.001$) than their sex-matched controls.

For the emotion recognition test a similar ANCOVA revealed significant main effects of Group ($p < 0.001$) and Sex ($p < 0.001$), with females outperforming males. Interaction effects were absent. Planned contrasts revealed that both adults with ASC ($p < 0.001$) and parents of children with autism ($p < 0.05$) showed significant impairments on basic emotion recognition. A Group* Sex MANCOVA analysing the 6 distinct basic emotions separately indicated that the ASC group showed impaired performance across all emotions, whilst for the autism parent group impaired recognition of individual emotions was restricted and less consistent.

Conclusions:

This study indicates that the social and communication difficulties characteristic for individuals with ASC are reflected in significant impairments on a self-rated measure of empathy and in performance on a basic emotion recognition test. The first-degree relatives of individuals with ASC exhibited more subtle deficits on these tests, which are indicative of the Broader Autism Phenotype. These results suggest that some of the underlying components of empathy are heritable.

134.014 14 Assessing the Potential of Social Networking Sites as Social Forums for Individuals with Autism. G. Park*[1], K. Gillespie-Lynch[1], D. S. Smith[1], S. K. Kapp[2], P. M. Greenfield[1] and T. Hutman[2], (1)*UCLA*, (2)*University of California, Los Angeles*

Background:

Do Social Networking Sites (SNS) allow individuals with autism to compensate for difficulties socializing offline? SNS help other socially isolated groups, such as people with anxiety, overcome isolation (Pierce, 2009). Computers are reinforcing for individuals with autism (Moore & Calvert, 2000) who may use computer based social interaction to compensate for reduced face-to-face interaction (Benford, 2008). While Internet use may facilitate the formation of social connections, individuals with autism report difficulties recognizing online social codes and maintaining connections formed online (Burke et al., 2010). Interactions on SNS often involve impression management (Boyd & Ellison, 2008) which could be difficult for individuals with autism. Usability analysis indicates that teenagers with autism may find SNS confusing (Bahiss et al., 2009). The current study is the first to quantitatively assess whether the frequency of SNS use differs between individuals with autism (ASD), relatives of autistic people (Family), and people without autistic relatives (Unrelated).

Objectives:

1. Determine if overall Internet use is compensatory (negatively correlated with offline social interaction) for ASD, Family, or Unrelated.
2. Evaluate enjoyment of and frequency of SNS use across groups.

Methods:

204 ASD, 60 Family, and 98 Unrelated participants were recruited to an Internet survey from autism advocacy and family support groups, forums and discussion boards, social networking sites, schools, vocational rehabilitation centers, and Craigslist. The AQ (Baron-Cohen, 1998) was administered to all participants. Age, gender, and education were entered into all statistical analyses. Reported p values index pair-wise comparisons following significant univariate tests.

Results:

Hours spent communicating online did not differ between groups. ASD spent less time interacting face-to-face than Family ($p=.005$) and Unrelated ($p<.001$). However, hours communicating face-to-face were unrelated to hours communicating online.

ASD reported enjoying SNS less than Unrelated ($p<.001$). While there were no group differences in enjoyment of SNS when communicating with friends with autism, Unrelated liked to use SNS to communicate with friends without autism more than Family ($p=.031$) and ASD ($p=.001$) liked to.

ASD used the following functions of SNS less than Unrelated: writing updates ($p=.013$), adding friends ($p=.01$), getting added ($p=.004$), getting tagged in pictures ($p=.001$), and commenting on pictures/having pictures commented on ($p<.001$). ASD had their walls written on and wrote and received emails less on SNS less than Unrelated ($p<.001$) and Family ($p=.031$). Unrelated wrote on people's walls, tagged people in pictures, and commented on others' updates more than Family ($p<.036$) and ASD ($p<.001$).

Conclusions:

This study only partially supports the hypothesis that individuals with autism use the Internet to compensate for difficulties communicating face-to-face. While ASD did spend less time interacting face-to-face than those without autism, no relationships between time spent interacting online and offline were observed.

As suggested by previous qualitative research (Bahiss et al., 2009), SNS are not a preferred medium for individuals with autism. Individuals with autism use many features of SNS less than people without autism. Often differences were only observed between ASD and Unrelated or even distinguished between Unrelated and Family. SNS use may index characteristics of the broader autism phenotype.

134.015 15 Performance Pattern Differences on Measures of Verbal Intelligence In Children with Autism Spectrum Disorders and Attention Deficit-Hyperactivity Disorder. E. L. Wodka*[1], L. Kalb[1] and M. Zayat[2], (1)*Kennedy Krieger Institute*, (2)*Loyola University*

Background: With current Autism Spectrum Disorder (ASD) diagnostic assessment tools being more sensitive than specific (Lord et al., 2000), it is often recommended that they be used as part of a broader evaluation to diagnose an ASD (Chawarska, Klin, Paul, & Volkmar, 2007). However, specific recommendations of additional tools useful in the screening or diagnosis of ASD are less available. Although not specifically designed for ASD diagnostic purposes, children with ASDs frequently undergo developmental/psychological evaluation including cognitive/intelligence assessment. Given the widespread use of cognitive measures (e.g., in schools, outpatient clinics), identification of a performance pattern specific to ASD could be useful for screening and further diagnostic evaluation referral purposes. To date, no such pattern has been identified.

Objectives : Performance patterns on verbal subtests from the Wechsler Intelligence Scale for Children-IV (WISC-IV) were compared between a clinically-referred sample of children with autism spectrum disorders (ASD) and attention deficit/hyperactivity disorder (ADHD).

Methods: Data used for this study were from a clinical registry housed at an outpatient clinic specializing in autism spectrum disorders that is part of a large urban children's hospital.

Retrospective chart review was used to gather data, including demographic information (i.e., sex, age, handedness, parent education, medication history), diagnosis, and WISC-IV performance. Children ages 6-16 years with Verbal Comprehension Index (VCI) greater than a standard score of 70 from the WISC-IV were included in the study. Children were also included if their evaluation resulted in a clinical diagnosis of autism, Asperger's disorder, PDD-NOS, or ADHD. The final sample included 55 children with ASD and 24 children with ADHD.

Results: Independent samples t-test revealed significant differences between groups (ASD > ADHD) on the Similarities subtest ($t_{(2, 77)}$=2.3, p=.03); no differences were found between groups on the Vocabulary and Comprehension subtests or demographic variables (p > .05). Within groups, children with ADHD performed similarly across the three subtests; however, children with ASD demonstrated a distinct pattern of performance, where they obtained the highest scores on Similarities, followed by Vocabulary, and Comprehension. Specifically, only for the ASD group, paired samples t-tests revealed highly significant differences between performance on Similarities and Vocabulary ($t_{(1, 54)}$=5.2, p<.001), Similarities and Comprehension ($t_{(1, 54)}$=7.7, p<.001), and Vocabulary and Comprehension ($t_{(1, 54}$ 3.9, p <.001).

Conclusions: For children with ASD, but not those with ADHD, results indicated significant differences in performance across verbal measures from the WISC-IV, such that performance on the Similarities subtest was the highest, followed by Vocabulary, with Comprehension as the lowest. These findings suggest that while children with ASD and ADHD may share behavioral characteristics (e.g., inattention, social difficulties), they share less similarities in cognitive profile. The core language formulation and social reasoning deficits that are unique to ASD are hypothesized to explain the differing pattern of performance. Uncovering this pattern unique to children with ASD in our sample is particularly notable given use of clinical comparison group (who shared behavioral features with the ASD group), thereby increasing clinical applicability.

134.016 16 The Sensory Perception Quotient: Validation In Adults with and without Autism Spectrum Conditions. T. Tavassoli*[1], R. A. Hoekstra[2] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*Open University*

Background: Anecdotal reports suggest sensory differences in autism spectrum conditions (ASC) (Grandin, 1996; Chamak et al, 2008). In addition questionnaire based studies report sensory issues in ASC (Leekam et al., 2007, Klintwall et al., 2010). The most widely used sensory questionnaire, the Sensory Profile, shows differences in over 90% of children and adults with ASC (Kientz &Dunn, 1997). However, the Sensory Profile evaluates the behavioural response towards sensory experiences and there is a need for an adult questionnaire investigating basic sensory sensitivity towards stimuli.

Objectives: (1) To report data from a new measure, the Sensory Perception Quotient (SPQ), which assesses basic sensory sensitivity. (2) To investigate if adults with ASC report sensory differences on the SPQ. (3) To examine if reported sensory sensitivities are linked to autistic traits.

Methods: 545 adults with (n=275) and without (n=262) ASC participated in an online study. Participants were asked to fill in the SPQ, as well as the Sensory Over-responsivity Inventory (SenSOR) (Schoen & Miller, 2009). The SenSOR was developed to evaluate sensory processing disorder, or sensory over-responsivity (Schoen & Miller, 2009). The SenSOR measures how many sensations are experienced as aversive (e.g. labels in clothes). Compared to the SenSOR the SPQ

investigates basic sensory perception rather than the emotional response towards it. The SenSOR was included to examine the validity of the SPQ. An online adaptation of the Raven matrices was used to measure intellectual ability (IQ) in both groups. Lastly, autistic traits were measured using the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001).

Results: The groups did not differ in terms of IQ or age ($p>.05$). Items of the SPQ were reduced using a principal component analysis. Split half-reliabilities were calculated and showed good item reliability ($r=.81$). Adults with ASC reported more sensory sensitivity on the SPQ compared to controls ($p<.001$). The SPQ score was significantly correlated with the SenSOR score ($r= .49$, $p<.001$). Finally, the SPQ score was positively correlated to the AQ across groups ($r=.33$, $p<.001$) and within the ASC group ($r=.34$, $p<.001$) and control group ($r=.24$, $p<.001$).

Conclusions: The Sensory Perception Quotient (SPQ) showed good split-half reliability and validity. In addition the SPQ discriminated between adults with and without ASC. Adults with ASC reported more sensitivity to sensory stimuli on both the SPQ and the SenSOR. Lastly, greater sensory sensitivity was associated with more autistic traits. Sensory issues in adults with ASC have been understudied; the SPQ provides the first questionnaire to measure an individual's sensory sensitivity. This quick and reliable tool can be of great value in future projects studying this important topic.

134.017 17 Electrophysiological Assessment of Attention Regulation In ADHD, Autism Spectrum Disorder, and Typical Children. E. M. Sokhadze*, J. M. Baruth, L. L. Sears, G. Sokhadze, A. S. El-Baz and M. F. Casanova, *University of Louisville*

Background: Autism Spectrum Disorders (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are very common developmental disorders which share some similar symptoms of social, emotional, and attention deficits. This study is aimed to help understand the differences and similarities of these deficits using analysis of dense-array Event-Related Potentials (ERP) during Kanizsa illusory figure recognition task.

Objectives: Although ADHD and ASD seem very distinct, they have been shown to share some similarities in their symptoms. The aim of this study involved comparing the ERP profiles of ADHD, ASD, and typical control subjects in a shape recognition task in order to investigate effectiveness of differentiation of target and non-target stimuli. Our hypothesis was that children with ADHD and ASD will show less pronounced differences in ERP response to target and non-target stimuli as compared to typical children. We expected to find other ERP manifestations of attention regulation and other executive function differences between ASD and ADHD.

Methods: Participants with ASD (N=16) and ADHD (N=16) were referred by the Department of Pediatrics. Typical children (N=16) were recruited through advertisements in the local media and schools. There was no significant difference in age (mean 13.6 years, SD=2.5), gender, or IQ between the three groups. EEG was collected using 128 channel EGI EEG system. The task involves the recognition of a specific illusory shape, in this case a square or triangle, created by three or four inducer disks. Subjects were instructed to press button only in response to an illusory square figure.

Results: There were no between group differences in reaction time (RT) to target stimuli, but both ASD and ADHD committed more errors, specifically the ASD group had statistically higher commission error rate than controls. Post-error RT in this group was exhibited in a post-error speeding rather than corrective RT slowing typical for the controls. The ASD group also demonstrated an attenuated error-related negativity (ERN) as compared to ADHD and controls. The fronto-central P200, N200, and P300 were enhanced and less differentiated in response to target and non-target figures in the ASD group. The same ERP components were featured by more prolonged latencies in the ADHD group as compared to both ASD and typical controls.

Conclusions: Our results show significant differences both in behavioral and electrocortical responses between ASD, ADHD, and typical controls during performance on illusory figure test. The findings are interpreted according to the "minicolumnar" hypothesis proposing existence of neuropathological differences in ASD and ADHD, in particular minicolumnar number/width morphometry spectrum differences. In autism, a model of local hyperconnectivity and long-range hypoconnectivity explains many of the behavioral and cognitive deficits present in the condition, while the inverse arrangement of local hypoconnectivity and long-range hyperconnectivity in ADHD explains some deficits typical for this disorder (Williams & Casanova, Med Hypotheses, 2010, 74:59) Current ERP study supports the proposed suggestion that some between group differences could be manifested in the frontal ERP indices of executive functions during performance on illusory figure categorization task.

134.018 18 Longitudinal Profiles of Adaptive Behavior In Children with ASD From Ages 2 to 8. C. A. Saulnier*[1], P. Ventola[1], K. D. Tsatsanis[1], K. Chawarska[2] and A.

Klin[3], (1)*Yale Child Study Center*, (2)*Yale University School of Medicine*, (3)*Yale School of Medicine*

Background:

Research has shown a widening gap between IQ & adaptive behavior across age groups in ASD, with older individuals having poorer functional skills comparative to younger individuals. This is particularly evident in higher functioning ASD, with discrepancies emerging as early as age 4. However, most studies to date have been cross-sectional and have not included a broad IQ range. Less information is known about the relationship between cognitive and adaptive skills within the same group of individuals over time, and the role that level of IQ plays.

Objectives:

The relationship between IQ and adaptive functioning, measured by the Vineland, is investigated in a longitudinal sample of children at ages 2, 4, and 8. Acquisition of cognitive and adaptive skills over time and the gap between these constructs are examined.

Methods:

Participants included 46 children with ASD with mean ages of 28 months at Time 1, 53 months at Time 2, and 104 months at Time 3. The sample included 24% females and 76% males.

Results:

Mean IQ scores (SDs) for the 3 age groups using ratio IQ scores for the *Mullen Scales of Early Learning* and General Conceptual Ability scores for the *Differential Ability Scales, Second Edition* were as follows: Age 2: 68.10 (17.19); Age 4: 86.49 (22.56); Age 8: 88.68 (25.17). A Repeated Measures ANOVA revealed that cognitive skills significantly improved from ages 2 to 4 and 2 to 8, but remained stable between ages 4 and 8 ($F=37.80$, $P<.001$). Mean Vineland Adaptive Behavior Composite scores, Expanded Form, were as follows: Age 2: 74.07 (10.88); Age 4: 67.43 (11.24); Age 8: 77.09 (16.89), with significant improvements noted between ages 4 and 8 ($F=3.84$, $p=.064$). Significant discrepancies were evidenced between mean IQ and Vineland scores at Age 4 ($t=-7.56$, $p<.001$) and Age 8 ($t=-5.96$, $p<.001$), but not at Age 2 ($t=.25$, $p=.81$). The gap between IQ and adaptive skills significantly widened from ages 2 to 4 and 2 to 8, but remained stable from 4 to 8 ($F=18.96$, $p<.001$), with Vineland scores falling significantly below IQ at ages 4 and 8. Profiles differed between individuals with high (>70) vs. low (<70) IQ, with adaptive daily living skills being the most impaired area of adaptive functioning in the High IQ group, yet the strongest adaptive area in the Low IQ group. In general, adaptive skills were higher than cognitive skills in the Low IQ group, and lower than cognitive skills in the High IQ group.

Conclusions:

Results indicate that despite acquiring cognitive and adaptive skills overtime, children with ASD evidence significant deficits in adaptive functioning as early as age 4 that continue through age 8. Consistent with previous findings, profiles of adaptive functioning greatly differ between individuals with low vs. high IQs, with overall adaptive functioning being stronger than cognitive ability in the less cognitively able group, and significantly lower than IQ in the more cognitively able group. Given the strong role of adaptive functioning in adult outcome, predictors of adaptive functioning are examined and implications for intervention are discussed.

134.019 19 Sleep and Executive Control Among Young High Functioning Children with Autism Spectrum Disorders.

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Background: Among typically developing children sleep patterns have been related to executive control (e.g., Karpinski et al., 2008; Beebe et al., 2004) and sleep disorders are more common among children with autism spectrum disorders (ASD) (Richdale & Schreck, 2009). To our knowledge, there have been no published investigations of sleep and executive control in children with ASD.

Objectives: To test whether young, high-functioning children with ASD differ from controls in parent reported sleep duration and sleep problems. And, to test whether sleep is related to executive control ability among children with ASD.

Methods: Subjects were 21 6- and 7-year-olds with ASD and 21 age- and IQ-matched controls. Diagnosis was confirmed with the ADOS, ADI-R and DSM-IV-TR. All children in both groups had cognitive ability in the average to above average range (measured by the Differential Ability Scales). Parent report of sleep-related breathing disorders (SRBD), snoring, sleepiness, and associated behavioral difficulties were measured using the Pediatric Sleep Questionnaire (PSQ; Chervin et al., 2000). Children completed a battery of executive control tasks. Parents provided additional information about executive functioning and symptoms in other settings via the Behavioral Rating Inventory of Executive Function (BRIEF) and Repetitive Behavior Scale-Revised (RBS-R).

Results: Children with ASD had more sleep-related breathing disorders overall, $t(39) = 3.87$, $p < .001$, and greater sleep-related behavior challenges, $t(39) = -4.93$, $p < .001$, but scores on the sleepiness and snoring scales did not differ. Children with ASD also slept less during the week than controls, $t(38) = -2.29$, $p = .03$. Children with ASD who slept less during the week exhibited more difficulty with behavioral regulation (BRIEF BRI, $r(19) = -.55$, $p = .01$) and overall executive functioning (BRIEF GEC, $r(19) = -.50$, $p = .03$), as well as more repetitive behaviors (RBS-R, $r(19) = -.46$, $p < .05$). Higher SRBD scores also corresponded with more executive difficulties, (BRIEF GEC, $r(19) = -.614$, $p = .005$) and repetitive behaviors (RBS-R, $r(19) = .79$, $p < .001$). Increased snoring related to more errors during a basic stimulus-reward association task ($r(19) = .484$, $p = .03$). Working memory and short-term spatial memory were not related to sleep.

Conclusions: Children with ASD slept less during the week and had greater parent reported sleep-related breathing disorders and behavioral disruptions. These difficulties corresponded to greater impairments in executive control, repetitive behaviors, and information processing, suggesting that more investigation is needed to understand how sleep disruptions are related to poor executive control in children with ASD.

134.020 20 Evaluation of the Diagnostic Accuracy and Reliability of the Pediatric Autism Early Diagnostic (PAED) Assessment: A New Tool for Community-Based Pediatricians.

V. Wright*[1], W. Roberts[2], M. Shouldice[3], M. Gordon[4], S. Barker[4], N. Jones-Stokreef[4], J. Flanagan[5], L. Feitelberg[5], E. Jimenez[2], S. Stead[5], J. A. Brian[3] and R. Barber[1], (1)*Bloorview Research Institute*, (2)*Holland Bloorview Kids Rehabilitation Hospital*, (3)*Hospital for Sick Children*, (4)*Orillia Soldiers Memorial Hospital*, (5)*St Joseph's Health Centre*

Background: Practice guidelines emphasize using standardized diagnostic tools with high specificity and sensitivity to directly assess features of Autism Spectrum Disorders (ASD) during diagnostic assessment. In an effort to construct an assessment for community pediatricians, our team developed the Pediatric Autism Early Diagnostic tool (PAED). Its six activities (free play, response to name, bubbles, snack, pretend play and social games) were modified from the Autism Diagnostic Observation Schedule (ADOS), a well-validated diagnostic tool for Autism. ADOS administration requires 30-60 minutes and standardized equipment. The PAED takes 15-20 minutes and uses readily-available equipment. Information from the PAED Observation Form is mapped by the examiner onto a 12-point DSM-IV criteria scoring form for diagnostic classification

Objectives: To compare the PAED against the validated ADOS Module 1 for diagnostic accuracy with pre-verbal children, and evaluate PAED scoring reliability between/within raters.

Methods: Twenty eight pre-verbal children (mean age 33 months) referred to one of three child development clinics with suspected Autism, language/social concerns, and/or repetitive behaviours received both a PAED and ADOS by independent clinicians prior to the developmental history/physical examination being completed. The PAED was administered and scored by one of four raters (child development practitioners) who received PAED training by an ADOS trainer. None of the PAED raters were ADOS trained. After the rater completed PAED and DSM-IV scoring, a diagnostic category of 'Autism', 'PDD-NOS/ASD' or 'Not Autism (NA)' based on DSM-IVTR criteria was assigned. PAED videotapes were independently scored by two raters to evaluate intra/inter-rater reliability. The ADOS Module 1 was administered and scored at a separate visit by a different ADOS reliable rater (blinded to PAED results). Following ADOS assessment, the rater scored the DSM-IV, and assigned a diagnostic category as above.

Results: Following ADOS assessment, 6 children were classified as NA, 3 children with PDD-NOS, and 19 children with Autism. Following the PAED, 8 children were classified as NA, 4 children with PDD-NOS, and 16 children with Autism. ADOS and PAED classification agreement was excellent: weighted kappa (K)=0.83. Category agreement was lowest for PDD-NOS (K=0.51). Sensitivity and specificity were from 91%-100% for Autism/PDD-NOS versus NA and Autism versus PDD-NOS. Intra-rater reliability (n=28) of the PAED DSM-IV score was high when done from video-viewing (ICC = 0.92; 95%CI =0.83-0.96), and moderate when live versus video-viewing was evaluated (ICC=0.63, 95%CI=0.34-0.81). Inter-rater reliability (n=16) was excellent when two raters not involved in initial live rating scored from video (ICC=0.86, 95%CI=0.65-0.95).

Conclusions: When used alongside the history/physical examination, the PAED demonstrated strong ability to classify children correctly and holds promise as a shorter but still reliable observational tool for community pediatricians who would not do a full ADOS. Further testing is needed to confirm results with a larger sample and more verbal children.

134.021 21 Can the AOSI at Nine Months Discriminate Between Infants at High or Low Risk for ASD?.

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Background: Recently, an important focus of longitudinal research has been to isolate specific risk markers that are present in the first year of life, long before a confirmed ASD diagnosis is typically given. As a result of this body of early risk research, the Autism Observation Scale for Infants (AOSI) was developed by Bryson and her colleagues (Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2007). The AOSI has the ability to identify infants who are later diagnosed with autism from other low risk controls as early as twelve months (Zwaigenbaum et al., 2005); however, at 6 months, AOSI scores do not predict later diagnostic outcomes. It is not yet known whether AOSI scores in infants younger than twelve months can be used to predict later ASD symptoms.

Objectives: The objective was to determine whether differences in infants at high (HRA; defined as infants with an older sibling with an ASD diagnosis) versus low risk (LRC) for ASD are evident as early as nine months for scores on the AOSI regardless of outcome. Furthermore, to investigate whether AOSI scores at nine months predict ASD symptoms at eighteen months, as measured on the Autism Diagnostic Observation Schedule (ADOS), independent of risk group.

Methods: The AOSI was administered to HRA (n=32) and LRC infants (n=31) at nine months and HRA infants (n=71) and LRC infants (n=43) at twelve months as a part of their participation in the Infant Sibling Project taking place at Boston University and Children's Hospital. A total of 42 infants (HRA n=26; LRC n= 16) were administered the AOSI at both ages. At eighteen months, the (ADOS) was administered to all infants enrolled in the study to determine a preliminary outcome.

Results: Independent samples t-test confirmed significant differences found by Zwaigenbaum et al. in total AOSI scores at twelve months for HRA infants (M=3.86, SD=2.914) and LRC infants (M=2.16, SD=2.137); $t(112)=-3.313$, $p<.01$. A significant difference was also found in total nine month AOSI scores for HRA infants (M=4.91, SD=3.073) and LRC infants (M=3, SD=1.265); $t(61)=-3.201$, $p<.01$. Furthermore, an additional independent samples t-test removing infants who received a preliminary ASD outcome (based on meeting cutoff scores on the ADOS at 18 months) still revealed significant group differences between nine month AOSI total scores and group with HRA infants performing significantly poorer on the AOSI (M=4.84, SD=3.099) than LRC infants (M=3, SD=1.265); $t(60)=-3.058$, $p=<.01$. Nine month AOSI scores did not, however, predict scores on any of the subscales of the ADOS.

Conclusions: These findings suggest that high risk infants show differences on the AOSI at nine months. Further analyses will investigate whether specific items of the AOSI (such as response to name, atypical eye contact, social smiling, etc.) can predict ADOS scores at eighteen months.

134.022 22 Autonomy, Dependency, and the Attainment of Developmental Tasks In the Third Decade of Life Among Young Adults with High Functioning Autism Spectrum Conditions. A. Yannay-Shani* and O. Golan, *Bar-Ilan University*

Background: The last two decades has seen a continuous increase in the prevalence of High Functioning Autism Spectrum Conditions (HFASC). However, besides descriptive statistics regarding vocational and accommodation aspects, little is known about the nature of adult life for individuals with HFASC, let alone of their own perspective of adult life, their self-perception as autonomous adults, and the challenges they face struggling between autonomy and dependency.

Objectives: This study employed qualitative and quantitative methods to explore themes of perceived autonomy and dependency manifested by young adults with HFASC, in comparison to young adults from the general population. In particular, we focused on the young adults' relationships with their parents and the association of these relationships to the young adults' attainment of developmental tasks in the third decade of life.

Methods: A group of 16 young adults with HFASD (12m, 4f) and a group of 24 adults from the general population (18m, 6f) were matched on age, sex, and educational level. Participants were individually interviewed using semi-structured interviews on their personal experience of entering adulthood and its relation to their relationships with both their parents. Interviews were transcribed and scored by two independent judges. Scores were grouped into two factors: autonomy level and relationship quality. In addition, participants' mothers and fathers filled in a questionnaire evaluating 3 factors of their relationships with their son/daughter: autonomy, dependence, and oppositional behavior. Participants at the HFASC group alone filled in a questionnaire assessing their attainment of developmental tasks in the third decade of life.

Results: Over all, young adults with HFASC perceived themselves as less autonomous and as having poorer relationships with their parents, compared to controls. Parents of adults with HFASC described their son/daughters as less autonomous and more dependent than parents of controls.

Relationships with the mother were affected in particular, as individuals in the HFASC group viewed the quality of relationships with their mothers to be lower than that of controls, and mothers in the HFASC group perceived their son/daughter as more oppositional, compared to mothers of controls. There were no such differences for fathers.

In the HFASC group, adults' perceived quality of relationships with the father was negatively correlated to their perceived quality of relationships with the mother, and positively correlated to their perceived autonomy in their relationships with the mother. Mothers' reported level of their son/daughter's autonomy was marginally correlated with the son/daughter's attainment of developmental tasks in the third decade of life.

Themes describing the unique coping of adults with HFASC with autonomy and dependency issues in the third decade of life, as manifested in their interviews, will be discussed and demonstrated.

Conclusions: This study offers a closer perspective on young adults' with HFASC coping with the challenges of individuation and autonomy in their third decade of life. In particular, it indicates their use of splitting in relationships and their need for empowerment of their autonomous self by their parents. Future research directions and implications for intervention will be discussed.

134.023 23 Autism Spectrum Disorders In Hispanics and Non-Hispanics. V. Chaidez*[1] and I. Hertz-Picciotto[2], (1)*University of California, Davis*, (2)*University of California Davis*

Background: ASD prevalence varies by ethnicity, where Hispanics have reportedly lower prevalence. Comparative studies between ethnic groups may unveil differences in autism profiles that could potentially provide us with better and more culturally appropriate approaches for diagnosis and treatment of ASD. Furthermore, this type of study may suggest explanations for the lower prevalence of ASD seen in Hispanics.

Objectives: To describe demographic and phenotypic differences potentially relevant to ASD in a comparison between Hispanics and non-Hispanics.

Methods: The Childhood Autism Risks from Genetics and the Environment (CHARGE) study is an ongoing population-based case-control study with subjects sampled from three strata: children with autism (AU) or autism spectrum disorder (ASD), children with developmental delay (DD) but not autism, and children selected from the general population (GP). Study participants: a) are between the ages of 24 and 60 months, (b) live with at least one biologic parent, (c) have a parent who speaks English or Spanish, (d) are born in California, and (e) reside in one of the catchment areas of a specified list of Regional centers in California. This study population consisted of 827 children. Diagnosis of AU and ASD was confirmed in all subjects using the Autism Diagnostic Interview-Revised (ADI-R) and the Autism Diagnostic Observation Schedules (ADOS). Other data collected and compared for all participants include demographics, household language use, adaptive and maladaptive behavior scores, and cognitive scores. We also examined the relationship between multiple language exposure and language function and scores of children.

Results: Among GP control participants, a larger percent of Hispanics met criteria for atypical development (10.1% vs. 0.5%) and delayed development (9% vs. 3.2%) compared to non-Hispanics ($p<0.0001$). Among those children recruited with DD, approximately 20% of both Hispanics and non-Hispanics met criteria for ASD or AU. Compared with non-Hispanic households, multiple language use was far more common in Hispanic households (72.7% vs. 37.6% in cases, 66.2% vs. 30.7% in TD controls, 81.8% vs. 50.7% in DD controls). Among cases, regression status and language function were not significantly different between ethnic groups. Non-Hispanic cases also demonstrated higher cognitive ability on the composite score for the Mullen Scales of Early Learning (MSEL), but not the Vineland Adaptive Behavior Scales (VABS). For both cases and TD controls, Hispanics scored significantly lower on receptive language and expressive language subscales of MSEL. Speaking to a child 25-50% time in a second language was associated with lower scores on expressive ($p=0.0005$ TDs, $p=0.003$ AU/ASD) and receptive language subscale scores ($p=0.003$ TDs, $p=0.06$ AU/ASD) for both typically developing children and children with ASD within the 2-5 year age range.

Conclusions: Overall, the CHARGE Hispanic group displayed more similarities than differences compared to non-Hispanics in terms of autistic phenotypes and maladaptive & adaptive scores for cases. The relationship between multiple language use and cognitive scores warrants a closer look.

134.024 24 Danger Lurking? Dissociation of Psychophysiology and Behavior In Response to Provoked Anxiety. M. South*[1], T. Newton[1], M. Christensen[1], O. Johnston[1], K. Taylor[2], N. K. Jamison[1], R. Gilliland[1], P. Chamberlain[1], S. van Tassell[1], A. Cooper[1], A. LeBaron[1], A. LeBaron[1] and J. D. Higley[1], (1)*Brigham Young University*, (2)*Virginia Commonwealth University*

Background: In addition to core impairments in social communication, many individuals diagnosed with an autism spectrum disorder (ASD) experience severe and debilitating symptoms of anxiety. Characterization of both shared and distinct neural mechanisms in ASD and anxiety may give insight into the neurodevelopmental course of ASD and improve the specificity of intervention techniques. Our aim was to measure both physiological and behavioral responses to an anxiety-provoking situation where a stranger intrudes on the experiment. In monkey studies and in the wild, such situations tend to be accompanied by increased vigilance but decreased physical activity in order to avoid detection.

Objectives: We recently demonstrated a disconnect between everyday anxiety and risk-taking in an ASD sample (South, Dana et al., in press). In using a richer, ecologically-valid procedure we hypothesized that our more anxious ASD sample would not be able to contain physical activity in response to the stranger (see Kalin, 2003). We predicted that we would again find evidence for atypical physiological arousal in ASD.

Methods: The *Intruder Paradigm for Humans* was adopted from studies of emotion regulation in monkeys (Kalin, 2003). Three distinct phases occur while the participant attends to a computerized cognitive task: 1) the attending research assistant leaves the room for a short time, leaving the participant alone; 2) after the RA returns, an ill-dressed male confederate enters the room and begins an argument with the RA until both leave; 3) the confederate intruder re-enters the room but does not engage the participant. Disposable electrodes are used to collect skin conductance response for the duration of the experiment. Participants included 39 children and adolescents diagnosed with an ASD and 34 typically-developing (TYP) individuals matched on age and IQ.

Results: The ASD group was significantly more anxious than the TYP group according to parent- and child-report symptom measures. Baseline skin conductance levels were equivalent across groups. Repeated-measures ANOVA analyses of the skin conductance response (SCR) across all phases of the experiment demonstrated significant a main effect for phase (Isolation < Intrusion > Recovery); and a significant main effect of diagnostic group, due to substantially less psychophysiological responsiveness in the ASD group during all phases of the experiment. In contrast, coding of the video taped experiment demonstrated significantly more body, head, and vocal activity for the ASD group.

Conclusions: This is our second recent finding of significant dissociation of behavioral and physiological states in ASD. This disconnect of internal and external states may reflect atypical connectivity between the amygdala and other key emotion-regulation regions of the brain, and how this confusion is manifested in everyday emotion regulation in ASD. Experiments that can explicitly link results in human ASD samples with existing studies in animal models have strong translational value. We suggest that individual differences in the capacity to monitor internal emotional states (see South, Larson et al., 2010), as found in this adapted animal paradigm, may provide an useful marker for neurobiological and behavioral measurements of heterogeneity in ASD, and offer more specific targets for treatment.

134.025 25 Health Related Quality of Life: Perspectives From Youth with Autism Spectrum Disorders and Their Mothers. J. Magill-Evans*[1], C. Koning[2] and B. G. Clark[1], (1)*University of Alberta*, (2)*Glenrose Rehabiliation Hospital*

Background: The perspective of adolescents with Autism Spectrum Disorders (ASD) on dimensions of their health related quality of life (HRQoL) has not received adequate attention in previous research. To understand changes in perceptions of HRQoL over time and address needs in this population, both youths' and parents' perspectives need to be considered.

Objectives: This study explored HRQoL in Alberta youth aged 13 to 18 years old with ASD. It also examined the concordance between the self-identified HRQoL scores of youth and those of their mothers, particularly in dimensions related to social functioning, including "Social Support/Peers" (quality of social relationships with friends/peers and feeling part of a group) and "Social Acceptance/Bullying" (feeling rejected or bullied by peers). This study lays a baseline for looking at changes over time.

Methods: Sixteen participants with ASD (2 girls, 14 boys) and their mothers were recruited through an autism follow-up clinic and the Autism Society. Mean age was 15.6 years (SD= 1.7) and reading level was Grade 6 or higher based on parent report. Participants provided informed consent or assent. Mothers completed the Adaptive Behaviour Assessment System–II (ABAS-II) to describe the youth. Youth and their mothers completed the parent or child version of the KIDSCREEN-52 HRQoL standardized questionnaires which examine 10 HRQoL domains. Results are compared with international normative data (Mean= 50, SD=10). Differences between parent and youth self-report were examined using paired t- tests with a correction for multiple t-tests. Correlations

between parent-rated ABAS-II scores and HRQoL dimensions related to social functioning are explored.

Results: Contrary to studies of HRQoL in adults with ASD, youth with ASD reported average quality of life for all 10 domains with scores within 1 SD of the mean. HRQoL was highest for School Environment and Self-perceptions and lowest for Social Support/ Peers and Moods/Emotions. Mothers rated their child's HRQoL lowest in areas related most directly to social functioning with scores more than 1 SD below the mean in Social Support/Peers, and Social Acceptance/Bullying. They also rated Moods/Emotions in the same range. Interestingly, there was a significant difference between mothers' and youths' report in Social Acceptance/Bullying. In this domain, youth reported a mean of 45.6 (SD=12.6) and mothers reported a significantly lower mean of 37.7 (SD=.12.8). Surprisingly, mothers' ABAS-II scaled scores in the social area were not significantly correlated with HRQoL social functioning dimensions as rated by either mothers or youths.

Conclusions: Youth with ASD rate their HRQoL positively and within the average range in comparison to international norms. This suggests that the lower HRQoL reported in the literature may occur later than adolescence. Differences between parent and youth ratings in the dimension of Social Acceptance/Bullying suggests that youth are either less aware of bullying experiences or perceive them less negatively than their parents. A larger sample size is needed to determine if there are any age related differences during adolescence and to further understand similarities and differences between mothers and their children.

134.026 26 Early Object Manipulation In Infants at Risk for Autism Spectrum Disorder. V. L. Armstrong*[1], L. Zwaigenbaum[2], I. M. Smith[1], J. Brian[3], W. Roberts[4], P. Szatmari[5] and S. E. Bryson[1], (1)*Dalhousie University/IWK Health Centre*, (2)*University of Alberta*, (3)*Holland Bloorview Kids Rehabilitation Hospital*, (4)*University of Toronto*, (5)*Offord Centre for Child Studies, McMaster University*

Background: Relative to typical infants, infants later diagnosed with autism spectrum disorder (ASD) show more atypical object exploration at 12 months (Christensen et al., 2010) and deficits in functional play at 18 months (Ozonoff et al., 2008). Little is known about the developmental course of these atypicalities, as infants were assessed only at 12 or 18 months.

Objectives: Our goal is to understand differences in the development of early object manipulation between high-risk infant siblings (infants with an older sibling with ASD) and low-risk controls (infants with no family history of ASD).

Methods: We observed solo, interactive, and atypical object manipulation in high-risk infant siblings and low-risk controls at 6, 12, and 18 months. We coded behaviours from video-recordings of infants engaged in play in the context of the Autism Observation Scale for Infants, a semi-structured assessment of early signs of autism. Each infant sat on his parent's lap, facing an examiner across a small table. The infant was allowed to play freely with a set of toys (e.g., a rattle, ball, small toy animals, and blocks) for 3 - 5 minutes. The duration of the behaviours of interest was coded using Noldus Observer software. Object manipulation was categorized for analyses as: (1) lower-level solo (e.g., banging, mouthing); (2) higher-level solo (e.g., throwing a ball, building a tower of blocks); (3) interactive (e.g., reaching, showing); and (4) atypical (e.g., atypical grasp, sensory stimulation).

Results: We compared the percentage of time infants spent engaged in object manipulation across age (6, 12, & 18 months) and between groups using four 3 x 3-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. Preliminary results indicate that, overall, infants showed similar patterns of development of solo object manipulation. Specifically, across ages the percentage of time infants engaged in solo object manipulation decreased for lower-level behaviours, and increased for higher-level behaviours. However, at 6 months, ASD siblings spent more time than controls engaged in lower-level solo object manipulation, while at 18 months, ASD siblings spent more time than controls engaged in higher-level solo object manipulation. As expected, ASD siblings spent more time engaged in atypical behaviours than controls; although, this was true only at 12 months and occurred only ~ 5% of the time. The percentage of time infants engaged in interactive object manipulation increased between 6 and 18 months for controls but not for ASD siblings. Non-ASD siblings showed a mixed pattern, with some behaviours more similar to controls and others more similar to ASD siblings.

Conclusions: These preliminary results suggest that, until 18 months, ASD siblings spend more time engaged in solitary play than controls, much of which appears *qualitatively* similar to that of controls. By 18 months, ASD siblings spend less time than controls engaged in behaviours that involve others in their play. Given the role of play on cognitive and social development, these findings may point to critical targets for early intervention for ASD.

134.027 27 Potential Gender Difference In Attentional Filtering In Girls Relative to Boys with Higher Functioning Autism. T. Oswald*[1], K. Fukuda[1], E. Vogel[1], M. A. Winter-Messiers[1], B. Gibson[2] and L. Moses[1], (1)*University of Oregon*, (2)*Oregon Social Learning Center*

Background:

The ratio of males to females diagnosed with an Autism Spectrum Disorder (ASD) is 4:1. For this reason ASD research has primarily focused on males. Recent work suggests that higher functioning individuals with ASD in comparison to typically developing controls may have superior fluid intelligence, or the ability to reason quickly and to think abstractly (Dawson et al., 2007). However, due to the small sample size of females in the study (N = 5), these results cannot be generalized to females with ASD. Hayashi et al. (2007) found that boys with higher functioning ASD (N = 10) outperformed the TD group, whereas girls with higher functioning ASD (N = 7) showed equivalent performance to the TD girls. These data suggest that girls relative to boys with higher functioning ASD may have lower fluid intelligence.

In TD adults, fluid intelligence has been found to strongly correlate with visual working memory (VWM), or the ability to actively maintain visual information in a readily accessible state (Colom et al., 2005; Fukuda et al., 2010; Engle et al., 1999). Further, VWM in TD adults has also been found to correlate strongly with attentional filtering, or the ability to ignore salient stimuli while restricting attention to goal-relevant stimuli.

These typically developing adult findings in combination with the fluid intelligence ASD findings, suggest that girls with higher functioning ASD in comparison to boys with ASD may have lower fluid intelligence, VWM, and attentional filtering abilities.

Objectives:

The objective of the current study was to examine whether there are gender differences in the higher functioning ASD population with respect to fluid intelligence, VWM, and attentional filtering.

Methods:

Adolescents with higher functioning ASD (male = 15; female 9), ranging in age from 11.6-17.9 years (M = 14.62), participated in the study. We employed Fukuda and Vogel's (2009) attentional filtering paradigm. In this task, participants are instructed to remember the colors of target stimuli (i.e., squares) over a brief delay. Then they are presented with one test stimulus and must respond yes or no depending on whether or not the test stimuli matches the color of the target stimuli presented in that same location. In three conditions, there are only targets present (set size 2, 4, 6). In a fourth condition, there are two target stimuli in addition to four distracting stimuli (i.e., colored rectangles). This measures how well participants filter out contingent distractors in the environment.

Results:

Based on our preliminary data, females with higher functioning ASD compared to boys with higher functioning ASD did not significantly differ in terms of fluid intelligence or working memory capacity. However, girls relative to boys with higher functioning ASD showed significantly worse attentional filtering, even after controlling for age and composite IQ, $F(1, 22) = 5.86$, $p = 0.03$.

Conclusions:

These preliminary data suggest that there may indeed be gender differences in the ASD cognitive profile, specifically in attentional filtering.

134.028 28 IQ as An Outcome Measure In Children with Autism Spectrum Disorder: What Are We Measuring?. L. R. MacMullen*[1], R. Manfredi[2] and J. E. Connell[3], (1)*Temple University*, (2)*Children's Hospital of Philadelphia, Center for Autism Research*, (3)*University of Pennsylvania*

Background:

Global intellectual functioning scores are frequently used to evaluate the effects of behavioral interventions for children with autism spectrum disorder (Eldevik, Jahr, Eikeseth, Hastings, & Hughes, 2010). Although this has become standard practice, administering IQ tests to children with ASD can be extremely difficult and potentially result in invalid scores due to behavioral symptoms common to individuals on the spectrum including limited attention, limited expressive and receptive communication, disruptive behaviors (such as task avoidance and escape behaviors), and lack of motivation (Dietz, Swinkels, Buitelaar, Daalen, & Engeland, 2007; Koegel, Koegel, & Smith, 1997). Therefore, researchers suggest that cognitive assessments fail to capture intelligence and thus become measurements of motivation, attention, and compliance (Koegel & Koegel, 1995). As a result, increases in IQ scores may actually reflect a decrease in problematic behavior, and not improved cognitive ability.

Objectives:

This pilot study evaluated the extent to which problem behavior was related to IQ scores by collecting data on both (IQ and problem behavior) during the IQ testing session to analyze the relationship between the two. That is to say, we hypothesized that comparatively low IQ scores were more likely to correlate with comparatively higher scores on problem behavior, and conversely, high IQ would more be more likely to correlate with low problem behavior.

Methods:

The participants in the study included all identified students in the kindergarten through second grade autistic support classrooms in a large mid-Atlantic school district. All students met the criteria for autism including children with an autism spectrum disorder, autism, or pervasive developmental disorder. A total of 255 students were administered the Differential Abilities Scale, Second Edition and the study researchers completed a Behavioral Rating Form immediately after the assessment.

Results:

The relationship between overall IQ scores and challenging behaviors was evaluated. In addition, data were analyzed to determine if specific cognitive profiles had a stronger relationship to problem behaviors.

Conclusions:

Analysis is ongoing; preliminary results suggest that there is a negative correlation with the occurrence of undesired behaviors and IQ score. Future directions should assess the remediation of high frequency undesired behaviors and its subsequent effect on measures of intelligence.

134.029 29 A Comparable Analysis of Emotion Recognition In Autism Spectrum Disorders (ASD) and Attention Deficit Hyperactivity Disorder (ADHD). K. L. Ashwood*[1], B. Azadi[2], P. Asherson[3] and P. Bolton[4], (1)*Institute of Psychiatry*, (2)*Institue of Psychiatry*, (3), (4)*Institute of Psychiatry (The)*

A Comparable Analysis of Emotion Recognition in Autism Spectrum Disorders (ASD) and Attention Deficit Hyperactivity Disorder (ADHD)

Background: The ability to discriminate and recognise facially expressed emotions has been studied extensively in Autism Spectrum Disorders (ASD). Less research, however, has been conducted on individuals with Attention Deficit Hyperactivity Disorder (ADHD). Although emotion recognition deficits have been observed in both clinical populations, few studies have compared individuals with autism and ADHD or considered whether the co-occurrence of ASD traits in ADHD may be relevant.

Objectives: To compare the extent of potential facial affect recognition deficits in individuals with autism and/or ADHD, questioning whether emotion recognition deficits are specific to autism.

Methods: To date, 102 male children and adolescents between the ages of 7 and 16, with an IQ>70, have taken part in the study. Included were individuals who, according to the DSM-IV, fulfilled the diagnosis of an ADHD (n=39) or an autistic disorder (Asperger syndrome, high functioning autism and atypical autism) with (n=18) and without (n=28) comorbid ADHD symptoms and a typically developing group (n=19). Facial affect recognition was assessed using labeling 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: A significant main effect of diagnostic classification was found for percentage correct on the labelling task ($F_{3,100}$=3.20, $p<0.05$). Bonferroni corrected post hoc pairwise comparisons revealed a significant difference in performance for ASD vs control ($p<0.05$), ADHD vs control ($p<0.05$) and a non-significant tendency for comorbid vs control ($p=0.086$). No significant group differences were revealed on the discrimination task and no overall group effects were found on either the labelling or discrimination task when covarying for PIQ, VIQ, SCQ, or Conners. However, when performance on the labelling task was predicted a significant model emerged (($F_{3,97}$)=9.07, $p<0.01$, Adjusted R^2 =0.19) with VIQ as a significant predictor ($\beta = 0.37$, $p<0.001$). Conners and SCQ scores were not a significant predictor of performance with β=-0.13 and β=-0.07, respectively ($p>0.05$).

Conclusions: Preliminary results indicate that typically developing individuals were significantly better able to label emotions than were children with ASD and ADHD. However, differences between groups on the discrimination task, which has a low verbal demand, were non significant. Pairwise comparisons revealed that differences in performance of ASD and ADHD individuals were related to inattention, hyperactivity and autistic symptomatology. Furthermore, group differences on the labelling task disappeared when VIQ scores were covaried. Overall, the results show that emotion labelling

deficits are not specific to ASD, but reflect the verbal demands of an emotion labelling task.

134.030 30 Do Measures of Crystallized Intelligence Lie on ASD?. A. San Jose*,

Background: The study of Inspection Time (IT) tasks in relation with intelligence measures has been intriguing researchers since the early 70's. It is now known that this relation fluctuates around a correlation of -0.5. To date, only two studies have addressed this relation in autism. Scheuffgen et al (2000) showed that, despite low measure IQ - as measured by the Wechsler Scales - children with autism performed as good or better than age-matched controls in the IT task. Following these results, Wallace et al (2009) corroborated the lack of relation between IT and IQ but not the superiority of IT in ASD, concluding that this difference may be more pronounced in the low end of the spectrum.

Objectives: The question of untapped cognitive potential is perhaps particularly important for low functioning individuals with ASD. In an attempt to replicate the Schueffgen et al study in a sample of individuals with autism and severe intellectual impairment, the present study aimed to examine the relation (or lack of) between IT and IQ in autism. In particular, it was hypothesized that participants with ASD and low measured IQ would show faster speed of processing than participants with low measured IQ but not ASD.

Methods: 47 participants with Intellectual Disability (ID) and 33 participants with ASD and additional ID between the ages of 6 and 19 completed both the Raven's Coloured Progressive Matrices (CPM) and a visual IT task. Both tasks were adapted in order to accommodate the low level of ability in participant groups.

Results: Preliminary results show that the ASD group performed faster at the IT task than the ID group, however this difference was not significant. After comparing groups matched by mental-age, the difference remained non-significant. Contrary to expectations, a significant relationship between IT and intellectual ability (CPM raw scores) were found in both the ASD and the ID groups.

Conclusions: These findings support the hypothesis proposed by Scheuffgen et al (2000); who state that individuals with ASD have an intact basic processing mechanism (as in Anderson's model of minimal cognitive architecture) or "*g*", but that low measured IQ scores result from a failure in theory of mind mechanisms, impeding them to access information through social means. In our study, the social and communicative constrains were reduced by using a measure of pure fluid intelligence. These results could imply a future difference in the way the low end of the autistic spectrum is conceptualized and assessed.

134.031 31 Eye Gaze Cueing In Fragile X and Autism: A Pilot Study. K. M. Venema*, S. T. Lee, K. Wilner and S. J. Webb, *University of Washington*

Background: Generally, people rely on the ability to detect and follow another individual's eye gaze to infer valuable social information such as turn taking in conversation, a shift in attention, or to signal to an object. Individuals with neurodevelopmental disorders such as Autism Spectrum Disorder (ASD) and Fragile X Syndrome (FXS) show specific deficits in gaze following and joint attention, look less at social stimulus, and fixate less on the eye region. In individuals with FXS, eye gaze avoidance has been theorized to be due to hyperarousal and anxiety.

Objectives: This pilot study investigates two questions: (1) Can we effectively test low-functioning individuals with FXS and ASD in a computerized social and non-social attention tasks that requires gaze to the eye region and manual reaction times? (2) Do individuals with FXS and ASD show similar patterns of using social (eye gaze, hands) and nonsocial cues (arrows) to direct their attention?

Methods: Individuals with ASD with cognitive impairment, FXS, or neurotypical (NT) development between 13 and 40 years participated in a social and non-social cueing task. Three types of stimuli were used: faces, signs with arrows or hands. In the baseline condition, the face remained still and neutral, the signs did not change, and the hands pointed forward; a target was then presented on either the right or left side of the cue. In the test trials, the eyes on the face stimuli shifted to either the right or left, the sign arrows pointed to the left or right, and the hands pointed to the left or right. In the congruent condition the direction of the cue matched the target while in incongruent trials, the target appeared on the opposite side of the cue. Participants were instructed to press a button with their right or left hand that matched the side of the target appeared. Practice trials were administered to ensure all participants understood and could perform the task.

Results: Failure to complete the task was related to verbal skill in the ASD group; as well, more subjects in the ASD group were non-compliant with task procedures. Preliminary analyses indicate that the FXS group were slower to react to the target and did not benefit from congruent cue-trial pairings. The FXS group also displayed more target detection errors. The ASD and NT groups showed a similar pattern of reaction

time to both congruent and incongruent trials and were faster at detecting the target during congruent cues.

Conclusions: Preliminary results suggest that the FXS group is slower to react to a target regardless of whether it is congruent or incongruent with the cue. The ASD and NT groups' reaction time speed was facilitated by congruent cues. Further analysis will investigate differences in reaction times between social (eyes, hands) and nonsocial stimuli (arrows). We will also analyze IQ scores to find the cut-off IQ score for successful completion of the cueing task.

134.032 32 Fast-Mapping In Boys with Autism and Fragile X Syndrome. A. McDuffie*[1], S. T. Kover[1], D. P. Benjamin[2], A. M. Mastergeorge[3], R. J. Hagerman[2] and L. Abbeduto[4], (1)*University of Wisconsin, Madison Waisman Center*, (2)*U.C. Davis MIND Institute*, (3)*University of California, Davis/M.I.N.D. Institute*, (4)

Background:

"Fast-mapping" describes the process by which children make an associative pairing between label and referent during initial word learning. Despite its relevance to lexical acquisition, no previous study has assessed fast-mapping in fragile X syndrome (FXS), an inherited cause of intellectual disability and comorbid autism. Research comparing word learning in children with FXS and autism has the potential to clarify factors that contribute to overlapping ability profiles. The current study examined fast-mapping in boys with autism, FXS, and typical development.

Objectives:

- To compare fast-mapping across groups after controlling for nonverbal cognitive ability.
- To examine concurrent associations between fast-mapping and nonverbal cognition, autism severity, and vocabulary.
- To examine the potential contribution of task demands to fast-mapping performance.

Methods:

Participants were boys with autism (n = 16; ages 4-10 years), FXS (n = 32; ages 4-10 years) and typical development (n = 36; ages 2-6 years). Leiter-R Brief IQ growth scores provided a measure of nonverbal cognition; participants with autism and FXS had IQs between 36 and 80. Autism symptom severity was calculated from the ADOS. The Peabody Picture Vocabulary Test-4 and Expressive Vocabulary Test-2 provided the measures of vocabulary. The fast-mapping task consisted of four trials, each with an exposure and test phase. During each exposure phase, two novel objects were sequentially presented. The target object was accompanied by 5 presentations of a nonsense label (e.g., dawnoo) embedded in connected speech. The foil object was accompanied by an equivalent amount of talking without labeling. Side and order of presentation were randomized. During each testing phase, the child was asked to find the labeled object when both objects were presented simultaneously. The dependent variable was the number of correct choices out of four.

Results:

- After controlling for nonverbal cognition, TD boys did better at fast-mapping than did boys with autism or FXS (both ps < .001), who did not differ from one another (p < .939).
- For boys with autism, there were significant associations between fast-mapping scores and (1) nonverbal cognition (r = .50, p < .024), (2) receptive vocabulary (r = .57, p < .01), and (3) expressive vocabulary (r = .71, p <.001). For boys with FXS, only the association between fast-mapping and receptive vocabulary was significant (r = .42, p < .008). Autism symptom severity was not related to fast-mapping scores. For TD boys, no correlations were significant.
- Order of target presentation during exposure (first or second) impacted fast-mapping scores for TD boys, whose performance was better when the target object was presented second (i.e., immediately before the test phase; p < .03).

Conclusions:

After controlling for nonverbal cognition, fast-mapping performance was similar for boys with autism or FXS, but impaired relative to cognitively matched TD boys. Participants with autism or FXS did not show increased difficulty when presentation order required them to hold the novel label in mind longer, leading to questions about what other factors might impact word learning performance (e.g., attention, perseveration). Implications for interventions targeting word learning will be discussed. Data collection is ongoing.

134.033 33 Comparing Patterns of Errors on the Raven's Progressive Matrices Test: Strategy Differences Among

Typically Developing Individuals, Individuals with Autism, and Computational Models. M. Kunda*[1], I. Soulières[2], L. Mottron[2] and A. Goel[1], (1)*Georgia Tech*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: Recent studies of the Raven's Progressive Matrices (RPM) test have shown differences in both behavior (Dawson et al. 2007) and neural activity (Soulières et al. 2009) between individuals with autism and typically developing (TD) individuals. We hypothesize that these effects stem from differences in the cognitive strategies used by each group. In particular, fMRI data suggests that individuals with autism might use more visually oriented strategies, whereas TD controls may use more verbally oriented strategies. These data are consistent with computational accounts of the behavior of TD individuals on the RPM, which suggest that they convert perceptual inputs of test images into propositional representations (e.g. Carpenter, Just, & Shell 1990). However, our recent computational models (Kunda, McGreggor, & Goel, IMFAR 2010 oral presentation) have proposed that purely visual strategies that reason directly on perceptual inputs can also be successful on the RPM.

Objectives: To investigate differences in patterns of incorrect answers on the RPM chosen by TD individuals versus individuals with autism, and to compare these human data with data from Kunda, McGreggor, and Goel's (2010) visual affine algorithm.

Methods: Participants included 84 typically developing individuals and 111 individuals with autism, ranging from children to adults. Data on answer choices were obtained from previous RPM and IQ evaluations of these participants. Answer rankings were calculated according to the percentage of each group choosing each answer choice. For the visual algorithm, answer rankings were obtained directly from the algorithm's output. Differences between answer rankings were calculated using a normalized Kendall's Tau measure, which counts the number of pairwise transpositions between two given rankings.

Results: Initial results show that, using a paired t-test, differences in answer rankings between the two human participant groups were found to be significantly smaller than differences in rankings between each human group and the visual algorithm ($p < 0.001$ for each). However, differences in rankings between each human group and the visual algorithm were not significantly different ($p = 0.9$). Preliminary analyses were also conducted according to participant variables (e.g. total RPM score, age, cognitive profile) as well as according to RPM variables (e.g. RPM sets, problem types). Differences in rankings between TD individuals and individuals with autism, as well as differences between each group and the algorithm, seem to increase with the progression of RPM problem types from gestalt to visuospatial to verbal.

Conclusions: These preliminary results appear to indicate some relationship between the cognitive strategies used on RPM problems and the patterns of incorrect answer choices that emerge. In particular, for problems classified as gestalt or visuospatial, there is less disagreement on incorrect answer choices among individuals with autism, TD individuals, and the visual affine algorithm than on problems classified as verbal, although problem difficulty might be a confounding factor. Ongoing analyses include the use of alternative and finer-grained measures for comparing answer rankings, as well as the development of additional methods for analyzing this type of error pattern data from human participants and computational models.

134.034 34 Troubled adolescence and beyond; the characteristics of addiction in autism. B. B. Sizoo*, *Dimence*

Background: Addiction, or Substance Use Disorder (SUD), among adults with Autism Spectrum Disorders (ASD) has never been studied before, contrary to SUD in ADHD. However, we know from clinical practice that comorbid SUD in ASD can present with a considerable impairment. Distinguishing between ASD and ADHD can be challenging, but becomes increasingly so in case of comorbid SUD. The approach to SUD in ASD is hampered by a lack of knowledge about this comorbid condition.

Objectives: The main objective of this study was to gain insight into the aspects of comorbid SUD in ASD on three levels: an observable phenotypical level, an underlying endophenotypical level, and a genetic level. A second objective was to determine how ASD differs from ADHD in adult patients on these three levels, with and without comorbid SUD.

Methods: We studied 130 patients with ASD (n=75) or ADHD (n=55) with or without SUD. Firstly, on the phenotypical level, we looked at risk factors for developing SUD, prevalence, and outcome. Furthermore, we studied personality profiles with the Temperament and Character Inventory and autism spectrum profiles with the Autism Spectrum Quotient (AQ). Secondly, on the underlying neuropsychological (endophenotypical) level, we assembled data on intelligence profiles (WAIS III), attention tasks and executive functioning tasks. Thirdly, on the genetic

level we studied five candidate genes in the different patient groups.

Results: The results show that SUD is more common in ADHD than in ASD, but that the prevalence of SUD in the ASD group is comparable to the prevalence of SUD in other psychiatric patients. Early onset of smoking, adverse family history, and parental SUD, increase the risk on SUD significantly. On a phenotypical level, self-report questionnaires on personality and autistic symptoms suggest that the ASD-with-SUD subgroup presents with a better social orientation than the subgroup ASD-without-SUD. This effect is not seen in the ADHD patients. On the endophenotypical level, however, the ASD-with-SUD subgroup shows significantly more cognitive impairment than the ASD-without-SUD subgroup, whereas this SUD effect was not seen in the ADHD group. In our study there were also genetic differences between the ASD and ADHD groups in the polymorphisms of three of the five candidate genes we analyzed, independent of the SUD status. However, the numbers were small, and replication of the data is necessary

Conclusions: The results show that comorbidity of SUD with ASD is less common than in ADHD, but that the consequences are at least as severe. Comorbid SUD is not always associated with a negative outcome, at least in the perception of the individual on a phenotypical level. Assessment of adults with ASD and SUD can be misleading when the neuropsychological functioning is not also taken into consideration. Finally, in the absence of SUD, ASD and ADHD in adults share many features on the (endo-) phenotypical level, but may be distinguishable at a genetic level. In the presence of SUD, the differences between ASD and ADHD are more pronounced.

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119.007 70A Determining Sex Differences In Social Cognition of the Individuals with and without Autism Spectrum Disorders Using Advanced Mind-Reading Tasks. M. Kuroda*[1], A. Wakabayashi[2], T. Uchiyama[3], Y. Yoshida[4], T. Koyama[5] and Y. Kamio[6], (1)*Tokaigakuin University*, (2)*Chiba University*, (3)*Fukushima University*, (4)*Yokohama Psycho-Developmental Clinic*, (5)*Shinsyu University*, (6)*National Institute of Mental Health*

Background:

Regarding sex differences in social cognition, females have been ascertained to understand nonverbal communication better than males do (Hall, 1978). Even three-year-old girls can understand another's emotions and thoughts better than boys of the same age do; that is, girls are already ahead of boys regarding mind-reading ability (Baron-Cohen, 2003). With respect to the sex differences, the individuals with autism spectrum disorders (ASD) display inherent deficits in mind-reading abilities. The results of this study, using the Cambridge Mindreading test, revealed that females recognized emotions from facial expressions better than males did, regardless of the diagnosis of Asperger Syndrome (Golan, 2006).

Objectives: We aimed to examine the sex difference in the mind-reading ability for the both of the groups with and without the ASD in nonverbal communication by using an advanced mind-reading test, which included both visual and auditory tasks.

Methods: The participants comprised 28 male adults with ASD (mean age = 24.5±7.7 yrs, FIQ= 105±12) and 13 female adults with ASD (mean age = 28.3±9.9 yrs, FIQ= 112±11). The control groups comprised 49 male adults (mean age = 20.7±1.5 yrs) and 38 female adults (mean age = 20.6±1.7 yrs). The advanced mind-reading tasks comprising 41 video clips were designed to assess mind-reading ability from either visual information alone (facial expressions, gestures, posture) or auditory information alone (non-verbal aspects of speech: pitch/intonation/tone). A word or a phrase that expressed the mental state was shown along with each video and sound clip. The participants were asked to judge whether each word or phrase was appropriate for each scene.

Results:

To test for differences between the accuracy rates of the visual and auditory tasks among the groups (modality effect) and between them (a modality by group interaction), an ANOVA was performed with the accuracy rates as dependent variables and with group and sex as independent variables. A three-way interaction of modality by group by sex was found to be significant (F [1, 124] = 5.43, p = 0.02). An analysis of simple main effects revealed that while there existed no differences between the control groups (male: Visual = 70.4%, Auditory = 70.4%; female: Visual = 69.3%, Auditory = 69.1%) and females with ASD (Visual = 69.5%, Auditory = 70.1%) for both tasks, there was a significant difference among males with ASD (Visual = 66.0%, Auditory = 58.8%). Additionally, positive correlations were found for the female group with ASD with respect to the accuracy rates for both tasks and FIQ.

Conclusions: These results suggest that the female adults with ASD compensated for their deficits in mind-reading by using their intelligence. Clinically, while the males with ASD may

exhibit severe social problems, the deficits of females with ASD appear to be subtle. However, females with ASD exhibit some stress because they do not understand others' emotions intuitively but always need to make an effort to do so by using their intelligence.

134.035 35 Clustering of External Representations In Young People with Autism Spectrum Disorder. B. Grawemeyer*, *Bath University*

Background: There is a growing need to develop software, especially user interfaces, which can address the needs of individuals affected by Autism Spectrum Disorder (ASD). Effective user interface design for those with ASD necessitates an understanding of preferences for how visual material should be organised and represented (upon the screen). Previous research has suggested that external representations (ERs), such as textual and visual information, are utilised in a different way by those with ASD when compared to controls.

Objectives: In order to inform the design criteria for effective and efficient user interfaces for those with ASD, particularly their textual and visual aspects, we investigated the clustering of ERs by young people with and without ASD.

Methods: The study involved 29 high-functioning young people with ASD (25 male; 4 female) aged between 11-15, and 28 young people without ASD (18 male,10 female) aged between 11-14. The two groups (ASD and non-ASD) were matched on age, mathematical ability and verbal ability. Each group was enrolled in specialist and non-specialist schools (respectively), in years 7, 8 and 9 of the UK curriculum.

Results: From participants' card sorts a similarity matrix for each group was created, which was then input to the SPSS CLUSTER procedure to produce a hierarchical cluster analysis. The major ASD clusters were: 1. Maps; 2. Text, 3. Drawings; and 4. Graphs, charts, network diagrams and tree diagrams. In contrast the non-ASD clusters were: 1. Maps, 2. Drawings; and 3. Text, graphs, charts, network diagrams and tree diagrams. Also, the distance between the map and text clusters in the ASD group was less then half that for the non-ASD group.

Conclusions: Both groups identified 'Maps' as the most salient cluster, suggesting that incorporating map-like structure within user interface design would be the most intuitively appealing for all potential users. The differences in how text is clustered may also be of importance. The data suggest that whilst the non-ASD participants cluster text with other ERs such as graphs, this is not the case for ASD participants who cluster text separately from other ERs. Combined with the difference in distance between clusters, this would suggest that the way text is integrated within user-interface design may be very different for those with and without ASD.

134.036 36 Executive Functioning Profiles of Younger Siblings of Children with ASD at School Age. C. R. Newsom*[1], J. H. Foss-Feig[1], E. B. Lee[1], J. A. Crittendon[1], C. P. Burnette[2], E. Malesa[1], J. L. Taylor[3] and Z. Warren[1], (1)*Vanderbilt University*, (2)*University of New Mexico*, (3)*Vanderbilt Kennedy Center*

Background:

Younger siblings of children with autism (Sibs-ASD) often are studied longitudinally to explore early markers of ASD due to heightened risk for the disorder. However, school-age outcome in such well-characterized cohorts of children has rarely been examined, despite literature indicating that Sibs-ASD who do not themselves have ASD are at risk for cognitive, language, and social difficulties. In addition, evidence for executive functioning (EF) deficits in relatives of individuals with ASD exists. Thus, we examined the neurocognitive profiles of five-year-old Sibs-ASD and age-matched siblings of typically developing children (Sibs-TD) who previously participated in a longitudinal study of early social and communication development.

Objectives:

To examine EF abilities and their relation to ASD features at school age in a group of Sibs-ASD who did not receive a diagnosis of ASD themselves, in comparison to a group of Sibs-TD.

Methods:

23 Sibs-ASD and 19 Sibs-TD were evaluated between the ages of 5 and 7 years (mean CA: Sibs-ASD=65.55 months; Sibs-TD=64.84 months).These children represent a subset of children followed longitudinally since age 15 months on average to examine early risk factors for ASD. . At the school-age assessment, all children were administered select subtests (Auditory Attention, Inhibition-Naming and Inhibition-Inhibition, Statue) from the NEPSY-II to examine EF abilities; an EF composite score was derived by averaging the four subtest scores, all of which were highly correlated ($r>.401$, $p<.01$).Parents of 18 Sibs-ASD completed the ADI-R to assess ASD symptoms. Between group comparisons were conducted using independent sample t-tests for the EF composite and each NEPSY subtest score. Bivariate correlations were conducted between EF composite and subtests and ADI-R

domain scores in the Sibs-ASD group to explore the relations among EF abilities and ASD features.

Results:

Sibs-ASD performed significantly lower than Sibs-TD on the overall EF composite score (p=.007), as well as on the combined scaled score (p=.008) and raw omission errors (p=.037) from the Auditory Attention test and the combined scaled score from the Inhibition-Naming subtest (p=.025). Group differences approached significance on the Statue subtest total scaled score (p=.067), but were not found on the Inhibition-Inhibition subtest. In Sibs-ASD, significant correlations were found between the EF composite and the Communication (r=-.486, p=.041) and Restricted Interests and Repetitive Behavior (r=-.514, p=.029) domains of the ADI-R. While the EF composite did not correlate with the ADI-R social domain, greater number of omission errors on the auditory attention task was correlated with greater social impairment on the ADI-R (r=.689, p=.002).

Conclusions:

Sibs-ASD who do not themselves have ASD diagnoses nevertheless show subtle but significant differences from Sibs-TD at age five years. Specifically, they show differences in EF abilities, which are related to broader, subclinical ASD symptoms. Executive functioning and the brain regions coordinating these skills continue to mature throughout childhood, and subtle deficits may have implications for later social and academic success in this vulnerable population. Thus, future directions include exploring various EF abilities in Sibs-ASD during adolescence and adulthood.

134.037 37 Can Individuals with Autism Abstract Prototypes of Faces?. H. Z. Gastgeb*, D. Wilkinson, N. J. J. Minshew and M. S. Strauss, *University of Pittsburgh*

Background: Perceptual explanations for the face processing difficulties seen in individuals with autism are often bottom-up accounts, suggesting that these individuals are biased toward processing local features as opposed to global patterns (Frith & Happé, 1994; Mottron et al., 2006). However, theories on the development of expertise in face processing suggest it is also critical to consider the impact that top-down processes, such as prototype formation, may have on the ability to process and recognize facial information (e.g., Newell, et al., 2010).

Objectives: To examine prototype formation ability using subtly varying natural faces and explore individual differences in performance as related to measures of intelligence and behavioral symptoms of autism. Also, to examine eye movement patterns to determine whether differences in attentional distribution can explain difficulties with prototype formation.

Methods: High-functioning adult males with autism (n = 20) and age and IQ matched controls (n = 20) were tested in a prototype formation task utilizing natural faces. Participants were familiarized with sets of faces that were created by manipulating specific features and spatial distances between features. After each set, participants chose which face was more familiar, the prototype face or a face comprised of features that were previously seen (mode face). Participants' eye movements were also recorded to gather information about which areas of the faces participants looked at when viewing the familiarization trials (learning).

Results: The control group (M = 72.5%) selected the prototype faces as familiar more often than the autism group (M = 50.83%) indicating that the individuals with autism had significant difficulty forming prototypes of natural faces (t (38) = -2.96, p < .01). However, there was a subset of individuals with autism (n = 8) who performed well and appeared to form a prototype. These individuals had lower Stereotyped Behavior and Restricted Interests Total Scores on the ADOS (M = 1.13) than those who performed poorly (M = 3.00) (t (18) = 3.04, p < .01). Eye-tracking data indicated that the groups did not differ in the amount of time that they spent looking at the faces or particular facial features. The general pattern of attention to the facial features was also similar for both groups.

Conclusions: Results are consistent with past research indicating a deficit in prototype formation in individuals with autism. Prototype formation difficulties cannot solely be accounted for by differential attention to features or different attentional patterns to faces but may be related to differences in the way in which individuals with autism cognitively process information. This study highlights the need to consider the role that top-down cognitive processes such as prototype formation may play in the syndrome of autism.

134.038 38 The Nature of Working Memory Impairments In Children and Adolescents with Autism Spectrum Disorder. J. M. Schuh* and I. M. Eigsti, *University of Connecticut*

Background:

Executive functioning, involving attention shifting, inhibition, working memory (WM), and planning, is thought to be impaired in autism spectrum disorders (ASD; Eigsti, in press). However, because executive function encompasses such a wide range of processes, the exact nature of these impairments remains

unclear. There is controversy regarding the presence or specificity of WM impairments in ASD, with some studies finding deficits (Bennetto, et al, 1996; Williams, et al., 2005) and others reporting adequate performance (Dawson, et al., 2002). The type of WM assessed (verbal vs. spatial) and task complexity likely amplify these discrepancies. This study aims to better understand WM abilities in children and adolescents with ASD in a large, carefully-matched, high-functioning sample.

Objectives:

The current study examined WM abilities in ASD, utilizing standardized assessments of verbal and spatial WM abilities, which varied in complexity. We hypothesized that children with ASD will display WM deficits in relation to their typically-developing (TD) peers, particularly for spatial WM as consistent with previous research (e.g., Williams, et al. , 2006), and that deficits would be most marked for the most complex skills.

Methods:

Children with ASD (n = 19) and TD controls (n = 24) matched on age (range 9-16; mean 12.9 years), gender, IQ, and receptive vocabulary completed four WM tasks. 1) *Spatial short term memory* was examined using the Finger Windows subtest from the Wide Range Assessment of Memory and Learning (WRAML); 2-3) *Verbal WM* was examined using Letter-Number Sequencing from the Wechsler Intelligence Scale for Children-IV Edition (WISC-IV), and with a modified version of the Competing Language Processing Task (CLPT), which required participants to respond to true/false statements and remember the last word from each; 4) *Verbal short term memory* was examined via non-word repetition. A repeated-measures ANOVA on four WM measures, with appropriate post-hocs, examined performance by group, and correlational analyses examined relationships between WM performance and standardized measures of language (Clinical Evaluation of Language Fundamentals, 4th Edition; CELF-4) and parent-report measures of executive function (Behavior Rating Inventory of Executive Function; BRIEF), behavior (Child Behavior Checklist; CBCL), and ASD symptom severity (Social Responsiveness Scale; SRS).

Results:

There was a main effect of Group on WM measures, $p < .001$; specifically, the ASD group had lower scores *across verbal and spatial* WM tasks. For both groups, better language skills were associated with higher scores on *verbal*, $p = .001$, and *spatial*, $p = .04$, WM, and behavioral regulation (as measured by the BRIEF) was associated with verbal WM, $p = .03$. For the ASD group, there were trends for poorer spatial WM to associate with symptom severity (SRS), $p = .10$, and attentional problems (CBCL), $p = .06$.

Conclusions:

Individuals with ASD displayed notable impairments in WM across verbal and spatial domains. Behavioral regulation and language ability for both groups, and inattention and symptom severity for the ASD group, were related to WM performance. Findings highlight the need to incorporate WM goals into interventions for individuals with ASD.

134.039 39 Specificity of Risk Averse Decision-Making to the Autism Spectrum. S. A. Johnson*[1], J. H. Filliter[1], T. J. Pleskac[2], J. Gillespie[1], S. Queller[3] and P. Corkum[1], (1)*Dalhousie University*, (2)*Michigan State University*, (3)*Indiana University*

Background:

Our previous studies of decision-making in youth with Autism Spectrum Disorder (ASD) have shown evidence for risk aversion during several decision-making tasks (e.g., Johnson et al., 2006). Specifically, mathematical modeling analyses have revealed that people with ASD attend to loss and avoid potentially “risky” behaviour significantly more than their typically developing peers.

Objectives:

To examine the specificity of these findings to ASD, we examined risk-aversion in clinical groups that are characterized by symptoms frequently observed in ASD, namely anxiety and attention problems. We hypothesized that a risk-averse decision-making style would also be present in a group of participants diagnosed with an Anxiety Disorder, but not in youths with Attention Deficit/Hyperactivity Disorder.

Methods:

Current analyses included 28 youths with ASD (24M/4F), 16 with an Anxiety Disorder (11M/5F), 10 with ADHD (6M/4F), and 83 typically developing controls (40M/43F). Data collection for the ADHD group is ongoing. The ADHD and Anxiety groups (mean = 11.2 and 11.3 years, respectively) were significantly younger than the ASD group (mean = 13.1) and thus, we created two control groups. One matched the ASD group (N = 36) and the other matched the Anxiety and ADHD groups (N= 54), on age, IQ, and sex ratio. All participants completed a battery of decision-making tasks including the Iowa Gambling

Task (IGT) and Balloon Analogue Risk Task (BART). In addition to traditional group comparisons of task performance, we utilized formal cognitive models to assess IGT and BART performance. The ASD group and their controls did not differ with regard to anxiety severity (Screen for Child *Anxiety* Related Disorders). The Anxiety group had a significantly higher anxiety score than all other groups. The ASD and ADHD groups were higher than their control groups and the Anxiety group on the Conners Rating Scale-Revised. The ASD group far exceeded all other groups on the Social Responsiveness Scale, a measure of autism symptom severity.

Results:

Despite reporting minimal anxiety, the ASD group showed significantly fewer risky choices on the BART compared to the controls, whereas the ADHD and Anxiety groups did not differ from their control group. Mathematical modeling results for the BART indicated group differences on two parameters: 1) the *choice consistency* parameter, with the ASD group exhibiting more consistent (i.e., less exploratory) responses than the ADHD and control groups; and 2) the *sensitivity to rewards* parameter, with the ASD group showing lower sensitivity to rewards relative to control and ADHD participants. In contrast to our main hypothesis performance of the Anxiety group did not differ from controls on any measure. Currently, there are no group differences on the IGT.

Conclusions:

Overall, these findings indicate that risk-averse decision-making may be specific to youth with ASD. Although our ASD group had a low level of anxiety, they showed more risk-averse behaviour than a group of youth with Anxiety Disorders. As expected, youth with ADHD showed a pattern of risky decision-making. Results will be discussed in the context of the preference for sameness and aversion to change often associated with the autism spectrum.

134.040 40 Effects of Weak Central Coherence on Resistance to Distractor Inhibition for Children with Autism. N. C. Adams*[1] and C. Jarrold[2], (1)*University of Alabama*, (2)*University of Bristol*

Effects of Weak Central Coherence on Resistance to Distractor Inhibition for Children with Autism

Background: Inhibition tasks requiring resistance to distracting stimuli, such as flanker tasks, reveal a deficit in children with autism (Christ et al., 2007). However, for tasks requiring suppressing a prepotent response, children with autism appear to have intact inhibition (Bryson, 1983). These data may reflect a distinction between prepotent response and resistance to distractor inhibition (Friedman & Miyake, 2004), which may be differentially impaired in autism. Children with autism are also known to experience a weak bias to central coherence (Best, Moffat, Power, Owens, & Johnstone, 2007). This could be related to resistance to distractor inhibition performance of children with autism.

Objectives: The current study investigated the possibility that children with autism may be differentially impaired in prepotent response and resistance to distractor inhibition and investigated effects of weak central coherence in autism on the flanker task.

Methods: Seventeen children with autism, with learning disabilities, and typically developing children were assessed. Groups were matched using the Raven's Coloured Progressive Matrices Test and were given the Embedded Figures Test. Experimental tasks included one task of prepotent response inhibition (modified stop-signal task) and of resistance to distractor inhibition (flanker task). During the stop-signal task, children categorized pictures as animals or non-animals except when they heard a beep, which occurred at three time intervals based on each participant's average reaction time, where they were instructed to withhold response. For the flanker task, children identified the direction of a central arrow varying in size and space from distractors across trials, which appeared flanked with congruently or incongruently pointing arrows.

Results: On the stop-signal task, there was no group effect on reaction time, $F(2, 44) = 0.55$, $p = .58$. Although beeps appearing at interval three were the most difficult, $F(2, 41) = 4.02$, $p = .02$, there were no group differences, $F(2, 42) = 1.46$, $p = .24$, and no sign of group effect on prepotent errors made, $F(4, 84) = 0.47$, $p = .76$. Results from the flanker task showed a four way interaction, essentially showing that while the groups made comparable errors on the classic flanker condition, $F(2, 44) = 2.37$, $p = .12$, children with autism maintained interference on modified (easier) trials , $F(2, 44) = 7.87$, $p = .001$, while the group with learning disabilities did not, $t(44)=3.07$, $p = .002$.

Conclusions: Individuals with autism seem to show intact prepotent response inhibition. On the flanker task, while the group with autism performed comparably to controls on the classic condition, they showed more error interference than the group with learning disabilities across modified conditions. This can be explained in terms of weak central coherence in autism, which makes competitor items in the global display less

distracting and serves as an advantage for those with autism on the classic flanker. However, when advantages from a weak central coherence in autism were accounted for they no longer experienced an advantage in comparison with controls, making inhibitory difficulties for those with autism clear.

134.041 41 Judgment-of-Learning In Children with Autism Spectrum Disorder. C. Souchay* and D. Z. Wojcik, *University of Leeds*

Background: Autism Spectrum Disorder (ASD) is characterised by a specific memory profile of spared semantic (factual memory) and relatively impaired episodic memory (memory for events) (see Boucher and Bowler, 2008). Despite the suggestion that being aware of one's own memory abilities affects memory and academic performance (Pierce & Lange, 2000), this area has rarely been explored in autism (Farrant et al., 1999; Wilkinson et al., 2010). The metamemory framework proposed by Nelson and Narens (1990) offers reliable ways to measure awareness of memory abilities. According to this framework, metamemory consists of knowledge about memory functioning (e.g., influence of the task or the material on the memory performance) but also monitoring processes allowing individuals to assess their memory performance during learning. This monitoring function is crucial as it will then influence which memory strategies will be implemented and will thus affect memory performance.

Objectives: The novelty of this study was to explore monitoring abilities in autism by asking ASD children to make Judgments-of-learning (JOLs, Nelson and Dunlosky, 1991). JOLs are predictions, made immediately after the presentation of the item or after a delay, about future test performance on recently studied items (Nelson and Narens, 1994). Several studies show that children can make accurate JOLs (e.g. Schneider et al., 2000; Koriat & Shitzer-Reichert, 2002). However, Theory of Mind impairments and neuropathological findings in autism lead to the prediction that JOLs might be inaccurate in ASD children.

Methods: 21 ASD children and 21 typical children were included in this study. There were no significant group differences on age and IQ ($t(40)=1.52$, $p=.14$ and $t(40)=-1.07$, $p=.29$ respectively). All participants were tested in the immediate and delayed JOL conditions. In the immediate condition, participants were presented with 24 word pairs and immediately after the presentation of each pair were asked to predict whether or not they will be able to recall the target at a later (immediate JOL). In the delayed condition children saw a different set of 24 word pairs. After all items were presented participants were showed the cue word and asked to make their JOLs (delayed JOL). JOL accuracy was measured by the relationship between the judgments and the recall performance (Gamma, Nelson, 1984).

Results: Overall there were no group differences neither on the immediate nor delayed JOLs. For both groups, delayed JOLs were more accurate. However, unlike for the typical children ($\gamma=.27$); immediate JOL gamma was at chance levels in the ASD group ($\gamma=.05$), suggesting inaccuracy in the ASD group.

Conclusions: The findings suggest some difficulties in ASD children when asked to predict their future memory performance (immediate JOL), thus suggesting difficulties in estimating memory performance accurately in this population. Results are interpreted in relation to recent memory theories and Theory-of-mind abilities.

134.042 42 Categorization Speed and Accuracy In 6-Year-Old Children with ASD. L. Naigles*, D. Rubin and D. A. Fein, *University of Connecticut*

Background:

Categorization is usually considered to be challenging for individuals with autism (e.g., Minshew et al., 2002), because they tend to focus on the details of objects rather than abstracting their overall category. However, Gastgeb et al. (2006) have recently demonstrated that high-functioning 10-year-olds and adolescents with autism behaved similarly to typical peers in responding more quickly and accurately to items that are typical of their category (e.g., robins for *bird*) compared to atypical items (e.g., ostriches).

Objectives:

The current study investigates the categorization speed and accuracy of *6-year-old* children with ASD and compares these with their performance on standardized tests; we also include TD controls.

Methods:

Eight children with ASD (*M*(age) = 6.6 years, *SD* = .287) and 13 TD children (*M*(age) = 5.76 years, *SD* = .414) participated as part of a longitudinal study. The children had been matched on language level at the onset of the study (4 years prior) but now differed in their TACL Q (*M*(TD) = 121.42, *SD* = 8.71; *M*(ASD) = 77.88, *SD* = 21.50), DAS (*M*(TD = 110.2, *SD* = 13.92; *M*(ASD) = 78.12, *SD* = 19.07), and Vineland composite (*M*(TD) = 108, *SD* = 6.85; *M*(ASD) = 76.11, *SD* = 13.9). The groups being unmatched for mental age, performance is primarily compared within groups.

The categorization task was modeled after Gastgeb et al. (2006). Children saw pictures of cars, cats, chairs, and birds, plus foil (e.g., house) items, presented on a laptop. For each category, some items were rated 'highly Typical' by naïve adults while others were rated 'highly Atypical'. Coincident with each picture, children were asked "Is this a cat/car/bird/ chair?" Two-thirds of the items were designed to elicit 'yes' responses. Accuracy and response time (correct responses only) data were collected via E-prime using enlarged response buttons.

Results:

As expected, the TD children responded significantly more accurately for the Typical items (98%) than for the Atypical items (74%, $p < .01$), and significantly more quickly to the Typical items ($M = 2.1$ seconds) than the Atypical items ($M = 3.1$ seconds, $p < .01$). The children with ASD showed no typicality effects for the response time measures, but did respond significantly more accurately for the Typical items (90% correct) than for the Atypical items (68%, $p < .05$). Moreover, while the TD children responded more quickly to the foil items than did the ASD children, the groups did not differ on accuracy with these items (over 90% for both). Finally, the children with ASD who performed more accurately also had higher scores on the TACL, the DAS, and the Vineland (rs > .708, ps < .05).

Conclusions:

These results suggest that some high-functioning children with ASD demonstrate sensitivity to the typicality organization of common categories as young as 6 years of age. This sensitivity is demonstrated by their decreased accuracy for atypical items, but not by any changes in response time. Further research will investigate how the children's early variations in trajectory of language development might predict their ability to categorize.

134.043 43 Social Relevant Stimuli and Cognitive Flexibility In Autism. M. de Vries* and H. M. Geurts, *University of Amsterdam*

Background: Children with an autism spectrum disorder (ASD) are known to show difficulties in cognitive flexibility in everyday life, but research data are inconsistent. Studies on cognitive flexibility differ on type of stimuli used, and predictability of task-switch. Children with ASD seem to perform as good as typically developing (TD) children on tasks using pictures as stimuli that are easy to process. However, in everyday life, the interpretation of complex stimuli is needed to adept your behavior to the changing environment. Moreover, while in experimental tasks the adaptation to the environment is predictable; in day-to-day live the children with ASD have to cope with unpredictable changes.

Objectives: To bridge the gap between day-to-day flexibility and cognitive flexibility as measured in the laboratory, we developed a task in which the sorting rules are relatively simple, but the stimuli are complex (faces) and the switches will be unpredictable. By using faces as stimuli, some social interpretation is needed and, therefore, the task has a closer resemblance to real life flexibility as classical switch tasks.

Methods: Twenty-four children with ASD and 24 age- (range between 8 and 12 years), and gender-matched TD children will perform a gender-emotion switch-task. Stimuli consist of male and female faces with a happy or angry expression. Children need to switch between two sorting rules; sorting on facial expression or on gender. The switch of the sorting rule (after 2, 3 or 4 trials) is unpredictable for the children.

Results: Data for the TD children are collected, while the data collection of the ASD group will be finished this March. Based on our preliminary data-analysis, we predict that children in the ASD group perform differently on the gender-emotion switch-task compared to the TD group. In the TD group children with less ASD symptoms (as measured with the Social Responsiveness Scale) perform better in the gender than in the emotion task; they make less errors in repeat- as well as switch-trials. Children with more ASD symptoms however, seem to show relatively more slowing in the emotions task, but there is no effect on accuracy. Children with more ASD symptoms seem to work slower when emotions need to be processed.

Conclusions: The results should provide information to what extend the cognitive flexibility impairment in children with ASD in everyday life is possible to measure in a research setting if the complexity of stimuli used and unpredictability are taken into account.

134.044 44 Metamemory Functioning In Children with Autism Spectrum Disorder. D. Z. Wojcik* and C. Souchay, *University of Leeds*

Background:

Metamemory entails two processes which coordinate cognition: monitoring (e.g. assessing own memory knowledge and performance) and control (e.g. allocating strategy to aid performance) (Nelson & Narens, 1990). Although it has been suggested that due to Theory of Mind difficulties, metacognition

could be impaired in ASD (Baron-Cohen, 1995) little research explored this area. While Farrant et al. (1999) found no impairment in ASD knowledge about variables affecting memory, studies exploring online metacognitive monitoring accuracy produced mixed results (Wilkinson et al., 2010; Wojcik et al., under review). A study investigating the metacognitive control, found ASD children to be poorer than typical in allocating sufficient study time to achieve optimum performance (Farrant et al., 1999).

Objectives:

The aim of this study was to explore metacognitive control in ASD children by looking at their ability to self allocate sufficient study time to achieve optimum performance. We also assessed ASD children knowledge regarding the effect of study time on memory performance (metacognitive knowledge) and their abilities to predict their memory performance (metamemory monitoring).

Methods:

21 ASD children and 21 typical children were included in this study. There were no significant group differences on age and IQ ($t(40)=1.52$, $p=.14$ and $t(40)=-1.07$, $p=.29$ respectively). All children were tested in 4 different learning conditions. In the 1st condition, participants were given unlimited amount of study time to study 10 words. In the 2nd condition they had double of the unlimited time condition to learn another list of 10 words and then half the unlimited condition in the 3rd list. In the 4th condition, one minute was given to learn the 10 words. To measure metacognitive knowledge and monitoring abilities, children were asked prior and after the study phase to predict how many words out of 10 they would be able to recall (Moulin et al., 2000).

Results:

First of all, ASD children were found to allocate the same amount of study time and subsequently achieved the same recall levels as typical children. Both groups recalled more items in the unlimited condition. However, for both groups doubling the time at learning did not improve their memory performance. ASD children were also found to predict accurately their memory performance. Finally, both groups predicted better recall with increased study time.

Conclusions:

Our results confirm that ASD children have preserved metacognitive knowledge and are able to predict their memory performance thus showing adequate monitoring abilities. ASD children were found to use a similar strategy as typical children when let free to control their study time, suggesting preserved control processes. Finally, the fact that both groups did not benefit from doubling their study time is interpreted in the context of the '*labour in vain'* effect (Nelson & Leonasio, 1988)

134.045 45 Neural Correlates of Relational Memory In Autism. E. J. H. Jones*, J. Tiwana and M. Murias, *University of Washington*

Background:

While many studies have observed relatively typical recognition memory for objects in individuals with ASD, less is known about memory for object-context relations. Dual-process models of recognition memory (e.g. Aggleton & Brown, 1999) propose two mechanisms by which object-context pairs can be remembered: (i) a 'feeling of familiarity' that acts on blended object-context representations; (ii) hippocampus-dependent recollection of the relations between objects and the contexts in which they appear, thought to facilitate more 'flexible' memory retrieval (Eichenbaum, 1997). Several authors have proposed that individuals with high-functioning ASD have impairments in recollection/relational memory, but relatively intact familiarity-based recognition (e.g. Joseph et al., 2005; Gaigg et al., 2008; Boucher et al., 2008). Although neurotypical adults predominantly use recollective memory to remember object-context associations, individuals with ASD may show atypical reliance on less flexible familiarity-based mechanisms. In the present study we used event-related brain potentials (ERPs) to examine this proposal, because familiarity and recollection have been associated with different components of the ERP response to a recognized stimulus (e.g. Curran et al., 2006).

Objectives:

To assess whether recognition memory for object-background pairs relies on atypical neural mechanisms in adults with high-functioning ASD.

Methods:

Participants were 15 high-functioning adults who met gold-standard diagnostic criteria for ASD, and 15 age- and IQ-matched neurotypical controls (NT group). Participants were asked to remember a series of object-background pairs. At test, participants saw familiar backgrounds paired with either i) the same object as during learning (Same); ii) an object previously seen on a different background (Rearranged) or iii) a novel object (Novel). Participants were asked whether the object-background pairing was one they had seen before.

During the task, brain activity was continuously measured with high-density electroencephalography. Initial analyses explored i) accuracy and reaction time of behavioral responses and ii) ERPs during correct responses to test stimuli.

Results:

Relative to the NT group, the ASD group found it significantly more difficult to correctly identify Same and Rearranged but not Novel stimuli, suggesting difficulty remembering object-background relations. Preliminary analyses of brain activity focused on two ERP components previously associated with memory: an early frontal component associated with familiarity-based recognition, and a later parietal component associated with recollection-based recognition. As expected, in the NT group neural responses in the Same and Rearranged conditions significantly differed during the recollection-associated parietal component; there was no significant difference between Same and Rearranged conditions over this component for the ASD group. In contrast, the familiarity-associated frontal component significantly differed between Same and Rearranged conditions for the ASD group but not the NT group. These findings support the hypothesis that recognition of object-background pairs relies on atypical neural mechanisms in adults with high-functioning ASD.

Conclusions: Preliminary findings are consistent with the proposal that participants with ASD find it more difficult to remember object-background relations than age- and IQ-matched neurotypical controls, and suggest that participants with ASD may rely on less efficient familiarity-based retrieval mechanisms to compensate for deficits in recollective recognition. Further work will explore how these differences relate to reduced cognitive flexibility in autism.

134.046 46 Recall and Recognition of Episodically-Defined Word Pairs: Further Evidence of a Relational Binding Difficulty In ASD. D. M. Bowler*, S. B. Gaigg and J. M. Gardiner, *City University London*

Background: Individuals with ASD resemble healthy typical older adults in experiencing greater difficulty on unsupported memory tasks such as recall rather than supported tasks such as recognition. This reliance on *Task Support* has also been demonstrated for incidentally encoded context and for semantic relatedness between studied items and incidental context. Bowler, Gaigg & Lind (2011) argue that these difficulties result from a diminished capacity for *relational binding* in ASD which may also underlie diminished episodic recollection in this population. Naveh-Benjamin (2000) reported greater impairment in recognition of pairs of unrelated words than single words by older typical adults, reflecting an associative deficit in this population. Using a modification of Naveh-Benjamin's task, we predicted undiminished recognition but diminished recall of unrelated word pairs in adults with ASD.

Objectives: To compare recall and recognition of unrelated word pairs in high-functioning adults with ASD and typical comparison participants.

Methods: Groups of about 16 adults with ASD and verbal ability matched typical individuals were shown lists of 12 (Experiment 1) or 16 (Experiment 2) pairs of weakly-associated words and asked to try to remember as many of the pairs as they could. At test, in Experiment 1, they were asked to recall as many of the pairs as they could. In Experiment 2, they were presented with cards each bearing one studied word, together with 16 lure cards and asked to make up as many of the studied pairs as they could.

Results: In the recall test, ASD participants could recall 58% of the word pairs compared to a recall rate of 80% by the comparison group, a difference that was significant ($p<.05$). By contrast, the correct pair recognition in the ASD group was not significantly different from that of the comparison group (45% vs 42%).

Conclusions: The findings extend the Task Support Hypothesis of memory in ASD to the recall of episodically-defined pairings of stimuli and supports the view put forward by Bowler et al. (2011) that atypical memory performance in ASD is a reflection of relational binding difficulties.

134.047 47 Prototypical Category Learning Intact In Adolescents and Adults with High-Functioning Autism. O. Olu-Lafe*[1], T. Vladusich[2], D. S. Kim[3], S. Grossberg[1] and H. Tager-Flusberg[1], (1)*Boston University*, (2)*Brandeis University*, (3)*Boston University School of Medicine*

Background: Categorization is something we all do with little effort. Some researchers have claimed that this basic ability is impaired in individuals with autism spectrum disorder (ASD). According to a recent neural theory of atypical cognitive development in autism (Grossberg and Seidman, 2006), "hypervigilant" category learning in some persons with autism may cause an impaired ability to learn prototypes for abstract general categories, with consequences for deficits in attention and related behavioral symptoms of autism (e.g. difficulty generalizing learned concepts, over focus on fine detail). Several studies have observed atypical prototype learning in autism; others failed to find any impairments.

Objectives: The present study utilized a classic prototype formation task to examine if individuals with autism would (1) struggle to learn categories, and (2) have difficulty generalizing from learned categories to new members of those categories.

Methods: Twenty high-functioning individuals with autism and matched controls participated in a classic prototype learning paradigm. Two prototype dot patterns were generated; a set of dot patterns with varying similarity (high, medium, or low) to these prototypes was also created. During training, participants categorized medium-similarity patterns into two categories until criterion was reached. At test, participants were shown training items and a novel set of dot patterns with varying similarity to the unseen prototypes (high-, medium-, and low-similarity to unseen prototypes).

Results: Individuals with autism learned more slowly and less well; the ASD group (1) required significantly more blocks to reach criterion, and (2) had significantly lower accuracy in both training and test. However, there were no group differences in *pattern* of performance during the test phase; individuals with autism showed a typical pattern for normal prototypical category learning (greatest accuracy for high-similarity dot patterns, equal accuracy for training and test medium-similarity dot patterns, lowest accuracy for low-similarity dot patterns).

Conclusions: These data indicate that high-functioning individuals with autism do not manifest gross deficits in prototypical category learning. A possible theoretical interpretation of these data is given in terms of underlying brain mechanisms.

134.048 48 Effortful Control and Executive Functioning In Children with ASD. V. J. Samyn*[1], H. Roeyers[1], P. Bijttebier[2] and J. R. Wiersema[1], (1)*Ghent University*, (2)*Katholieke Universiteit Leuven*

Background: Despite increased interest in the role of Effortful Control (EC) in developmental disorders, few studies have focused on EC in children with Autism Spectrum Disorder (ASD).

Objectives: A first aim of the current study was to compare children with ASD and typically developing children (TD) in their ability to regulate attention and behavior. Secondly, we want to examine the relationship between EC levels and symptom expression in ASD. Finally, we want to investigate the relationship between EC and other, conceptually overlapping, inhibition constructs.

Methods: **Participants**. 54 children (11-15 years, all boys with a FSIQ of 80 or higher) participated. 27 children had ASD and 27 were TD controls.

Instruments. EC was measured using *the Effortful Control Scale* (ECS; Lonigan & Phillips, 2001), *the Attentional Control Scale* (ACS; Derryberry & Reed, 2002) and the EC scale of *the Early Adolescent Temperament Questionnaire* (EATQ-R; Rothbart, 2001). ASD symptoms were evaluated using *the Social Responsiveness Scale* (SRS; Constantino & Gruber, 2005). Inhibition was assessed by means of *the Behavior Rating Inventory of Executive Function* (BRIEF; Gioia, Isquith, Guy & Kenworthy, 2000), a stroop task and a go/no-go task.

Results: **Group differences in EC**. Children with ASD scored lower than their TD peers on EC total scores. The ASD group did not differ from the TD group on self-reported levels of persistence, impulsivity and activation control.

EC and ASD symptoms. All EC scales except the ECS subscales and the EATQ-R Activation Control scale, were negatively related to ASD symptom levels.

EC and executive functioning. There were no significant correlations between EC levels and Interference Control (IC) as measured by the stroop task. Only parent-rated EC and self-reported attention focusing (ACS) were positively related to the number of false alarms made in a go/no go task. We found significant correlations between EC scores and scores on all BRIEF subscales, with lower levels of EC being associated with more difficulties in executive functioning.

Conclusions: Analyses are still in progress, but preliminary results are to a large extent in accordance with previous research. Children with ASD showed lower levels of EC than their TD peers, suggesting that children with ASD are less able than TD children, to regulate their behavior and attention when needed. Also, higher EC levels were associated with lower levels of ASD symptoms. Considering the conceptual overlap between EC and other inhibition constructs, we expected to find a significant relationship between EC levels and scores/performance on the measures tapping executive functions, inhibition and IC. As expected, EC scores significantly correlated with executive functions as measured by the BRIEF, suggesting that these measures may tap the same/similar underlying construct(s). However, preliminary results did not show a consistent relationship between the EC scales and performance on neuropsychological measures. This lack of correlation could possibly be explained by differences in type of measurement. Results suggest that questionnaires and

neuropsychological tasks may not be interchangeable when measuring EC.

134.049 49 Mental Time Travel in ASD: Assessing Episodic Memory and Episodic Future Thinking. S. E. Lind*[1], L. Crane[2] and D. M. Bowler[3], (1)*Durham University*, (2)*Goldsmiths, University of London*, (3)*City University London*

Background: Recent research has revealed that episodic memory (remembering past experiences) and episodic future thinking (imagining future experiences) rely on the same underlying neuro-cognitive system (Spreng et al., 2009, *J Cognitive Neurosci, 21,* 489-510). Numerous studies have demonstrated that individuals with ASD show impaired episodic memory (see Lind, 2010, *Autism, 14,* 430-456) but Lind and Bowler (2010, *J Abnorm Psychol, 119,* 896-905) were the first researchers to establish that individuals with ASD show impairments in *both* episodic memory and episodic future thinking.

Objectives: The current study was designed to further explore the nature of ASD-specific impairments in episodic memory and episodic future thinking.

Methods: Eighteen intellectually high-functioning adults with ASD (diagnoses confirmed using ADOS) and 18 age- and IQ-matched comparison participants undertook two sentence-completion tasks designed to assess memory and future thinking, respectively (Anderson & Dewhurst, 2009, *Memory, 17,* 367-373). In the Past Events Task, participants completed 11 past-oriented sentence stems such as *"When I think back to…"* In the Future Events Task, participants completed 11 future-oriented sentence stems such as *"Next year…"* Each sentence was scored on a scale from 0 to 4 according to degree of specificity (0 = omissions; 1 = semantic associates; 2 = extended events; 3 = categoric [reoccurring] events; 4 = specific events). Scores across the 11 sentences were then summed to produce a "total" score for each task (total score range: 0 to 44). It was predicted that the sentences produced by individuals with ASD would be significantly less specific (more overgeneral) in both the Past Events and Future Events Tasks, reflecting impaired episodic memory and episodic future thinking, respectively.

Results: The ASD group obtained slightly lower scores than the comparison group in both the Past Events Task (ASD: M = 28.22, SD = 8.58; comparison: M = 29.06, SD = 2.90) and the Future Events Task (ASD: M = 22.83, SD = 7.83; comparison: M = 24.61, SD = 5.53). A 2 (Group: ASD/comparison) x 2 (Task: Past Events/Future Events) mixed ANOVA revealed no significant main effect of Group, $F(1,34) = 0.42$, $p = .52$; a significant main effect of Task, $F(1,34) = 31.12$, $p < .001$; and no significant interaction effect, $F(1,34) = 0.29$, $p = .60$.

Conclusions: In contrast with previous research and contrary to predictions, results indicated that participants with ASD and comparison participants showed similar levels of episodic memory and episodic future thinking. While it is possible that these results are an accurate reflection of the habitual levels of episodic memory and episodic future thinking in these groups, an alternative explanation is feasible. Whereas previous studies have explicitly asked participants to try to recall/imagine *specific* events, the current study imposed no such constraints. This aspect of the method may have elevated the proportion of *general* (i.e., non-episodic) memories and simulations in the *comparison group*, thereby masking difficulties in episodic memory and episodic future thinking in the ASD group. Therefore, this study has important implications for how we assess episodic memory and episodic future thinking in ASD.

134.050 50 Weak Central Coherence In Autism Over the Preschool Years. K. K. Powell*, E. S. Kuschner and L. G. Anthony, *Children's National Medical Center*

Background:

Weak Central Coherence (WCC) theory describes the unique, detailed-focused cognitive processing style common in individuals with autism as the limited capacity or ability to understand context or to 'see the big picture.' Research on WCC support impairment in gestalt processing with strength in local processing among older preschool-aged children, school-aged children, adolescents and adults with autism as compared to a variety of controls. As part of an on-going project, this study aimed to examine the emergence of cognitive subtypes in younger preschoolers with ASD. This is an important step in further uncovering the role of a WCC cognitive bias in young children with autism.

Objectives:

To examine the relative strengths and weaknesses within each child's cognitive profile across time using a nonverbal measure of WCC to examine if a detailed-focused processing bias is present at both time points (mean age=39.5 months and mean age=60.5 months).

Methods:

Participants consisted of a clinically referred sample of 14 children (n= 12 [85.7%] male) with an ASD diagnosis based on

the Autism Diagnostic Observation Schedule and clinical impression (Autism n= 7; PDD-NOS n= 7). All data were collected during a comprehensive clinical diagnostic and psychoeducational evaluation at a special education preschool program. Central coherence was estimated using patterns of cognitive performance on 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=39.5 months and mean age=60.5 months). A WCC profile was characterized by a relative strength in the subtests that depend on detail-focused 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).

Results:

Paired samples t-tests at Time 1 indicate no differences (*ps*> .14) among the Brief IQ subtests, providing evidence against a WCC profile at this earlier age. Paired samples t-tests at Time 2 indicate differences between FG-SO and FC-SO (*ps*< .01); however differences between FG-RP and FC-RP were not found (*ps*>.06), providing partial support for a WCC profile with a strength in detail-focused tasks (i.e., FG and FC) and a relative weakness in abstract processing tasks (i.e., SO).

Conclusions:

At Time 1, we find that young preschoolers with autism are not showing specific strengths and weaknesses within their cognitive profile, suggesting that an enhanced local processing style is not present. At Time 2, children with autism are showing strength on FG and FC when compared to SO. However, this same pattern is not evident when FG and FC were compared to RP. Findings suggest that an uneven pattern of strengths and weaknesses in cognition found in previous research on individuals with autism, namely strengths in nonverbal perceptual versus nonverbal conceptual skills, which are proxies for WCC, are evident for older preschoolers, but not younger preschoolers. We conclude that the development of a drive for local processing may occur over the preschool years, which would subsequently have implications for intervention.

134.051 51 Declarative Memory and Language In ASD. S. Anns*[1], S. Bigham[2], J. Boucher[1], A. Mayes[3] and D. M. Bowler[1], (1)*City University London*, (2)*Bournemouth University*, (3)*University of Manchester*

Background:

We have hypothesized that the language and learning impairments that distinguish lower functioning autism (LFA) from higher-functioning forms of autism (HFA) result partly from an impairment of semantic memory additional to the impairment of episodic memory known to occur across the spectrum. More specifically, we hypothesize that whereas recollection (which plays a critical role in episodic memory) is impaired across the spectrum, familiarity (which plays a critical role in semantic memory) is impaired only in individuals with LFA.

Objectives:

The main objective of the research is to assess recollection and familiarity in LFA relative to comparison groups including an HFA group. If, as predicted, familiarity is impaired in the LFA group, but not the HFA group, a subsidiary objective is to assess the predicted associations in LFA between impaired familiarity, language (in particular, lexical-semantic knowledge), and learning (as manifested in crystallized intelligence).

Methods:

Participants. Four groups of c. 25 participants are being assessed: adolescents (11-17 years) with LFA (VQ ≤75; adolescents (11-17 years) with intellectual disability without autism (ID) (VQ≤75; children (6-10 years) with HFA (VIQ≥90); and typically developing (TD) children (6-10 years) with VQ in the average range.

Baseline tests. Participant groups will be equated for verbal MA on the Similarities and Vocabulary subtests from the Wechsler scales. Additional baseline tests are: Ravens Matrices (to assess nonverbal IQ); The Children's Embedded Figures Test (to assess field dependence-independence); and the Pyramids and Palm Trees test (to assess lexical-semantic knowledge).

Experimental studies (ongoing). Two methods of assessing familiarity and recollection independently of each other are being used. In Study 1, 'Shape recognition, action recall' tests are used. This pair of tests was developed and used with the predicted result in children with HFA, as reported in Bigham, Boucher, Mayes, and Anns (2010). In Study 2 two forced choice recognition tests are used. This pair of tests was developed and successfully used to discriminate between familiarity and recollection in patients with acquired amnesia associated with selective hippocampal lesions, as reported by Migo, Mayes et al. (2009).

Statistical analyses. Between group differences on the tests of recollection and familiarity will be assessed using analyses of

variance, covarying the effects of nonverbal IQ (fluid intelligence) and field dependence-independence (central coherence). Within-group associations between familiarity and lexical-semantic knowledge, and between familiarity and crystallized intelligence, will be assessed using correlation tests.

Results: and Conclusions:

These will be available in time to be reported.

134.052 52 Perseveration In Autistic Spectrum Disorders; Role of Negative Feedback. J. Broadbent* and M. A. Stokes, *Deakin University*

Background:

Autistic individuals (ASD) have been shown to have executive function deficits in cognitive flexibility, as demonstrated by perseverative behaviour on the Wisconsin Card sorting Task (WCST). Several authors have argued that the social nature of the WCST administration plays a role in ASD deficit in cognitive flexibility, with improved performance shown when the WCST is administered via computer to this cohort (*cf*. Ozonoff, 1995). However, other environmental influences have not been taken into consideration. It is possible that it is not just the social interaction given by the experimenter alone that increases perseverative behaviour, but the type of feedback given. There is some evidence to suggest that ASD individuals may be overly persistant with certain behaviour, despite the negative consequences. For example, Stokes, Newton and Kaur (2007) found that ASD individuals were more likely to pursue a romantic target for longer when you give them negative feedback compared to typically developing individuals. The authors found that this pursuit continued despite negative feedback from the target or the targets friends and family.

Objectives:

While current theories emphasize that autistic individuals are persistent, they do not address the possibility that negative feedback exacerbates their socially inappropriate behaviours. The purpose of the current study is to determine what influence negative feedback has on perseverative performance on the WCST.

Methods:

We compared 50 individuals with ASD (age: *M*=39 years *SD*=17.34) and 50 typically developing individuals (age: *M*=26.9 years *SD*=8.78) for their abilities to successfully complete the Wisconsin Card-Sorting Task under two conditions: (1) traditional WCST containing positive feedback for an correct strategy negative feedback for an incorrect strategy, and (2) Modified WCST containing positive feedback for a correct strategy and no feedback for an incorrect strategy.

Results:

The results of the current study found that negative feedback led to perseveration in autistic individuals. When negative feedback was removed from the WCST (modified version), we found that an ASD individuals' performance was enhanced, and no different to that of the Typically Developing individuals.

Conclusions:

These results suggest that individuals with ASD are able to inhibit incorrect responses and are capable of shifting cognitive sets when they are not presented with negative feedback. The potential implication of this is that individuals with ASD may be more successful when receiving only positive reinforcement, and this should be taken into account when ASD individuals are learning a new task. It is also possible that ASD individuals' poor performance on the WCST does not reflect a deficit in executive function but an inability to attend to, and process, the verbal and social interaction demands of the task in the same way that this is performed in TD individuals.

134.053 53 Executive Functions In Asperger's Syndrome: Evidence for a Modality Bias. A. McCrimmon*[1] and J. M. Montgomery[2], (1)*University of Calgary*, (2)*University of Manitoba*

Background: Investigations of deficits in executive functions (EF) in individuals with Asperger's syndrome (AS) have yielded mixed results. A possible reason for this inconsistency may be the use of specific, often single, EF tasks, an approach that does not provide a structure by which commonalities in performance among tasks can be examined. As well, much of the past research has utilized a heterogeneous sample comprised of individuals with AS and High-Functioning Autism, leading to potentially unrepresentative findings for AS specifically.

Objectives: To understand the nature of executive functions in adolescents and young adults with AS. Specifically, to determine if a modality bias exists.

Methods: Seven subtests of the Delis-Kaplan Executive Function System (DKEFS) were administered to 33 individuals with AS and 33 age-and gender-matched controls (M = 18.85

years, SD = 1.56; 78.8% male). Three of these tasks are verbally-mediated while four are nonverbally-mediated.

Results: Initial exploratory factor analysis yielded a two-factor solution, with verbally-mediated EF tasks classified into one factor and nonverbally-mediated tasks classified into another. Cluster analysis yielded a two cluster solution, with 78% of AS participants classified into Cluster A and 67% of control participants classified into Cluster B. Investigation of the performance characteristics indicated that assignment into Cluster A was made predominantly on the basis of poor performance on the nonverbally-mediated EF tasks whereas assignment into Cluster B was done on the basis of good performance on the nonverbal tasks.

Conclusions: This study provides initial evidence supporting the notion that modality of EF should be further examined in AS. Specifically, the majority of EF tasks previously used in research are nonverbally-mediated, resulting in findings that are potentially unrepresentative of EF abilities in this population. Individuals with AS in this study demonstrated a deficit in nonverbally-mediated EF tasks, but not in verbally-mediated tasks. This finding provides clarification to the research literature and a structure by which to better understand EF in this population.

134.054 54 Prospective Memory Performance In Autism Spectrum Disorders: Using a Naturalistic Task. M. Altgassen*, N. Koban and M. Kliegel, *Technische Universitaet Dresden*

Background:

Individuals with autism spectrum disorders (ASD) 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). However, these few existent studies on prospective memory in ASD have used very abstract tasks that do only allow a limited transfer of these laboratory-based results to participants' everyday performance.

Objectives:

The purpose of the present study was to apply an everyday-like, ecologically valid task.

Methods:

Twenty-five adults with high-functioning ASD 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 the ASD group 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 completed less tasks than controls and showed poorer planning performance. Moreover, groups differed in rule adherence, efficiency and time-monitoring.

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 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).

134.055 55 Association of Deficits In Executive Functioning and Neurocognitive Status In Low/High Levels of Autistic Traits In a Sub-Clinical Sample. R. Hansen*, K. Swanson, L. Deling, A. Johnson and F. R. Ferraro, *University of North Dakota*

Background: Previous work demonstrated the Executive Function Index (EFI) useful in detecting neurocognitive differences between sub-clinical groups reporting higher and lower levels of autistic traits as measured by the Autism Spectrum Quotient (AQ). As levels of autistic traits increased (AQ), executive functioning decreased (EFI Total). High-AQ individuals reported higher deficits than low-AQ individuals in Motivational Drive, Empathy and Organization. Assessing additional domains, such as those measured by the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998), may provide convergent evidence for executive deficits related to autistic-trait severity in

addition to identifying other neurocognitive aspects unique to Autism Spectrum Disorders (ASD).

Objectives: Study expands on demonstrated AQ and EFI relationships and evaluates possible RBANS associations. Negative correlations between AQ and EFI measures with EFI means for Low-AQ group expected higher than High-AQ. Lower performance on RBANS Language Index was predicted to coincide with higher AQ, based on language deficits salient to ASD. RBANS Attention Index was expected to moderately correlate with general executive functioning. Attention differences were not expected between High-AQ and Low-AQ groups, as inattention is not a core ASDimpairment. Possible predictors of AQ trait levels using EFI and RBANS indicators were explored.

Methods: Self-rated autism trait level and executive function performance were measured using the AQ and EFI. The AQ (50 questions) quantifies autistic traits on the autism-normality continuum with sub-clinical High-AQ and Low-AQ groups following the high (16-31) and low (5-15) AQ score dichotomy. The EFI (27 questions) assesses 5 frontal lobe functions: Motivational Drive, Impulse Control, Empathy, Organization, and Strategic Planning. The RBANS battery of 10 standardized subtests measures Immediate and Delayed Memory, Visuospatial Skills, Language and Attention. Sample consisted of Midwestern university students (*N*=214, ages 18-50, *M*=21.47).

Results: Negative correlations were found between AQ and Motivational Drive, Organization, and EFI Total along with mean group differences between Low-AQ and High-AQ groups. Negative correlations were found between AQ and RBANS Picture Naming, Semantic Fluency, Story Recall, and Language Index. RBANS Attention Index positively correlated with EFI Total. High-AQ group means were lower than Low-ASQ on RBANS Picture Naming, Story Recall, and Language Index. Attention Index group scores did not significantly differ. Exploratory linear regression analysis using a sample subset (*N*=100, ages 18 - 41, *M*=21.68) matched by group propensity revealed predictors of Motivational Drive (β = -.32, *p* = .001), Organization (β = -.23, *p* = .01) and Picture Naming (β = -.30, *p* = .001) accounting for 27% of AQ variance, $F(3,94) = 11.63$, $p < .001$.

Conclusions: Negative correlations between AQ and EFI persist as results suggest that some aspects of executive functioning show decrement with increases in autistic trait levels. AQ and RBANS associations refine the ASD neurocognitive profile to include intact attention and impairments found in confrontational naming, semantic fluency and recall of contextual information. Results also suggest that deficits in motivational drive may moderate neurocognitive performance - an important consideration when interpreting neuropsychological performance within the autism continuum.

134.056 56 Affective Decision Making: Relation to Social and Behavioral Outcomes for Young Children with Autism Spectrum Disorders. R. Montague*,

Background:

Children with autism spectrum disorders (ASD) have difficulty processing social and emotional information. Research suggests that deficits in executive functions (EF) play a role in the social and cognitive difficulties for children with ASD. To date, most of this research has focused exclusively on cognitive aspects of EF, such as motor inhibition or working memory tasks. Recent research has coined the term hot EF to describe problem solving in situations with emotional or motivational components. Research from cognitive neuroscience suggests children with autism may show a primary deficit in hot EF, as damage to the brain systems associated with integration of affective information is common. To date there is little information known about how children with autism recruit EF skills during emotion-eliciting situations.

Objectives:

The primary goal of this study is to determine how affective decision-making skills are associated with the social competence and externalizing behaviors for children with autism.

Methods:

Participants will include 72 children between the ages of 3:0 and 6:6 years old. Participants with a diagnosis of an autism spectrum disorder (ASD) will be matched on verbal skills, sex, and age to participants with typical development (TD). Children complete individual assessments of their verbal ability (DAS-II) and affective decision-making abilities (Children's Gambling Task; Kerr & Zelazo, 2004). Parents and teachers complete questionnaires about children's social competence (SSRS) and externalizing problems (BASC, 2nd edition).

Results:

To date, 48 children have enrolled in the study (38 TD and 10 with an ASD diagnosis) and data collection continues. The mean age of children in the TD group is 4.7 years compared 5.5 years in the ASD group.

Outcome variables were regressed on the predictor (group diagnostic status). After controlling for verbal ability, group diagnostic status accounts for 13.7% of the variance in parent report of social competence, $F(2,45) = 9.24$, $p < .01$, 28.6% of the variance in teacher report of social competence, $F(2,45) = 12$, $p < .01$, and 23.4% of the variance in teacher report of externalizing behaviors, $F(2,43) = 7.188$, $p < .01$. After controlling for verbal abilities, group status did not explain a significant amount of variance in parent report of externalizing behaviors. My hypothesis is that children's advantageous decision-making ability (hot EF skills) will positively influence social competence and negatively predict externalizing behaviors and that the interaction will not be the same for TD and ASD groups. Thus, I will test a moderation model whereby children's advantageous decision-making ability during the Children's Gambling Task moderates the relation between child status and social competence and externalizing behaviors.

Conclusions:

Even after controlling for verbal ability, diagnostic status predicts significant variance in social competence and externalizing problems. I will test whether children who demonstrate advantageous decision making strategies experience better social adaptation and decreased problem behaviors. Children with ASD may integrate affective information differently than TD peers when facing situations with emotional significance. Understanding how hot EF skills influence cognitive abilities and behavior may inform the field about protective factors and interventions for children with ASD.

134.057 57 Developmental Change In Theory of Mind: Late Onset, Yet Normal Rate of Development. M. Robberts-Hoogenhout*, S. Malcolm-Smith and K. Thomas, *University of Cape Town*

Background: Previous studies have found that individuals with autism spectrum disorders (ASD) have specific deficits and delays in theory of mind (ToM) development. However, few studies have systematically compared ToM development across ASD subtypes. Results regarding ToM development have been contradictory; this may be because individuals of different functioning levels were seen, or because only a limited aspect of ToM ability was assessed.

Objectives: Using a comprehensive ToM battery, we tested whether development is evident in high and low-functioning autism (HFA and LFA), Asperger's syndrome (AS) and pervasive developmental disorder not otherwise specified (PDD-NOS).

Methods: This study was a cross-sectional comparison of 87 children with ASD (20 LFA, 25 HFA, 22 AS and 20 PDD-NOS) and 30 typically developing (TD) children, aged 4-16 years. Children were tested on 11 ToM tasks ranging in difficulty from imaginary play to interpreting complex social situations, and on several measures of cognitive function. (1) To compare overall group performances on ToM, an analysis of covariance was done with verbal IQ, Verbal Generativity, Inhibition/Set Shifting, Digit Span and Processing Speed as covariates. (2) To explore the development of ToM ability, five separate regressions were performed (TD, LFA, HFA, AS, PDD-NOS), and the rate of development and onset of ToM was compared.

Results: (1) Even after controlling for possible confounding cognitive factors, significant differences in ToM remained between the groups, $F(4, 69) = 9.02$, $p < .001$. Of particular interest here is the large difference in ToM between the HFA and AS groups ($M_{HFA} = 63.95$, $M_{AS} = 112.38$; $p < .001$). (2) Regarding ToM development, the HFA, PDD-NOS and TD groups showed statistically significant increases in ToM with age (all $p < .01$). The groups also did not differ in their overall rate of ToM development, $F(4, 107) = 2.01$, $p = .098$. However, the LFA group showed significantly slower ToM development than the TD group, $F(1, 46) = 7.39$, $p = .009$. All the ASD groups except for the AS group showed delayed ToM skills at age 48 months, $F(4,111) = 63.53$, $p < .001$. ToM onset was especially delayed in HFA and LFA.

Conclusions: These results support a delayed development hypothesis: ToM does develop in certain ASD groups, and seems to develop at a normal rate, but the onset of the ToM abilities measured in this study is much later than in typical development. The fact that the LFA group showed no increase in ToM with age suggests that certain language and cognitive skills may be necessary for ToM development, or that compensatory skills play a large role in the observed increases in ToM in the other ASD groups. The differences found in ToM are pertinent to the HFA/AS debate, and highlight that some distinction between different levels of ability needs to be made for teaching and intervention purposes if these diagnostic categories are to be grouped into one, and that ToM may be a good way to do so.

134.058 58 Behavioral Flexibility Impairments In Autism Spectrum Disorders Are Related to Symptoms of Insistence on Sameness. A. M. D'Cruz*, M. W. Mosconi, L. Schmitt, S. Shresthra, E. H. Cook, M. E. Ragozzino and J. A. Sweeney, *University of Illinois at Chicago*

Background:

Individuals with ASD demonstrate impairments in flexibly shifting to newly adaptive response strategies when environmental contingencies change. This cognitive impairment may underlie aspects of behavioral rigidity and insistence on sameness in ASD, which are a major cause of functional disability in this disorder.

Objectives:

To examine flexible choice behavior in ASD, and its relationship to clinical measures of behavioral rigidity.

Methods:

Forty-seven individuals with ASD and 32 age- and IQ-matched controls performed a probabilistic reversal learning task. Participants were required to choose the correct stimulus from a pair of stimuli in order to obtain as many points as possible. After successfully choosing the correct stimulus over multiple trials during acquisition, the rewarded stimulus was switched unpredictably to the other stimulus choice. Thus at reversal, participants had to inhibit their response to the previously correct stimulus, and select the new correct stimulus to continue to accumulate points. Reinforcement, in the form of 10 point rewards, was presented immediately following participants' response choices on an 80:20 probabilistic schedule, such that the "correct" choice was reinforced on 80% of trials and "incorrect" choice was reinforced on 20% of trials during both acquisition and reversal.

Results:

Both the ASD and control group performed comparably in the initial acquisition phase of the task. However, following reversal of the response-outcome contingency, the ASD participants required significantly more trials to successfully shift their response choice to criterion than did controls. This was due to ASD participants making significantly more regressive errors post-reversal, such that after initially choosing the new correct choice, they more frequently reverted back to the previously correct choice than did controls. Thus, in contrast to controls, ASD participants had difficulty maintaining the new choice pattern following reversal. This effect was driven by significantly more "lose-shift" responses post-reversal, such that the ASD group incorrectly shifted their choice to the other response after intermittent inaccurate feedback. In addition, the number of regressive errors, and lose-shift behavior was positively correlated with clinical measures of insistence on sameness, as measured by the RBS-R and repetitive behavior scores on the ADI-R.

Conclusions:

These data suggest that individuals with ASD have difficulty shifting from a previously learned and rewarded response to a newly adaptive response choice, and have difficulty maintaining this newly learned choice in the face of intermittent non-reinforcement. Moreover, these reversal learning impairments are related to individuals' clinical symptoms of insistence on sameness, suggesting that this clinical dimension is associated with a more general problem of cognitive and behavioral inflexibility. Distinct frontostriatal circuitry supports reinforcement learning and response inhibition processes necessary for successful reversal learning performance. Alterations in frontostriatal circuitry may thus underlie impaired flexible choice behavior in ASD, and contribute to insistence on sameness and other manifestations of behavioral rigidity.

134.059 59 Getting Stuck: Children with High Functioning Autism Spectrum Disorders Demonstrate Impaired Cognitive Flexibility on the Flexible Item Selection Task (FIST). B. Yerys*[1], B. Wolff[2], E. Moody[3], B. F. Pennington[4] and S. Hepburn[5], (1)*Children's National Medical Center*, (2)*University of Colorado Denver School of Medicine*, (3)*University of Colorado, Denver*, (4)*University of Denver*, (5)*University of Colorado / JFK Partners*

Background: Individuals with an autism spectrum disorder (ASD) show a lack of cognitive flexibility across different settings (Geurts, Corbett & Solomon, 2009). Inflexible thinking can have a significant impact on social functioning and development of adaptive skills. There are two types of tasks designed to assess flexibility: (1) Inductive (i.e., tasks which provide feedback to participants and require them to demonstrate flexibility in problem-solving by inferring a new rule (e.g., Wisconsin Card Sorting Test [WCST]); and 2) Explicit (i.e., tasks which do not require reasoning, but provide explicit cues to guide the participant, e.g., Preparing to Overcome Prepotency [POP]). A third type of task that is relatively absent in ASD research is deductive flexibility tasks (i.e., provide a general rule and children demonstrate flexibility by executing new behaviors within the rule).

Objectives: To measure flexibility in pre-adolescent children with ASD relative to typically developing (TD) children matched on verbal mental age with a deductive flexibility task.

Methods: Forty-four children participated in this study. The ASD group (n=22) and the TD group (n=22) were matched on verbal mental age (ASD M(SD)=7.92(2.14; TD M(SD)=7.16(1.18) $t(42)=1.59$, $p>.05$) and gender (ASD M/F=

18/4; TD M/F= 16/6; χ^2(N=44)=0.47, p>.05), but not chronological age (ASD M(SD)=8.48(1.52; TD M(SD)=6.26(0.82) t(42)=6.02, p<.05). Children completed the Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001). In the FIST, children are presented three simple pictures (e.g., small blue shoe, small yellow teacup, small yellow shoe) and asked to group two items that go together. Children are given two opportunities to select pairs (pair A and pair B), and pair B is "two things that go together but in a different way" from pair A. In order to focus deliberately on switching we examined the percentage correct of selecting Pair B *after* correct selection of Pair A (hereafter, referred to as shift score).

Results: The ASD group had a lower shift score than the TD group (ASD M(SD)=76.08%(29.33); TD M(SD)=89.48%(9.77) even when controlling for differences in chronological age (Fs>10, ps<0.001).

Conclusions: Pre-adolescent, school-aged children demonstrated impaired performance on the FIST, a deductive measure of cognitive flexibility, relative to verbal-age matched controls. There are few executive control tasks for this age range that do not require inductive reasoning or provide explicit instructions regarding the new rule (e.g., now sort by shape). This form of flexibility may have greater ecological validity because many everyday tasks require a self-selected rule (e.g., putting toys in a toy chest based on toy theme) and then adaptation (e.g., putting toys in a toy chest so that the lid actually closes!), and provides a useful metric for evaluating flexibility in younger children with ASD.

134.060 60 Attention and Executive Function In Children with ASD. Y. V. Jiang*[1], K. Koldewyn[2], S. Weigelt[2], E. Pellicano[3] and N. G. Kanwisher[2], (1)*University of Minnesota*, (2)*MIT*, (3)*Institute of Education*

Background:

Difficulties with attention are often implicated in autism. However, attention has many distinct components, and deficits have not been found in all of them. Some HFA adults have even been reported to perform better than controls in some attentional tasks. The previous work, however, has focused primarily on HFA adults, whose attentional function may have reached plateau.

Objectives:

The goal of the present study is to examine a wide range of attentional functions in young children with ASD and their typically developing (TD) counterparts. We studied children aged 5 to 10 years old, which allows us to test the developmental change of attention and compare these changes between ASD and TD. We used tasks that tap into a variety of basic attentional functions, including selective attention, divided attention, executive control, conflict resolution, and attention to local and global levels. Testing different attentional functions allows us to detect any differences in the development of different aspects of attention in ASD.

Methods:

We tested 5-10 year old children with high-functioning autism (N~10) and a large number of typically developing children (N~50) to provide a "norm" in the following attention tasks. (1) *Executive function* was tested with a computerized version of the Dimension Card Sorting Task, in which children first sort colored shapes according to one dimension (e.g., color), then sort them according to another dimension (e.g., shape), hence requiring them to suppress the previously learned rule, then sort by either color or shape, depending on a contextual cue, requiring them to flexibly implement rules based on a task cue. *(2) Selective & divided attention* functions were tested with the *multiple object tracking* task, in which children were asked to track a certain number of moving objects among other visually identical moving objects, requiring selection of pre-specified targets, filtering out of distractors, and dividing attention among the multiple moving targets. *(3) Attention to local and global levels*, in which children viewed compound Navon stimuli (e.g., a big triangle made of little squares) and were asked them to classify the shape either at a particular level (local or global, in different blocks), a task that requires children to select a property, and to ignore and suppress information from another property of an object. Another task measured children's natural tendency in categorizing compound stimuli.

Results:

ASD children were comparable with TD controls in all attention and executive function, despite lower performance in a visually-guided reaching task and other tasks such as face perception. Yet our tasks were able to detect group differences, as evidenced by significant developmental improvements in all of our tasks.

Conclusions:

Preliminary evidence indicates that attention and executive function improve with age but are unaffected by ASD diagnosis.

134.061 61 Decision-Making of Children with Autism Spectrum Disorder. T. Fujioka* and S. Miyamoto, *University of Tsukuba*

Background: Authors revealed that decision-making of children with autism spectrum disorder (ASD) might be affected by "magnitude" of stimulus using gambling tasks. But it is not clear which mostly give influence to their decision-making, award? or punishment? Balloon Analogue Risk Task （BART; Lejuez et al, 2002） is one of the tests which see manners of decision-making. Although there is only one research that examined BART to children with ASD (South et al., 2010), we examined the decision-making way of children with ASD using this method.

Objectives: The purpose of this study is to examine how children with ASD make decisions after punishment events.

Methods: 13 children with ASD (12.8±1.6 years, FIQ > 80) and 21 control (11.7±1.1 years) were recruited. All Participants completed BART on laptop computer in quiet room. BART is a task that assess risk-taking propensity (Lejuez et al., 2002). During this task, the computer screen showed "simulated balloon", "pump button", "a reset button", "the temporary bank display" and "the permanent bank display". With push pump button, simulated balloon is slightly blown up and 3 Japanese yen ware added in the temporary bank display. When a balloon is reached its explosion point, balloon is explored with pop sound and all money in the temporary bank is lost. As participant click the reset button before a balloon explored, all money in the temporary bank is transmitted to the permanent bank and update total earned money. After a balloon explosion or click the reset button, a new balloon is appeared on monitor until 30 balloons (trials) are completed. Each balloon has a different explosion point from 1 to 128 (from 3 Japanese yen to 384 Japanese yen). We adjusted Average explosion point is 64 (192 Japanese yen) through 30 balloons. Our purpose was to analyze Successive strategy change, we divided 30 balloons to 3 blocks consisted of 10 balloons and adjusted average explosion points through each block are in the 60s. In addition, we excluded one participant who exploded more than 20 balloons from ASD group.

Results: The first balloon explosion trial is not significant (ASD = 4.9±2.3 vs. Con = 3.9±1.5, $p > .10$). ANOVA on z-score of the earned money revealed a significant interaction($p < .05$).Separate post hoc analysis revealed that control group gradually increased from block1 to block3 (block1 -0.17, block2 0.02, block3 0.26, $p < .1$), but ASD group did not (block1 0.12, block 2 0.00, block3 -0.15, $p > .1$).

Conclusions: Children with ASD did not showed a gradually increase in the frequency of clicking pump button. There was no difference the number of trial on first punishment even between ASD group and control group. These suggest that children with ASD made their decision-making norm earlier than control group and that they did not change their decision-making manner once they made their norm was confirmed by themselves.

134.062 62 A Continuous False Belief Task Reveals Egocentric Biases In Adolescents with Autism. S. Begeer*[1], J. van Wijhe[1], D. M. Bernstein[2], A. M. Scheeren[1] and H. M. Koot[1], (1)*VU University*, (2)*Department of Psychology, Kwantlen Polytechnic University Department of Psychology & Institute for Learning and Brain Sciences, University of Washington*

Background:

The false belief task is widely used to determine Theory of Mind in autism. However, the task lacks sensitivity to false belief reasoning after childhood, especially in high functioning (normal IQ) individuals with autism (HFASD).

Objectives:

This study reports on a more sensitive false belief measure that allows for direct comparison between individuals with and without autism.

Methods:

In the classic false belief paradigm, the participant witnesses an object being relocated from one container to the next, in the absence of a protagonist, after which the child is asked to predict in which container the ignorant protagonist will look for the object. The same paradigm is used in the current Sandbox task, but the object is buried in a sandbox. This enables participants to predict where the protagonist will look for the object on a continuum between the original and the new location.

Results:

Most participants (n=124) aged 6-20 years showed an egocentric bias, based on their inclination to reason from their own privileged knowledge of the object's location, rather than taking the protagonist's false belief into account. Compared to typically developing individuals (n=62), those with HFASD (n=62) were found to be impaired on the Sandbox task, but not on a selection of second order Theory of Mind tasks. The egocentric bias in the HFASD group correlated with their verbal

skills. However, group differences on the sandbox task remained after controlling for verbal skills.

Conclusions:

Despite their adequate ability to infer second order mental states, individuals with HFASD still showed an egocentric bias on a continuous measure of first order false belief reasoning. This indicates that sensitive measures can be used to show subtle first order Theory of Mind impairments in HFASD individuals. This may approach may provide more valid measure of autism related problems with Theory of Mind than the assessment of complex conceptual reasoning about mental states.

134.063 63 Number Sense In Autism. E. Pellicano*[1], D. Murphy[2], C. Attucci[1], E. Klaric[1] and D. Burr[2], (1)*Institute of Education*, (2)*University of Florence*

Background: Number skills are often reported anecdotally and in the mass media as a relative strength for individuals with an autism spectrum condition. Yet the few existing studies on arithmetic ability using standardized assessments suggest that these skills are in fact extremely heterogeneous. As informative as these standardized tests are, they are unable to provide a detailed and comprehensive analysis of *why* such achievement is so variable in autism. Here we investigate autistic children's so-called "number sense" - their intuitive understanding of numerical magnitude - to determine whether individual differences in this sense are a potential source of the variability in these children's formal arithmetic skills.

Objectives: The objectives of this study were threefold: (1) to compare numerosity performance in groups of school-age children with and without autism of similar age, gender, and ability using a child-friendly and developmentally-sensitive psychophysical task; (2) to determine whether children with autism, like typical children, are able to translate between symbolic representations and spatial representations of number using the "number line", another potential source of individual differences in arithmetic achievement; and (3) to establish whether individual differences in these skills are related to differences in mathematical achievement within each group.

Methods: In an ongoing study, eight children with autism aged between 8 and 12 years, and 15 typically developing children, of similar age and nonverbal ability, were administered two experimental estimation tasks: one psychophysical non-symbolic estimation task, which asked children to make simple more/less judgments, and one symbolic estimation task, which asked children to estimate the location of numbers on a number line. Mathematical achievement and general cognitive abilities were measured with standardized tests.

Results: Group-based analyses revealed that children with autism performed significantly worse than typical children on the standardized measure of arithmetic skills. More crucially, children with autism also performed poorly on both experimental tasks relative to typical children, showing difficulties estimating numerical magnitude and matching spatial quantities with a numerical value. Furthermore, individual differences in estimation were significantly correlated with children's mathematical scores in both groups of children.

Conclusions: Contrary to widespread opinion that mathematical skills are generally enhanced in autism, these initial findings suggest that children with autism show poorer mathematical achievement relative to typical children of similar age and ability, and importantly, that individual differences in such achievement might be due to fundamental difficulties in autistic children's number sense.

134.064 64 Spatial Working Memory and Patterns of Academic Achievement In 9-Year-Old Children with ASD. P. Cali*[1], A. M. Estes[1], T. St. John[2], J. Munson[1] and G. Dawson[3], (1)*University of Washington*, (2)*University of Washington Autism Center*, (3)*Autism Speaks, UNC Chapel Hill*

Background: Academic achievement in children with ASD is not yet well understood. Recent evidence suggests that children with ASD, 90% in one study (Estes et al., 2010), are highly likely to show a discrepancy between IQ and academic achievement. In that study, children with significant discrepancies demonstrated both higher-than-expected and lower-than-expected achievement. Examination of neurocognitive factors may shed light on the heterogeneous academic achievement outcomes observed in this population. For example, poor SWM skills have been associated with poorer arithmetic skills in typically developing children and adults and with lower early numeracy skills in typically developing children. However, research is needed to understand the relationship between SWM and academic achievement in ASD.

Objectives: This study will examine the relationship between SWM and academic outcomes in a sample of school-aged children with ASD. More specifically, this study will (1) examine the relationship between SWM at age 6 and math, spelling, and reading skills at age 9.

Methods: Thirty participants were recruited from a larger longitudinal study on the neurobiology and developmental

course of ASD at the University of Washington. All thirty children had a clinical diagnosis of ASD based on the Autism Diagnostic Interview-Revised (ADI-R), Autism Diagnostic Observation Schedule (ADOS), and DSM-IV. Participants demonstrated a nonverbal IQ over 70 at age 9 and were able to complete a standardized measure of academic achievement. Data reported for the current study was obtained when participating children were aged 6 and 9 years. Intellectual ability was measured at age 6 and 9 and academic achievement was assessed at age 9 using the Differential Ability Scales. The DAS Achievement Test consists of three academic subtests: Basic Number Skills, Spelling, and Word Reading. SWM was measured at age 6 using the Spatial Reversal (Kaufman et al., 1990) and A not B with invisible displacement (Diamond et al., 1997).

Results: This study will test the hypothesis that better performance on SWM tasks (spatial reversal and A-not-B with invisible displacement) at age 6 will be associated with higher scores on the Basic Number Skills subtest at age 9 but not higher scores on the Word Reading subtest. We will also test an exploratory hypothesis that performance on SWM tasks at age 6 will be related to improved Spelling scores at age 9.

Conclusions: Studying the relationship between neurocognitive functioning and academic outcomes in children with ASD is important because it may help to identify specific skills and intervention strategies to support improved academic achievement in children with ASD. Furthermore, it may assist with identifying children at-risk for later academic difficulties. Finding neurocognitive protective factors, such as strong spatial work memory, could provide clues about the positive outcomes observed in many children with ASD.

134.065 65 Asking the Right Questions: Planning Differences During Verbal Problem-Solving In Children with Autism Spectrum Disorders. B. D. Alderson-Day*, *The University of Edinburgh*

Background: Proficient verbal problem-solving requires a range of executive and linguistic skills; on the Twenty Questions Task (TQT), categories must be used to systematically eliminate a set of possibilities. Children and adults with autism spectrum disorders (ASDs) show difficulty in using category-based questions on TQT despite having good category recognition skills. Specifically, ASD participants ask questions that eliminate fewer items than typically-developing (TD) controls, leading to less efficient overall search.

Effective TQT searches narrow down possibilities hierarchically (living; animal; *etc*). Groups with frontal-executive impairments tend to show difficulty using narrowing and hierarchical planning on TQT while ASD participants show executive impairments on non-verbal planning measures. These findings provide a potential explanation of the ASD TQT profile; inefficient performance as the result of specific difficulties in constructing effective question plans.

Objectives: First, we aimed to examine in detail the planning processes of ASD participants prior to attempting TQT, including assessment of question discrimination, plan construction, “narrowing” (the extent to which general questions precede specific questions) and question content. Second, we assessed how this affected TQT performance, to evaluate whether the encouragement to plan improved problem-solving skills.

Methods: 22 children with an ASD and 21 age- and IQ-matched controls attempted a forced-choice question discrimination task, a 5-question plan construction task, and six TQT trials (Age_M=13:7; $FSIQ_M$=96.42). For question discrimination participants identified the most effective question from two options across 10 trials. In plan construction, participants selected five category questions from a 40-question array and arranged them into a TQT search plan. The TQT consisted of a 24-picture array of everyday objects. The experimenter selected a target and participants asked yes/no questions to establish its identity. Changes in TQT performance were assessed in a repeated measures design comparing “baseline” performance (2 trials) with scores on TQT trials following the different planning tasks (2 trials each).

Results: No group differences were observed in question discrimination. On plan construction, ASD participants selected more specific questions at the start of their plans than controls. However, ASD performance also differed markedly with VIQ. When groups were split into participants above/below the mean VIQ (95.91), problems with narrowing were only seen in the Lower-ASD group (n=12), who demonstrated a flat profile of questions and poor question efficiency. Higher-ASD participants (n=10) constructed narrowing plans, but their questions were consistently inefficient compared to controls. Participants in both ASD subgroups showed moderate improvements on TQT following planning activity. Further results on question content will be discussed.

Conclusions: Inefficiencies on TQT appear to relate to poor plan construction for individuals with ASD. However, the nature of planning problems depends on VIQ: lower-ASD participants failed to use narrowing and selected inefficient questions, indicating a failure to generate categorical search beyond

restricted semantic groupings. Higher-ASD participants utilised narrowing but still selected inefficient questions, suggesting intact hierarchical planning abilities in the context of irregular or weakened semantic relations. This variation of planning difficulties with VIQ is likely to impact on everyday functioning and has implications for the education and training of problem-solving skills in ASD.

134.066 66 Understanding People and Understanding Objects: Characterizing Folk Theories In Young Children with Autism Spectrum Disorder (ASD). N. L. Matthews*, A. Lukowski and W. A. Goldberg, *University of California, Irvine*

Background: The extreme male brain theory of ASD has progressed from the early "folk psychology (FPS) versus folk physics (FPH)" theme to an overarching theoretical model supported by neuropsychological and neurobiological studies (Klin, 2009). However, a gap in the folk theory literature remains; namely, little is known about FPS and FPH in young children with ASD.

Children with ASD demonstrate impairment in FPS; particularly in theory of mind (ToM), or the ability to infer mental states of others (Pellicano, 2010). In contrast to this deficit, older children and adolescents with ASD exhibit advanced abilities in FPH (Baron-Cohen et al., 2000). The current study is the first to our knowledge to examine the relationship between ToM and a measure of FPH, the gravity error task (GE; Hood et al., 2006), in young children with ASD and typically developing (TD) children.

Objectives: To determine 1) whether young children with ASD will perform poorer on ToM tasks, but better on GE tasks compared to TD children, and 2) the relationship between ToM and GE within the ASD and TD groups.

Methods: Participants are 40 ASD and 40 TD children (M = 6.32 years, SD = 2.35). Over two sessions, children were administered a battery of ToM tasks including two analogous versions of the "Smarties" and "Sally-Anne" false-belief tasks (Baron-Cohen et al., 1986; Wimmer & Hartl, 1991) and the appearance-reality task (Sapp et al., 2003). Children were also administered basic and advanced GE tasks. One parent of each child was administered the SCQ (Rutter et al., 2001) in order to confirm ASD diagnosis.

Results: Preliminary analyses are based on 22 ASD and 22 TD children. Mann-Whitney tests indicated that the TD group outperformed the ASD group on the ToM tasks (z = -2.015, p < .05). No significant group differences were found on the basic or advanced GE tasks (z = -.292, *NS*; z = -1.336, *NS*). In the ASD group, higher ToM scores were positively correlated with better performance on the advanced GE task (*Spearman's r* = .599, p = .031). The relationship between ToM and GE was not significant in the TD group.

Conclusions: Preliminary results indicate that young children with ASD exhibited ToM impairment, but did not demonstrate advanced performance or impairment in FPH. These findings are somewhat inconsistent with the few previous studies in this area. In prior research, older children and adolescents with high functioning ASD have demonstrated advanced FPH, and FPS and FPH were negatively correlated in ASD samples. One interpretation could be that the previously reported advanced abilities undergo a protracted development, such that they are not detectable until an older age. Alternatively, these results may indicate that advanced FPH abilities are not universal in ASD. Final analyses will be conducted on the full sample, and will include age and verbal intelligence as covariates. Findings from the current study will serve to better characterize the developmental trajectory of folk theories in ASD and TD children, including whether FPS and FPH are modular or domain general in nature.

134.067 67 Global and Local Contextual Learning In Persons with ASD. P. S. Powell*, M. E. Crisler, B. G. Travers, J. L. Mussey, M. R. Klinger and L. G. Klinger, *University of Alabama*

Background:

Individuals with ASD often have difficulty with learning to use the environment to guide attention. For example, learning to drive requires learning which environmental cues we should attend to (e.g., road signs), which enhances our ability to navigate the road. Contextual cueing tasks have found conflicting results in persons with ASD. Some studies have found intact contextual learning using contextual cues with both local and global elements (Barnes et al., 2008; Brown et al., 2010; Kourkoulou, Findlay, & Leekam, in press). However, a study using only local cues found impaired contextual learning (Klinger, Klinger, Travers, & Mussey, 2007). We hypothesized that these conflicting findings may reflect underlying methodological differences between the types of cues used.

Objectives:

The present study adapted the Klinger et al. contextual cueing paradigm by adding global elements to the contextual cues. We predicted that this change may facilitate persons with ASD learning of the relationship between the context and the target.

Methods:

Twelve high-functioning adolescents and young adults with ASD and 16 individuals with typical development completed a visual search task in which contextual information predicted the location of a target character (data collection is ongoing). This paradigm differed from Klinger et al. (2007) by including an overall global arrangement cue (i.e., overall shape of the array) in addition to local contextual cues(i.e., identity of individual characters in specific locations predicts the target location). Participants located the target as quickly and accurately as possible while hidden amongst an array of 19 other characters. Participants had limited awareness that the arrangement of characters predicted the location of the target. In the first eight blocks of 48 trials the context predicted the location of the target. This was followed by an unpredictable ninth block, and then a final predictable 10th block.

Results:

For this task, learning was defined as the difference in reaction time to the final blocks of predictable trials compared to the block of unpredictable trials. As predicted, when local and global contexts were provided, participants with typical development, (+50ms), $t(15) = 4.74$, $p < .001$, *Cohen's d* = 1.19, and participants with ASD (+88ms), $t(11) = 2.52$, $p = .03$, *Cohen's d* = .73, showed significant contextual learning. There was not a significant group difference, $t(26) = .13$, $p = .90$, *Cohen's d* = .07.

Conclusions:

These results suggest that when both local and global contextual information predicts target location, individuals with ASD learn to use this information similarly to individuals with typical development. However, when only local cues are provided, individuals with ASD may have difficulty with implicit contextual learning (Klinger et al., 2007). This study helps explain the inconsistencies in the results of past contextual learning research and has implications for future research on the attentional mechanisms of contextual cueing in individuals with ASD.

134.068 68 Emotional Intelligence, Theory of Mind, and Executive Functions as Predictors of Social Outcomes In Asperger Disorder. J. M. Montgomery*[1] and A. McCrimmon[2], (1)*University of Manitoba*, (2)*University of Calgary*

Background: Social interaction is frequently cited as a core deficit of individuals with Asperger disorder. This deficit is particularly evident when the processing of emotional information is required in social situations (Grossman et al., 2000). Deficits in theory of mind (ToM) and executive functions (EF) are the two primary hypotheses for social deficits in AS that dominate the literature, however, each of these explanations has limitations. Emotional intelligence (EI) has emerged as a relatively new explanation for social difficulties in typically developing individuals. Recent research (Montgomery, McCrimmon, Schwean, Saklofske, 2010) has demonstrated that EI predicted important social outcomes for a group of individuals with Asperger disorder.

Objectives: The purpose of the present study was to explore EI as an alternative or additive explanation for the social deficits of individuals with AS in light of the predominant theories accounting for social difficulties.

Methods: 25 participants aged 16-21, screened for Asperger disorder, completed measures of two forms of EI (trait and ability), various subtests of executive functions, and a theory of mind test.

Results: Multiple regression procedures revealed that together ToM and trait EI predicted 33 % of the variance for self-reported Social Stress.

Conclusions: The findings suggest that ToM and EI are important predictors of social outcomes in Asperger Disorder and information generated by measures of these constructs may be useful to inform interventions.

134.069 69 SOURCE Memory and SOCIAL Impairments IN Children with High Functioning ASD. E. Gilbert*[1], K. Morasse[2] and N. Rouleau[3], (1)*Centre de Recherche Université Laval Robert-Giffard*, (2)*Hotel-Dieu de Lévis*, (3)*Laval University*

Background: Social difficulties are considered the core deficit of ASD. While there is growing research in many areas related to the social and emotional competences of children with high functioning ASD (HF-ASD), there is relatively few understanding of the cognitive factors contributing to the social functioning impairments. Evidences from empirical studies and theoretical models have put to light the contribution of episodic memory to social functioning in HF-ASD. However, it has been suggested that the episodic memory impairments in HF-ASD may be caused by deficits in source memory. Moreover, we have shown in a previous study that source memory deficits in HF-ASD are not generalized and may be more important when the to-be remembered source involves social aspects. Still, to date, no study has explored if source memory contributes to social functioning in this population.

Objectives: The aim of the current study is to examine relations between source memory and social functioning in children and adolescent with HF-ASD.

Methods: A group of 15 HF-ASD boys aged from 8 to 18 years old participated in this study. Memory was assessed using a theory driven experimental task designed to measure item memory, binding processes and source memory for self-other and temporal context (Doré et al., 2007). Social skills were measured with the Social Skills Improvement System Rating Scale (SSIS; Gresham & Elliott, 2008) which allows the evaluation of various subdomains of social skills (i.e. Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement and Self-Control).

Results: Correlation analyses revealed a significant relation between source memory and social functioning in HF-ASD. Furthermore, social skills appear related specifically to self-other source memory as no relations were found with temporal context. Results also indicated that self-other source memory is significantly associated only with social skills measured by the Cooperation, Responsibility and Empathy subdomains. No relation was found between social skills and binding processes or item memory.

Conclusions: This study brings preliminary evidences of a relationship between source memory and social skills in children with HF-ASD. Findings go further in specifying that the association seems limited to self-other source memory and also that particular subdomains of social skills are more significantly related. A number of explanations for these specific relations in HF-ASD are considered. Amongst others neurological dysfunctions, atypical processing of social information and self-awareness deficits are addressed. The implications of these findings for clinical interventions are also discussed.

134.070 70 Visuospatial Learning and Memory Performance on the Indiana Faces In Places Test In Children and Adolescents with Autism Spectrum Disorder. J. H. Filliter*[1], L. R. Goodman[1], M. L. Tower[2], J. Baker[2] and S. A. Johnson[1], (1)*Dalhousie University*, (2)*Mount Saint Vincent University*

Background: Findings regarding visuospatial learning and memory in autism spectrum disorder (ASD) have been inconsistent to date (Williams et al., 2006). The results of several studies (e.g., Zinke et al., 2010; Williams et al., 2005) suggest impaired performance by individuals with ASD on visuospatial memory tasks. However, some examinations of visuospatial memory in ASD (e.g., Klin et al., 1999) have failed to demonstrate differences between ASD and comparison participants. To further examine the nature of visuospatial learning and memory in individuals with ASD, we administered the Indiana Faces in Places Test (IFIPT; Beglinger et al., 2009). This is a novel, yet reliable and valid, test of visuospatial learning and memory that has been previously been shown to be sensitive to group differences between clinical and comparison samples.

Objectives: Given the potential clinical utility of the IFIPT, the current study investigated visuospatial learning and memory in youths with high-functioning ASD using this measure. We hypothesized that participants with ASD would show poorer ability to match faces with spatial locations during both immediate and delay conditions, relative to comparison participants.

Methods: To date, 12 youths (aged 9 to 16) with ASD and 17 age-, sex-, and IQ-matched comparison participants have completed the study. In the IFIPT, stimuli consist of black-and-white photographs of faces with neutral expressions (10 targets, 30 foils). During each of three acquisition trials, each target stimulus was presented for two seconds in 1 of 10 spatial locations. Then, in two immediate recognition trials and one delayed recognition trial, participants were presented with 10 target and 10 foil stimuli, asked if they recognized each face and, if ”yes”, asked to identify the spatial location in which it was presented. Dependent variables included number of faces accurately recognized, number of faces correctly matched to spatial locations, and number of false positives.

Results: A 2 x 3 (Group x Recognition Trial) mixed repeated measures ANOVA was conducted for each dependent variable. The ANOVA for number of faces correctly matched to spatial locations revealed a significant effect of Group (F (1, 27) = 11.55, p = .002; partial eta^2 = .30), with comparison participants correctly identifying more spatial locations than participants with ASD. Though no significant main effects of group were observed for number of faces accurately recognized or number of false positives, there was a non-significant trend toward poorer performance in the ASD group for number of faces accurately recognized (F (1, 27) = 3.6, p = .069; partial eta^2 = .12). For all dependent variables, there was a significant main effect of Recognition Trial, with performance for both groups improving between the first and second immediate recognition trials and then declining between the second immediate recognition and delayed recognition trials. However, no Group x Recognition Trial interactions were observed.

Conclusions: This study revealed that individuals with ASD experienced more difficulty than comparison participants when asked to recall the spatial location of stimuli. Discussion will focus on the implications of these findings for our understanding of visuospatial learning and memory in ASD.

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134.071 71 Early Word Learning In Neurodevelopmental Disorders: Implications for Eye-Tracking Trajectories In Autism and Fragile X Syndrome. D. P. Benjamin*[1], A. McDuffie[2], S. W. Harris[3], S. T. Kover[2], A. M. Mastergeorge[4], R. J. Hagerman[1] and L. Abbeduto[5], (1)*U.C. Davis MIND Institute*, (2)*University of Wisconsin, Madison Waisman Center*, (3)*M.I.N.D Institute, University of California at Davis Medical Center*, (4)*University of California, Davis/M.I.N.D. Institute*, (5)

Background: Learning words requires that children use adult social cues to make mappings between novel labels and objects (Hollich et al., 2000). Techniques for assessing this process, often termed "fast-mapping," typically employ in-person assessments that require attention to and behavioral compliance with examiner directions (McDuffie, Yoder, & Stone, 2006). In young males with neurodevelopmental disorders, however, characteristics such as gaze avoidance, social anxiety, and poor response planning may interfere with the assessment of word learning in the context of in-person interactions requiring overt behavioral responses (Dalton et al, 2008; Hessl et al, 2006). By eliminating the need for such responses, eye-tracking methodology in combination with a video presentation of a fast-mapping paradigm may provide a more sensitive and in-depth measure of word learning.

Objectives: The purpose of this study is to compare two approaches to assessing novel word learning in young males with autism, FXS, and typical developmental profiles. The approaches include: (1) an interactive fast-mapping paradigm during which an examiner presents novel label-object pairings in a teaching phase followed by a testing phase requiring an overt behavioral response from the participant, and (2) a passive eye-tracking version of the interactive paradigm requiring only visual attention to a computer screen.

Methods: Participants are 45 males, 15 each with typical development, autism, and FXS, with groups matched on nonverbal mental age. The eye-tracking task involves a video-recorded presentation of an examiner sequentially introducing four pairs of novel objects to a participant. For each pair, the target object is presented and labeled 5 times in sentence final position, whereas the foil object is talked about in general terms without labeling. The duration of exposure to each object is equivalent. Following exposure to the novel object pair, the child is asked to *look at* the target object. The outcome measure of the eye-tracking task is the relative duration of gaze to the target object during the comprehension probe.

Results: Preliminary analyses from a subset of the participants suggest that those with typical development, autism, and FXS are significantly different in the percentage of gaze to the target objects during comprehension probes. Specifically, typically developing participants showed the greatest average duration of fixation to target objects, followed by participants with autism. Participants with FXS showed little gaze to the target object during comprehension probes, which may be related to a lack of visual attention to examiner cues during exposure. We will compare these results to those obtained in the interactive-version of the task

Conclusions: A discussion of the fidelity and efficacy of eye-tracking paradigms for assessing socio-cognitive processes will be provided. Implications for developing targeted interventions for children with ASD and Fragile X Syndrome based on eye-tracking trajectories will be discussed.

134.072 72 Emotion Understanding and Empathic Responsiveness In Children with An Autism Spectrum Disorder (ASD). C. Dissanayake*[1], A. Newbigin[2] and F. K. Chandler[3], (1)*Olga Tennison Autism Research Centre*, (2)*Olga Tennison Autism Research Centre, La Trobe University*, (3)*Olga Tennison Autism Research Centre, School of Psychological Science, La Trobe University*

Background: The failure to attend to other people's faces is considered to impact on the ability of children with an ASD to process emotions, which has downstream consequences on emotion understanding and responsiveness. However, although impairments in the realm of emotions have long been considered a key feature of people with an ASD, the findings in the behavioural literature remain mixed.

Objectives: Our aim in the two studies presented here was to investigate emotion understanding and emotion responsiveness (empathy) in children with high-functioning Autistic Disorder (HFA), Aspergers Disorder (AspD) and typically developing (TD) children.

Methods: The sample in Study 1 comprised 21 children with HFA, 19 children with AspD and 20 TD children, aged between

5 – 11 years and matched on overall mental age. The sample in Study 2 included 21 children with HFA and 17 TD children between 8 – 11 years. Children in Study 1 were administered Denham's (1986) affective labelling and perspective taking task to test emotion understanding, as well as an expressed distress task where the experimenter feigned distress upon accidently hurting her knee. Children in Study 2 were administered a real-apparent emotion task adapted from Dennis et al.(2000) and two emotion responsiveness tasks: Hobson et al.'s (2009) task of anticipatory concern where an experimenter tears up another experimenter's drawing in the presence of the child, and an expressed distressed task where the experimenter feigned distress at losing her watch. The degree of concern for the experimenter was scored in each empathy task.

Results: Group comparisons in each study failed to reveal differences, with children with an ASD showing equivalent affective perspective taking abilities to the TD children, even on the more difficult real-apparent emotion measure. They also showed equal levels of concern for the experimenter in each of the empathy tasks in comparison to the TD children. Moreover, their expressed concern was greater in situations of anticipated and expressed distress in comparison to control settings where a blank piece of paper was torn rather than the experimenter's drawing, and when she did not express distress, respectively.

Conclusions: High-functioning children with an ASD are able to understand and respond to emotions, even to anticipated emotions, in structured situations with adult experimenters, and their levels of understanding and responsiveness do not differ from their TD peers. Furthermore, the children with ASD modulated their empathic response appropriately to the setting, in relation to the experimenters anticipated and expressed emotion, as did TD children, indicating that they are differentially affected by other people's emotions, and respond accordingly.

134.073 73 Gaze/Point Following In Children with Autism Spectrum Disorders In Relation to Communicative Skills: An Eye-Tracking Study. T. Falck-Ytter*[1], E. Fernell[2], C. Gillberg[3] and C. von Hofsten[4], (1)*Karolinska Institute*, (2)*Autism Centre for Young Children, Handicap and Habilitation*, (3)*Neurosciences Unit, Institute of Child Health*, (4)*Uppsala University*

Background: The tendency to follow other people's non-verbal communicative signals (e.g. gazing/pointing at objects) is thought to be linked to the severity of socio-communicative symptoms in individuals with Autism Spectrum Disorders (ASD). Using eye-tracking one can accurately evaluate children's tendency to follow non-verbal communicative cues, and thus test this hypothesis directly.

Objectives: The objective of the present study was to test the relationship between gaze/point-following and socio-communicative symptom levels in children with ASD, using eye-tracking. We hypothesised that accurate following of non-verbal communicative cues would be specifically linked to the level of adaptive communication skills.

Methods: Three-to-seven year old children (n = 80) with ASD were tested in a brief eye-tracking experiment (~ 60 sec), watching videos (n = 9) of a model gazing and/or pointing at one out of three toys placed in front of her on a table. The difference between the number of correct gaze shifts (going from the model's face or pointing hand to the attended toy) and the number of incorrect gaze shifts (gaze shifts to any of the unattended toys) was calculated for each participant. Symptom measures included the Vineland Adaptive Behavior Scales - Second Edition (VABS-II) and the Autism Behaviour Checklist (ABC).

Results: We found a significant positive correlation between gaze/point following and the VABS-II communication subscale. This relationship remained significant controlling for the VABS-II socialization subscale, the ABC total score and chronological age, respectively. Moreover, it remained significant controlling for the total number of gaze shifts (to both correct and incorrect targets). Eye-tracking measures accounted for about 30 % of the variance in VABS-II communication scores. Performance was significantly worse in ASD than in an age matched control group.

Conclusions: We conclude that there is a specific link between the tendency to accurately follow non-verbal communicative cues (gazing and pointing) and adaptive communication symptoms. This finding has theoretical and potential clinical implications.

134.074 74 Preference Choices and Gaze to Faces In High-Functioning Autism. A. Gharib*[1], D. Mier[2], R. Adolphs[1] and S. Shimojo[1], (1)*Caltech*, (2)*Central Institute of Mannheim*

Background: Preference and gaze interact in a positive feedback loop to produce a phenomenon known as the 'gaze cascade' effect (Shimojo, Simion, Shimojo, & Scheier, 2003). When observers are shown stimulus pairs and instructed to choose which of the two they find more attractive, their gaze is equally likely to be on either picture. However, in the few seconds before a decision is made, a gaze bias occurs toward

the stimulus that is eventually chosen. This gaze bias is especially robust in tasks that involve face preference decisions. Recent research suggests individuals with autism spectrum disorders (ASD) have deficits in evaluating and making social judgments about faces, including inattention to faces and direct gaze aversion.

Objectives: The present study was set up to examine whether these known aberrations in visual face processing interfere with preference choice decision making in ASD, reflected in a deviant gaze cascade pattern.

Methods: 4 ASD subjects and 4 age and gender matched healthy controls (HC) performed a 2-alternative forced-choice task while their eye-gaze was tracked. The planned subject group size is 10 each of HC and ASD. The task was to select the stimulus they prefer by pressing a button under a free viewing condition. Stimulus types consisted of faces and natural scenes.

Results: First, we were able to replicate the findings of a gaze cascade in the HCs, already with this temporary group size. Interestingly, the known gaze aversion for faces in ASD did not interfere with the gaze bias toward the to-be-chosen picture at decision time, independent of stimulus type. Reaction time analysis showed that there was a main effect of group. ASD subjects responded faster than HCs in the trials where a decision about facial attractiveness had to be made, but not in trials where natural scenes were presented. Further analysis of the gaze patterns showed that autistic subjects had an increased gaze bias toward the selected picture compared to HCs, especially in trials involving decisions about facial attractiveness.

Conclusions: These findings implicate that while gaze is clearly involved in preference formation in ASD subjects, the psychological process that leads to the decision may differ from that of HCs. The course of viewing behavior in ASD clearly deviated from that of the HCs and is not in agreement with the typical gaze cascade. In light of the reduced reaction times in ASDs for facial stimuli and the pattern of their gaze behavior we suggest that the subjects have an abnormal preference decision process when confronted with facial stimuli.

134.075 75 Pupillary Responses During Audio-Visual Speech Perception. J. M. Bebko*, M. Slusarczyk, L. N. Hancock and S. M. Brown, *York University*

Background: Intermodal perception involves the simultaneous integration of information from different sensory modalities into a coherent conceptual unit. Audio-visual intermodal processing has been largely studied using a visual preference method known as preferential looking (Spelke, 1976), used as a means of detecting audio-visual temporal invariants, namely rate and synchrony. Individuals who are able to discriminate between the visual stimuli and show non-random preferential looking patterns are considered to be intermodally processing the incoming audio-visual information. Bebko et al. (2006) examined intermodal processing in children with autism using the preferential looking paradigm and found that children with autism showed a deficit in the processing of complex linguistic information compared to their typically developing peers. Initial eye tracking studies have revealed distinct scanning patterns in adults with autism compared to typically-developing controls (Klin et al, 2002) indicating that there is an attentional component to audio-visual processing. Modern eye tracking technology offers the ability to look at the role of differential attention during scanning of stimuli, providing a more subtle interpretation of what is occurring during preferential looking. Eye tracking recordings can provide additional data about pupil dilation. Pupils have been shown to dilate under stress (Hicks et al, 1967), cognitive difficulty (Beatty, 1981), arousal and pain (Chapman et al, 1999 & Oka et al, 2000). The current study aims to extend our previous findings by more closely examining pupillary responses of children with autism spectrum disorder (ASD) as well as typically developing controls when viewing audio-visual stimuli.

Objectives: To determine if eye-tracking responses (pupil diameter) would differentiate young children with ASD from the mental-age matched controls during the presentation of congruent and incongruent audiovisual stimuli within a modified preferential looking model.

Methods: Children between 6 and 10 years of age diagnosed with ASD were matched to typically developing controls based on mental age. Both groups were shown a series of linguistic and non-linguistic videos displaying four visually identical video recordings, one in each quadrant of the screen. Each quadrant differed only in its synchrony or asynchrony with a single auditory track, the audio track temporally matched to only one of the four videos.

Results: Data analysis is ongoing. Individual pupillary responses will be analyzed and an average pupil size will be computed for fixations among the four screens (within trial) as well as for between trial comparisons. All participants are predicted to demonstrate significant increases in pupil diameter towards the temporally synchronous screens, supporting the previous findings of Bebko et al. (2006). However, it is predicted that the ASD group will show pupillary constriction when viewing a person's face (linguistic stimuli), while the

control group will show an overall pupillary dilation for the same stimuli.

Conclusions: The identification of distinctive pupillary responses as a measure of attentional engagement between children with ASD and control groups may help to extend the understanding of intermodal processing deficits found in previous studies (Klin et al, 2002; Bebko et al, 2006).

134.076 76 Emotional Regulation In Autism: A Relational, Therapeutic Perspective. J. A. Hobson*[1] and P. Hobson[2], (1)*Institute of Child Health*, (2)*University College London and Tavistock Clinic, London*

Background : For typically developing infants, interpersonal contact with caregivers entails mutual regulation of affect and with this, expanding and deepening intersubjectivity (Tronick et al. 1988). Autism involves early-occurring limitations in the capacity to engage in affective contact with others (Kanner, 1943; Hobson, 1993; Mundy, 1986). Such limitations may lead to disturbances in mutual emotion-regulation between the children and their caregivers. Gulsrud, Jahroni and Kasari (2010) illustrated how toddlers with autism showed high levels of distress and negativity. The greater these emotional difficulties, the more stress reported by their parents, and the more difficult parents found it to manage their children's distress.

Objectives : Our aims were to assess how far, for parent-child dyads involving children with autism: (a) individual differences in quality of parent-child interaction corresponds with the children's social-communication impairment as measured by the ADOS (also Beurkens, 2010); (b) quality of parent-child interaction might change over the course of an intervention intended to foster such interaction; and (c) any observed changes in parent-child interaction are accompanied by changes in the children's social-communication.

Methods : Participants were 18 children with autism (16 boys, 2 girls), ranging in age from three to 12 years. With their parents, the children took part in Relationship Development Intervention (RDI). At baseline and again approximately 18-months later, children and their caregivers participated in a semi-structured assessment of parent-child interaction. This assessment was videotaped, and later coded for qualities of relatedness by blind, independent judges using the Dyadic Coding Scales (DCS: Humber & Moss, 2005). The subscales included: Coordination, Communication, Partner Roles, Emotional Expression, Responsiveness/Sensitivity, Tension/Relaxation, Mood, Enjoyment, and an Overall Score (ICC = .86). Videotapes of the ADOS administered at baseline and outcome are currently being coded.

Results : At baseline, the sample of children with autism participating in RDI received scores on the DCS which were significantly lower than the typically developing sample of Humber & Moss (2005) and very similar to the autism sample of Beurkens (2010). Parent-child interaction differences on the DCS were significantly associated with individual variability in severity of social-communication impairment. At outcome, dyads participating in RDI showed significant change on the DCS, $t(17) = 2.82$, $p < .05$, with outcome scores similar to those received by typically developing children. We will report whether changes in parent-child interaction corresponded with changes in the children's social-communication scores on the ADOS.

Conclusions : In autism, difficulties with interpersonal engagement may disrupt the caregiver-child emotion regulation system. Relationship Development Intervention attempts to foster dyadic regulation. The present study reports objectively evaluated improvements in parent-child interaction within families receiving RDI, and now comparison with control groups is indicated. The relation between changes in dyadic interaction and changes in children's social-communication will be reported. Treatment approaches which focus on interaction between children with autism and their caregivers have the potential to affect the children's emotion regulation abilities which, in turn, are likely to influence other areas of emotional, cognitive, and social development.

134.078 78 Assessing Face Processing Impairment In ASD Using the Benton Facial Recognition Test. S. A. Anderson*, K. Loggins, D. L. Robins and T. Z. King, *Georgia State University*

Background: Face processing deficits in populations of individuals with autism spectrum disorders (ASD) are often reported, though findings vary according to type of task, sample characteristics, and study design. When face processing deficits are identified, conclusions regarding theoretical etiology of these deficits (social motivational vs. cognitive processing style) vary, including whether face processing deficits underlie broader social difficulties.

Objectives: The present study investigated face-processing abilities in ASD using the Benton Facial Recognition Test (BFRT), a widely used face-matching test. We hypothesized:

1. Control group would score significantly higher than ASD group on BFRT.

2. Classification of scores based on calculated, age-based z-scores would differ from classification based on Benton et al. (1994).

3. BFRT performance would significantly correlate with socialization.

Methods: Twenty-eight participants with ASD (23 male, 7.3-19.5 years old) and 29 typically-developing controls (24 male, 7.5-21.2 years old) from a larger emotion perception study completed the BFRT, the Wechsler Abbreviated Scale of Intelligence (WASI). Caregivers completed the Vineland Adaptive Behavior Scale-II (VABS-II). ADI-R and ADOS confirmed diagnoses.

Results: Based on BFRT education-corrected raw score classification (Benton et al. 1994), the control group consisted of 15 (52%) in the Normal range, six (21%) in the Borderline range, five (18%) in the Moderately Impaired range and three (10%) in the Severely Impaired range. Within the ASD group, 11 (39%) were in the Normal range, seven (25%) in the Borderline range, three (11%) in the Moderately Impaired range, and seven (25%) in the Severely Impaired range. BFRT raw scores were converted to age-based *z*-scores according to normative data (Benton et al., 1994; Baron, 2004) and re-classified using standard (Wechsler, 1997) cutoffs of Superior (z>1.33), Average (z= -1.33 to 1.26), Borderline (z= -1.4 to -2.0), Moderately Impaired (z= -2.067 to -2.667), and Severely Impaired (z<-2.7). Among controls, one was Superior (3.4%), 25 were Average (86.2%), two were Borderline (6.9%), and one was Moderately Impaired (3.4%). Within the ASD group, 24 were Average (85.7%), two were Borderline (7.1%), one was Mildly Impaired (3.6%), and one was Severely Impaired (3.6%). Age-based z-scores revealed significantly poorer performance by the ASD group ($t(55)$=1.682, p=.049), whereas raw scores did not reveal this difference ($t(55)$=1.595, p=.058). However, neither BFRT raw nor z-scores correlated to VABS-II Socialization (ps>.05).

Conclusions: Evidence of significant differences in face recognition abilities was not detected in this sample when using raw scores, but were detected using z-scores based on age-based norms. Conceptualization of level of impairment can be impacted greatly by the classification system used to assess performance. However, despite reclassification of age-based z-scores using standard Wechsler classification cutoffs, both control and ASD group scores spanned the Average to Impaired ranges, with the vast majority of the participants' scores classified as Average. Furthermore, the expected relationship between face processing and socialization was not found. Given face-recognition deficits in ASD are well-established in the literature, results suggest that the BFRT may either lack sufficient sensitivity to detect differences in ASD or tap into skills other than configural, whole-face recognition abilities, for which it commonly used.

134.079 79 Mother and Stranger Comparison of Selective Attention in the Context of Jealousy and its link with Attachment. N. Bauminger*[1] and D. Shoham[2], (1)*Bar - Ilan University*, (2)*Bar – Ilan University*

Background : Selective attention in a triadic interpersonal interaction (mother, target child, and a peer rival) – as requested in a jealousy situation – holds implications for understanding the emotional deficit in ASD. To experience jealousy, the child must develop a social bond with a significant other (attachment) and must understand thirdness. In autism, forming affective bonds and understanding others' intentions are major deficits; thus, examination of selective attention towards the mother versus a stranger in jealousy situations and its link with attachment may illuminate these children's emotional deficit.

Objectives : Current study aimed to examine: (1) similarities and differences in selective attention markers of jealousy between children with HFASD and Typical development (TYP); (2) similarities and differences in jealousy expression in a personal situation (mother-child-peer rival) versus non-personal situation (stranger-child-peer rival); (3) differences in jealousy expression in a social scenario (mother/stranger reading a book to peer rival) versus non-social scenario (mother/stranger reading a book to self); (4) group differences in security of attachment; (5) links between selective attention markers of jealousy in the personal situation and attachment security.

Methods : Study included 30 children with HFASD and 30 TYP (ages 3-6 years); matched on SES, MA, VMA, NVMA, IQ, age, and sex (each study group included 4 girls). To examine jealousy, we manipulated two triadic social conditions: personal (mother-child-rival) and non-personal (stranger-child-rival). The mother/stranger put the target child's peer on her lap, cuddled the rival, and read a story aloud to the rival. Selective attention expressed through eye gaze, verbal comments, and gestures were coded, as well as the most direct and explicit expression of jealousy. In a control (nonsocial) scenario, the mother/stranger read a book to herself. Attachment was assessed using the observer Attachment Q-Set.

Results : Group differences in jealousy expressions were not found. The personal (mother) triadic situation provoked more explicit expressions of jealousy than the non-personal

(stranger) situation in both groups. In addition, children in both groups (HFASD and TYP) made more verbal comments toward the mother than toward the stranger and displayed more actions to attract the mother's attention, compared to the stranger's. Furthermore, only in the social scenario was selective attention toward the mother higher than toward the stranger. Attachment security was lower for the HFASD than the TYP group, but attachment correlated negatively with selective attention jealousy verbalization markers for both groups, and with selective attention jealousy eye gaze markers only for HFASD.

Conclusions : The fact that selective attention markers of jealousy were higher in the mother than the stranger situation holds significant implications for understanding HFASD children's intersubjective capabilities. Also, the correlation between jealousy and attachment substantiates the mother's role in the development of relationships in HFASD and TYP.

134.080 80 Emerging Language and Social Abilities In ASD: Reciprocal Effects?. T. A. Bennett*[1], 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)*University of Toronto*, (6)*University of Ottawa*, (7)*University of Alberta*, (8)*Simon Fraser University*

Background: Language ability and social competence are inter-related and important predictors of later outcomes in individuals with autism spectrum disorders (ASDs). Poor social attunement in individuals with ASD may limit their opportunities for language learning; this may in turn further constrain social development. To our knowledge, the extent to which language and social competence are reciprocally related in young children with ASDs has not been explicitly tested.

Objectives: We aimed to test whether language ability and social competence influenced each other in a reciprocal manner over time in preschoolers with ASD.

Methods: A cohort of 347 children newly diagnosed with ASD, aged 2-4 years old, provided data at baseline, 6- and 12 months post-enrolment. First, a latent variable measurement model was developed to represent language ability and social competence domains across time points. The Preschool Language Scale -4 (PLS-4), Social Responsiveness Scale (SRS), Early Social Communication Scale (ESCS) and Vineland Adaptive Functioning Scale (VABS) provided potential indicators. Examination of factor loadings and goodness of fit tests determined the suitability of each latent variable. A structural model estimated the stability of the language and social competence constructs across time points, as well as the strength of reciprocal cross-lagged associations between domains.

Results: The sample comprised 292 boys (84.1%) and 55 girls. Mean age at diagnosis was 38.39 months (SD=8.63), and mean age at enrolment was 40.05 months (SD=8.84). Measurement model: Factor loadings for the PLS-4 indicators were very high (ß=0.85-0.9, $P < 0.001$), indicating that a measured score adequately represented language ability. SRS and the ESCS scores did not share sufficient variance to contribute to a common latent variable. Only the VABS social domains demonstrated measurement invariance between verbal and nonverbal children, therefore these scores were used to represent social competence in both groups combined. Structural model: The cross-lagged model demonstrated excellent fit to the data (CFI=0.99, TLI=0.97, RMSEA =0.05). Language ability was highly stable across time points (ß=0.69-0.80, $p < 0.001$) and social competence was moderately stable (0.59-0.61, $p < 0.001$). Small, statistically significant associations (ß=0.17-0.24, $p < 0.001$) were found from language ability to social competence 6 months later, and vice-versa, across all time points and controlling for cross-sectional associations at baseline.

Conclusions: Preschoolers newly diagnosed with ASD constitute a heterogeneous group, and measures of social competence may vary in important ways depending on verbal ability. Language and social competence demonstrated reciprocal effects on each other over 12 months in a cohort of preschoolers with ASD. This may support the "social orientation theory", that poor social attunement constrains language learning in ASD. Conversely, given the substantial heterogeneity in symptoms and functioning in young children with ASD, those with comparatively greater social competence may, as a result, develop superior language ability, which may in turn scaffold further social learning. Early reciprocal influences between social and language learning may contribute to significantly different developmental trajectories over time.

134.081 81 Social functioning, systemising ability and emotion recognition in autism spectrum disorders. E. L. Ashwin*, *Bath University*

Background: Autism spectrum disorders (ASD) are characterised by a triad of impairments afflicting social

interaction, verbal communication and imagination. Accordingly, individuals with ASD are found to have marked difficulties in empathising with others, which includes the ability to recognise emotional states. 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 maths, physics and computers. This enhanced ability to systemise may also provide a compensatory mechanism in the social realm, by way of rule-based learning about emotional states. However, the relationship between severity of functioning in ASD, systematic abilities and how this may influence emotion recognition given different types of stimuli remains unclear. This study examined emotion recognition in human faces in addition to emotion in non-human faces. These non-human faces were stylised 'caricatures' of emotion (e.g. a smiley 'emoticon'). We reasoned that if those with ASD were using systemising as a compensatory mechanism for emotion recognition, they may have preserved or enhanced non-human emotion recognition.

Objectives: To test the relationship between severity of functioning, systemising strengths and performance on an emotion recognition task with human and non-human stimuli in individuals with and without ASD.

Methods: 21 children with ASD and a comparable number of children 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 short-version Social Responsiveness Scale (SRS-short), the Systemising Quotient (SQ), the Empathising Quotient (EQ) and an emotion recognition task with human and non-human stimuli.

Results: Severity of social functioning, as measured by the SRS-short and EQ, showed significant correlations with overall performance on the emotion task for both the ASD and control groups, in the direction expected. However, another finding was a significant positive correlation between SQ and emotion task scores for the ASD group. Additionally, the ASD group performed equally as well as controls on the emotion task. Further analysis showed that these results may be attributable to reduced, although non-significant, performance across all human stimuli and significantly better performance across all non-human stimuli in the ASD group. Performance was unrelated to verbal IQ.

Conclusions: Overall, the findings suggest that both severity of functioning and systemising ability in ASD is related to the ability to recognise emotions. Whilst controls show difficulties in recognition of non-human stimuli, individuals with ASD do not show the same detrimental effect. This may be explained by a reduced salience to human stimuli and/or compensatory mechanisms in processing features by the ASD group, which in turn may be related to systemising ability.

134.082 82 Recognition of Familiar Faces In Infants at Low and High Risk for Autism. A. P. F. Key*[1] and W. L. Stone[2], (1)*Vanderbilt University*, (2)*University of Washington*

Background: Ability to remember and recognize faces is important for successful social functioning (Schultz et al., 2005). Children and adults with ASD are often reported to have difficulty processing faces, including poor recognition of familiar faces (Boucher et al., 1998; Dawson et al., 2002; Klin et al., 1999).

Objectives: The purpose of this study was to investigate whether infant siblings of children with autism process familiar and novel faces differently from typical infants and whether sensitivity to face familiarity is associated with infants' social and communicative behaviors.

Methods: Visual event-related potentials (ERPs) were recorded in 36 infants, age 9 months +/- 15 days (20 infants with no family history of autism and 16 infant siblings of children with autism, sibs-ASD). Infants repeatedly viewed photographs of their mother's smiling face and on 30% of the trials, a smiling face of an unfamiliar female (varied across participants) was presented. In addition, eye tracking data were recorded in a subset of infants (10 sibs-ASD, 14 TD infants) in response to a different stranger face (same for all infants). Mothers of infant participants completed Receptive and Expressive Communication, and Interpersonal Relationships subscales of VABS-II.

Results: The two infant groups did not differ in receptive communication or interpersonal relationships scores, but sibs-ASD had significantly lower expressive communication scores (albeit within the typical range).

ERPs revealed that infants in both groups differentiated between their mothers and strangers as reflected in amplitude modulations of face-specific posterior N290/P400 as well as general novelty-sensitive frontocentral Nc and temporal PSW responses. Group differences were present only in the latency of the P400 response, where shorter latency for the mother's than stranger's face was observed in typical infants but not in sibs-ASD. When entered into a logistic regression predicting risk group membership, latency of the P400 to the stranger's face improved classification accuracy for sibs-ASD (81.3%

correct) compared to the classification model based on expressive communication scores alone (68.8% correct). There was no change in classification accuracy for the TD infants (85% correct).

Eye tracking data indicated no group differences in the number or duration of fixations on the stranger's face or any of its features. However, for sibs-ASD and TD infants combined, increased number of fixations on the mouth area of the stranger's face was associated with smaller amplitudes of the P400, Nc, and PSW responses to the stranger's face.

Similarly, in the combined sample, shorter Nc latency to mother's face was associated with better VABS-II interpersonal relationships V-scores (r=-.382, p=.021).

Conclusions: Nine-month-old infants at low and high risk for autism utilize similar face scanning strategies and comparable brain mechanisms when viewing familiar faces. However, typical infants appear to be faster at detecting familiar faces than are sibs-ASD. Individual differences in the speed of detecting familiar faces are associated with stronger interpersonal skills and may therefore be an informative marker of elevated risk for autism.

134.083 83 Using Emotional Signals to Make Sense of People's Actions – Autism and Typical Development. G. Vivanti*[1], C. McCormick[2], G. S. Young[3], S. Ozonoff[3] and S. J. Rogers[3], (1)*La Trobe University*, (2)*M.I.N.D. Institute*, (3)*UC Davis M.I.N.D. Institute*

Background: From infancy, typically developing children understand and predict people's actions relying on emotional signals. For example, they expect an agent to pick up an object that they are looking at with a happy or satisfied expression, rather than an object that they are looking at with a disgusted expression. Literature indicates that children with autism show abnormalities in both attending to people's faces and interpreting emotional signals. We investigated to what extent children with autism are sensitive to emotional signals and use them to predict an agent's behavior.

Objectives: We tested two alternative hypotheses:

(1) Children with autism will fail to predict an agent's behaviour as a consequence of diminished visual attention to changes in the agent's emotional expressions

(2) Children with autism will fail to predict an agent's behaviour as a consequence of difficulties in interpreting such emotional signals

Methods: 18 children with autism and 18 typically developing subjects matched for IQ and age observed a series of videos showing an actor performing actions on objects. The videos stopped before the action was completed and participants were asked to complete the observed action. In the experimental condition the actor's behavior could be predicted only by considering her emotional expressions. For example, in one trial the actor was choosing what objects to put in a container and while doing so she was looking at certain objects with a happy expression and to other objects with a disgusted expression. In the control condition the actor's emotional expression was neutral and her action could be predicted based on the characteristics of the objects. During the observation of the videos, participants' eye movements were recorded using an eye-tracking system.

Results: Both groups predicted the agent's behavior based on the objects' characteristics in the control conditions. Contrary to our hypotheses, both groups predicted the agent's behavior based on the agent's emotional expressions in the experimental condition. Children with autism looked at the agent's face less frequently than participants in the control group in the neutral condition. However, they looked at the agent's face as much as controls in the experimental condition.

Conclusions: These data suggest that emotional cues trigger attention to the agent's face in children with autism, and are used successfully by them to predict an agent's behaviour. Implications for treatment will be discussed.

134.084 84 Perception of Emotions From Facial Expressions In High-Functioning Adults with Autism. D. P. Kennedy*, B. C. F. Cheng, C. R. Holcomb and R. Adolphs, *Caltech*

Background: Although a considerable amount of research has examined the ability of individuals with autism to perceive emotions from facial expressions, results have so far been largely mixed, and especially in studies of high-functioning individuals.

Objectives: Here, we used a task that is sensitive to subtle aspects of the perception of emotional expression to determine whether high-functioning adults with autism are impaired at judging the intensity of and recognizing emotional facial expressions.

Methods: Fifteen high-functioning male adults with autism and 19 age-, gender- and IQ-matched control participants took part in this experiment. Each participant rated the emotional intensity of 36 faces, each displaying 1 of the 6 basic emotions (i.e., happiness, surprise, fear, anger, disgust, sadness). Each

of these 36 faces was rated 6 times - once for each emotion category (e.g., rating the intensity of happiness in happy, surprised, fearful, angry, disgusted, and sad faces; then rating the intensity of fear on these same faces, etc.), with the order of images and rating categories randomized within and across participants. Intensity was rated on a Likert scale from -4 to +4, with a +4 indicating that the face very strongly displayed the emotion of the rating category, while a -4 indicated that the face very strongly displayed an emotion opposite to the rating category (a rating of 0 indicated that the face was neutral for the rating category). A subset of participants from each group performed the experiment twice (autism n = 11, control n = 8), and we used this data to examine differences in response reliability between groups. Category specificity was calculated by comparing the rating of each face on it's true category compared to ratings given for all other emotion categories.

Results: The autism group demonstrated overall reduced category specificity for emotional faces, and particularly for happy and surprised faces. Follow-up analyses revealed that this reduction could be accounted for by abnormally low intensity ratings for happy faces, and by broader than normal attribution of emotions for surprised faces (reduced selectivity). An analysis of response reliability across groups demonstrated that individuals with autism gave less reliable ratings for emotional extremes (i.e., -4, -3, +3, +4) compared to control participants. There was no group difference for less extreme ratings (i.e., -2, -1, 0, 1, 2).

Conclusions: We found evidence for altered perception of emotions from facial expressions in a group of high-functioning adults with autism. Abnormalities were found either in the intensity or the selectivity of specific emotions (happiness and surprised, respectively). Additionally, an analysis of response reliability revealed reduced stability for ratings of emotional extremes in the autism group. These results are consistent with altered emotion recognition and emotion intensity judgments in high-functioning adults with autism.

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134.085 85 Referential Generalization In Children with Autism Spectrum Disorder. H. Bani Hani*, K. Howarth and A. Nadig, *McGill University*

Background: Previous findings suggested that children with autism spectrum disorders (ASD) rely mainly on perceptual salience to map novel labels to novel objects. Unlike typically-developing children (TD) they did not rely on a speaker's social cues (i.e., pointing, gazing) alone to identify referents, when these conflicted with salience (Preissler & Carey, 2005; Parish-Morris et al., 2007). However, Luyster and Lord (2009) found that when ASD and TD groups were matched on both expressive language and age, these higher-functioning children with ASD were able to use social cues to map novel labels to objects regardless of salience.

Moreover, recently learned labels need to be generalized to other objects of the same kind. Labels can be extended associatively, linking with one particular object, or referentially, linking to the object's symbolic category. Preissler (2008) reported that TD children understand word-picture relations referentially, while children with ASD understand them associatively.

Objectives: Our first aim was to directly test whether higher language ability is related to the use of social cues for word-mapping in children with ASD. Our second aim was to investigate whether children with ASD display referential understanding of novel labels, and whether this is also related to higher language ability.

Methods: Sixteen children with ASD (16-72 months) were individually matched on receptive language using the Mullen with 16 TD children (14-31 months). Our word-mapping task followed Parish-Morris et al. (2007): a pair of novel objects was presented, one more perceptually salient than the other. Speakers provided a novel label in two conditions: coincident, where social cues and salience indicated the same object, and conflict, where social cues indicated the less salient object.

Each word-mapping trial was followed by a photograph task where participants viewed four photographs: color and black-and-white images of both objects just seen. Participants were asked to indicate any of the "novel label" they saw. We defined referential generalization as extending the novel label to *both* photos of the named object. Data was included only if the child passed the word mapping task, and was analyzed for the coincident condition alone.

Results: No significant group differences were found on the word-mapping task in selecting the correct referent in either condition, replicating Luyster and Lord (2009). However, whereas the TD children performed equally well across conditions, the ASD group performed better when social cues matched salience, consistent with Parish-Morris et al. (2007). For both groups word-mapping success was significantly correlated with receptive and expressive language ability.

In addition, a similar number of ASD (6/13) and TD children (4/13) displayed referential generalization (p=.42). However, in the ASD but not the TD group, referential generalization was

displayed only by children with high rather than low receptive and expressive language, based on a median split of scores.

Conclusions: Our findings demonstrate that, contrary to early reports, some children with ASD display similar word learning processes to TD children; they are able to learn words by following social cues and display referential understanding of novel labels. These children have higher language abilities.

134.086 86 Can Adolescents with Autism Rapidly Infer Mental States From Faces?. E. Back*[1], K. Ramdhonee[1] and I. Apperly[2], (1)*Kingston University London*, (2)*University of Birmingham*

Background: Recent research has suggested that individuals with autism spectrum conditions (ASC) can infer mental states accurately from dynamic faces and they especially rely on the eyes (Back et al., 2007). Given sufficient time, participants with ASC can infer mental states but in our everyday social interactions we need to respond quickly as well as accurately.

Objectives: This study investigates whether individuals with ASC can rapidly infer mental states from faces using an online task. It was predicted that participants with ASC will be just as accurate as participants without ASC when inferring mental states but they will be generally slower in processing the correct response. Moreover, if participants with ASC rely on the eyes to infer mental states then this will result in slower response times when information from the eyes is not available.

Methods: 21 adolescents with ASC aged between 12 and 16 were individually matched on chronological age, gender and full-scale IQ to 21 typically developing adolescents. On each trial, a mental state cue word was presented, followed by a video clip of a face depicting a mental state that is either congruent or incongruent with the word. Participants were encouraged to respond as quickly and accurately as possible (at any time during or after the video clip) to judge whether the face was congruent with the mental state term. Eight mental states (deciding, disapproving, don't trust, not interested, not sure, relieved, surprised and worried), were presented six times (three trials when the word correctly corresponded to the face and three trials when the word incorrectly corresponded to the face) in three different display types (the whole dynamic face, eyes frozen and mouth frozen). In the frozen conditions, a particular facial region remained static and neutral whilst the rest of the face was dynamic and expressive.

Results: A trend was found that adolescents with ASC were slower than controls at inferring mental states from faces even though they had similar levels of accuracy. There was an effect of display type where adolescents were significantly slower at inferring mental states when both the eyes and mouth were frozen compared to the whole dynamic face. Interestingly, when investigating the ASC group independently, they were significantly slower to respond to only the eyes frozen condition compared to the whole dynamic face. This indicates that individuals with ASC responded faster to mental states when eye information was present.

Conclusions: Findings suggest that adolescents with ASC need more time to process mental states from facial expressions and this could explain some of their difficulties with social interactions. However, they are able to make speeded interpretations of mental states when eye information is available which supports the premise that individuals with autism can effectively process information from the eyes.

134.087 87 Is Face Recognition Selectively Impaired In Children with ASD?. K. Koldewyn*, S. Weigelt and N. G. Kanwisher, *MIT*

Background: Impairments in face memory are widely thought to be at the core of autism. However, only a few studies have compared face recognition performance in autism with performance on visual recognition of other non-face visual objects (e.g. cars). Thus, it is still an open question if the recognition impairment is specific for faces, or reflects a more general deficit in object memory per se. Further, few if any studies have asked whether any deficit in face recognition in autism arises because of a difficulty in perceptual discrimination of faces, or a difficulty with encoding faces into memory.

Objectives: In the present study, we asked if face recognition is impaired in those with autism compared to control subjects, and more importantly i) whether any such deficit is specific to faces, and ii) whether any such deficit reflects a problem in perceptual discrimination, memory encoding, or both .

Methods: So far we have tested 51 typically developing children (age range: 5 to 10 years), 11 children with ASD (age range: 5 to 10 years) and 32 healthy adults on a newly developed task battery that measures both perceptual discrimination thresholds and memory in each of four different stimulus classes: faces, bodies, cars, and scenes/houses. Crucially, the same stimuli were used for the perception and memory tasks so that any differences in perceptual versus memory performance cannot be due to stimulus differences. In the memory task, subjects studied ten items from each category, then chose which of two items was the previously studied one. For the discrimination task, pairs of similar faces,

cars, bodies (without heads), and houses/scenes were morphed with each other to create a continuum of morph levels. Participants saw a single un-morphed exemplar and then immediately thereafter chose which of two stimuli they had just seen: an exact match of the sample or a stimulus at a particular distance from it along the morph continuum. Using the QUEST staircase procedure, morph levels were gradually adjusted to determine the threshold stimulus distance for which participants could discriminate between the two pictures correctly 75% of the time. Discrimination thresholds were ascertained for each stimulus class separately.

Results: Our preliminary results suggest that children with ASD perform worse than typically developing children in **both** face memory and face discrimination tasks, while performance for the car, body, and scene memory and discrimination tests is similar for children with ASD and typically developing children.

Conclusions: We provide preliminary evidence that both face discimination and face memory are selectively impaired in children with ASD.

134.088 88 Face Processing In Persons with Asperger Syndrome. T. S. Falkmer*[1] and M. S. Falkmer[2], (1)*Curtin University*, (2)*Jonkoping University*

Background:

It is still unclear if face processing is deviant within the whole spectra of autism. A greater understanding of visual search strategies and their impact on face recognition and recognition of facially expressed emotions in controlled experimental conditions is thus needed. An awareness of the visual search strategies is also a prerequisite for the development of interventions. However, prior to any interventions, the transferability of findings from a laboratory setting into the "real world" needs to be investigated.

Objectives:

-to explore face identification abilities, the ability to recognise facially expressed emotions and visual search strategies, with special focus on the importance of the eye area in adults with Asperger syndrome (AS)

-whether or not these laboratory results are transferable to a "real world" situation

Methods:

While wearing a head mounted eye tracker, 24 adults with AS and their 24 matched controls viewed 12 pairs of photos of faces. The first photo in each pair was cut up into six puzzle pieces. Six of the 12 puzzle pieced photos had the eyes bisected. The second photo showed either three faces of which one was the same person as in the first photo, or three faces showing a happy, an angry and a surprised face of the same person as in the initially shown puzzle pieces. Differences in visual search strategies between the groups were established with respect to fixation durations and number of fixations. Following the completion of the photo viewing parts, the participants kept the eye tracker on and were seated at a table in the same room, opposite to the test leader. A dialogue about the test created an interactive dynamic condition, so the visual strategies on a face during such a "real world" event could be measured.

Results:

Persons with AS had more difficulties in identifying faces and recognizing basic emotions than controls. However, the entire face identification superiority in controls was found in the condition when the eyes were distorted, supporting that adults with AS do use the eye region to a great extent in face identification. The visual search strategies in controls were more effective and relied on the use of the 'face information triangle', i.e., the two eyes and the mouth, while adults with AS had more fixations on other parts of the face.

A within-group comparison showed that people with AS, and their matched controls, displayed a high degree of stability in visual search strategies when viewing faces, regardless of the facial stimuli being photos (static) or real "real world", as in the interactive dynamic condition.

Conclusions:

There is a difference between the overall visual search strategies for information seeking in faces between adults with AS and matched controls. In future intervention strategies, the distribution of fixations on facial details may be most important to cue. The stability of our results across conditions warrants laboratory findings to be generalized to "real world" situations.

134.089 89 Vocal Emotion Recognition In Autism Spectrum Disorders: When Psychoacoustics Meet Cognition. O. Golan*[1], E. Globerson[1], M. Lavidor[1], L. Kishon-Rabin[2] and N. Amir[2], (1)*Bar-Ilan University*, (2)*Tel-Aviv University*

Background: Prosody is an important tool of human vocal communication. Prosodic attributes of speech affect our ability to recognize, comprehend, and produce affect as well as semantic and pragmatic meaning based on the intonation,

stress, and rhythm patterns of vocal utterances. Vocal emotion recognition relies on successful processing of prosodic cues in speech that are interpreted according to predefined socio-emotional scripts. Individuals with Autism Spectrum Disorders (ASD) show deficiencies in prosodic abilities, both pragmatic and affective. Such deficiencies have been mostly related to cognitive difficulties in emotion recognition. Recently, we have demonstrated a strong association between vocal emotion recognition and lowed level auditory perceptual abilities in the general population. The current study evaluates this paradigm with individuals with ASD.

Objectives: To evaluate the association between psychoacoustic abilities and prosodic perception in individuals with ASD, in comparison to controls from the general population.

Methods: 21 high functioning male adults with ASD and 32 male adults from the general population, matched on age and verbal abilities, and screened for normal hearing limits, undertook a battery of auditory tasks: psychoacoustic tasks, a pragmatic prosody recognition task (narrow focus recognition) and a vocal emotion recognition task. A facial emotion recognition task represented non-vocal emotion recognition abilities.

Results: Individuals with ASD scored significantly lower than controls on vocal and facial emotion recognition, but not on the pragmatic prosody recognition task or on any of the psychoacoustic tasks. Psychoacoustic abilities were strong predictors of vocal emotion recognition in both the ASD and control groups, whereas facial emotion recognition abilities were a significant predictor of vocal emotion recognition only in the ASD group. In the clinical group, psychoacoustic and facial emotion recognition abilities together explained R^2=57.5% of the variance of vocal emotion recognition scores

Conclusions: Our results support previous findings of cross-modal emotion recognition difficulties in ASD. Furthermore, our findings suggest that lower level psychoacoustic factors and higher-level emotion recognition skills taken together may improve our understanding of vocal emotion recognition in ASD.

134.090 90 An Eye-Scanning Approach to Measuring Receptive Language Abilities In Infants at High and Low Risk for Autism. S. C. Green*, K. W. Chua, D. N. Wexler and M. S. Strauss, *University of Pittsburgh*

Background: Language difficulties are a primary feature of autism. Consequently, there is interest in understanding the developmental origins of these difficulties. In order to study the development of language difficulties in children with autism, several studies have focused on infants who are at either high risk (HR) or low risk (LR) for autism based on whether or not they have an older sibling already diagnosed with autism. These studies suggest that by 12 months of age, children who ultimately develop autism demonstrate language delays. Results with HR infants who do not develop autism are mixed but suggest they may also have language delays (see review, Rogers, 2010). Receptive language ability in infants is typically measured by use of assessments such as the Mullen and parental vocabulary checklists like the McArthur Bates Communicative Developmental Inventory (MB-CDI). These measures rely on parental judgment which may limit their accuracy. With the advent of eye-tracking technologies, it may be possible to objectively assess receptive language abilities. Thus, the current study was designed to use eye-tracking as a novel methodology to objectively measure receptive language and categorization abilities in high and low risk 16- month old infants.

Objectives: To use eye-tracking technology to assess the performance of low and high risk infants in their language and categorization abilities.

Methods: Sixteen month old infants at high and low risk for ASD were shown stimuli that had realistic photographs of 8 different objects. Four of the 8 objects belonged to a single super-ordinate category (e.g., animals) and the other 4 objects belonged to a second category (e.g., food items). The objects chosen were commonly used words found in tests such as the PPVT, the CDI, and the Mullen. While the infants were presented with the 8-object stimulus, they heard one of the objects (the target word) verbally labeled several times in short sentences such as “see the (target)?” Across all stimuli, infants heard twelve target words while their eye movements were recorded by a Tobii x120 eye tracker. Percentage of looking towards the target word (e.g., dog) and the target category (e.g., animals) was calculated as the dependent measures.

Results: LR infants looked at the target category ($t = 3.19$, $p < 0.05$) and target word ($t = 3.20$, $p < 0.05$) significantly above chance. This indicates that they recognized the target word and its category. In contrast, the HR infants did not perform above chance for either the target category or the target word.

Conclusions: At 16 months, low risk infants were able to not only recognize the target word, but they were also able to recognize the target category. This ability was not demonstrated by HR infants. This finding suggests that not only are there receptive language delays in HR infants, but that

these delays may be related to an inability to categorize objects. Results also suggest that eye-tracking technology may provide a more objective way of assessing receptive language compared to parental measures as used in the Mullen or the MB-CDI.

134.091 91 Impaired Face Recognition In Autism Spectrum Disorder: Local Bias or No Bias?. H. C. Leonard*[1], D. Annaz[2], A. Karmiloff-Smith[1] and M. H. Johnson[1], (1)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (2)*Middlesex University*

Background: Previous research has suggested that Autism Spectrum Disorder (ASD) is characterized by a local bias, or a reliance on stimulus features. In face processing, this could impair recognition, as it represents a different strategy from the more global or configural approach seen in most typically-developing controls.

Objectives: The current study investigated subtle details of the use of facial information for identity recognition, using non-verbal mental age to assess changes in biases over developmental time in ASD and typically-developing (TD) controls. The objective of this comparison was to determine whether the two groups relied on similar facial information for identity recognition at any point in development, and if these biases followed similar trajectories with increasing mental age.

Methods: Thirty-two males between the ages of 7 and 15 completed the study. Fifteen were diagnosed with ASD, the remaining seventeen being TD controls. Participants completed a face identity recognition task in which they first learned new faces and then these faces were presented with noise masks covering low, middle and high spatial frequency bands. Lower accuracy when a particular spatial frequency band was masked would imply that this band was used during face recognition.

Results: The use of each spatial frequency was plotted over developmental time for each group. In the TD group, an early bias toward high spatial frequencies decreased significantly with increasing mental age (Adj. R^2 = .48, p =.001). Participants with the highest mental ages showed an adult-like bias toward middle spatial frequencies for upright but not inverted faces. By contrast, individuals with ASD did not show a bias to one spatial frequency band for upright faces at any stage of development. Middle and high spatial frequencies were equally important for those with lower mental ages, while none of the three spatial frequency bands were used preferentially by participants with higher mental ages.

Conclusions: Our novel findings for upright face recognition in ASD challenge earlier claims regarding a local bias, as would have been suggested by a reliance on high spatial frequencies. In addition, individuals in this group followed different developmental pathways from TD controls, who specialized over developmental time toward a band of middle spatial frequencies for identity recognition in upright trials. The failure to specialize toward the optimal band of spatial frequencies for face recognition could be the result of a lack of early interest in faces, and therefore reduced face-specific experience, in ASD compared to TD controls.

134.092 92 Ecological Momentary Assessment: A New Method for Studying Affect In Adolescents with Autism. K. Rump*[1] and M. S. Strauss[2], (1)*Children's Hospital of Philadelphia*, (2)*University of Pittsburgh*

Background: Individuals with autism demonstrate difficulties in understanding and reporting on their own emotions (e.g., Losh & Capps, 2006; Rieffe, et al., 2007). Most prior research has used laboratory measures, thus it is unclear how well individuals with autism are able to report on their emotions in more ecologically valid settings. Ecological momentary assessment (EMA) is a non-invasive method of gathering real-time data that incorporates multiple daily assessments and allows for the detection of incremental variability in subject responses. It is highly effective at capturing the affective experiences of typically developing children and adolescents (e.g., Larson, 1989; Silk, Steinberg, & Sheffield, 2003), but has not been utilized with individuals with autism.

Objectives: To determine if EMA is an effective methodology for use with individuals with autism and, if so, to provide further insight into how adolescents with autism report on their own affective experiences.

Methods: Nineteen high-functioning adolescents with autism (M = 14.7 years) and 19 age- and IQ-matched controls (M = 14.1 years) were given answer-only cell phones and were called 40 times over 14 consecutive days and asked to rate their current levels of positive and negative affect using the PANAS-C. Corresponding parent reports were collected for up to 10 of the 14 days. In addition, prior to the EMA data collection phase, participants and their parents completed the Child Depression Inventory (CDI) as well as the Screen for Child Anxiety Related Emotional Disorders (SCARED).

Results: Adolescents with autism were just as likely to complete the protocol, averaged the same number of completed calls, and were willing to remain on the telephone for the same mean length of time as controls. In addition, their use of the rating scale was not significantly different from controls, they endorsed experiencing some form of emotion just as

frequently as controls did, and their general pattern of reporting for specific emotions was the same. Overall, the adolescents with autism, in contrast to controls, reported higher intensity negative affect and more lability in positive and negative affect. In comparison to parent report, there was some suggestion that the adolescents with autism, but not controls, were underreporting the intensity of their negative affect. For both groups, lability of negative affect was related to self-reported depression symptoms, but not to parent reports of child depression or self- or parent-reported anxiety symptoms.

Conclusions: This is the first study to illustrate that EMA methodology can be effectively implemented with adolescents with autism. The data indicates that, at least by adolescence, individuals with autism can perceive and report on varying levels of affect. Although the accuracy of the intensity of affect they report is still unclear, data suggests they can introspect sufficiently to detect a change in their base level of affect. Additionally, their ability to recognize fluctuations in negative affect on a day to day basis is related to their ability to report on mood symptoms.

134.093 93 Face Recognition In 5-Year-Olds with ASD: An Investigation of Identity, Featural and Configural Changes. N. M. Kurtz*[1], J. Parish-Morris[2], R. T. Schultz[3] and S. Paterson[3], (1), (2)*Temple University*, (3)*Children's Hospital of Philadelphia*

Background: Relative to typically-developing children, children with ASD exhibit impairments in face processing (e.g., Wolf et al., 2008), and attend less frequently to eyes (Klin et al. 2002). It has been suggested that an overall local bias to visual attention (Happe & Frith, 2006) and/or a general deficit in processing visual configural information might account for these face recognition impairments (Behrman et al., 2006).

Objectives: The primary aim of the current project was to understand, relative to controls, whether children with ASD differentially recognize faces when presented with changes in their identity, featural, or configural characteristics. We also plan to examine the effect of preferential attention toward either eye or mouth regions in these groups.

Methods: Ten children with ASD (6 boys, mean age: 5:1) and 12 control children (all boys, mean age: 4:6) were matched on non-verbal cognitive ability (p>.10). Face processing was explored using an infrared Tobii X120 eyetracker in a Visual Paired Comparison paradigm. In the Familiarization phase, children saw a human face for 10 seconds. A blank screen and centering stimulus were followed by a Test trial showing two side-by-side faces: one face was from the Familiarization phase and the other was novel. Children saw two trials in three conditions: (1) Novel face at Test had a different *Identity* than the Familiar face (features and configuration of features differed), (2) the Novel face at Test had the overall identity as the Familiar face, but a key *Feature* was different and (3) the Novel face had the same identity and features as the Familiar face, but the *Configural* relationship between features was altered (e.g., the distance between the nose and mouth was shortened).

Results: A novelty preference ratio was calculated for each child in each condition. Children's scores were included if children looked at least once to each face during test, and for a minimum of two seconds during Familiarization on both trials). Looking more than 50% toward the novel face during Test suggested recognition of the Identity, Featural, or Configural change. One-sample t-tests compared looking during Test to chance rates of looking (.5). Results revealed that children in the control group preferred to look at the novel face in the Test trial when the novel face differed on Identity or Featural information (t(11)=3.06, p<.05 and t(8)=3.42, p<.01, respectively), but not when configural changes were the defining difference, t(11)=.41, p>.10. Children in the ASD group did not look more than expected by chance at the novel face in any condition (all ps=n.s.). However, there was a tendency toward increased looking at the novel Identity in the ASD group.

Conclusions: Although preliminary, these results appear consistent with previous research indicating differential face processing abilities in children with ASD (e.g., Wolf et al., 2008). With a larger sample size, we also will analyze our gaze tracking data to explore how children's attention to different parts of faces (i.e., eyes v. mouth) impacts their recognition ability in the three conditions.

134.094 94 Early Childhood Language In Autism Spectrum Disorders and Fragile X Syndrome. E. M. Quintin*[1], A. A. Lightbody[1], H. C. Hazlett[2], J. Piven[3] and A. Reiss[1], (1)*Stanford University*, (2)*University of NC*, (3)*University of North Carolina, Chapel Hill (UNC-CH)*

Background: Autism spectrum disorders (ASD) share similarities with other neurodevelopmental disorders including fragile X syndrome. ASD is currently diagnosed based on behavioral manifestations whereas fragile X (fraX) is a specific genetic disorder caused by mutations of the *FMR1* gene on the X chromosome, which leads to reduced production of the fragile X mental retardation protein *FMRP* (Vekerk et al., 1991).

At least one third of individuals with fraX also receive a diagnosis of ASD and another third have significant autistic behavior (Hatton et al., 2006; Rogers et al., 2001). Behavior, cognitive development and social cognition in ASD and fraX have often been studied and compared between the two disorders. However, language profiles in ASD and fraX have not been compared extensively. Such a comparison is warranted given that receptive language is thought to be more impaired in adolescents and young adults with fraX and a co-occurring ASD diagnosis than those with fraX but without ASD (Lewis et al., 2006).

Objectives: We compared language development in ASD and fraX during early childhood and assessed whether cognitive, social, and/or behavioral aspects of the ASD and fraX profiles contribute to atypical language development in these populations.

Methods: *Participants.* Fifteen boys with ASD, 37 with fraX, 11 with developmental delay (DD), and 14 typical development (TD) aged between 1 to 5 years old were assessed at two time points, with a period of approximately 24 months between time 1 and time 2 assessments for each participant. *Materials.* The Preschool Language Scale (PLS-4 at time 1 and 2) was administered to assess receptive and expressive language and the aberrant behavior checklist (ABC at time 2 only) was completed by parents to assess their son's social and behavioral profile. IQ (cognitive profile) was obtained with the Mullen Scales of Early Learning. Participants in the ASD and fraX group completed the standardized measures of autism symptomatology (Autism Diagnostic Observation Schedule and Interview: ADOS-G and ADI-R).

Results: From time 1 to time 2, PLS-4 standard scores for receptive language increased for the ASD group (p = .03) while expressive language remained stable. Receptive and expressive language scaled scores remained stable for both fragile X and TD groups and increased for the DD group ($p_{comprehension}$<.01, $p_{expression}$ = .02). For all groups combined, PLS-4 standard scores at time 1 and 2 were significantly negatively correlated to stereotypy and hyperactivity subscales of the ABC at time 2 (p<.01) and were significantly positively correlated with fine motor and visual reception subscales of the Mullen at time 2 (p<.01). For the ASD and fraX groups, ADOS scores for social interaction at time 1 were significantly negatively correlated with PLS-4 expressive language at time 1 but not at time 2 (p<.01).

Conclusions: Language development in early childhood is associated with cognitive function, social interaction, and behavior in ASD and fraX. Children with autism present a discrepancy between receptive and expressive language while language profiles are more homogenous in children with fragile X. Findings support continued research into early language assessment and intervention for children with ASD and fragile X.

134.095 95 Emotional Face Processing In Autism Spectrum Disorders: Evidence From China. C. Wang*, *Nankai University*

Background:

Autism spectrum disorders (ASDs) are neurodevelopmental disorders which are thought primarily to affect social interactions, while both behavioural and neuroimaging evidence indicate that individuals with ASD demonstrate marked abnormalities in the processing of faces and facial expressions. However, the literature on face processing in ASD presents quite a confusing picture. There is evidence that individuals with ASD tend to process the eye region of faces less effectively than typical individuals (e.g. Spezio et al., 2007), and that this difficulty may arise from a tendency not to look at the eye region of faces unless specifically instructed to (Dalton et al., 2005; Pehplrey et al., 2002). This tendency could, in turn, arise from the well known aversion to direct gaze in ASD.

Objectives:

This study explores how individuals with ASD preferentially attend to video extracts containing human actors with different emotions and averted gaze. The proportion of gaze time spent fixating on different parts on faces, bodies and the background was investigated. This study was also designed to find out if individuals with ASD fail to orient toward the eyes or they actively avoid direct eye contact.

Methods:

The reflexive eye-movements of 36 children and adults with ASD and 40 typically developing children and adults were recorded as they watched videos of fearful, sad, happy, and neutral faces and averted gaze. The proportion of time spent viewing eyes, mouths and other scene details was calculated, as was latency of the first fixation to eyes.

Results:

While people with ASD preferentially attended to faces for less time than was typical, individuals with ASD atypical gaze behaviours extended across faces. People with ASD had more

difficulties engaging visual attention and emotions from faces than typically developing people. Participants initially fixated either on the eyes or on the mouth. The ASD group showed a reduced preference for the eyes relative to the control group, primarily characterized by more frequent eye movements away from the eyes. When looking at people's faces, children with ASD spent less time on the nose and mouth than typically developing group, but the fixation duration on eyes did not differ between the two groups. There are also differences on positive and negative facial emotions between two groups.

Conclusions:

The eye-tracking data revealed influence of active avoidance of direct eye contact on atypical gaze in ASDs. Young children with ASD show less visual attention to facial expression and have impairments in perceiving facial emotions especially in comprehending negative emotions which may relate to early abnormal development of amygdale in ASD. The results also confirmed the former findings that perception of face is dependent on eye dominance in contrast to earlier literature of the lack of interest in eye region by people with ASD. These findings therefore give important insights into the social pathology of ASD and implications for future research and interventions.

134.096 96 Electrophysiological Response to Words In Infants at Risk for ASD. A. Seery*[1], W. Talcott[2], V. Vogel-Farley[3], H. Tager-Flusberg[1] and C. A. Nelson[4], (1)*Boston University*, (2)*Harvard University*, (3)*Children's Hospital Boston*, (4)*Harvard Medical School/Children's Hospital Boston*

Background: In typical development, the developing brain responds to linguistic stimuli in an increasingly focused and lateralized manner as infants gain experience with using language (Mills et al., 2005). However, converging research suggests that individuals with ASD commonly show atypical lateralization of language networks in the brain such as reduced or even reversed asymmetry of frontal language areas. The high prevalence of language delay or impairment in ASD can make it difficult to determine the aspects of this atypical response that are symptomatic of ASD specifically and which more closely related to language ability. Here, we compare infants at risk for ASD (HRA) against low-risk controls (LRC) who are in the process of acquiring language in order to tease apart the effects of language and ASD symptomology on brain response.

Objectives: To investigate whether infants at risk for ASD show atypical neural response to words and, if so, to examine whether this response is related more closely to language ability or to more general traits indicative of an ASD endophenotype.

Methods: As part of a larger longitudinal study, we recorded event related potential (ERP) in response to words at 18 months in HRA infants (n=18) and low-risk control infants (LRC; n=8). Infants listened to a stream of words that are either understood or not understood by the majority of 18-month-olds. To characterize language and ASD status, behavioral and parent report measures of language ability and ASD symptomology are collected at 12 and 18 months.

Results: Preliminary results revealed the negative response between 600 and 1000ms over frontal and temporal/central electrode sites (N600) that was faster to known words that to unknown words over the left hemisphere (condition by hemisphere interaction: $F(1,24)=4.91$, $p=.036$). This was qualified by a trend suggesting a three-way interaction ($p=.09$) such that the differential N600 response to known versus unknown words may have been restricted to the left hemisphere of the low-risk group. Additional analyses are in progress and are focused on examining whether this pattern of lateralization is more closely related to language ability or to ASD symptomology/group status.

Conclusions: Our preliminary results suggest a possibility of different patterns of N600 response to comprehended words in HRA and LRC infants. Additional investigation of language ability will help us to more closely determine whether the difference in response is more closely related to risk status for ASD or to experience with language. Future work will ultimately look longitudinally to examine the predictive value of language ability in earlier infancy on the pattern of ERP response to words at 18 months.

134.097 97 5-HTTLPR In Relation to Behavioral and Emotional Self-Regulation In Children with High Functioning Autism. K. E. Ono*[1], H. A. Henderson[1], L. Mohapatra[2], N. Kojkowski[1] and P. C. Mundy[3], (1)*University of Miami*, (2)*University of Minnesota Medical Center*, (3)*UC Davis*

Background: Non-syndrome specific processes (e.g., genetics, temperament, family relationships) are hypothesized to alter the expression of autism and therefore contribute to the heterogeneous behavioral and emotional presentation of this disorder. Serotonergic neurons densely innervate the amygdala and AC regions (areas associated with emotional and behavioral self-regulation), thus implicating neurotransmitter genes (5-HTTLPR) as potential modifiers of behavioral and emotional functioning in children with autism.

Objectives: To examine genetic variability (5-HTTLPR) in relation to behavioral and electrophysiological indices of self-regulation and parent-reported behavior problems in a sample of children and adolescents with HFA and a matched comparison group.

Methods: Participants were 50 HFA and 40 age- and verbal IQ-matched comparison children, between the ages of 8 and 16. Participants completed a modified Eriksen Flanker task and saliva samples were collected for genetic analysis. Two fragments from the 5-HTTLPR polymorphism were extracted: short (S) and long (L). Participants were classified as having the S variant if they carried at least one short allele, and as having the L variant if both alleles were long. EEG was collected continuously during the Flanker task from 15 scalp sites using a Lycra stretch electrocap. 18 HFA and 19 comparison children had analyzable EEG data. Response-locked ERPs were created for error and correct trials separately and the amplitude of the error-related negativity (ERN) was scored at midline sites as the most negative peak occurring in the time window -20 to 150ms on error trials. Dependent measures of interest from the Flanker task were: ERN amplitude and self-correction rates. Parents completed the Behavioral Assessment System for Children (BASC-2).

Results **:** A chi-square analysis revealed that 5-HTTLPR group did not differ between the diagnostic groups, $\chi^2(1, N = 90)=.17$, $p=.812$. A series of 2 (diagnostic group) x 2 (5-HTTLPR S vs. L) ANOVAs were conducted to examine associations with (a) ERN amplitude, (b) rates of self-correcting, and (c) parent reported behavior problems. Across both diagnostic groups, 5-HTTLPR allele frequency differences predicted ERN amplitude at FCz, $F(1, 37)=4.00$, $p=.049$, and Cz, $F(1, 37)=4.43$, $p=.043$, such that the L variant was associated with a smaller ERN amplitude. Additionally, the percent of self-corrected trials was predicted by (a) diagnostic group, (b) 5-HTTLPR group, and (c) the interaction of diagnostic and 5-HTTLPR group. HFA adolescents carrying the S variant self corrected significantly more than carriers of the L variant, $t(27)=2.29$, $p=.030$, while allelic frequency did not affect self correction rate for the comparison sample, $t(19)=.05$, $p=.958$. Finally, across both diagnostic groups, parent-reported Externalizing Problems were associated with 5-HTTLPR group, $F(1, 78)=3.84$, $p=.052$. The L variant was reported as exhibiting significantly more externalizing problems.

Conclusions: Results highlight the importance of genetic markers, such as 5-HTTLPR, in relation to behavior and physiological measures of self-regulation in both HFA and typically developing children. Together these results suggest that across all children, variation in the serotonin transporter gene may be related to emotional and behavioral differences in part through the effects of serotonin on the structure and function of neural systems related to self-regulation.

134.098 98 Differential Scanning of Core Facial Features In 12- and 18-Month-Old High Risk Infants. J. B. Wagner*[1], R. Luyster[2], H. Tager-Flusberg[3] and C. A. Nelson[4], (1)*Children's Hospital Boston/Harvard Medical School*, (2)*Laboratories of Cognitive Neuroscience*, (3)*Boston University*, (4)*Harvard Medical School/Children's Hospital Boston*

Background: A hallmark feature of autism spectrum disorder (ASD) is impairment in social processing. To investigate these difficulties empirically, numerous studies have examined behavioral measures of face processing in ASD individuals and found differences in scanning patterns that include decreased time scanning the core features of the face, particularly the eyes and mouth. Recently this finding was extended to ASD children as young as 2-years-old. Prospective work with infant siblings of children with ASD has begun testing whether differences in face processing might be seen early on in development, asking both whether this could be an early risk marker for infants who later develop ASD, and whether differences found in high-risk infants could be part of the broader autism phenotype.

Objectives: With prior work in ASD children and adults pointing to decreased scanning of core facial features, the present study aimed to ask whether these differences in face processing will be found earlier in development and how they might change over time in a group of infants at risk for ASD.

Methods: A Tobii eye-tracker was used to monitor eye gaze while infants were presented with side-by-side images of their mother's face and a stranger's face displaying a neutral expression for 10s. Twenty-eight infants were tested at both 12- and 18-months-of-age: 19 infants at high-risk for ASD (HRA; by virtue of having at least one older sibling with ASD) and 9 low-risk infants (LRC). Eye-tracking data captured duration of looking to regions of interest, including the full images of mother and stranger and the eye and mouth regions within each image. Analyses examined a) duration of looking to core features of the face (sum of eyes and mouth) and b) percentage of time on core features as a function of total time on the image (sum of eyes and mouth divided by total time on image).

Results: A 2 (identity; mom, stranger) x 2 (age; 12-months, 18-months) x 2 (group: HRA, LRC) mixed model ANOVA

examined duration of time on core features and found a main effect of identity, $F(1, 26) = 4.78$, $p = .04$, with infants showing more time on the eyes and mouth in their mother than the stranger. LRC also spent more time on the core features overall (M = 1950ms) as compared to HRA (M = 1497ms), but this was only a trend ($p = .16$). A second analysis examined the percentage of time on core features and found a main effect of group, $F(1, 26) = 5.84$, $p = .02$: HRA infants spent significantly less time scanning the eyes and mouth when looking at these images (M = 52%) as compared to LRC infants (M = 67%). No other main effects or interactions were significant.

Conclusions: The present work finds that differences in face scanning that are found in ASD children and adults are also seen in at-risk infants during the second year of life. Future work with HRA infants will examine individual trajectories of face processing in relation to ASD outcome.

134.099 99 Face Benefit In Auditory-Only Speech and Speaker Recognition In Asperger Syndrome and High-Functioning Autism. S. Schelinski*, P. Riedel and K. von Kriegstein, *Max Planck Institute for Human Cognitive and Brain Sciences*

Background: Successful human social interaction is based on the fast and accurate online perception of communication signals. It is traditionally assumed that in auditory-only conditions, e.g. when talking on the phone, this online perception relies solely on the auditory sensory system (auditory-only model) (e.g. Hickok & Poeppel, 2007). In contrast, recent research suggests that the brain exploits previously encoded audio-visual correlations to improve behavioural performance in auditory-only perceptual tasks (auditory-visual model) (von Kriegstein et al., 2008). For example, observing a specific person talking for only about 2 min improves auditory-only speaker and speech recognition for this person. This effect is called the face benefit. The improvement is based on face-specific visual areas, which are instrumental for auditory recognition even if no visual input is available. These findings challenge auditory-only models, because they imply that ecologically valid auditory-only input is processed using audiovisual processing strategies. Here we test the predictions of the auditory-visual model in a group of individuals with Asperger syndrome or high-functioning autism (AS/HFA). These conditions are associated with impaired face processing. The auditory-visual model would therefore predict that in AS/HFA speaker-specific facial information is not available to improve auditory-only recognition.

Objectives: The aim of the present study is to investigate whether individuals with AS/HFA use speaker specific audiovisual information to improve auditory-only speech and speaker recognition.

Methods: We trained individuals with AS/HFA (n=14) and typically developed controls (n=14, age, gender, and IQ matched) to identify 6 speakers by name and voice. Three of the speakers were learned by a video showing their talking face (voice-face learning). The other 3 speakers were learned with an occupation symbol (voice-occupation learning). During auditory-only testing, sentences spoken by the same 6 speakers were presented. Participants decided whether a visually presented name matched the voice (speaker task) or if a visually presented word appeared within the sentence (speech task). Additionally, a lip reading and a face recognition experiment were performed.

Results: The AS/HFA group did not benefit from voice-face learning in contrast to voice-occupation learning, while the control group did (learning x group interaction, $F(1,26) = 10.41$, $p = .003$; face benefit speaker/controls, $t(13) = 2.96$, $p = .011$; face benefit speech/controls, $t(13) = 2.47$, $p = .028$). Individuals with AS/HFA performed worse after voice-face learning compared to voice-occupation learning in the speech task ($t(13) = -2.88$, $p = .013$). This was paralleled by worse lip reading performance in AS/HFA in comparison to the controls ($t(26) = 2.38$, $p = .025$). Face identity recognition was within the normal range.

Conclusions: The findings indicate that in AS/HFA speaker specific dynamic visual information is not available to optimize auditory-only speech recognition as predicted by the auditory-visual model. As facial speech processing is a key requirement for robust human speech processing, less successful communication in AS/HFA might be linked to deficiencies in the facial speech network.

Reference List: Hickok & Poeppel, 2007, *NatRevNeurosci*, *8;* von Kriegstein et al., 2008, *PNAS*, *105*

134.100 100 Differential Sensitivity to Synthetic Face Stimuli Across Viewpoint In Autism. K. Morin*[1], C. Habak[2], H. R. Wilson[3], A. Perreault[1], L. Pagani[4], L. Mottron[5] and A. Bertone[1], (1)*Perceptual Neuroscience Laboratory for Autism and Development, CETEDUM*, (2)*Institute of Geriatrics, University of Montréal*, (3)*Biological & Computational Vision*, (4)*School of Psycho-Education, University of Montreal*, (5)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: Face perception is the most commonly used visual metric of social abilities in autism. However, when found to be atypical, the nature of its origin is often contentious. One hypothesis proposes dysfunction of face-sensitive brain areas as a potential origin, reflecting a more general altered functioning of the social brain network (e.g., Schultz, 2005). Alternatively, a less "social" proposal suggests that autistics' characteristic locally-oriented visual analysis ultimately affects (i) performance on most face tasks where global or configural analysis is optimal, and plausibly, (ii) the typical, experience-dependent development of integrative neural architecture involved in the perception of complex visual objects, including faces (e.g., Vlamings et al, 2010).

Objectives: To evaluate these two hypotheses by assessing face identity discrimination between synthetic faces presented with and without viewpoint changes, with the former condition necessitating a more global, integrative analysis to be efficiently completed.

Methods: Ten autistic and nonautistic adults matched for global IQ and age were asked to perform a face identity discrimination task similar to that of Habak et al (2008). Stimuli were synthetic faces (Wilson et al, 2002), consisting of simplified (hair and skin texture removed) and ecologically-validated stimuli extracted from traditional face photographs in both frontal (front) and 20° side (side) viewpoints. Face photographs were digitized from 37 points (including head shape, features, etc), which were then defined relative to mean head radius, to provide a continuous measure of facial geometry. Face identity discrimination thresholds (defined by the minimum % change in face geometry at 75% correct performance) were obtained using a two-alternative, temporal forced choice match-to-sample paradigm consisting of a target face (1000ms), followed by a 200 ms mask, then by 2 choice faces presented side-by-side. Participants were asked to identify which choice face matched the target for three viewpoint conditions and one inverted face condition. Thresholds were measured when the target face and choice faces were all facing forward (a) front-front view, all facing 20° to the side (b) side-side view, when the target was facing forward and the choice faces to the side (c) front-side view: the viewpoint change condition, and when all faced forward but were upside-down (d) inverted.

Results: Face identity discrimination thresholds were highest (worst) for the front-side view condition for both groups, suggesting that identity discrimination was most difficult across views. Between-group differences in performance were not evidenced for either (a) front-front view, (b) side-side view conditions, or (d) inverted front-front view. However, mean identity discrimination thresholds for the autism group was higher for the front-side view (the viewpoint change condition) compared to that of nonautistics.

Conclusions: The selective decrease in autistic performance for the viewpoint change condition suggests that face identity discrimination in autism is more difficult when (i) access to local cues are minimized, and/or (ii) an increased dependence on integrative analysis is introduced to the face task used. This finding suggests that atypical face perception in autism may originate from "non-social" perceptual origins related to integrative information processes.

134.101 101 SEARCH Strategies and Audiovisual Speech PERCEPTION IN Children with AUTISM. L. N. Hancock* and J. M. Bebko, *York University*

Background: Individuals with autism often exhibit ineffective sensory processing, and integration of information across auditory and visual modes appears impaired (Iarocci & McDonald, 2006). Some of the deficits in sensory processing are consistent with impairments in the ability to efficiently organize sensory information through multiple sensory modalities, a process more formally known as intermodal processing. Deficits in intermodal processing may be related to some of the language impairments that characterize autism (Bebko et al. 2006), however; the process underlying this deficit is not well understood.

Objectives: The objectives of the current study are twofold. First, to identify search strategies that may suggest efficient and inefficient looking patterns in this type of task. Second, to examine how differences in these sequential search patterns may contribute to the understanding of differences in intermodal speech processing in children with TD and ASD.

Methods: Fourteen children (ages 4-11) with an autism spectrum disorder (ASD) were matched with fourteen children with typical development (TD) based on chronological age, verbal and non-verbal abilities. The present study used eye-tracking with a 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. Data were analyzed on a per trial basis to assess the sequencing of looking patterns displayed by each participant. The time spent looking in each of the four quadrants was analyzed with the use of the Tobii eye-tracking software program. Within each of the four quadrants, Areas of Interest (AOIs) were identified to distinguish between 'relevant'

and 'irrelevant' areas within and between the quadrants. For example, 'relevant' areas of the face were defined by the mouth and the eyes of the stimuli. Looking patterns in both groups were analyzed to determine efficient and inefficient looking patterns. Efficient looking patterns were characterized in one of two ways: 1) gaze shift from a 'relevant' AOI to another 'relevant' AOI, or 2) gaze shift from an 'irrelevant' area to a 'relevant' area. Inefficient looking patterns were characterized by: 1) gaze shift from a 'relevant' AOI to an 'irrelevant' AOI, or 2) gaze shift between two 'irrelevant' AOIs.

Results: Initial results for the linguistic stimuli showed more efficient transitions in the group of children with TD compared with the group with ASD. Specifically, the group with TD looked more from mouth to mouth, which is the most efficient search strategy. There were no group differences found for the non-linguistic stimuli.

Conclusions: Group differences in sequential search strategies may help to clarify the underlying processes contributing to the observable differences in intermodal processing of linguistic information in children with Autism.

134.102 102 Facial Expression Perception In Relatives of ASD Children: Is There a Reliable Endophenotype?. C. Fiorentini*[1], C. M. Startin[2] and D. H. Skuse[3], (1), (2)*UCL*, (3)*Institute of Child Health*

Background:

The ability to recognize facial expressions (FE) of emotions is crucial for mediating human social interactions, a domain in which individuals with autism spectrum disorders (ASD) have great difficulties. Recent research showed that abnormalities in FE processing are present also in first-degree relatives of individuals with ASD, and might be part of a set of features associated with the disorder. (e.g. Adolphs et al., 2008; Bolte & Poutska, 2003).

Objectives:

Our study investigated the presence of subtle abnormalities in the perception of FE of four emotions (Anger, Fear, Happiness, and Disgust) in a sample of families with a child with ASD (*ASD relatives*), as compared to families with typically developing children (*controls*).

Methods:

Participants: The *ASD families* group included 40 relatives (10 fathers, 17 mothers, 13 typically developing siblings) of ASD probands between 5 and 23 years old. All probands met DSM-IV criteria for ASD. Participants were recruited through special schools in London. Controls included 33 subjects (8 fathers, 12 mothers, 13 children). Groups were globally matched for age and IQ.

Material: Four photographs portraying the FE of Anger, Fear, Happiness, and Disgust, posed by an actor were used as prototypes. The actual stimuli shown in the experiment were two sequences of morphed pictures. Within each sequence, morphed FE described a linear transition between two endpoints (Anger-Fear, [A-F] and Happiness-Disgust, [H-D], respectively.

Task and procedure: For each FE pair, participants performed a forced-choice identification task. In each trial, one stimulus was displayed for 3 s, and participants had to decide which prototype the stimulus is more similar to (e.g. "Anger" or "Fear"). We recorded the response and the RT (in ms) measured from stimulus onset. Each stimulus was presented several times, in random order.

Results:

For each FE pair and each group, we computed the psychometric function relating the probability of giving a certain answer (e.g. P("Fear")) to the rank order of the morphed stimulus. The parameters (i.e. point of subjective equality [PSE] and just noticeable difference [JND]) of the psychometric function afford an assessment of the recognition ability of the observer. There was no systematic difference between groups in these parameters. The absence of differences between JNDs for the two groups suggests that ASD relatives can recognize FE as accurately as control parents and children. However, we found that ASD parents and siblings respond to FE significantly faster (p <.05) than control parents and children. The difference is bigger for the pair A-F (mean RT: ASD = 641 ms; controls: 966 ms) than for H-D (mean RT: ASD = 558 ms; controls: 691 ms).

Conclusions:

Our findings suggest that, although ASD relatives might not exhibit obvious deficits in the recognition of emotional FE, they nonetheless differ from controls in some aspects of FE processing, as evident when RTs are taken into account. The further observation that the effect is more compelling when Anger or Fear are involved might be interpreted as reflecting an automatic avoidance of negative facial affect signalled predominantly by the eyes.

134.103 103 Visual Scanning Strategies and Facial Identity Recognition In Autism Spectrum Disorder. E. Wilson*[1], J. Brock[2] and R. Palermo[3], (1), (2)*Macquarie University*, (3)*Australian National University*

Background:

Difficulties in facial identity recognition are commonly reported in autism spectrum disorder (ASD), although factors contributing to this are unclear. One possibility is that atypical visual scanning strategies could underlie this impairment. Previous studies have reported that children with ASD differ from typically developing children with respect to: a) how they visually scan people and non-people in the environment; and b) how they scan face stimuli. The hypothetical link between scanning strategies and face recognition skills has yet to be directly tested.

Objectives:

This research has three aims. First, to measure face and object recognition ability in ASD and typically developing children. Second, to investigate differences between the way ASD and typically developing children view visual scenes and face stimuli. Third, to directly test associations between face and object recognition abilities, and measures on the visual scanning tasks.

Methods:

12 ASD children and 12 age-matched typically developing controls completed 2 alternative forced choice matching tasks for faces and objects. Scores were standardized according to age. Next, we recorded eye-movements whilst the children viewed visual scenes containing People and Objects. Finally, eye-movements were recorded during a 2-alternative forced choice recognition memory test for faces. Associations between performance on behavioural tests, and visual scanning measures were analyzed.

Results:

Wide heterogeneity was evident within the ASD group on all behavioural tasks, with some children performing as well as typically developing children, and others exhibiting severe impairments. As a group, ASD children were worse than typically developing children on the face-matching, but not the object-matching test. Age-standardized scores on the face-matching test were associated with the percentage of times ASD children fixated on the People before the Objects in visual scenes. In the recognition memory test for faces, the ASD group performed significantly worse than the typically developing group. Here, age-standardized scores were strongly associated with the number of times the participant shifted eye-gaze between facial features. This association was significant in both participant groups, and was not accounted for by verbal or nonverbal ability.

Conclusions:

Some, but not all children with ASD have difficulties recognizing faces. Two factors emerged as being related to skill level: a) initial allocation of attention to people, b) movement of eye-gaze between the features of a face. More generally, this research demonstrates the importance of investigating associations between abilities, and of being mindful of variability in symptom profile and skill level within individuals on the autistic spectrum.

134.104 104 High- and Low-Risk Six-Month-Olds' Visual Attention to Smiling and Neutral Faces: Effects of Smile Intensity and Infant Risk-Status. S. F. Hannigen*, K. Rump, K. M. Lynn and M. S. Strauss, *University of Pittsburgh*

Background: Individuals with autism demonstrate atypical attention to facial expressions (Pelphrey et al., 2002). Investigations of the early autism phenotype find signs of atypical socio-emotional reciprocity emerge as early as 12 months (Ozonoff et al., 2010). It remains unclear whether high risk (HR) infants who have an older sibling with autism and low risk (LR) infants who do not have an older sibling with autism differ in how they visually attend to facial expressions (Merin, Young, Ozonoff, & Rogers, 2007).

Objectives: To determine the effect of smile intensity and infants' risk-status on their visual attention to smiling versus neutral faces.

Methods: Six-month-old HR (n = 12) and LR (n = 18) infants' visual attention to pairings of neutral and smiling static faces was examined using eye-tracking technology. Risk groups were matched on verbal and nonverbal DQ. Infants viewed three levels of face pairings with each level distinguished by variation in smile intensity: neutral/closed-mouth smile (low intensity), neutral/open-mouth smile (moderate intensity), and neutral/exaggerated smile (high intensity). The dependent variable for analyses was the proportion of time spent looking at the smiling face (S ratio) relative to total looking at both the smiling and neutral faces.

Results: A 3 (smile intensity) X 2 (risk-status) repeated measures ANOVA was conducted to investigate the effect of these factors on the S ratio. An S ratio over 0.50 indicates

more looking to the smiling than neutral face. There was a significant interaction of smile intensity and risk-status, $F(2, 27) = 5.78$, $p = 0.008$. Follow-up analyses indicate:

- *Closed-Mouth Smiles*: Six-month-old HR (M = 0.48, SD = 0.16) and LR (M = 0.52, SD = 0.10) infants did not differ in visual attention to closed-mouth smiles, $t(28) = 0.77$, $p = 0.45$.

- *Open-Mouth Smiles:* Six-month-old HR infants (M = 0.44, SD = 0.23), $t(28) = 2.27$, $p = 0.03$ looked significantly *less* to open-mouth smiling faces than LR infants (M = 0.59, SD = 0.13) .

- *Exaggerated Smiles*: Six-month-old HR infants (M = 0.63, SD = 0.09) looked significantly *more* to exaggerated smiling faces than LR infants (M = 0.48, SD = 0.13), $t(28) = 3.35$, $p = 0.002$.

Conclusions: HR and LR group differences in looking emerged only for moderate and high-intensity smile/neutral pairings. LR 6-month-olds looked more to open-mouth smiles than HR 6-month-olds. In contrast, HR 6-month-olds looked significantly more than LR 6-month-olds to high-intensity, exaggerated smiles. These data suggest HR and LR group differences in looking to smile versus neutral faces emerge as early as 6 months. Results suggest HR infants may need more exaggerated expressions in order to elicit a preference.

134.105 105 Where's Wendy? Toddlers with ASD Exhibit Limited Attentional Capture by Faces. M. Coffman*[1], F. Shic[1], M. Meltvedt[1], J. Bradshaw[2] and K. Chawarska[1], (1)*Yale University School of Medicine*, (2)*University of California - Santa Barbara*

Background: Many studies have demonstrated that children with autism spectrum disorders (ASD) attend to socially relevant aspects of their visual environment differently from their typically developing (TD) and developmentally delayed (DD) peers. Before attending to a face, one must first detect it in an otherwise complex visual environment. While deficits in attentional engagement with faces (Chawarska et al., 2003; 2010), as well as scanning and recognition, (Chawarska & Shic, 2009; Bradshaw et al., inpress) have been documented, it is not clear if faces capture the attention of toddlers with ASD as rapidly as in typical controls.

Objectives: To examine attentional capture by faces in toddlers with ASD as compared to age-matched TD and DD controls. We evaluated (1) whether scenes containing faces elicit less attention from toddlers with ASD compared to controls; (2) where children with autism focus their attention within a naturalistic scene; and (3) whether children with autism take longer to orient towards a face in a complex scene.

Methods: Eye-tracking data were collected from toddlers diagnosed with ASD (N=28, M=2.30yrs) as well as TD (N=25, M=2.11yrs) and DD (N=16, M=2.07yrs) control groups. Participants were shown eight static images of women in naturalistic settings (e.g. in an office, living room) for 5s each. The faces of the women were positioned in random locations 7 visual degrees from a central fixation target which preceded each trial. Each image was parsed into discrete regions of interest (ROI). We also examined overall valid looking time and duration of looking at specific ROIs as well as latency to fixate the face for the first time after the stimulus onset.

Results: We found no significant differences between the groups in terms of overall amount of valid looking time recorded by the eye-tracker. However, children with ASD and DD spent more time looking away from the screen compared to TD children ($p<.01$; $p<.05$, respectively). Additionally, when children with ASD attend to the screen, they spend more time looking at the area surrounding the stimulus compared both to TD children ($p < .05$) and DD peers ($p = .064$). Children with ASD also oriented to the face later than both their TD ($p < .05$) and DD peers ($p < .05$).

Conclusions: Results show that both ASD and DD groups spent more time looking away from the screen compared to typically developing peers, which suggests difficulty in regulating attention, likely associated with presence of cognitive delays in both groups. However, when looking at the screen, toddlers with ASD were less likely to examine the complex scene containing the person than both contrast groups. This may be a function of lesser salience of scenes containing relevant social stimuli for toddlers wtih ASD. Finally, when children with ASD directed attention to the scene, they took longer to localize the face embedded into the scene. Thus, in addition to other attentional, processing, and recognition deficits associated with faces, toddlers with ASD also show limited attentional capture by faces.

134.106 106 Diminished Attention to Faces In 6-Month Old Infants Later Diagnosed with ASD. F. Shic*, S. Macari and K. Chawarska, *Yale University School of Medicine*

Background: Though several studies have shown that toddlers and young children with ASD scan and recognize faces atypically (e.g. see Chawarska & Shic, 2009), the phenotypic precursors to these atypical behaviors in infancy have not been well mapped.

Objectives: To examine the relationship between developmental changes in face scanning and outcome in a prospective longitudinal cohort of high-risk infant siblings of children with ASD.

Methods: Infants were presented at 6, 9, and 12 months with stimuli of adult female faces in three conditions: (1) *Static*: an image of a face; (2) *Affect*: a video of an actress smiling; (3) *Speech*: a video of an actress reciting a nursery rhyme. Stimuli were preceded by a central fixation before being presented for 20s; gaze patterns were recorded with an eye-tracker. At 24 months, high-risk siblings (N=62) were classified by a team of expert clinicians based on Mullen, ADOS, Vineland, and CSBS results into the categories: ASD (N=14), Broader Autism Phenotype (BAP; N=17), other specific Developmental Delays (DD; N=13), and No Concerns / Not Affected (NA; N=18). A longitudinal comparison group of typically developing (TD; N=46) infants was also recruited.

Gaze patterns were analyzed in a top down approach. Dependent measures were: (1) ValidTime% - proportion of time during the trial the eye-tracker recorded the eye; (2) InnerTime% - proportion of time spent examining the "inner face" (i.e. excluding hair, neck, and body) relative to looking at the stimulus; (3) EyeTime% and (4) MouthTime% - proportion of time spent examining the eyes and mouth, relative to looking at the inner face; and (5) EyeMouthRatio% - Eye/(Eye+Mouth). Statistical analyses were conducted using a top-down linear mixed models refinement approach (Diggle, 2002) with quadratic fixed and random age effects.

Results: At 6 months, infants later classified as ASD showed lower ValidTime% across conditions than BAP ($p<.01$), DD ($p=.084$), NA ($p<.05$), and TD ($p=.05$) groups. However, by 12 months the ASD group showed higher ValidTime% than both BAP ($p<.05$) and TD ($p<.05$) groups. No significant differences between ASD and other groups were found at 6, 9, or 12 months for InnerTime%, EyeTime%, MouthTime%, or EyeMouthRatio%. All groups exhibited sensitivity to experimental conditions with ValidTime%: *Static*<(*Affect*=*Speech*); InnerTime%: *Static*<*Affect*<*Speech*; EyeTime%: *Static*>*Affect*>*Speech*; MouthTime%: *Static*<*Affect*<*Speech*; and EyeMouthRatio%: *Static*>*Affect*>*Speech*. Profiles of non-ASD groups varied, but NA and TD groups exhibited marked similarities.

Conclusions: Results suggest that at 6 months infants who will later express marked ASD symptomology exhibit an overall pattern of decreased attention towards face stimuli shown in multiple contexts. This deficit lessens by 9 months. Internal patterns of face scanning are remarkably similar to other high-risk and low-risk groups, consistent with prior studies (Young, et al., 2009). Nevertheless, decreased attention towards faces at 6 months could suggest vulnerabilities in early social processing and result in substantial developmental consequences. As our study is ongoing, future reports will address issues of experimental power, specificity of attentional deficits, profiles of performance in non-ASD groups, and include other methodological developments.

134.107 107 Recognition of Context-Dependent Emotion In Autism. O. Tudusciuc* and R. Adolphs, *Caltech*

Background: Social cognition is a key feature of primate, and especially human, behavior which depends on the ability to evaluate the emotional and social meaning of complex stimuli as they occur in a given context. The process of emotion recognition can thus be thought of as consisting of several components, including initial perception of a stimulus and its integration with context. While complex emotion recognition is impaired in people with autism, it remains unknown which of these particular components are most affected.

Objectives: To address this issue, we compared the influence of context on the emotion recognition performance of adults with high-functioning autism. The core task consisted of photographs of people displaying strong, but ambiguous emotions, preceded by a context stimulus that served to disambiguate the target scene.

Methods: We have tested 15 autism participants and 16 controls. Participants were shown a series of photographs of people displaying strong emotions, in natural environments, ranging from laughter to anger and crying. These target stimuli ranged from very clear meanings to ones that were quite ambiguous in that they could be interpreted both positively and negatively (for instance a picture of people with wide eyes and open mouths looking upwards could be positively interpreted as pleasantly surprised people, who have just seen a mesmerizing fireworks show, or negatively interpreted as horrified people watching a drama unfold at an upper level of a building). We tested the influence of prior context information on the interpretation of these stimuli by presenting a short text (1 to 4 words) (for the text condition) or an emoticon (for the cartoon condition) immediately preceding the target stimulus.

Results: The pattern of responses shows a bias towards more negative interpretations of emotions for the autism participants compared to controls. Preliminary data indicates that the control participants were more likely to rate the photographs as positive emotions on the first presentation of each image, and

more likely to be influenced in their rating by a positive context, whereas participants with autism were less likely to let themselves influenced by the suggestion of a positive interpretation for a given ambiguous photograph. This effect was particularly strong for the text condition.

Conclusions: Our results indicate a possible impairment in context integration and a tendency to ignore a positive interpretation in an ambiguous emotional stimulus.

134.108 108 Diadochokinetic Rate and Accuracy In Autism Spectrum Disorders. J. J. Diehl*[1], J. Preston[2] and L. Bennetto[3], (1)*University of Notre Dame*, (2)*Haskins Laboratories*, (3)*University of Rochester*

Background: Several studies have found subtle deficits in diadochokinetic rate as a measure of oromotor functioning for children with ASDs; however, most studies have relied on overall scores and have not examined whether or not there are patterns of behavior as a function of task difficulty. This is important because demands on executive functioning and speech motor programming (oromotor sequencing) increase as the phonetic complexity of the task increases.

Objectives: We used acoustic and perceptual measurements of diadochokinetic rate and accuracy to measure the performance of children with ASD during repetition of several increasingly difficult syllable sequences.

Methods: Participants were 24 children and adolescents with high-functioning ASD and 21 typically-developing peers between the ages of 11-18. Participants were matched on chronological age, IQ, and language abilities, and diagnoses were confirmed using the ADOS, ADI-R, and clinical judgment. Participants completed a series of diadochokinetic test items, which required them to repeat a sequence of sounds multiple times as fast as possible without making any errors. Critical items included /pə/, /pə-tə/, /tə-kə/, /mə-bə/, /pə-tə-kə/, and /plə-trə-kə/. The executive demands of oromotor sequencing increase as the number and complexity of the sound sequences increase. We used PRAAT (Boersma & Weeninck, 2009) to acoustically analyze the speech signal. For monosyllable and di-syllable items, we measured the rate of syllable production. For the more challenging tri-syllables, we measured the percentage of sequencings accurately produced, because rate was confounded by the number of sequencing errors.

Results: There were no differences in diadochokinetic rate for the simple monosyllabic and disyllabic items. However, the group with ASD had a significantly higher percentage of errors than the typically developing comparison group (29% vs. 15%) on the more demanding /pə-tə-kə/ item, $F(1,43)=4.62$ $p<.05$, Cohen's $d=.66$, and marginally higher percentage of errors on the /plə-trə-kə/ item (43% vs. 29%), $F(1,43)=3.47$, $p=.07$, Cohen's $d=.57$.

Conclusions: Findings from this study are indicative of oromotor sequencing deficits in individuals with high-functioning ASD, even when controlling for general language and IQ functioning. Differences do not appear to be driven by slower speech motor systems, but by a reduced ability to retain the correct phonetic form in short-term memory and/or to accurately sequence the motor movements in complex sequences. Further exploration of speech output in children with ASD is needed, including the relationship between linguistic and motoric processes.

134.109 109 The Error-Related Negativity (ERN) In Response to Affect and Gender Face Processing In High Functioning Autism. C. Hileman*[1] and H. A. Henderson[2], (1)*MIND Institute*, (2)*University of Miami*

Background: Children with High Functioning Autism (HFA) have difficulty with error monitoring (Bogte et al., 2007). An inability to monitor errors in a social context may be associated with autistic symptomology.

Objectives: The aim of the current study was twofold: 1) To examine developmental and diagnostic group differences on the Error-Related Negativity (ERN), an electrophysiological indicator of error monitoring. 2) To examine how individual differences in the ERN relate to Autistic Symptomology.

Methods: Thirty-eight individuals with HFA and 39 individuals with typical development, ages 9-19, participated in the study. Participants viewed a series of 312 face stimuli under two task conditions: Affect and Gender. For the Affect and Gender Tasks respectively, participants quickly indicated whether each face stimulus was angry vs. happy or male vs. female. Participants wore a 128-lead Geodesic sensor net. ERN amplitude was calculated as the mean amplitude between 25-75 ms following the participant's response. ERN latency was calculated as the latency of the local negative peak between 25-75 ms following the participant's response. The difference score between correct and incorrect trials was analyzed, with the amplitude/latency of incorrect trials subtracted from the amplitude/latency of correct trials. The Autism Spectrum Screening Questionnaire, the Social Responsiveness Scale, and the Social Communication Questionnaire were used to assess Autistic Symptomology.

Results: There was a main effect of age on ERN Amplitude, $F(1, 74) = 15.61$, $p < 0.01$, $\eta^2_p = 0.17$, and ERN Latency, $F(1,$

74) = 9.25, $p < 0.01$, $\eta^2_p = 0.11$, such that participants showed a more negative amplitude and a longer latency for incorrect responses compared to correct responses with age. There was a marginal interaction between diagnostic group and task on ERN Amplitude, $F(1, 74) = 3.37$, $p = 0.07$, $\eta^2_p = 0.04$, such that individuals with typical development showed a greater amplitude difference between correct and incorrect responses than individuals with HFA, but only on the Gender Task. Controlling for age, verbal IQ, and diagnostic group, ERN Latency on the Affect Task, $t(71) = -1.79$, $p = 0.08$, and Gender Task, $t(71) = 1.93$, $p = 0.06$, marginally predicted autistic symptomology. A greater latency difference between correct and incorrect responses was associated with less autistic symptomology on the Affect Task, but more autistic symptomology on the Gender Task.

Conclusions: Regardless of task demands, development had a strong influence on error monitoring for both diagnostic groups. Group differences suggest that individuals with HFA may be impaired in monitoring their errors with respect to the gender of a face, not the affect of a face. These results are consistent with a recent literature suggesting individuals with HFA may automatically engage in face processing of affect (Magnée et al., 2007). For those individuals who automatically engage in affect processing, monitoring of gender may require executive functioning skills such as set-shifting. In contrast, individuals who engage in gender processing more automatically may be less sensitive to socially pertinent aspects of a face, such as affect. Thus, these individuals may show more severe impairments in social interaction and communication.

134.110 110 Immediate Recall of Faces with Positive Emotions Correlates with Density of Eye Movements During REM Sleep In Children with Autism.

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Background: Among multiple variants in their sleep phenotype (Limoges at al 2005) autistics show original REM sleep measures. Specifically, autistics display less rapid eye movements than typical individuals. Rapid eye movements of REM sleep are generated by a limbic system-based neural network that includes the amygdala. This structure is implicated in the socio-cognitive function in which autistics display atypicalities, in the form of diminished overt and neural responses to emotional loaded stimuli

Objectives: Investigate the relationship between rapid eye movements density during REM sleep, a marker of limbic system functioning, and performance on a recognition performance task involving emotional stimuli. A positive correlation between performance in this task and amounts of rapid eye movements during REM sleep in autism is predicted, on the basis of the typical relation between this structure and this behavior.

Methods: Thirteen male autistic children (AUT; 10.3 ± 1.9 years) and thirteen comparison children (COM; 9.6 ± 2.2 years) were recorded for two consecutive nights. Before and after night 2, participants were administered a recognition task of unfamiliar face showing positive, negative or neutral emotions; immediate recall (in the evening) and delayed recall (in the morning) were also tested. The total number of correct answers on immediate and on delayed recall were computed; the number of omission errors were computed separately for positive, negative and neutral faces for immediate and for delayed recall. The duration of REM sleep and the number of rapid eye movements during REM sleep were computed for night 2. Results from the two groups were compared using Mann-Whitney U-tests. The correlation between REM sleep measures and face recognition was tested using Spearman's rho. Significance level was set at .05.

Results: REM sleep time (AUT = 97.2 ± 23.5, COM = 87.9 ± 17.0) and number of rapid eye movements per hour of REM sleep (AUT = 514.5 ± 133.5, COM = 462.2 ± 116.4) were comparable in the two groups (see also Lambert A. et al., this meeting). However, the correlation pattern differs between groups. Whereas immediate recall of faces with positive emotions was positively correlated with the number of rapid eye movements per hour of REM sleep in autistic children (rho = 0.62), it was not the case in COM children (rho = 0.10). In contrast, only COM children showed a significant positive correlation between the duration of REM sleep and the number of errors on neutral faces on immediate recall (rho = 0.57), a correlation not found in AUT children (rho=0.28). This different pattern of correlation may be used to interpret the inferior performance of autistic children on immediate recall of faces with positive emotions (errors: AUT=3.8 ± 2.0, COM=2.1 ± 1.8).

Conclusions: Although correlations do not allow drawing causative relationships, these findings indicate that the neural networks dedicated to the recognition of faces with positive emotions relate differently with sleep variables in typically developing and in HFA children.

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134.111 111 Typical Patterns of Visual Filtering Among Children with ASD with Dynamic Presentation of Targets and Flankers. T. Dawkins*[1], D. Brodeur[2], O. Landry[3], S. Rishikof[1] and J. A. Burack[1], (1)*McGill University*, (2)*Acadia University*, (3)*Dalhousie University*

Background: Visual filtering is the ability to selectively focus on important information while ignoring task-irrelevant information. Filtering efficiency is often studied with some variation of the flanker paradigm (Eriksen & Eriksen, 1974), a computer-based task on which participants are asked to quickly and accurately identify a target among flanking stimuli. Among adults with ASD, impairments in both the narrowing (Burack, 1994) and broadening (Mann & Walker, 2003) of attention have been reported. In fine-tuned analyses of the effect of stimulus-distractor compatibility on performance, children with ASD showed a typical flanker compatibility effect (FCE) as flankers that were physically compatible with the target were associated with faster and more accurate response times (RTs), whereas incompatible flankers were associated with slower and less accurate RTs (Henderson et al, 2006; South et al., 2010). However, the implications of the traditional flanker task are limited as it entails the simultaneous presentation of the flankers and targets, thereby failing to depict the dynamic real-world in which distractions may occur before, during, or after the appearance of an attended-to stimulus or event.

Objectives: To investigate the spatial and temporal modulation of visual filtering among children with ASD in a study of the effects of asynchronous onset of visual stimuli on target identification.

Methods: Fifteen children with ASD and 15 MA-matched TD children completed a modified version of the flanker task. The targets appeared at the centre of a computer screen with flankers to their left and right either before (-200, -400 ms), simultaneous with (0 ms) or after (200, 400 ms) the target. Feature compatibility was also varied. In the Response Compatibility condition, the flankers and target were from the same response (RC; response compatible) or opposite response (RI; response incompatible). In the Feature Similarity condition, the flankers and target either shared a feature (FS; feature similar) or did not (FD; feature dissimilar). Response compatibility and feature similarity were varied across asynchronies. The dependent measure was response time (RT) and percentage of error (POE).

Results: The TD children responded faster than the children with ASD although a similar pattern of filtering emerged for both groups. The presentation of flankers before the target led to faster RTs, whereas the presentation of flankers after the target led to slower RTs. The highest POEs were committed when the flankers were RI or FD with the target. The presentation of the flankers after the target was associated with the smallest POE, whereas the flankers presented before and simultaneous with the target were associated with a higher POE.

Conclusions: Similar to the TD children, the children with ASD showed faster RTs, but reduced accuracy, when the flankers cued the onset and location of the target. Slower RTs were found when flankers appeared abruptly after the target along with increased accuracy. The findings suggest that, despite slower RTs, the children with ASD showed similar patterns to the TD children in their performance on a task of visual filtering with a dynamic presentation of stimuli.

134.112 112 Aiming and Catching Abilities Distinguish ASD From ADHD. L. J. Koenig*[1], M. M. Talley[1] and S. H. Mostofsky[2], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins School of Medicine, Kennedy Krieger Institute*

Background:

An increasing number of research studies have pointed to motor control as an area of difficulty in children with autism spectrum disorders (ASD) (Jansiewicz et al., 2006; Fuentes, Mostofsky, & Bastian, 2009). Critical questions remain regarding the profile and specificity of motor deficits in ASD.

Objectives:

To better characterize the profile of motor difficulties associated with autism using the Movement Assessment Battery for Children, 2nd Edition (Movement ABC-2, Henderson & Sugden, 2007), which assesses three different sub-categories of motor functioning: balance, manual dexterity, and aiming/catching; and, to examine the specificity of motor findings in autism by comparing performance of children with ASD with that of typically developing (TD) children as well as that of another control group with developmental motor difficulties – children with Attention Deficit/Hyperactivity Disorder (ADHD).

Methods:

Participants included 104 children, ages 8-12 years: 33 with ASD (6 female), 34 with ADHD (8 female), and 37 TD children (8 female). Groups were matched on age, gender, race, and the Perceptual Reasoning Index (PRI) of the Wechsler Intelligence Scale for Children-4th ed. (WISC-IV, Wechsler, 2003). Three-group ANOVAs were used to examine an effect of diagnosis on total and subtest scores on the Movement ABC-2,

with follow-up Bonferroni-corrected post-hoc analyses of two-group comparisons.

Results:

Three-group ANOVAs revealed a significant effects of diagnosis for the components of Balance ($F = 24.366$, $p < .001$), Manual Dexterity ($F = 22.609$, $p < .001$), and Aiming and Catching ($F = 8.852$, $p < .001$). Post-hoc tests revealed that: 1) Balance: Both the ASD group ($p < .001$) and ADHD group ($p < .001$) showed significantly poorer balance compared to TD children. The ASD group also showed poorer balance compared to ADHD children ($p = .037$). 2) Manual Dexterity: Both the ASD group ($p < .001$) and ADHD group ($p < .001$) showed poorer manual dexterity compared to TD children, with a trend for poorer manual dexterity in the ASD group compared with the ADHD group ($p = .061$). 3) Aiming and Catching: The ASD group showed significantly poorer aiming and catching than the TD group ($p < .001$); however, there was no significant difference between the TD and ADHD groups. The ASD group also showed poorer aiming and catching than did the ADHD group ($p = .035$).

Conclusions:

Children with ASD and children with ADHD show significantly poorer Balance and Manual Dexterity compared with TD children. In contrast, impairment in Aiming and Catching was observed only in children with ASD (and not in ADHD). Results from Manual Dexterity and Balance component scores suggest that ADHD and ASD groups appear to differ motorically more in severity than in kind. Differences in Aiming and Catching suggest that skills involving a greater degree of visuomotor integration are particularly impaired in autism. Alternatively, given that ball games involve social interaction, it is possible that impaired aiming and catching may be a function of lack of social observation and participation.

134.113 113 Dynamic Allocation of Visual Resources In the First 6 Months. J. D. Jones*, A. Klin and W. Jones, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background: From birth, infants actively shape the environment in which they interact and learn by specifically directing their attention to content they perceive to be salient. For example, longitudinal studies of eye-tracking data suggest that infants who are later diagnosed with autism spectrum disorders (ASD) decrease the amount of time they spend looking at the eyes during their first 6 months of life, which, in turn, shapes the information they have access to. While this method of quantifying attention provides a summary of individual viewing, it does not show how viewing changes dynamically from one moment to the next. A novel method for quantifying visual attention continuously assesses group agreement in the allocation of visual resources within a certain context. This method provides a dynamic measure of group tendency as well as a measure of individual deviation from group norms. Previous research using this method has demonstrated that older children with ASD often fail to attend to content that is highly salient to typically developing peers. This research suggests that dynamic measures of visual attention may be useful as an early indicator of ASD.

Objectives: This study aims to identify the earliest age at which measures of dynamic visual attention indicate a child's risk for developing autism. Specifically, this research will 1) provide information about aspects of the environment that are salient to typically developing infants, and 2) investigate the process by which children with ASD construct alternative schemas of salience during infancy.

Methods: Data were collected prospectively and longitudinally from cohorts of infants at high- or low-risk for ASD (infant sibling study design), and conventional diagnostic evaluations at 24 months defined two groups: typically-developing children (TD, N = 25), and children with confirmed ASD diagnosis (ASD, N = 11). 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 typically developing children to create a continuously changing map of normative visual salience in relation to movie-content. This process was repeated using infant eye-tracking data from children with ASD, and differential landscapes of salience for this group were constructed and compared to salience data from the typically developing group.

Results: Preliminary results suggest that children with ASD begin to exhibit unique strategies for allocating attention as early as 4 months of age. During the first 6 months of life, typically developing infants diminish their attention to physically salient stimuli in favor of more socially relevant content. In addition, results indicate that individual measures of deviance from typical viewing patterns increase over time for children with ASD.

Conclusions: Overall, this research demonstrates that dynamic measures of visual attention reveal early indicators of risk for ASD in the first 6 months of life. Furthermore, because of the importance of attention for learning, this study suggests that intervention programs may capitalize on early development in

ASD through better measures and improved understanding of what is or is not inherently salient to infants with ASD.

134.114 114 Imitation In a Large Cohort of Preschoolers with ASD: Measurement Structure and Correlates. I. M. Smith*[1], C. N. Lowe-Pearce[2], T. Vaillancourt[3], J. Volden[4], S. Georgiades[5], E. Duku[5], P. Szatmari[5], S. E. Bryson[1], E. Fombonne[6], P. Mirenda[7], W. Roberts[8], C. Waddell[9] and L. Zwaigenbaum[4], (1)*Dalhousie University/IWK Health Centre*, (2)*IWK Health Centre*, (3)*University of Ottawa*, (4)*University of Alberta*, (5)*Offord Centre for Child Studies, McMaster University*, (6)*Montreal Children's Hospital*, (7)*University of British Columbia*, (8)*University of Toronto*, (9)*Simon Fraser University*

Background: Children with autistic spectrum disorders (ASD) show impaired imitation of actions (Rogers & Williams, 2006). Indeed, poor elicited imitation is an early predictor of ASD in high risk infants (Zwaigenbaum et al., 2005). Most detailed investigations of imitation in ASD have used relatively small and/or selected samples, and few imitation tasks, often of 1 or 2 types (e.g., actions with objects, conventional gestures). These tasks may be insufficient to describe the growth of imitation skills in the preschool years.

Objectives: The present study examines (1) the structure of a novel multi-dimensional elicited imitation measure, and (2) the correlates of imitative performance in a large representative sample of preschoolers with ASD.

Methods: The study draws upon baseline data (within 4 months of diagnosis) from a longitudinal study of preschoolers with ASD (n=361; 83% males; mean age=40.8, SD=9.2 months). The Multidimensional Imitation Assessment (MIA; Lowe-Pearce & Smith, 2005) contains 48 items organized into 11 *a priori* domains. In this study, performance was scored in vivo on a 4-point scale for accuracy (0 = no response 1 = emerging response / not imitation; 2 = partial / inaccurate imitation; 3 = exact imitation). Age equivalent (AE) scores were used for measures of intellectual (Merrill-Palmer-Revised Scales, Developmental Index), and language abilities (Preschool Language Scales 4th ed., Auditory Comprehension and Expressive Language). Other measures were of adaptive behaviour (Vineland Scales of Adaptive Behaviour, 2nd ed, Adaptive Behaviour Composite), initiating and responding to joint attention (JA; Early Social Communication Scales) and autism symptoms (Social Responsiveness Scale Total score).

Results: A principal components analysis (PCA) with varimax rotation on the 48 MIA item scores yielded a 3-factor solution explaining 76% of the variance. Factor 1 - Actions With Objects, accounted for 68.9% of variance; Factor 2 - Vocalizations/Words with Objects, for an additional 4.1%, and Factor 3 – Actions Without Objects, for a further 2.9%. Mean accuracy scores for each factor increased across age groups (2-, 3-, 4 –year-olds), all p's <.001. MIA Total accuracy scores were significantly positively correlated with all ability and JA measures (r's from .18 to .63; all p's<.001). However, relationships with the Actions Without Objects factor appeared to be somewhat more heterogeneous, warranting further exploration. Specifically, for 2-year-olds, significant correlations were seen between both cognitive and language abilities and imitation accuracy, for both Actions With Objects and Vocalizations/Words With Objects (r's from .20 - .50, all p's <.02). However, for Actions Without Objects, only language scores were significantly correlated with imitation accuracy (r's = .21 and .26, p's <.02 and .003 for EL and AC). Relationships were non-significant between autism symptoms and all imitation factor scores.

Conclusions: The MIA provides an index of age-related improvements in multiple aspects of imitation accuracy. Furthermore, associations with measures previously linked to imitation show evidence of criterion-related validity for the MIA. We conclude that the three empirically derived factors of the MIA provide useful indices for assessing longitudinal change in imitation in preschool children with ASD.

134.115 115 No Maturational Effects In A Visuo-Tactile Cross-Modal Size Discrimination Task In ASD. E. M. Hahler*[1], J. Lecompte[2], R. Doti[1] and J. Faubert[1], (1)*University of Montreal*, (2)*The Canadian Institute for Neurointegrative Development (Giant Steps School)*

Background: Autism Spectrum Disorders (ASD) are currently characterized by a triad of impairments including social dysfunction, communication deficits and perseverative behaviours. Expected changes in the DSM-V will include unusual sensory reactions and interests as part of one of two diagnostic criterions. Many theories suggest that anomalies in basic sensory processing might underlie atypical sensory behaviours in ASD and explain some of their current core symptoms. However, there is a lack of empirical evidence to support this hypothesis. Previous findings have shown anomalies in audio-visual speech integration (e.g., Bebko et al., 2006) and auditory-somatosensory integration (Russo et al., 2010) in autistic children. To our knowledge, no study has looked at the developmental trajectory of multisensory processing in ASD.

Objectives: The general objective of the study was to investigate multisensory processing differences in ASD children and adolescents in a visuo-tactile cross-modal size discrimination task. A more specific aim was to study the development of visuo-tactile cross-modal abilities in ASD children and adolescents.

Methods: 26 ASD children and adolescents (aged 5 to 18 years) with typical intelligence and 20 age-, gender- and PIQ-matched typically developing (TD) children and adolescents discriminated ecological coin-like stimuli on the basis of tactile (T), visual (V) or cross-modal (CM) visuo-tactile information. In a simultaneous two-alternative forced-choice task, performances were measured based on difference thresholds, which evaluate the smallest difference at which observers are capable of discriminating size. The correct answer was considered as the identification of the bigger of two stimuli. An adaptive staircase protocol (two down/one up) was used in order to adjust the difference among stimuli between trials relative to the subject's answer.

Results: Preliminary results showed that for both groups difference thresholds were lower (better performance) for the visual versus the tactile and cross-modal conditions. However, ASD children and adolescents, as a group, were less capable to discriminate stimuli in all three conditions, compared to TD children and adolescents. The biggest difference in performance was found in the CM condition, with ASD participants being significantly less capable to make a judgment across senses. Whereas typicals showed an improvement in performance as a function of age in all three conditions, no maturational effects were observed in the ASD group.

Conclusions: The present study corroborates and extends previous findings of anomalies in multisensory processing in ASD. A critical finding of our study seems to be the lack of maturation observed in the ASD group in their sensory processing abilities. The ASD group, unlike the TD group, did not improve as a function of age in any of the three sensory modalities. These findings therefore show the great importance of understanding how these sensory processing abilities develop over time in ASD as this may impact our understanding of their core symptoms, including their atypical sensory behaviours.

134.116 116 Enhanced Perception of Pitch Direction In Young Adults with Autism Spectrum Disorder. K. L. Hyde*[1], N. E. Foster[1], A. A. Simard-Meilleur[2] and L. Mottron[2], (1)*Research Institute of the Montreal Children's Hospital, McGill University*, (2)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background:

Enhanced pitch perception has been previously documented in autism spectrum disorders (ASD), particularly in the context of discrimination and categorization tasks (e.g., Bonnel et al., 2010). However, to our knowledge, no one has yet specifically examined higher-order perception such as pitch change direction in ASD, and if individuals with ASD maintain superior pitch processing even under challenging experimental conditions.

Objectives:

The objectives of the present research were to: 1) test whether perception of pitch direction is enhanced in ASD individuals relative to typically-developing controls; 2) to test if ASD individuals maintain enhanced pitch perception under conditions in which they are often found to be impaired, such as at fast temporal rates of presentation (e.g., Gepner and Feron, 2009), 3) to investigate whether ASD individuals with and without delayed speech onset show different performance profiles on a pitch direction task.

Methods:

We tested three subject groups: 1) 10 autism spectrum individuals (ASD) with delayed speech onset (DSO) (defined as first words after 24 months and/or first phrase after 33 months old), 12 ASD with typical speech onset (TSO), and 12 typically developing individuals (TYP). All groups were matched on IQ, age (mean 21), gender and manual preference.

In a pitch change direction task (Gougoux et al, 2004), subjects heard two pure tones of different frequencies on each trial and had to decide whether the pitch rose or fell. Task difficulty was parametrically manipulated from a reference condition, in both the temporal and spectral domains, either by successively dividing tone duration by two (temporal series), or by dividing the frequency spacing between the tones by two (spectral series). Subjects heard stimuli through headphones binaurally and reported the pitch-change direction by pressing a key.

Ethical approval for the present work was obtained in accordance with the National Institute of Health guidelines.

Results:

For all groups, performance was best in the reference condition and was significantly reduced when either the tone duration, or

the frequency difference between the tones was decreased. The ASD-DSO and TSO groups combined showed significantly better performance relative to CTR overall, even at the fast temporal rates. Each of the ASD-DSO and ASD-TSO groups alone performed better than CTR overall. However, the ASD-DSO showed more significant enhanced performance and at all of the spectral and temporal difference levels.

Conclusions:

We extend previous findings in ASD by demonstrating novel results of enhanced pitch change direction judgement in ASD. Thus, the pitch processing superiority in ASD extends to higher levels than just simple pitch discrimination tasks. 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 (Samson et al., 2006). Importantly, enhanced pitch direction perception was found in ASD even when the pitch changes were presented at fast temporal rates. These findings are provocative since they are in contrast to the view that ASD individuals are generally impaired in processing information at fast temporal rates of transition.

134.117 117 The Forest and the Trees: Increased Sensitivity to Bilateral Symmetry In Autism. A. Perreault*[1], R. Gurnsey[2], M. Dawson[3], L. Mottron[3] and A. Bertone[1], (1)*Perceptual Neuroscience Laboratory for Autism and Development, CETEDUM*, (2)*Concordia University*, (3)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*

Background: The question of how local stimulus attributes are grouped into meaningful spatial patterns has not yet adequately been studied in autism. Bilateral symmetry, where half of a pattern is a mirror reflection of the other half, is a prototypical example of an ecologically-significant type of grouping. It exemplifies how local information is organized into highly salient and meaningful visual arrays involved in figure-ground segregation and object perception. Although symmetry perception is initiated by local comparison of individual elements on either side of a symmetrical axis, the extraction of its global symmetric configuration is contingent on integrative or global analysis, which in turn is found to solicit higher-order cortical visual areas in nonautistics. Typical individuals are often best at detecting symmetry oriented about a vertical axis, reflecting its ecological and social importance.

Objectives: To assess spatial grouping in autism by measuring sensitivity to bilateral visual symmetry oriented about vertical, oblique, and horizontal axes.

Methods: Fourteen autistic and 15 nonautistic participants matched for global IQ and age were asked to detect mirror symmetry oriented along randomly-presented vertical, oblique (45^{o}), and horizontal (90^{o}) axes. Patterns were composed of 500 dot-pairs (1000 total dots) and presented within a circular aperture for 250ms. Level of signal strength for symmetrical patterns was manipulated by varying the proportion of dots matched across the axis of symmetry (30%, 36.7%, 44.8%, 54.8%, 66.9%, 81.8% and 100%), such that 100% matching level meant the pattern was perfectly symmetrical. Symmetry detection thresholds were measured using a method of constant stimuli and a 2-alternative, temporal forced choice procedure by asking participants to detect which of two successively presented patterns contained symmetry (target), with one stimulus containing no symmetry signal (0% matching or non-target).

Results: A 2 X 3 mixed-factorial ANOVA did not reveal an interaction between group and axis of symmetry orientation. However, a main effect of axis of orientation ($p < 0.05$) was identified, revealing that vertical symmetry ($p < 0.05$) was perceived most efficiently by both groups. In addition, a main effect of group ($p < 0.05$) was identified. Autistics demonstrated an advantage for symmetry perception, suggesting that autistics required less signal strength than did nonautistics, in order to detect visual symmetry across all axis orientations.

Conclusions: A typically-manifested vertical advantage in the autism group suggests that mechanisms underlying symmetry perception in autism develop with, rather than in the absence of, innate and/or acquired sensitivity to environmental regularities that are important to nonautistics. However, autistics were atypically better at detecting visual symmetry across axes of orientation, which suggests that autistic perception is not characterised by a visuo-spatial integration deficit. Instead we suggest that under some circumstances, autistics can take advantage of an atypically parallel access to both local (symmetrical dot pairs) and global (oriented symmetrical patterns) spatial information. When genuine regularities exist within noisy visual arrays, autistics may sometimes see the forest *and* the trees.

134.118 118 Visual Search In Autism Spectrum Disorder: A Consistent Islet of Ability?. J. W. MacLeod*[1], S. E. Bryson[2] and R. M. Klein[1], (1)*Dalhousie University*, (2)*Dalhousie University/IWK Health Centre*

Background: Empirical research has reliably demonstrated attention and visual processing abnormalities in individuals with Autism Spectrum Disorder (ASD). For example, individuals with ASD are faster to find a target shape within a complex design in

an embedded figures task (Jarrold, Gilchrist, & Bender, 2005; Joliffe & Baron-Cohen, 2006), show a smaller divided-attention cost in a task that requires attention to multiple targets (Rutherford, Richards, Moldes, & Sekuler, 2007), are slower to disengage attention in visual orienting tasks (Landry & Bryson, 2004), and tend to prefer a detail-focused, rather than meaning-focused, processing style (Happe & Frith, 2006). Most importantly for the present study, individuals with ASD have also demonstrated better than normal visual search ability when tested using difficult visual search tasks (e.g. Plaisted, O'Riordan, & Baron- Cohen, 1998; O'Riordan & Plaisted, 2001; O'Riordan, Plaisted, Driver, & Baron-Cohen, 2001).

Objectives: The present study sought to replicate previous ASD visual search research, while examining whether amount of inhibition of return (IOR; an attentional bias away from previously inspected locations) in the aftermath of visual search may provide some explanation for enhanced visual search efficiency in ASD. It was expected that individuals with ASD would search more efficiently than typical controls, and that amount of IOR may differ between the ASD group and controls.

Methods: In a typical visual search task a participant is asked to search a display for a pre- specified target item that is sometimes present and sometimes absent. In addition to the target item, the display contains several distracter items that are present regardless of the trial type. In an easy visual search task, the distracter items appear visually dissimilar to the target item, making the target item easy to find when it is present. In a difficult visual search task, the distracter items are visually similar to the target item, and the target is harder to find when it is present (Duncan & Humphreys, 1989). In the present study, participants completed both an easy and a difficult visual search task. Both tasks also included a measure of IOR in the aftermath of visual search, creating a dual task requirement on each trial.

Results: Participants with ASD demonstrated slower overall RT on both easy and difficult search tasks. No evidence of a difference between ASD and control groups was observed in search efficiency (search time/item in search display), or amount of IOR following search.

Conclusions: The present study failed to replicate previous research on visual search in ASD. The dual-task requirement on each trial in the present study's visual search tasks may have selectively disadvantaged the ASD group, thereby reducing ASD group search efficiency. Also, the difficult visual search task used in the present study was considerably more difficult than that used in previous research. Ongoing research will explore these factors as potential reasons for our non-replication of earlier visual search research in ASD.

134.119 119 Association of Tactile Symptoms with Core Features of Autism: Evidence From Direct Observation and Parent Report. J. H. Foss-Feig*[1], J. L. Heacock[1], C. R. Jacobi[1] and C. J. Cascio[2], (1)*Vanderbilt University*, (2)*Vanderbilt University School of Medicine*

Background: Differences in sensory processing have been noted in autism spectrum disorders (ASD) across modalities, and sensory processing differences discriminate children with ASD from those with both typical development (TD) and generalized intellectual disability (ID). Evidence exists for both sensory seeking and defensiveness in ASD, as well as for both hypo- and hyper-responsiveness to sensory input. Of note, at least one study found that hyporesponsiveness best discriminated individuals with ASD from those with ID. While visual and auditory processing have been the focus of many studies, less is known about tactile processing in ASD. Further, despite the fact that sensory processing abnormalities have been proposed for inclusion in the DSM-V diagnostic criteria for ASD, little is known about the relation between tactile processing deficits and core ASD features.

Objectives: To examine the relation between tactile processing and autism symptomatology in young children with ASD.

Methods: Tactile processing was examined in 33 children with ASD between 5 and 7 years of age (mean CA= 6.8 years, mean MA= 5.2 years) using the Tactile Defensiveness and Discrimination Test-Revised (TDDT-R). Parent report of tactile processing (including defensiveness, seeking, and hypo- and hyper-responsiveness) was collected using the Sensory Profile Caregiver Report (SP) and the Sensory Experiences Questionnaire (SEQ). Autism symptomatology was assessed directly with the ADOS, and parent report was obtained from the ADI-R. Bivariate correlations were conducted between direct assessment and parent-report measures of tactile defensiveness, seeking, and hyporesponsiveness and direct and parent-report assessments of social, communicative, and behavioral differences in ASD. A significance threshold of $p < .05$ was used for all correlations.

Results: Increased tactile seeking behaviors, as indexed on the TDDT-R and SEQ tactile scale, was associated with increased social impairment on the ADOS and ADI-R and increased repetitive behaviors on the ADOS. In contrast, increased tactile defensiveness on the TDDT-R was associated with decreased repetitive behaviors on the ADOS. Higher levels of tactile hyporesponsiveness, as measured by the SP

tactile high threshold items, were related to increased social impairment on the ADOS and ADI-R, increased nonverbal communication impairments on the ADI-R, and increased repetitive behaviors on the ADOS. The SEQ index for tactile hyporesponsiveness was correlated with ADI-R report of increased social and non-verbal communication symptoms. However, neither the SP or SEQ measures of tactile hyperresponsiveness were correlated with any core ASD symptom domains, as measured by the ADOS and ADI-R.

Conclusions: Results suggest that increased hyporesponsiveness to external tactile input as well as increased internally-driven tactile seeking behavior are associated with increased social-communicative impairment and higher levels of restricted and repetitive behaviors in young children with ASD. Tactile defensiveness and hyper-responsiveness, however, seem less related to core ASD symptoms, though preliminary evidence for decreased repetitive behaviors with increased defensiveness was found. Results regarding hyporesponsiveness and sensory seeking behaviors confirm previous findings suggesting that these symptoms may represent the sensory differences most specific to ASD. Future research exploring the neural mechanisms underlying relations between tactile processing and core ASD symptoms is warranted.

134.120 120 Sensory Sensitivities In Children with ASD: A Qualitative Analysis. A. E. Robertson* and D. R. Simmons, *University of Glasgow*

Background:

There is a variety of evidence (e.g. parent reports, first-hand accounts and experimental data) which suggests that individuals with ASD show atypical responses to sensory stimuli. Although the existence of these sensory issues in ASD are consistently reported, there are few qualitative studies which have investigated the effect that sensory stimuli has on the lives of people with ASD (Jones et al., 2003; Dickie et al., 2009). In this study, we formed small discussion groups, which consisted of children with ASD, in order to gain first-hand information about the nature of sensory issues in ASD. We were also interested in the effect that sensory sensitivities had on the ability of individuals with ASD to access certain facilities within their community.

Objectives:

- To uncover details about the nature of the sensory stimuli the children found most problematic or pleasurable
- To determine the impact that these experiences have on the lives of the children in our sample
- To discover whether there are particular qualities associated with some types of sensory stimuli which make them difficult to deal with.

Methods:

10 children with ASD (9-12 years old) were recruited for this study through local schools. Parents were informed about the nature of the study and asked to give consent for their child's participation. Parents were also asked to fill out the Social Communication Questionnaire (Rutter et al., 2003) for their child. Three discussion sessions were held, each taking between 40 and 50 mins to complete. Sessions consisted of a) group discussion, b) practical activities (e.g. guessing smells and listening to sounds) and c) answering questions posed by the first author on an individual/smaller group basis. All groups were audio recorded and later transcribed. The responses to the practical activities were recorded using worksheets.

Results:

Both transcripts and worksheets were used to develop codes for the data. Using the grounded theory approach (Strauss & Corbin, 1990), four main categories were developed from the data: difficult sensory experiences; positive sensory experiences; strong/atypical responses to sensory stimuli and coping mechanisms employed. Our data showed that the children in our sample described both positive (e.g. "I like to feel smooth stuff") and negative (e.g. "I just didn't like the colour or the feeling [of the sweater])" experiences with sensory stimuli. Some participants also described experiencing pain or strong negative emotions in response to some types of sensory stimuli (e.g. "I feel physically sick when I have to have a haircut"). Lastly, the coping mechanisms that the children reported using were varied, with pleasurable sensory experiences being reported as well as avoidance techniques and doing something enjoyable (e.g. [I] jump on a trampoline).

Conclusions:

- The children in our sample reported having difficulties with sensory stimuli, sometimes even experiencing pain. The sample also gave details of pleasurable sensory experiences.
- Aversive sensory stimuli diminished the enjoyment that the children reported for activities they typically enjoyed.

- Strong, unexpected stimuli, beyond the children's control, appeared to be the most problematic.

134.121 121 Intersubjectivity and Understanding Motor Intentions: Evidence From Autism and Williams Syndrome. L. Sparaci*[1], S. Stefanini[2], L. D'Elia[3], G. Rizzolatti[2] and S. Vicari[3], (1)*National Research Council of Italy (CNR)*, (2)*University of Parma*, (3)*Children's Hospital Bambino Gesù*

Background: Many authors have underscored impairment in intention understanding in autistic spectrum disorders (ASD), but only recently has research outlined in ASD the presence of specific impairments in intention understanding at the motor level during the observation of others' actions. Motor intention understanding is an essential component of social cognition, as it allows to be efficiently attuned and to establish reciprocal communicative interactions with others. Two types of motor understanding are enrolled during the observation of others' actions: understanding *what* specific motor act is being performed and understanding *why* an act is being performed. The first offers immediate perceptual information on the observed motor act, while the second foreshadows the other's future actions and contributes to intention understanding. Neurophysiological data have shown that two different mechanisms underlie *what* and *why* comprehension and behavioral studies have highlighted how these two abilities follow specific developmental patterns in typical development (TD). Furthermore two different studies highlighted a specific impairment in *why* understanding in children with high-functioning autism and an impairment in *what* understanding in Williams syndrome (WS), a deficit also affecting social cognition and intention understanding.

Objectives: The main aim of this study was to better our understanding of *what* and *why* comprehension in ASD by comparing performance of younger children with low-functioning autism, children with WS and children with TD matched for mental age on a behavioral task. This would allow to evaluate whether impairment in motor intention understanding during the observation of simple motor acts: (a) proved to be different in ASD and in WS on comparable groups; (b) would present in ASD a similar developmental pattern to the one found in previous studies.

Methods: Participants (17 children with ASD, chronological age 8;7 ± 2.9, mental age 6;6 ± 1.4; 17 children with WS, chronological age 13;7 ± 6.9, mental age 6;6 ± 2.0; 18 children with TD, chronological age 6;2 ± 1.5, mental age 6;6 ± 1.9), were shown pictures depicting hand-object interactions (i.e. touching, grasping to use, grasping to put away) and where asked to indicate *what* action was being performed (i.e. touching or grasping) and *why* it was being performed (i.e. grasping to use or grasping to put away) in presence or in absence of contextual cues.

Results: Results showed (a) differential impairment in ASD and WS, i.e. a significant difference emerged between the ASD and WS groups on error rate when participants were required to indicate *what* action was being performed, WS group performing significantly worse than both ASD and TD groups; (b) differing developmental pattern in ASD, especially considering performance when participants were required to answer *why* the action was being performed in relation to previous studies on TD.

Conclusions: Behavioral data highlight a differential developmental pattern in the ability to understand others' intentions at the level of simple motor actions in ASD, underscoring the importance of the distinction between *what* and *why* comprehension when considering understanding of specific differences in social skills present in ASD and WS.

134.122 122 Stream Segregation In Autism: An Auditory Embedded Figures Task?. L. Bouvet*[1], S. Donnadieu[2], L. Mottron[3] and S. Valdois[1], (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: One of the first enhanced cognitive abilities reported in the autism literature was the superior performance of autistics in the Embedded Figures Task in vision (Shah & Frith, 1983). In audition, stream segregation paradigms can represent a well-suited counterpart to this task. Current cognitive models (Happé & Frith, 2006; Mottron et al., 2006) propose that superior disembodying ability in autistics is related to an enhanced processing of local elements. A local superiority has been observed in the auditory modality, for instance, many studies reported enhanced pitch processing in autism (Bonnel et al., 2003; Jones et al., 2009). However, the relation between superior local processing and more complex auditory cognitive tasks has not yet been investigated.

Objectives: First, we examined the ability of autistic individuals to segregate auditory sequences and to discriminate sound frequencies. Second, we explored the relation between the levels of performance in those two tasks.

Methods: Our preliminary sample included eleven non autistic and eight autistic adults, matched on age. **(1)** *Stream segregation task* (Bey & McAdams, 2002): a target melody of 6 notes was presented alone, then embedded with a distractor

melody. We used four embedded conditions in which the distractor melodies are transposed by 0, 6, 12 or 24 semi-tones. Participants had to decide whether the embedded target melody was similar to the target melody presented alone. **(2)** *Frequency discrimination task* (Bonnel et al., 2003): pitches were presented in pairs and participants had to decide whether they were the same or different. In different pairs, the two sounds differed by 1, 2, 3, or 4% in pitch frequency.

Results: In the segregation task, results indicate that the autistic group performed better than the typical group when there was no transposition of the distractor (0 semitone condition)**,** $F(1,17) = 8.29$, $p < .01$. Moreover, our results indicate that, in this condition, the typical group performed the task at chance level, which was not the case for the autistic group. In the frequency discrimination task, a main effect of increasing difficulty has been observed, $F(3,53) = 25.24$, $p < .001$. There were no significant group effect and no interaction. Then, to explore the link between these tasks, a correlation has been carried out across all participants. This analysis revealed a trend ($r = 0.383$ $p = 0.1$) which suggests that a superior ability to segregate streams might be related to the ability to discriminate frequency.

Conclusions: In this preliminary work, the autistic group presented with a superior ability to detect a simple melody embedded in a more complex auditory sequence. Thus, this task might represent a promising counterpart for the Embedded Figures Task in the auditory modality. We also suggest that this ability may be related to pitch discrimination. More subjects will be tested to validate this finding.

134.124 124 Induction of Contagious Yawning In Children with ASD with Gaze-Contingent Stimulus Display. S. Usui*[1], A. Senju[2], Y. Kikuchi[1], H. Akechi[1], Y. Tojo[3], H. Osanai[4] and T. Hasegawa[1], (1)*The University of Tokyo*, (2)*Birkbeck, University of London*, (3)*Ibaraki University*, (4)*Musashino Higashi Gakuen*

Background: Recent studies suggest that children with ASD are less susceptible to contagious yawning than typically developing children (Senju et al. 2007; Giganti et al. 2009; Helt et al. 2010). Since Provine (1989) reported that yawning eyes are stronger releaser of yawn contagion than yawning mouth, it is possible that the diminished susceptibility to contagious yawning in children with ASD is driven by their atypical fixation on the eyes.

Objectives: To compare the susceptibilities to contagious yawning between the children with ASD and typically developing children under the condition in which they fixated on the yawning eyes.

Methods: Children with ASD (n=28) and typically developing children (n=50) between 6 to 18 years of age observed yawning and control movies, which are presented in pseudorandom order. Participants were instructed to watch the eyes of the face stimuli. The eye-tracker controlled the onset of yawning and control movies, which started only when participants fixated on the eyes for at least 500ms.

Results: Children with ASD and typically developing children yawned equally frequently in both the yawning as well as in the control condition (Mann-Whitney test: $z = 0.08$, $p > 0.10$) and both groups of children yawned more frequently in the yawning condition than in the control condition (Wilcoxon signed-rank test: children with ASD: $z = -2.63$, $p < 0.01$, typically developing children: $z = -3.18$, $p < 0.01$).

Conclusions: Results demonstrated that video images of yawning face induce yawning in children with ASD, when they fixated on the yawning eyes. It was suggested that the absence of contagious yawning in children with ASD, which is reported in the previous studies, may relate to the weaker tendency to spontaneously fixate on other's eyes.

134.125 125 The Relationship Between Motor Demands and Processing Speed In High Functioning Children with Autism Spectrum Disorders. R. Weinblatt*[1], L. Kenworthy[1], M. C. Wills[1], G. L. Wallace[2] and B. Yerys[1], (1)*Children's National Medical Center*, (2)*NIMH*

Background: Wechsler Processing Speed Index scores are impaired in children with autism spectrum disorders (ASD); however, when motor demands are removed and pure speed of processing is assessed using the "Inspection Time" (IT) task there is an advantage for lower functioning children with ASD relative to IQ-matched peers with developmental delays. There are two possible explanations for this discrepancy; one is that the ASD IT advantage only exists for low functioning children with ASD, not the higher functioning children typically studied with the Wechsler Processing Speed Index. Another explanation is that significant speeded motor output demands of the Wechsler Processing Speed subtests, not *mental* speed of processing, are what impairs performance in ASD. We are not aware of any study that has manipulated motor demands within the IT paradigm.

Objectives: Examine IT in a sample of high functioning children with ASD and explore the impact of varying motor demands on processing speed. We predicted intact performance on the

original IT task, but worse performance in the ASD group as motor demands are increased.

Methods: 27 school-aged children (TD, N=9, FSIQ=117.89; ASD, N=18, FSIQ=111.72) were recruited for research studies conducted at Children's National Medical Center. Participants were matched for IQ, age, and gender. Four additional participants were excluded from analyses because their performance was over 2.5 standard deviations from the mean. Three versions of IT that assess processing speed while progressively manipulating the complexity of the required motor response were administered. In the standard IT version, which has no speeded motor demands, children viewed an alien spaceship with antennae that were either the same or different length. They saw the spaceship for a brief time period, ranging from 18ms to 300ms and were given an unlimited amount of time to indicate whether the antennae were same or different lengths. In the low motor demand version, children viewed the spaceship's antennae until they made a simple timed button response. In the high motor demand version, children physically drew their response lines of same and different lengths – this version was thought to imitate standard processing speed measures from IQ tests. Symbol Search (processing speed) was also administered.

Results: Preliminary data analysis from this ongoing study suggests no group differences for accuracy or response time across the three IT tasks (p's>.05), but the ASD group scored lower on Symbol Search compared to the TD group. Significant positive correlations were found between IQ and some of the measures of IT for the ASD group (p<.05).

Conclusions: Finding no differences in IT performance supports a previous study showing no IT advantage in high functioning children with ASD. Furthermore, these preliminary data show that manipulations to increase motor demands did not lead to a decrease in accuracy or response time in the ASD group relative to the TD group, indicating that simple motor response time may be intact in our ASD group. Perhaps the increased complexity of the stimuli in Symbol Search is what interferes with ASD performance, as opposed to its motor demands.

134.126 126 The Relationship Between Pitch Discrimination and Enhanced Local Processing of Melodies In Autism.

A. A. S. Meilleur*[1], C. Paquin-Hodge[1], A. Bertone[2] and L. Mottron[1], (1)*Centre d'excellence en Troubles envahissants du développement de l'Université de Montréal (CETEDUM)*, (2)*Perceptual Neuroscience Laboratory for Autism and Development, CETEDUM*

Background: Enhanced pitch discrimination is one of the most robust findings within the perceptual domain in autism (Bonnel et al. 2003; O'Riordan & Passeti 2006; Heaton et al. 2008; Jones et al. 2009; Bonnel et al. 2010). Autistics have also displayed a local processing bias which may allow for more efficient detection of subtle changes in melodies under conditions where local analysis is advantageous (Mottron et al. 2000 vs. Heaton et al. 2005). These two findings suggest that enhanced auditory perception is manifested at both lower- (pitch) and higher-levels (melody) of processing in autism. However, since they were found independently, the relationship between enhanced pitch and melody discrimination remains unknown.

Objectives: The aim of this study is to investigate the relationship between enhanced pitch discrimination and improved local processing of simple melodies in autism. Furthermore, it will serve as a replication study for the enhanced local processing bias found by Mottron et al. (2000).

Methods: Pitch and melody discrimination abilities in 21 typical and 21 autistic individuals were measured. Autistic participants were diagnosed using DSM, ADI and ADOS standards and were slightly older than their typical counterparts (mean age: AUT=23.19yrs, TYP=20.0yrs; p=0.04); participants were matched on Wechsler IQ (FSIQ range: 81-126). There were two tasks. In a pitch discrimination task, participants were asked to indicate whether two pure tones were the same or different. Discrimination thresholds for each of three frequencies (500Hz, 1000Hz, 1500Hz) were found using a PEST adaptive staircase procedure. In a melody discrimination task investigating local-global processing abilities (based on Mottron et al. 2000), participants were asked to indicate whether two melodies were the same or different. This task included a "different contour" (DC) condition, in which change of a single tone affected the qualities of contour and an "identical contour" (IC) condition, in which this change did not affect the qualities of contour. Successful performance on the IC condition required better local processing abilities.

Results: Autistics had significantly lower pitch discrimination thresholds than typical controls when performance was averaged across frequency conditions (p=0.042). The results found in Mottron et al. (2000) were not replicated. When compared to the typical group, autistics did not display enhanced local processing through an enhanced performance on the IC condition (p=0.305). Nevertheless, group means, where higher scores reflect better performances, were in the expected direction (AUT=33.33>TYP=21.42). Preliminary correlation analyses showed a significant relationship between

enhanced pitch perception and improved performance in the IC condition (AUT:r=-0.492, p=0.038; TYP:r=-0.506, p=0.019). Enhanced pitch perception was related to improved performance on the easier DC condition for typical controls only (r=-0.508, p=0.019).

Conclusions: Results support previous findings of enhanced pitch perception in autistics. However, an enhanced local processing bias during melody processing was not supported. Although statistical power remains limited, it appears that for typical individuals, enhanced discrimination of pitch is associated with a better ability for discriminating between melodies, regardless of the level of difficulty. On the contrary, in autistics, enhanced pitch discrimination abilities were only related to the more difficult, IC melody discrimination condition.

134.127 127 Follow-up Studies of 4- to 6-Year-Old Siblings of Children with Autism Spectrum Disorders: Visual Contrast Sensitivity, Faces Vs. Objects, and Theory of Mind Tasks. M. McIntire*[1], P. Pallett[2], L. J. Carver[1] and K. R. Dobkins[1], (1)*University of California, San Diego*, (2)*Dartmouth College*

Background: In the last few years, we have reported that "High-Risk" infants, who are thought to carry some of the genes associated with Autism Spectrum Disorders because they have an older sibling diagnosed with the disorder, exhibit: 1) atypical sensitivity to luminance (light/dark) vs. chromatic (red/green) contrast at 6-months (McCleery, Allman, Carver & Dobkins, 2007), 2) Atypical event related potentials to pictures of faces vs. objects at 10-months (McCleery, Akshoomoff, Dobkins & Carver, 2009), and 3) Atypical social referencing skills at 18-months (Cornew, Dobkins, Akshoomoff, McCleery & Carver, 2010), compared to Low-Risk control infants (from families without a history of autism). These findings suggest possible early endophenotypes of ASD, reflecting genetically-mediated risk factors for the disorder.

Objectives: In the current study, we followed up these children at 4- to 6-years of age on three main measures to determine whether the endophenotypes were still present by this age: 1) contrast thresholds for luminance (light/dark) vs. chromatic (red/green) stimuli, thought to be mediated by the subcortical Magnocellular (M) and Parvocellular (P) pathways, respectively, 2) discrimination thresholds for face and non-face objects (cars), and 3) A Theory of Mind task, which is a test of social cognition.

Methods: The total sample of 4- to 6-year-olds was 26. Because all the children in this study were tested for ASD at 2- and 3-years and found not to on the autism spectrum, the groups referred to as "High-Risk" and "Low-Risk" as infants are herein referred to as siblings of individuals with ASD (SIBS) and typically developing (TD) controls, respectively. On task (1) children pointed to the side of a monitor that contained either a luminance or chromatic sinusoidal grating (0.27 cycles/degree, 4.2 Hz), and thresholds were measured by varying contrast across trials. On task (2) children were presented with a morphed face or object (with a certain percentage of one face (or object) vs. another, A vs. B) and pointed to which one of two images (A vs. B) the morph looked more similar to. On task (3), children were presented with the questions used to assess their knowledge of the desires, beliefs and emotions of others (Wellman & Liu, 2004).

Results: At the current time, we are not finding significant differences between the SIBS and TD groups on any of our three tasks, however, our sample size is still relatively low. We will also be testing children from our sample who ended up on the spectrum, however, we currently have no children in this category.

Conclusions: Given that there is a true lack of group differences on our measures, we suggest that the early endophenoptypes we observed in the first 18 months of life are no longer present by 4- to 6-years. It may be that the children who do *not* go on to develop ASD (i.e., SIBS) have compensated for and/or recovered from (possibly through intervention or other environmental and/or biological factors) the endophenotype they possessed earlier in life.

134.128 128 Perceptual Differences Between Young Adults with Autism and Their Parents. S. K. Kapp*[1], A. Gantman[2] and E. A. Laugeson[2], (1)*University of California, Los Angeles*, (2)*UCLA Semel Institute for Neuroscience & Human Behavior*

Background: Compared with their parents, children, adolescents, and young adults with autism spectrum disorders (ASD) tend to report more positive perceptions regarding skills and fewer endorsements of impairments. Lack of parent-child agreement has been attributed to the child's lack of self-awareness and poor perspective taking, externalizing behaviors that may stress parents, and possible poor self-control and self-presentation in familiar familial settings. Whatever the case, little is known about the variables that contribute to parent-child perceptual differences of strengths and impairments among young adults with ASD.

Objectives: This study examined the differences in perceptions of social functioning among young adults with ASD and their parents. In order to investigate the accuracy of rater report and

variables that may interfere with parent-child perceptual understanding, possible factors that might influence reporting were also examined.

Methods: Thirty-six young adults with ASD (ages 18 to 24 with a mean composite IQ of 101) and their parents completed a battery of tests to assess psychosocial functioning. Both raters completed the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001), Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004), and Social Skills Rating System (SSRS; Gresham & Elliot, 1990). Additionally, young adults completed the Social Skills Index (SSI; Riggio, 1986) and Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), while parents completed the Social Responsiveness Scale (SRS; Constantino, 2005), Systemizing Quotient - Revised (SQ; Wheelwright et al., 2006), and Vineland Adaptive Behaviors Scale - Second Edition (VABS-2; Sparrow, Balla, & Cicchetti, 2005).

Results: Results reveal that in comparison to parent-report, young adults reported better overall Social Skills (p<.01) and Cooperation (p<.0001) on the SSRS, predicted by better self-reported Self-control on the SSRS (r=.498), Impulse Control on the DERS (r=-.495), and Emotional Control on the SSI (r=.426), and lower parent-reported Self-control on the SSRS (r=.494). Parents reported higher autistic traits on the AQ (p< .0001), predicted by lower parent-reported Social Awareness on the SRS (r=.546) and higher Externalizing behaviors on the SSRS (r=.482), and higher self-reported Social Control on the SSI (r=.399). These predictors were significant for Social Skills, Attention Shifting, and Communication AQ subscales; only the SQ predicted AQ – Imagination discrepancy (r = .410), and both raters agreed on the AQ – Attention to Detail. Young adults reported higher empathy on the EQ (p<.0001), predicted by higher self-reported Social Control (r=.482) and Emotional Sensitivity on the SSI (r=.467), and parent-reported lower Social Awareness on the SRS (r=.502) and higher Externalizing behaviors on the SSRS (r=.347). Composite IQ and adaptive behavior did not relate to parent-child differences.

Conclusions: Results from the current study support the literature suggesting that young adults with ASD appear to exhibit poor self-awareness and may minimize their social impairments. They further reveal that young adults with ASD may exercise less control over their self-presentation and cooperative behaviors in familial surroundings. These findings suggest possible benefits from participating in interventions that improve the young adults' social skills and self-awareness, and that also help parents learn how to better support their child's psychosocial development and self-management.

134.129 129 Auditory Discrimination and Lateralization In ASD. A. Bhatara*[1] and Y. S. Sininger[2], (1)*Université Paris Descartes*, (2)*David Geffen School of Medicine, UCLA*

Background: Numerous studies have shown preserved or enhanced frequency perception in individuals with autism spectrum disorders (ASD; e.g. Bonnel et al., 2003; Heaton, 2003, Järvinen-Pasley & Heaton, 2007). For perception of auditory timing, however, there is evidence of impairment (Alcántara et al., 2003; Groen et al., 2009), and Boucher (2001) proposed that impaired time perception may underlie many of the impairments in autism. Typically, spectral information (as is used in pitch perception) is preferentially processed in the right hemisphere, and more temporally complex information is preferentially processed in the left hemisphere (Zatorre & Gandour, 2008; Zatorre & Belin, 2001). The evidence of differences in abilities between these two domains implies in individuals with ASD
that there is a lateralization difference in auditory processing in these individuals.

Objectives: We used psychophysical methods to investigate discrimination abilities as well as the laterality of processing of spectral vs. temporal information in children aged 10-14 with high-functioning autism or Asperger syndrome and age-matched typical controls.

Methods: Participants were 13 with ASD (2 females, 11 males) and 16 with typical development (TD) (7 females, 9 males). They completed a three-alternative forced-choice adaptive psychoacoustic task in two counterbalanced blocks: one tested frequency discrimination at 500, 1000 and 4000 Hz, and the other tested detection of small gaps of silence within a tone (again, 500, 1000 or 4000 Hz) or broadband noise.

Results: On the frequency task, the ASD group was impaired relative to the TD group. Results of an ANCOVA showed a main effect of group when IQ, scores on a task of auditory working memory, and sex were added to the model as covariates, $F(1, 172) = 13.2$, $p < 0.01$. However, a nonparametric median test of thresholds between groups showed no difference in frequency discrimination, $p = .16$, suggesting that this effect is small. On the gap detection task, the ASD group again showed impaired performance, $F(1, 230) = 21.0$, $p < .001$, along with a laterality difference on the 1000 Hz stimuli in the gap detection task [ear x frequency x group interaction; $F(3, 227) = 6.04$, $p < .001$]. In this case, a median test showed a significant difference between group means, $p < .001$. In addition, in the ASD group there was a subset of 5 poor performers on the gap detection task who performed typically

on the frequency discrimination task, and only one who showed the reverse pattern, implying differential processing abilities between these two tasks.

Conclusions: Though the ASD group showed some impairment on the frequency task as well as the gap detection task, nonparametric tests showed that their impairment on gap detection was greater than the impairment on frequency discrimination. In addition, the ASD group showed abnormal lateralization on gap detection, but there was no evidence of this abnormality in the frequency task. This study provides further evidence of a specific impairment in time perception, possibly due to atypical lateralization of processing.

134.130 130 Inattentional Blindness and Perceptual Capacity In Children with An Autism Spectrum Condition. J. Swettenham*, A. Remington, P. Murphy, M. Feurstein, K. Grim and N. Lavie, *University College London*

Background:

Our research examines selective attention in individuals with an Autism Spectrum Condition (ASC) using the Load Theory of Selective Attention and Cognitive Control (Lavie et al 2004). Perceptual load theory suggests that the perception of irrelevant stimuli depends on the perceptual load of task-relevant processing. At low levels of load, when finite perceptual capacity is not reached, remaining resources 'spill over' and irrelevant stimuli are automatically processed; when perceptual load exhausts capacity, irrelevant stimuli are no longer processed. Our previous results showed that as perceptual load (e.g. number of items in a search task) increases, distractor stimuli continue to be processed in adults with ASC but not in controls, suggesting a higher perceptual capacity in adults with ASC (Remington et al 2009).

The effect of perceptual load on selective attention in typical adults has also been studied using the 'inattentional blindness' paradigm. Cartwright-Finch and Lavie (2007) have shown that the awareness of an unexpected task-irrelevant stimulus is significantly reduced by higher perceptual load (e.g. harder discrimination vs. detection).

Objectives:

This study tested the effects of perceptual load on conscious perception in children with ASC using the 'inattentional blindness' paradigm. Previous data suggesting an increased perceptual capacity in ASC has only been reported for adults.

Methods:

24 children with ASC (mean age 10y 6m) and 38 typically developing children (TD) (mean age 10y, 9m), matched for chronological age and non-verbal ability (Ravens) took part. The procedure was an adaptation of Cartwright-Finch and Lavie (2007). On each of 7 trials participants observed a brief presentation (100ms) of a cross on a computer screen and were asked to judge which line was longest (vertical or horizontal). Half the participants in each group were randomly assigned to a high load condition (difficult discrimination – lines similar in length) and half to a low load condition (easier discrimination). On the 7th trial an unexpected and irrelevant critical stimulus (CS) (a small square) was simultaneously presented, and following the line length judgement participants were asked if they had seen anything else. On a final 8th trial participants were again shown the cross and the CS together, but instructed only to look for the CS.

Results:

All children passed the inclusion criteria (detection of CS on 8th trial and at least 5/7 correct line judgements). TD children showed significantly higher levels of CS detection on the low load vs. the high load condition (X^2 (1) = 8.105, p=.001) as predicted by load theory, in contrast children with ASC showed equally high CS detection for high and low load conditions (X^2 (1) = 0.087, p=.768) and a higher detection rate than the TD group overall (X^2 (1) = 9.851, p=.002)

Conclusions:

Our data demonstrate that conscious awareness of a task-irrelevant stimulus is reduced by increasing perceptual load in TD children but not in children with ASC. The results support the hypothesis that individuals with ASC have a higher perceptual capacity than neurotypical controls. We show this effect for the first time in children with ASC.

134.131 131 Relationship Between Performance on a Visual Search Task and Autistic Symptomology. K. Armstrong*, J. McDonald and G. Iarocci, *Simon Fraser University*

Background: Although not currently included in the DSM IV-TR criteria for diagnosis, there is some evidence that aspects of perception and visual attention are abnormal in ASD. Specifically, people with ASD perform better than typically developing people on visual tasks that require attention to detail, such as visual search tasks (O'Riordan et al., 2001). There is also evidence of a relationship between superior visual search ability and inferior social skills in ASD (Joseph et al., 2009) indicating visual search abilities in ASD may be related to some ASD symptoms more than others. Furthermore,

studies on visual processes have tended to focus on differences between people with ASD and the typical population, rather than on differences within the ASD group itself, which are also important to examine.

Objectives: To investigate whether there is a relationship between visual search performance and social deficits among adolescents with autism. This could help identify a link that could be explored further to understand why social skills are so impaired in autism, if these domains were found to be. This study hypothesizes that superior performance on visual search tasks will be significantly related to social deficits as indexed by parent ratings.

Methods: Forty adolescents with ASD aged 12-17 will be given a conjunctive visual search task in which they are asked to identify whether a target stimulus (red X) is present or absent amongst an array of highly similar stimuli (red T's and green X's) with display sizes consisting of 5, 15 and 25 elements. Their parent will complete the AQ-Adolescent which is a 50-item parent questionnaire measuring the number of autistic traits in five symptom domains (social skills, attention switching, attention to detail, communication and imagination), with higher scores reflecting more autistic-like symptoms.

Results: A regression analysis will be performed with the five AQ domains as factors to determine whether any of the symptom domains of ASD are underlying visual processing performance. The outcome measure will be performance on the conjunctive visual search task measured by slope in milliseconds (the amount of time taken to search per element in the display), with lower scores reflecting better performance. Preliminary results (N=11) revealed a relationship between poorer social skills as measured by the AQ and better performance on the visual search task. They also revealed a relationship between better attention to detail, and poorer imagination, with better performance on the search task.

Conclusions: Consistent with previous research (Joseph et al., 2009), the preliminary analysis of this study suggests that there is a relationship between poorer social skills and better performance on a conjunctive visual search task. It is expected that because this finding is consistent with previous research the results will hold once all forty participants have been tested. These findings indicate that there may be a connection between social processing and perceptual processing in autism, but further research will be conducted to investigate the nature of this relationship.

134.132 132 Visual Motion Processing In Autism Spectrum Disorders: Exploring the Profile of Ability Across a Hierarchy of Tasks. C. Jones*[1], T. Charman[1], J. Swettenham[2], A. J. S. Marsden[3], J. Tregay[3], G. Baird[4], E. Simonoff[5] and F. Happe[5], (1)*Institute of Education*, (2)*University College London*, (3)*UCL Institute of Child Health*, (4)*Guy's Hospital*, (5)*Institute of Psychiatry, KCL*

Background: It has been suggested that atypicalities in low level visual processing contribute to the expression and development of the unusual cognitive and behavioural profile seen in autism spectrum disorders (ASD). However, previous investigations have yielded mixed results. Further, the association between performance on these basic visual motion tasks and motion-based higher-order cognitive tasks is not characterised.

Objectives: (i) To explore the profile of basic visual motion processing abilities in ASD (ii) To explore the association with the Frith-Happé animations, a higher-level task that demands the interpretation of moving, interacting agents in order to understand mental states.

Methods: 89 adolescents with an ASD (mean age = 15 years 6 months (SD = 6 months); mean full-scale IQ = 85.5 (SD = 17.6)) and 52 adolescents without an ASD (mean age =15;6 (6 months); mean full-scale IQ = 88.4 (22.6)) were tested. We investigated performance on three measures of basic visual processing: motion coherence, form-from-motion and biological motion, as well as the Frith-Happé animations.

Results: At the group level, we found no evidence of differences between the two groups on the basic visual motion processing tasks. However, we identified a tail of individuals with ASD (18% of the sample) who had exceptionally poor biological motion processing abilities compared to the non-ASD group, and who were characterised by low IQ. Consistent with previous work, performance on the Frith-Happé animations was impaired in the ASD group. For both groups of participants, performance on the biological motion task uniquely correlated with performance on the Frith-Happé animations.

Conclusions: The data do not suggest a fundamental impairment in basic visual motion processing in adolescents with ASD. Understanding the mental states of motion-defined characters (Frith-Happé animations) uniquely associates with the ability to perceive biological motion. We hypothesise that this association reflects the shared motion-based social-cognitive characteristics of the two tasks, which have a common neural underpinning in the superior temporal sulcus.

134.133 133 Effects of Contingency on Social Visual Engagement In Infants at High- and Low-Risk for ASD. P. Lewis*[1], J. Emmons-Garzarek[2], J. B. Northrup[3], J.

Paredes[4], W. Jones[1] and A. Klin[1], (1)*Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*, (2)*Yale University School of Medicine*, (3)*University of Pittsburgh*, (4)*Yale University Child Study Center*

Background: Typically-developing babies, from within the first days of life, engage preferentially with social aspects of the surrounding environment. Examples include their ability to distinguish adults looking at them from those who are not, as well as their preferential fixation, from at least 2 months of age, to the eyes of others. An important goal of current research in autism should be to capitalize on these and other early-emerging mechanisms of sociability in order to trace the earliest detectable deviations from normative development. This is a key step in identifying autism at the earliest possible time point.

Objectives: This experiment is intended to: (1) test the hypothesis that visual scanning behavior in typically-developing children will evidence discrimination between contingent and non-contingent interactions within the first six months of life and (2) to test whether this discrimination is evident in infants at high risk for developing autism.

Methods: Participants were enrolled in a longitudinal prospective study of infant siblings of children with autism spectrum disorders (ASD). Infants at high risk for ASD (HR-ASD) had a full sibling with confirmed diagnosis of ASD, whereas infants at low-risk (LR-TD) had no sibling with, or family history of, ASD. Between 2 and 6 months of age, we compared visual scanning for 10 HR-ASD siblings and 10 LR-TD infants in two conditions: watching videotaped actresses (Condition 1) and having live interactions with their own mothers (Condition 2). We disambiguated the factors impacting differences between the two conditions (identity of adult [stranger/mother] versus presence of contingency [videotaped/live]) by adding a third condition: a pre-recorded, and hence non-contingent, video of the infant's mother (Condition 3). Eye-tracking data were collected during each of the three conditions. During collection of eye-tracking data, simultaneous video recordings captured the field-of-view of each participant (thus baby's view showed mom, while mom's view showed baby). Field-of-view recordings were coded into four regions (eyes, mouth, body and object). The eye-tracking data were then analyzed for time spent fixating on each of the four regions-of-interest.

Results: Preliminary results show that typically-developing infants show increased overall looking during contingent interaction with mothers (Condition 2) as compared with their responses to pre-recorded videos of actresses (Condition 1). Additionally, significant decreases in frequency of saccades, in offscreen fixations, and in fixations on body regions were noted across the two conditions. Strong positive trends were observed for increases in both eye- and mouth-looking. Additionally, mouth fixation increased when viewing non-contingent, pre-recorded clips of their own mothers (Condition 3). Preliminary results indicate increased variability in looking patterns for our HR-ASD sample.

Conclusions: Preliminary results suggest that typically-developing infants respond differentially to live interactions than pre-recorded videos. The significant decreases in saccades and offscreen fixations, in addition to increases in overall fixation time suggest that infants are more visually engaged during contingent interactions than when viewing pre-recorded movies. This experimental paradigm is likely to potentiate between-group differences relative to infants at-risk for ASD, thus increasing its utility in the detection of early deviations from the course of normative social visual engagement.

134.134 134 Children with Autism Show Enhanced Proprioceptive-Guided Motor Learning. M. E. Ranta*[1] and S. H. Mostofsky[2], (1)*Kennedy Krieger Institute*, (2)*Johns Hopkins School of Medicine, Kennedy Krieger Institute*

Background: Difficulty with performance of skilled motor gestures is commonly reported in autism. Previous studies of children with autism have demonstrated anomalous patterns of motor sequence learning on visually-guided motor tasks (e.g., serial reaction time, rotary pursuit) while a recent study of controlled reaching in a varying force field found an increased reliance on proprioceptive feedback in children with autism (Mostofsky et al., 2000, Larson and Mostofsky, 2008, Haswell et al., 2009).

Objectives: To use a blindfolded maze tracing task to examine whether children with autism show atypical proprioceptive-guided motor sequence learning and how that motor performance is related to core social/communicative impairment in autism.

Methods: 22 children with autism (5 female) and 23 typically developing (TD) children (5 female), 8-13 years, completed a task in which they used a stylus pen to trace a continuous closed-loop maze composed of linear segments while blindfolded. The task consisted of 4 blocks of trials, with 4 trials in each block. During blocks 1, 2, and 4 subjects traced a primary maze with eight decision points at which they could either make a correct turn or an error into a dead end; during

block 3 subjects traced an "interference maze" that was a mirror image of the primary maze. After completing the task, children were shown a picture of 5 mazes and were asked to identify the primary maze, first using solely visual feedback, then with the addition of proprioceptive feedback (when allowed to trace the pictures with their hands). Learning was assessed based on the number of loops completed in each trial and success in maze identification. Associations between performance and degree of autism symptom severity/social impairment were examined using the Autism Diagnostic Observation Schedule (ADOS) and the Social Responsiveness Scale (SRS) parent report.

Results: Children with ASD showed no impairment in maze learning compared to TD children: (RM)ANOVA revealed no effect of diagnosis for number of loops competed across trials or blocks (all $F<1.314$, $p>0.256$). Furthermore, for children with autism, we found positive correlations between average number of loops completed per trial and ADOS Total score, ADOS Social Interaction score and SRS T-score, such that greater autism symptom severity/social impairment was associated with *better* performance ($R=0.443$,$p=0.039$; $R=0.542$,$p=0.009$; $R=0.540$,$p=0.012$). Children with autism also showed an intriguing, although non-significant increase in successful maze identification when using proprioceptive in addition to visual feedback: the increase in successful identification was 40% for the autism group versus 15% for TD. Additionally, at a trend level, those children who benefitted from proprioceptive feedback had a higher average ADOS Social Interaction score (*greater* social impairment) than those who did not ($F=2.080$, $p=0.092$).

Conclusions: These findings suggest that children with autism may be excessively dependent on proprioceptive feedback for motor learning. Given that social and communicative gestures are often learned through visual imitation, these findings have important implications for understanding the neural basis of autism-associated impairments in motor, social and communicative development and for guiding therapies targeted at improving social and communicative skills in children with autism.

134.135 135 The Influence of Perceived Gaze Cues on Elementary Sound Perception In Individuals with Autism. J. I. Borjon*[1], S. V. Shepherd[2], 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: Prior research has shown that our brains are pervasively social and multisensory. Remarkably, perceived social cues such as eye gaze influence even basic sensory sound perception in typical adults: if a brief burst of sound is presented immediately after a face displaying averted gaze, typical adults systematically, and erroneously, perceive a shift in the direction of the sound's location. The shift in perception is in accordance with the direction of the perceived gaze cue: left-looking eyes bias listeners to perceive sounds as if coming from the left, while right-looking eyes bias perception to the right. This shift in sound localization also occurs when subjects are cued with arrows. At the neural level, human lesion studies demonstrated distinct neural pathways for the initial processing of arrows and gaze cues, while fMRI studies reported only subtle differences between networks cued by gaze and arrows. Thus, the extent to which the observed phenomenon is uniquely social is unknown. Past research with individuals with autism has documented atypical gaze cueing and impaired gaze following but intact following of non-social directional cues.

Objectives: The current study aims to use a psychophysical paradigm to explore the extent to which visually perceived social and non-social cues influence elementary sound perception in individuals with autism and matched controls.

Methods: Fifteen individuals with autism and fifteen age-, IQ-, and handedness-matched controls volunteered for the study. The psychophysical experiment was based on a variant of the Posner attention-cuing paradigm. A directionally-tuned broadband noise stimulus of brief duration was delivered via headphones to the participant's ears. The sound stimulus was presented 300ms after the presentation of a visual cue: a face with neutral affect gazing 30^{o} to the left or right; a double-headed arrow pointing to the left or right; or a directionally-neutral fixation cross. Participants were instructed to gaze steadily towards the screen and, as quickly and accurately as possible, indicate by button press whether the sound came from their left or right. At this time, the visual cue disappeared. Reaction time and performance data were collected and analyzed.

Results: While ASD subjects consistently fail to engage in joint attention in real-world settings, past laboratory studies of gaze following in ASD have reported mixed results. We quantify both the average magnitude and intersubject variability in perceptual shift to social and non-social cueing, examining whether ASD participants differ systematically from neurotypical subjects. Preliminary data suggest that ASD participants show higher variability in individual response to the task.

Conclusions: Preliminary results indicate a high degree of variability among individuals with autism in their responses to the performed multisensory perception task. This heterogeneity is consistent with the inherent variability exhibited across the autism spectrum. By considering both intergroup and intragroup differences in sensitivity to social signals, we will be able to investigate the mechanisms of such heterogeneity. As autism tends to have wide-ranging effects on individual function, the variety of individual task performance implicates a myriad of neural coping strategies used by the brain to mediate perception and interactions in the world.

134.136 136 Imitation In Young Children with Autism Spectrum Disorders. C. Wong*, *UNC Chapel Hill*

Background:

Young children with autism spectrum disorders (ASD) have difficulty imitating other people's actions. Impairments in imitation ability could negatively affect children's social-cognitive development, a specific area of concern for children with autism. Research is ongoing to determine the mechanism or specific deficit underlying imitation performance in children with ASD.

Objectives:

The objective of this study was to explore child characteristics and behaviors that may influence children's performance on imitation tasks.

Methods:

Fifty-five children were recruited from a suburban special-education public preschool. In this study, participants were analyzed in two groups: children with a clinical diagnosis of ASD (N=27) and children with other developmental delays (N=28). The children ranged in age from three to five years old and their mental ages ranged from 18 to 59 months. Child characteristics and demographics were not significantly different between the two groups. In this study, children were assessed using nine items from the Imitation Battery (Rogers, Hepburn, Stackhouse, & Wehner, 2003), which included 3 manual acts, 3 actions on objects, and 3 oral-facial movements. Additionally, children were also assessed on measures of joint attention and symbolic play.

Results:

Consistent with existing research, results indicate that compared to children with other developmental delays, children with autism completed fewer imitation tasks correctly, especially in imitating oral-facial tasks. However, a closer examination of child characteristics using analysis of variance procedures showed significant main effects of developmental scores as well as a significant interaction effect between disability group and developmental scores. While children with higher mental and language ages generally completed more imitation tasks successfully than children with lower developmental abilities, children with ASD showed a much greater disparity. Whereas children with higher developmental scores in both groups performed at similar levels, children with lower developmental scores in the ASD group failed significantly more imitation tasks than those children with other developmental delays. In addition, while preliminary results did not find significant groups differences in reversal errors and errors of style, results did indicate that children with ASD were less engaged with the experimenter and displayed fewer coordinated joint looks than the children with other developmental delays during the imitation battery.

Conclusions:

Findings suggest that children with ASD may need more guidance in imitating oral-facial tasks than non-meaningful manual and object tasks when compared to children with other developmental delays. Additionally, interventionists may need to specifically target imitation skills for children with ASD with lower mental ages. Further investigation is needed to examine imitation ability in more natural settings.

134.137 137 The Balance of Intended and Spontaneous Modes of Movement Control Is Atypical In Young Children with ASD. R. W. Isenhower* and E. B. Torres, *Rutgers University*

Background:

There has been a recent focus on the importance of understanding movement abnormalities in Autism Spectrum Disorder (ASD) (Fournier, Hass, Naik, Lodha, & Cauraugh, 2010; Mostofsky et al., 2009; Dowell, Mahone, & Mostofsky, 2009). In natural movements of daily life, normal adults modulate transitions between intended (toward specific goals) and spontaneous (not explicitly goal-related) movements. These modes normally coexist in good balance. An unexplored question is whether this balance is disrupted in ASD. Here we asked if the spatio-temporal variability of movement trajectories under these two modes is different in children with ASD. The answer could provide insight into specific sensory-motor impairments in ASD.

Objectives:

To quantify differences in the variability of spatiotemporal parameters from trajectories of natural movements performed in the classroom environment under intended and spontaneous modes of control.

Methods:

Children enrolled at the Douglass Developmental Disabilities Center (3-4 years of age) participated in this ongoing study, with 142 trials from TD children and 56 trials from children with ASD analyzed. Match-to-sample (e.g., color or shape) tasks common to the classroom curricula were used. Mousetracker software (Freeman & Ambady, 2010) displayed the tasks on a 21" touch-screen LCD monitor. On each trial the child's task was to match (touch) the correct stimulus to one of two target locations on the touch-screen, initiating the movement by touching the starting location on the screen. Motion sensors were attached to the child's hand, forearm, forehead, and trunk (Polhemus LIBERTY, 240Hz). Each session was videotaped (HD, 60Hz). Screen touches, video, and sensor data were synchronized and time stamped to determine intended movements towards the goal(s), correct responses, and to distinguish spontaneous movements in the continuous flow of motion.

Results:

Temporal aspects of intended movements (goal-directed movements toward the screen) in TD children, but not in children with ASD, were significantly different than the temporal aspects of their spontaneous movements. Specifically, the percentage of time to reach peak velocity and the percentage of time to reach maximal trajectory curvature were significantly different between the two modes of control for TD children but not for children with ASD. Furthermore, the control of spontaneous movements was significantly different between groups according to a metric –proven effective in adults— that quantifies deficits in sensory-motor transformations (Torres et al, 2010). In contrast, spatial parameters (related to hand trajectory length and curvature) were not distinguishable between the two modes of control for either group.

Conclusions:

The variability of the temporal dynamics of the movement trajectories in TD children is revealing of the mode under which each movement was performed. In contrast, the temporal dynamics of ASD trajectories cannot distinguish whether motions were intended or spontaneous. Our results suggest an imbalance between intended and spontaneous modes of control in children with ASD with a preponderance of movements of the type under study occurring in the spontaneous mode. Additionally, our objective metric suggests that the sensory-motor transformations that sub serve these two modes of control are likely atypical in children with ASD.

134.138 138 Exploring Intermodal Perception In Children with Asperger Syndrome Using a Preferential Looking Task.

S. M. Brown*[1], J. M. Bebko[1], L. Saleh[1], J. H. Schroeder[2] and J. A. Weiss[1], (1)*York University*, (2)*York University, Toronto*

Background: Intermodal perception (IMP) links information from more than one sensory modality so that multisensory information is perceived as a unitary event. In the amodal processing of speech stimuli, although the auditory and visual modalities are separate and discrete, their information is automatically extracted as one congruent event. Current research is inconsistent with regards to the IMP abilities of children with autism, although there is emerging research that indicates that there may be a linguistic-specific impairment in IMP in autism. Research examining these abilities in children with Asperger Syndrome (AS) is limited. Based on the emerging evidence of linguistic-specific IMP difficulties in children with autism, an examination of the intermodal perception of speech stimuli in individuals with AS would be beneficial due to the differences in language abilities between AS and autism.

Objectives: To provide insight into the intermodal perception abilities of children with AS, who diagnostically will have no language delay, and how these abilities may differ from children with autism, typical development and intellectual disabilities using a preferential looking task.

Methods: An unanalyzed AS group consisting of 18 children (*M* = 12.61 years, *SD* = 2.92) will be compared to three previously examined groups (autism, intellectually disabled [ID], typically developing [TD]) (Weiss, 2007, unpublished dissertation). Three criteria differentiated the AS group from the autism group: no significant language delay, limited or no problems in current language abilities, and no cognitive impairments. The authors presented the participants with non-speech, natural vowel (/i/, /a/), and fundamental tones that represented the vowels (3000 Hz for /i/, 300 Hz for /a/) conditions. The two videos for each condition were shown side by side on a split screen and the auditory sound matched only one of the two screens. Looking behaviours were coded using The Noldus Observer software.

Results: The duration of participants' eye gaze at each the screens is coded for each trial to determine the percentage of

looking time at the matching and non-matching screens. Data analysis is ongoing and will include comparing looking times for the AS group and the three comparison groups. Preliminary results based on Weiss (2007) indicate that there were no differences between children with autism, children with ID, and TD children in their preferential looking during the natural vowel condition. However, unlike their TD and ID counterparts, children with autism did not display preferential looking during the vowel tone condition after being primed by the natural-vowel conditions.

Conclusions: If the AS group shows looking patterns different from the autism group it would have two implications: First, it could suggest that the difficulties in the intermodal processing of linguistic stimuli found in individuals with autism may be linked to language impairments or delays, which are not present in AS samples. Second, future research could further examine the possible utility of a speech-based preferential looking task in early identification of autism-specific markers.

134.139 139 Spatial Navigation In Children with ASD: An Examination of Search Strategy Sub-Types. N. M. Ing*, M. Robberts, S. Malcolm-Smith and K. Thomas, *University of Cape Town*

Background: The neuropsychology of Autism Spectrum Disorder (ASD) is a field featuring lively debate. There have been various inconsistent findings regarding the spatial cognitive abilities of children with ASD; for instance, the question of whether autistic children have impaired, intact, or superior spatial cognitive abilities remains unanswered. Furthermore, few studies have focused specifically on spatial navigation in ASD; of those few, all have featured only high-functioning autistic children and/or those with a diagnosis of Asperger's syndrome (AS), thus limiting their ability to generalize to the entire population of ASD children. Additionally, no study has specifically examined the search strategies ASD children use during navigation.

Objectives: This study aimed to describe the types of navigational search strategies used by autistic children across the spectrum, with the goal of adding to the literature on purported superior spatial cognitive abilities in ASD. The study also aimed to include not only high-functioning autism (HFA) and AS children but also low-functioning autism (LFA) and pervasive developmental disorder not-otherwise-specified (PDD-NOS) children to ensure the sample was representative of children from across the ASD spectrum.

Methods: This study used a computer-based navigation task that allows examination of individual search strategies.

Participants were recruited into six age- and sex-matched groups (*n* = 15 per group): LFA, HFA, AS, PDD-NOS, DSM-defined mild mental retardation (MR), and typically developing (TD). Following Kallai et al. (2005), search strategies were classified as one of Visual Scan, Thigmotaxis, Circling, or Enfilading. Data analyses examined whether there were differences in the types of strategies used by (a) children across the autism spectrum, and (b) ASD children compared to TD and MR children.

Results: Previous studies of TD individuals show that Visual Scan strategies tend to be used by those who perform most efficiently on the task. The results showed that there was no significant difference between the autism groups and their IQ-matched controls. The PDD-NOS, HFA, AS, and TD children used the Visual Scanning strategy most frequently, whereas LFA and MH children tended to use the relatively inefficient Thigmotaxis strategy.

Conclusions: These results suggest that children diagnosed as LFA or MH might take somewhat longer to find an efficient route to a desired object in an unfamiliar environment, and might pay less attention to visual cues as they encounter unfamiliar environments. This finding points to a possible area of intervention for children with autism who struggle to adapt to new environments.

134.140 140 Inducing Change In Visual Scanning of Natural Scenes In Infants with ASD by Manipulating Physical Contingencies. 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, we found that two-year-olds with autism did not orient towards point-light displays of biological motion but attended instead to non-social, physical contingencies—contingencies that were disregarded by control children. In follow-up studies, we also found that toddlers with ASD varied their fixation on the faces of others as a function of the physical contingencies embedded therein. Finally, we also found that detection of audiovisual synchrony was not greatly influenced by social context in infants with ASD, although social context did alter preferential viewing patterns in typically-developing infants.

Objectives: The goal of the current project is to induce changes in visual scanning of naturalistic social scenes in infants with ASD by experimentally manipulating audiovisual synchrony

embedded in those scenes, and to then quantify those behavioral changes in visual scanning as predictors of dimensional outcome.

Methods: Infants with ASD and typically-developing infants (TD), ages 12-24 months, watched a series of clips of caregivers interacting with an infant against static backgrounds showing settings familiar to the infant. In addition to the caregiver, we introduced a time-varying, moving object into the room that was dynamically synchronized with the caregiver's speech. Specifically, we co-varied the object's rotational motions, rocking motions, 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 measure.

Results: Preliminary results show that when the non-social object is not fully synchronous, infants with ASD look more at the synchronous face. However, as the synchrony of the non-social object is increased, infants with ASD look more towards the object, diminishing their attention to the face. TD infants, on the other hand, preferentially attend to the socially relevant stimuli and spend more time looking at the face rather than the object, even when the motion of the object is fully synchronous to the audio of the utterance. In addition, preliminary results show that those infants with ASD who look more towards faces in the scenes (even when the object is fully synchronous) exhibit less impaired social behavior as measured by the ADOS 1 Social Affect Score.

Conclusions: The present study suggests that while TD infants preferentially attend to socially relevant stimuli, even in the presence of competing non-social, physical contingencies, such contingencies can be highly distracting to infants with ASD, particularly in naturalistic settings. These findings indicate an early interruption of typical social experience and suggest one mechanism by which infants with ASD may not attend to important social cues in their environment. By inducing change in visual scanning to measure individual sensitivity to non-social contingencies, we may also learn how to develop effective early interventions for infants with ASD by either (1) minimizing the impact of distracting environmental cues, or (2) using cues that may be innately attention-getting to infants with ASD to foster socially relevant learning.

134.141 141 Atypical Patterns of Motor Variability and Error Correction In ASD Individual Performing Repetitions of Complex Movements. E. B. Torres*, *Rutgers University*

Background: One element of the behavioral triad used to diagnose Autism Spectrum Disorder (ASD) is the presence of restricted and repetitive behaviors (APA, 2000). In experimental settings, during the repetition of intended movements, natural movement variability has been shown to contribute to error correction, which is important for the adjustment of upcoming movements (van Beers, 2010). Less is known about the variability of spontaneous, non-goal directed movements. Our goal is to analyze movement variability and transitions between intended and spontaneous movements during repetitive behaviors in ASD. We compared the movement variability of a martial arts expert, 5 novices and 1 individual with ASD as they performed a complex white belt routine that alternated between segments under intended control (overtly attended to) and simultaneous segments of spontaneous motion (covertly attended to). First we established the "ground truth" (expert performance) as a basis for comparison, then we determined differences between normal controls and the ASD individual.

Objectives: We seek to determine if the ASD system uses movement variability in the same way as the typically-developing system does to correct errors during repetitions of the same movement.

Methods: The white belt routine (Jab-Cross-Hook-Uppercut) was performed at 2 different speeds (normal-to-slow and fast). Full-body movements were recorded using 16 electro-magnetic sensors (240 HZ each) attached to the head, to various points of the trunk, arms, and legs (Motion Monitor, Polhemus LIBERTY) and 2 video cameras (HD, 60Hz) for further video frame analysis. The sensors output the rotations and positional displacements in physical space of each point of the body at the sensor locations. Each one of the 4 subroutines was first performed individually (10 trials each speed) and then in combination (10 trials each speed).

Results: Expert performance revealed that for simultaneous control of two or more limbs, the system funnels attention to one limb at a time. As the trajectory of the overtly attended limb unfolded, the trajectory of the other limb—which transitioned to another subroutine—was covertly attended to. This was evidenced by the different effects of speed on the movement variability of the two segment types. Segments that were overtly tended to maintained low variability and conserved the physical curve; whereas, segments that were simultaneously performed and covertly attended to qualitatively changed their trajectories with speed. Trial-to-trial variability revealed that the expert system used error from previous movements to correct future movements. Relative to the expert, the normal novices maintained the same trend. The ASD individual on the other

hand, performed differently. Variability in this case was lowered by locking degrees of freedom (DOF) at the expense of atypically large variability in the remaining DOF. Unlike the typical controls, speed had a large effect on the intended trajectories of the ASD individual, which did not conserve the physical path of the movements from the segments that required overt attention.

Conclusions: During error correction of consecutive trials, the ASD system uses movement variability differently than the normal system. These analyses may be useful to quantify aspects of repetitive behavior in ASD.

134.142 142 Two Ends of Coinciding Continuums: Visuospatial Processing Style and Social Functioning In Autism and Down Syndrome. E. S. Kuschner*[1], L. Bennetto[2] and S. L. Hyman[3], (1)*Children's National Medical Center*, (2)*University of Rochester*, (3)*University of Rochester School of Medicine*

Background:

Nonverbal perceptual tasks that involve disembedding are often an area of strength for children with autism spectrum disorders (ASDs). This strength, described as a detail-focused processing style, has been demonstrated in preschoolers with ASDs (e.g., Pellicano et al., 2010). The primacy of this cognitive style has led to examinations of its impact on core deficit domains in autism, such as social functioning. Findings have been inconsistent in autism (e.g., Pellicano et al., 2006; Teunisse et al., 2001), but there remains a foundation for a relationship between visuospatial processing style and social functioning in the literature on field independence/dependence in typical development (e.g., Saracho, 1995), thus warranting further research.

Objectives:

This study examined social functioning in children predicted to have contrasting visuospatial processing styles: children with ASDs and children with Down syndrome (DS).

Methods:

Participants included 18 children with ASDs, 18 children with DS, and 18 typically developing controls (ASD/DS=4-9 years; Controls=2.5-5.5 years). Groups were matched as closely as possible on nonverbal IQ and receptive vocabulary age equivalents (~4.5-5 years). Statistical controls addressed complicated matching. Diagnoses were confirmed or ruled out using the ADOS, ADI-R, and clinical judgment. Visuospatial processing style was measured with the Preschool Embedded Figures Test (PEFT; Coates, 1972). Social functioning was measured with observation based coding of ADOS social initiations and standardized parent-report measures, including the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) and the Vineland Adaptive Behavior Scales, 2nd Edition (Sparrow et al., 2005).

Results:

Results confirmed contrasting visuospatial processing styles. Children with ASDs were significantly more accurate on the PEFT than the children with DS (p<.0001, Cohen's d=1.4), while controls were marginally more accurate than the children with DS (p<.06, d=.7) and marginally less accurate than the children with ASDs (p<.06, d=.6). Results also highlighted generally contrasting profiles of social functioning. Children with ASDs, compared to children with DS, showed greater impairment in broad social functioning on the SRS Total Score (p<.001, d=2.3) and Vineland-II Socialization domain (p<.005, d=.9). More fine-grained observational coding indicated that although the children with DS made more declarative initiations than the children with ASDs, this difference was not significant (p>.05, d=.4). Preliminary correlations suggested that a more detail-focused style, (i.e., higher PEFT accuracy), is related to greater social impairment on the SRS Total Score (r=.28, p<.01) for all children. Although the direction of correlations differed for the children with ASDs (r=.18) and DS (r=-.14), the correlations were not statistically significant different via Fisher Z comparison.

Conclusions:

Findings in the present study suggest that children with ASDs and children with DS fall at extreme ends of a visuospatial processing style continuum that may coincide with variability in social functioning. The more detail-focused children with ASDs showed greater social impairment than the more globally-focused children with DS. These patterns parallel individual differences described for typically developing children with field independent/dependent cognitive styles. Larger samples with wide variability in visuospatial processing style and social functioning will be needed to test theoretical models of relationship among these domains.

134.143 143 Equivalent Visual Sensitivity to Human, Animal and Object Motion In Children with Autism Spectrum Disorder. S. Peters*[1], M. D. Kaiser[2], Z. Fermano[1], D. R. Sugrue[2] and M. Shiffrar[1], (1)*Rutgers University*, (2)*Yale University*

Background: Relative to typically developing (TD) children, those with Autism Spectrum Disorder (ASD) exhibit atypical

processing of human motion. For example, observers with ASD demonstrate equivalent visual sensitivity to point-light depictions of human motion and object motion while typical observers show enhanced sensitivity to human motion. This difference could indicate that observers with ASD show atypical visual processing of (1) human motion, per se, or (2) all biological motions, in general.

Objectives: We sought to determine whether ASD is associated with atypical visual sensitivity to human movement, in specific, or to human and non-human animal movements, in general. To that end, we compared visual sensitivity to point-light displays of human, dog, and tractor motion in matched observers with and without ASD.

Methods: Fifteen children with ASD and 18 TD children participated in the study. Groups were matched on chronological age (ASD=12.08; TD=11.33 years) and Performance IQ (ASD = 98; TD =103). Participants performed a psychophysical coherent motion detection task with masked point-light displays of human, dog, and tractor motion. On each trial, participants viewed a 5-second movie depicting point-lights that were either attached to a locomoting person, dog, or tractor (and thus moved coherently) or were scrambled such that no coherent motion was present. Observers reported with a Yes/No button-press whether the point-lights were "stuck" to a person (or dog or tractor, depending on the block). Participants completed a practice session with unmasked displays prior to the experimental task.

Results: Visual sensitivities (d-prime) to the presence of coherent human, dog, and tractor motion were calculated for each participant with each stimulus type. The TD and ASD groups performed above chance in all conditions (all *p*s < .005). A group by condition analysis revealed that detection performance across the ASD and TD groups differed for human ($t(21.682) = -3.339$, $p = .003$) (degrees of freedom adjusted for unequal group variance) and dog ($t(31) = -3.269$, $p = .003$) motion but not tractor ($t(31) = -1.661$, $p = .107$) motion. TD children exhibited enhanced detection sensitivity to coherent human ($t(17) = 3.874$, $p = .001$) and dog ($t(17) = 2.555$, $p = .020$) motions relative to tractor motion, and equivalent sensitivity, within the biological domain, to human and dog motion ($t(17) = 1.272$, $p = .220$). Conversely, children with ASD showed no significant differences in detection sensitivity across the three motion types (all *p*s > .287).

Conclusions: The results of this study suggest that observers with ASD are equally sensitive to biological and non-biological motion whereas TD observers have visual systems that are tuned to biological motion. The results characterize the nature of atypical processing of biological motion in children with ASD and indicate that this disruption does not appear to be specific to human motion. The typical visual system becomes increasingly tuned to human versus animal motion into adulthood. Insufficient tuning of the visual system for the detection of the actions of other people may derail social processing in observers with ASD.

134.144 144 Visual Search In Low Risk Infants and In the Infant Siblings of Children with Autism: The Role of Fixation Duration. E. Goldknopf*[1], K. Gillespie-Lynch[2], A. Marroquín[1], M. Sigman[1], T. Hutman[3] and S. P. Johnson[2], (1)*University of California, Los Angeles*, (2)*UCLA*, (3)*UCLA Center for Autism Research and Treatment*

Background: Children and adults show enhanced visual search (orienting to an unusual item in an array; e.g., O'Riordan et al., 2001). During visual search, children with autism had both faster reaction times and shorter fixation durations (Joseph et al., 2009). Longer fixation durations in infancy predict poorer cognitive performance in infancy and childhood (Colombo, 1995).

While typically developing infants have been found to orient to unusual elements in an array (Adler & Orprecio, 2006; Amso & Johnson, 2006), visual search has not been studied in the infant siblings of children with autism.

Objectives: To examine whether infant siblings have enhanced visual search relative to low-risk infants, and to explore the role of fixation duration. The study may help find early signs of autism and improve our understanding of the broader autism phenotype.

Methods: We have tested 56 infant siblings (16 6-month-olds, 13 12-month-olds, 17 18-month-olds, and 10 24-month-olds) and 59 low-risk infants (16 6-month-olds, 18 12-month-olds, 17 18-month-olds, and 8 24-month-olds).

Each stimulus consisted of a "plus" sign target among "L" distractors. In the Random condition, 7, 13, or 26 distractors were distributed randomly around the screen; in the Circle condition, 4, 7 or 13 distractors were distributed in a circle. All Random condition stimuli were presented before Circle condition stimuli.

Before each 2 sec stimulus, a central attention-getter was presented. Infants' gaze was measured with a Tobii eye-tracker; data from trials lacking an adequate central fixation were excluded. ANOVAs, univariate tests, and correlations

were conducted on average fixation duration in various conditions, accuracy (number of targets found), and time-to-target (time before the infant fixated the target). Infant siblings also received additional developmental tests.

Results: Across risk groups, accuracy decreased with increasing array size in Random ($p < .01$) and Circle ($p < .001$) conditions. Averaged over array size, accuracy increased with age in Random ($p < .001$) and Circle ($p < .05$) conditions. Contrary to predictions, time-to-target for Random arrays was longer in infant siblings than in controls ($p < .01$).

In both Random and Circle conditions, infant siblings had longer average fixation durations than low-risk infants (p. < .05). In the infant siblings, average fixation duration was negatively correlated with a measure of cognitive development (Mullen Composite *t*-scores) for both Random ($r = -.368$, $p < .05$, $N = 31$) and Circle ($r = -.628$, $p < .01$, $N = 26$) conditions. Average fixation duration was positively correlated with ADOS algorithm scores (summed across domains) in both Random ($r = .532$, $p < .05$, $N = 14$) and Circle ($r = .695$, $p < .05$, $N = 10$) conditions.

Conclusions: These preliminary results suggest that infant siblings are not better at visual search than low-risk infants; enhanced visual search may be specific to autism rather than to the broader autism phenotype or may not be evident in implicit visual search paradigms. The results support Colombo's hypothesis that longer average looking times may be associated with poorer cognitive performance.

134.145 145 Associations of Dyspraxia with Impaired Adaptive Behavior In Children with Autism. J. Foster*[1], M. M. Talley[2] and S. H. Mostofsky[3], (1), (2)*Kennedy Krieger Institute*, (3)*Johns Hopkins School of Medicine, Kennedy Krieger Institute*

Background:

Impaired performance of skilled movements, reflective of developmental dyspraxia, is a consistent finding in children with Autism Spectrum Disorders (ASD) (Mostofsky et al., 2006; Dzuik et al., 2007; Dewey et al., 2007; Dowell et al., 2009). Furthermore, dyspraxia in autism has been found to be robustly correlated with measures of the core social and communicative impairments that define the disorder (Dziuk et al., 2007; Dowell et al. 2009). Development of skilled movements is also critical in a child's ability to function effectively and independently in their daily environment. This "adaptive" functioning has been found to be impaired in autism; children with ASD have been found to show poorer daily living skills than their typically developing peers and than children with other developmental disorders (Kenworthy et al., 2009).

Objectives:

To examine whether impaired adaptive functioning is associated with dyspraxia in children with ASD, by examining adaptive behavior ratings and praxis performance for children with ASD and typically developing (TD) children.

Methods:

Participants included 26 children, ages 8-12 years: 14 with ASD (2 female) and 12 TD children (4 female). Groups were matched on age, gender, IQ, race, and handedness. Praxis was measured using the Florida Apraxia Battery, modified for children (Mostofsky et al., 2006) which examines for errors in performance of gestures to command, to imitation, and with tool use; total percent correct served as the main variable of interest. Adaptive behavior was measured using the Adaptive Behavior Assessment System, Second Edition (ABAS-II); variables of interest included subscales for Conceptual, Social and Practical adaptive behavior, as well as a Global composite score. Independent t-tests were used to examine effect of diagnosis on praxis and ABAS-II scores. Pearson correlations were used to examine the relationship of ABAS-II composite scores with total Praxis scores.

Results:

Independent sample t-tests revealed significant differences between ASD and TD groups for praxis performance ($t = 4.824$; $p < .0001$) and significant differences between ASD and TD groups for all composite scores on the ABAS-II (Global $t = 8.885$; $p < .0001$; Conceptual $t = 5.681$; $p < .0001$; Social $t = 8.34$; $p < .0001$ and Practical $t = 8.523$; $p < .0001$). Pearson tests revealed a significant correlation between praxis performance and global adaptive behavior ($R = .709$; $p < .0001$), as well as all three adaptive behavior sub-domains: Practical ($R = .744$; $p < .0001$), Social ($R = .700$; $p < .0001$), and Conceptual ($R = .604$; $p = .001$). These relationships remained consistent after controlling for IQ.

Conclusions:

Our findings reveal robust associations between development of adaptive abilities and praxis across children with ASD and TD children. As expected, a particularly robust association between praxis and adaptive abilities in the Practical domain, which includes skills for basic self-care (e.g. grooming oneself), was found. Significant associations were also found between

praxis and adaptive social functioning (e.g. engaging in recreational play) and conceptual functioning (e.g. self-directing tasks). These findings suggest that common mechanisms necessary to development of skilled behaviors may contribute to the motor, social, communicative, and self-care impairments displayed by children with ASD.

Invited Educational Symposium Program

135 The Role of the Amygdala In Mediating Anxiety and Core Deficits In Patients with Autism Spectrum Disorders

Moderator: D. Stephenson *Pfizer*

Anxiety often complicates the clinical picture of children and adolescents with autism and contributes to additional impairment. When present, anxiety also poses additional challenges to family members and care-givers, and may interfere with behavioral and educational interventions. Drugs that are commonly used to treat anxiety disorders (e.g., generalized anxiety disorder, panic disorder) have not been well-studied in individuals with autism. Given the common occurrence of anxiety in autism, it represents an unmet need. This unmet need presents an imperative and an opportunity to develop and test novel anti-anxiety medications. To begin addressing this challenge, it is critical to identify and understand the neural substrates of anxiety in patients with autism. The amygdala is a key brain region associated with emotion, with a primary role in fear and anxiety. Recent evidence suggests that the amygdala may show pathophysiological changes in autism, and that these changes may be linked to the core behavioral deficits of autism. This workshop focuses on recent advances in our understanding of the role of the amygdala in autism. The goal is to examine the structure and function of the amygdala in order to define their relevance to anxiety and core deficits in autism patients. This topic will be reviewed with an integrated educational symposium of panel experts that spans preclinical and clinical research.

135.001 • Investigation of synaptic plasticity deficits in a preclinical model of fragile X syndrome . S. Chattarji*, *National Center for Biological Sciences*

135.002 Neuropathology of the amygdala in autism . C. M. Schumann*, *UC Davis MIND Institute*

135.003 Neuroimaging of the amygdala in autism . K. A. Pelphrey*, *Yale University*

135.004 The clinical face of anxiety in autism . L. Scahill*, *Yale University School of Medicine*

4th Oral Brain Imaging in ASD temporary Program

136 Structural and Functional Brain Imaging In Older Children, Adolescents and Adults with ASD

Moderator: M. Dapretto *UCLA*

136.001 Longitudinal Changes of Heschl's Gyrus Volume In ASD and Typical Development. M. B. DuBray*[1], E. D. Bigler[2], P. T. Fletcher[1], A. L. Alexander[3], A. Froehlich[1], K. M. Maasberg[1], E. Papadopoulos[1], B. A. Zielinski[1], N. Lange[4] and J. E. Lainhart[1], (1)*University of Utah*, (2)*Brigham Young University*, (3)*University of Wisconsin*, (4)*Harvard University*

Background:

Difficulties with language acquisition and communication are often found in individuals with ASD. Imaging studies show atypical neural activation and lateralization during language tasks and suggest abnormal age-related changes in language lateralization. Despite these findings, the longitudinal development of cortical areas and white matter underlying auditory and language function are unknown.

Objectives:

The purpose of this longitudinal study was to examine developmental changes in an area involved in auditory and early language processing: the primary auditory cortex or Heschl's gyrus (HG). Using magnetic resonance imaging (MRI), volumes of HG gray matter (GM) and HG white matter (WM) were examined during childhood and early adolescence in a group of individuals with ASD compared to typical development.

Methods:

3T T1-weighted MRI images from 38 males with ASD and 12 typically developing male controls were examined at two timepoints acquired 2.5 years apart on average (mean age at Time 1: ASD=8.05 years, range 3-12; Control=9.42 years, range 4-12; mean age at Time 2: ASD=10.6 years, range 5-15; Control=11.75 years, range 6-15). HG was segmented manually on coronal MRI images using ITK-SNAP and longitudinal changes in HG GM and WM were measured. The ASD group was further examined by comparing HG changes in those participants with typical versus delayed language onset, as assessed by the ADI, and atypical auditory sensitivity measured by the Sensory Profile.

Results:

No significant between-group differences were found in mean HG GM or HG WM volumes at Time 1 or Time 2. A trend

toward reduced volumetric changes in right HG GM was found in the ASD group compared to the typically developing group controlling for the effects of age, handedness, and head circumference (p=0.055). Longitudinal development of left HG WM was increased in ASD individuals with typical language onset versus delayed language onset (p=0.035). Longitudinal changes in left HG GM were decreased in individuals with atypical responses to questions of auditory sensitivity (p=0.04).

Conclusions:

These findings suggest that in the absence of mean group differences at each timepoint, there may be differences in HG volumetric changes in ASD compared to typical development. We found increased longitudinal changes in the left HG in those individuals with ASD having typical language onset and typical auditory sensitivity profiles compared to those with delayed language onset and atypical auditory sensitivity, suggesting volumetric developmental differences in an area important for early auditory and language processing. The final analyses, that will include ASD and control participants with a 3rd timepoint, is in progress.

136.002 Thalamocortical Connectivity In Autism Spectrum Disorder: A Probabilistic DTI Tractography Study. A. Nair*[1], D. K. Shukla[2], J. Treiber[2], B. Keehn[1] and R. A. Muller[2], (1)*San Diego State University / University of California, San Diego*, (2)*San Diego State University*

Background: A number of studies have shown abnormal volume, neuronal integrity, perfusion, and metabolism of the thalamus in autism spectrum disorder (ASD). However, evidence on thalamocortical connectivity remains scant, except for a few functional studies. This lack of evidence is surprising, given the important role of thalamocortical connectivity in cortical functional specialization and differentiation, which are generally thought to be affected in ASD.

Objectives: We assessed the integrity of connections between thalamus and cortex in children and adolescents with ASD, using probabilistic diffusion tensor imaging (DTI) tractography.

Methods: DTI data from 17 children with ASD and 17 typically developing (TD)children were acquired from a 3T MRI scanner using single-shot diffusion-weighted EPI pulse sequence with two degrees of diffusion weighting (b=0 and 2000 s/mm^2, 15 non-linear directions, four repetitions). Geometric distortions due to local magnetic field inhomogeneities were corrected using field maps. The PickAtlas SPM toolbox was used to obtain white matter masks for thalamus, and fronto-temporal and parieto-occipital cortices from the standard MNI brain template. Tracts were derived for pairs between thalamus and frontal/temporal and parietal/occipital white matter regions-of-interest (ROIs). Bayesian estimation of diffusion parameters using Markov Chain Monte Carlo sampling techniques and trilinear interpolation of the probability density functions were employed to determine the streamline between given ROI pairs using probabilistic tractography toolbox in FSL software. Fractional anisotropy (FA) values of identified tracts were determined.

Results: FA of thalamocortical projections to and from the fronto-temporal cortex was significantly reduced in the ASD group compared to the TD group in both hemispheres (left hemisphere: 0.25±0.05 for ASD group versus 0.36±.04 for TD group, p=0.03; right hemisphere: 0.26±0.05 for ASD group versus 0.34±0.03 for TD group, p=0.04). For connections between thalamus and parieto-occipital cortex, the difference in FA was marginally significant (p=.08) in both hemispheres. No significant group differences in hemispheric asymmetry were found.

Conclusions: These results suggest that abnormalities in thalamocortical fiber tracts are present in children and adolescents with ASD. They add anatomical support for a few previous findings of impaired functional thalamocortical connectivity. Findings of white matter compromise were significant for thalamic connections with fronto-temporal cortex, but less robust for parieto-occipital cortex, consistent with evidence of severe white matter growth anomalies in frontal lobe, but relative sparing of occipital lobe. A follow-up study examining thalamocortical connectivity at higher resolution is underway.

Funding: R01-MH081023

136.003 Amygdala Connectivity with Frontal Mirror Neuron Areas Relates to Empathic Traits In Typically Developing Children and Children with Autism. E. M. Kilroy*[1], J. D. Rudie[2], N. L. Colich[2], L. M. Hernandez[1], S. Y. Bookheimer[2], M. Iacoboni[3] and M. Dapretto[2], (1)*Brain Mapping Center, University of California, Los Angeles*, (2)*University of California, Los Angeles*, (3)*UCLA*

Background: Deficits in emotional processing and empathy have commonly been observed in individuals with Autism Spectrum Disorders (ASD). The amygdala plays a central role in emotional processing and many studies have reported altered amygdala structure and function in ASD. The mirror neuron system (MNS) is believed to be connected to the amygdala via the anterior insula, allowing for an intuitive understanding of others emotions (Carr et al., 2003). In fact,

empathic behavior has been related to activity in both amygdala and MNS while processing emotional (Pfeifer et al., 2008) and non-emotional facial stimuli (Schulte-Ruther et al. 2007). Both altered amygdala and MNS activity (Dapretto et al, 2006), as well as functional connectivity (Rudie et al., under review), have previously been reported in children and adolescents with ASD during an emotional facial processing task.

Objectives: Here we sought to examine how the degree of functional connectivity between amygdala and MNS areas might be related to individual differences in empathic behavior in both typically-developing (TD) and ASD children and adolescents.

Methods: Seventeen children with ASD and 23 TD children (matched by age, gender, IQ and head motion) passively observed faces displaying different emotions (angry, fearful, happy, sad, and neutral) while undergoing functional Magnetic Resonance Imaging (fMRI). Using a jittered event-related design, faces were presented every 3 seconds according to an optimized random sequence, with each face being displayed for 2 sec. Each subject filled out the Interpersonal Reactivity Index (IRI), a multidimensional measure of empathy. The amygdala, as defined from the Harvard-Oxford probabilistic atlas (25% probability), was used as a seed region in a whole brain functional connectivity analysis. Covarying for age and IQ, scores from the IRI (total and subscales) were then used in multiple regression analyses using the amygdala connectivity maps.

Results: A significant relationship between amygdala-MNS connectivity and empathic behavior was observed for the empathic concern subscale, irrespective of diagnosis ($z > 2.3$, corrected for multiple comparisons at the cluster level). Specifically, individuals who rated themselves as having higher empathic concern, as measured by the IRI, displayed stronger connectivity between the amygdala and the right pars opercularis. This relationship was evident in both TD and ASD groups.

Conclusions: The present findings are consistent with a simulation model of affective empathy (Carr et al., 2003) whereby mirror neurons simulate the observed facial expressions and send signals to limbic areas, evoking neural activity that allows the observer to feel what others are feeling. Although empathic behavior, as well as MNS activity and connectivity, have been shown to be reduced in ASD as compared to neurotypical individuals, our findings indicate that the degree of coupling between limbic and MNS circuitry predict individual differences in empathic behavior in both typical and atypical development.

136.004 Neuroimaging Signatures of Autism In Siblings. M. D. Spencer*[1], R. J. Holt[1], L. R. Chura[1], J. Suckling[2], E. T. Bullmore[2] and S. Baron-Cohen[1], (1)*Autism Research Centre, University of Cambridge*, (2)*Brain Mapping Unit, University of Cambridge*

Background:

Siblings of individuals with autism spectrum disorder (ASD) have a greatly enhanced risk of ASD and there is accumulating evidence that apparently unaffected siblings may also display subtle impairments in comparable domains of cognitive function. Although siblings have been the subject of relatively little neuroimaging research, their study holds great promise as a means of identifying candidate endophenotypes of autism – expressed as differences in brain structure and function that are related to the genetic liability for the condition. This is the first report of results from a large MRC funded study of adolescents with autism and their siblings.

Objectives:

To recruit and scan adolescents with ASD, unaffected siblings and typically developing controls – with sufficient group sizes to investigate possible neural signatures of ASD as expressed in the structural and functional neuroimaging correlates of autism and of the broader phenotype in siblings.

Methods:

We recruited adolescents with ASD (n=40), their unaffected siblings (n=40) and typically developing controls (n=40), group matched for age and IQ. All ASD participants met DSM-IV criteria for autism or Asperger Syndrome and were assessed as positive on the ADI-R (Autism Diagnostic Interview – Revised) and ADOS-G (Autism Diagnostic Observation Schedule – Generic). All participants had IQ ≥ 70. No sibling or control participant reached the screening threshold for ASD on the Social Communication Questionnaire (SCQ). Participants completed brain structural and functional magnetic resonance imaging (MRI) on a 3T Siemens Tim Trio scanner. Image processing and analysis of MRI scan data was performed using SPM8 (Wellcome Department of Cognitive Neurology, London, UK), and statistical correction for multiple comparisons was performed at whole-brain level.

Results:

Preliminary results from this cohort reveal significant differences in brain structure between unaffected siblings and typically developing controls – including an excess of occipital grey matter in unaffected siblings (p = 0.02) that is expressed differently in sisters versus brothers of people with ASD. These results provide the first evidence of a sexual dimorphism of brain structure in the broader phenotype of autism.

Conclusions:

We have provided the first evidence of a sexually dimorphic signature of ASD in the brain structure of apparently unaffected adolescent siblings. These results build upon previous findings of an age-related excess of grey matter in autism and of associations between fetal testosterone and the development of autistic traits. These findings offer key insights into potential neuroendophenotypes of ASD and contribute to our understanding of the neural basis of autism.

136.005 Neural Correlates of Impaired Processing of Communicative Auditory Stimuli In Children with ASD. R. H. Bennett*[1], S. Shultz[1], A. M. Berken[2] and K. A. Pelphrey[1], (1)*Yale University*, (2)*University of Connecticut School of Medicine*

Background: Studies have demonstrated abnormal cortical processing of socially relevant auditory stimuli in adults with Autism Spectrum Disorder (ASD). Specifically, it has been demonstrated that a putative voice-selective region in the superior temporal sulcus (STS) is hypoactive in response to vocal sounds in adults with ASD, suggesting a deficit in processing human vocal compared with non-vocal sounds. However, research from our laboratory suggests that this STS region may actually be sensitive to voiced sounds emitted with communicative intent, rather than being sensitive to both communicative and non-communicative voiced sounds. This raises the possibility that reduced STS activity observed in adults with ASD may reflect a deficit in recognizing the communicative intent underlying auditory stimuli, rather than a deficit in processing voiced versus non-voiced sounds. However, few studies have examined STS activity in response to communicative compared with non-communicative sounds in individuals with ASD.

Objectives: Our objectives were 1) to replicate findings indicating that the STS is sensitive to communicative compared with non-communicative sounds in typically-developing children, and 2) to investigate whether children with ASD exhibit reduced sensitivity to communicative compared with non-communicative sounds.

Methods: To date, data have been collected from 8 participants (4 ASD) matched on age, gender, and verbal IQ as measured by the Differential Ability Scale. Participants listened to the following sounds while in the fMRI scanner: human speech (affective and neutral), human communicative non-speech (e.g. laughing, sounds of agreement), human non-communicative voiced (e.g. coughing, sneezing), human non-communicative non-voiced (e.g. walking, snapping), rhesus monkey calls, and sounds of water. Each condition was presented 5 times in a block design, each block lasting 20 seconds.

Results: Whole-brain analyses were performed to identify brain regions that are responsive to human communicative (speech and communicative non-speech) compared with non-communicative sounds (human non-communicative voiced, human non-communicative non-voiced, rhesus monkey calls, and water). A random effects analysis with $p<0.01$ and $k>10$ revealed greater activation in the right STS to communicative compared with non-communicative sounds in typically-developing children. Furthermore, a random effects ANCOVA with a $p < 0.01$ and $k > 10$ revealed that children with ASD exhibited reduced sensitivity to communicative sounds in the right STS compared to typically-developing children.

Conclusions: We observed increased activation in the right STS of typically-developing children in response to human communicative compared to non-communicative sounds, supporting the idea that the STS is sensitive not to voiced sounds, but specifically to voiced sounds emitted with communicative intent. This finding is consistent with research indicating that the STS is specialized for detecting and reasoning about social communicative stimuli in both visual and auditory domains. Further, our data indicate that reduced STS activation in children with ASD may not simply reflect a deficit in differentiating voiced compared with non-voiced sounds, but rather a deficit in detecting auditory sounds produced with communicative intent. This distinction illuminates the nature of previously reported auditory deficits in ASD, an important step towards understanding the language and social communicative deficits characteristic of ASD and developing optimal interventions.

136.006 Individuals with ASD and Co-Occurring Anxiety Show Increased Amygdala and Orbitofrontal Cortex Activity During Face Perception. J. M. Taylor*, R. T. Schultz, M. Riley, E. T. Hunyadi, J. Letzen and J. D. Herrington, *Children's Hospital of Philadelphia*

Background:

The nature of amygdala deficits in autism spectrum disorders has recently been the subject of considerable debate. Recent data have shown both hyper- and hypo-activation of amygdala in response to social and emotional stimuli in ASD. Almost no studies to date have examined whether these discrepant findings can be understood in terms of anxiety symptoms among individuals with ASD. This gap in the ASD literature is surprising and problematic, as decades of research in typically developing populations have associated anxiety with abnormal amygdala function, and recent studies have documented very high levels of comorbid anxiety symptoms in ASD.

Objectives:

Preliminary data are presented for an ongoing study testing the hypothesis that individuals with ASD and co-occurring anxiety symptoms would show increased activation in key emotion structures (namely amygdala) during the perception of negatively valenced stimuli (angry faces).

Methods:

Individuals with ASD (N=11) and a control sample (N=8) completed a probe detection task that has been used widely among typically developing adults and children with anxiety disorders, but seldom in ASD. Participants saw two side-by-side faces immediately followed by a probe appearing at the same location as one of the two faces. Face pairs consisted either of two neutral faces, or one neutral and one angry face. Participants were asked to indicate via button-press whether the probe appeared on the left or right side of the display. Individuals with anxiety are typically faster to identify the probe when it is preceded by emotional rather than a neutral face. Anxiety symptoms were measured via the parent report version of the SCARED – a DSM-IV-based inventory of anxiety symptoms in children.

Results:

fMRI analysis examined the interaction between group (ASD and control) and stimulus valence, i.e trials with angry versus neutral faces. The ASD group showed significantly greater activation in bilateral amygdala and orbitofrontal cortex when presented with an angry face. Results for completed SCARED reports indicated that ASD participants (N=8) presented with significantly more anxiety, $t(13) = 2.179$, $p < 0.05$, and generalized anxiety disorder, $t(13) = 2.278$, $p < 0.05$ symptoms than control participants (N=7). Post hoc analyses indicated that anxiety scores on the SCARED were significantly correlated with amygdala activation for angry faces among individuals in the ASD group.

Conclusions:

These preliminary data support the hypothesis that the profile of amygdala function in ASD depends on the presence or absence of anxiety symptoms. Individuals with ASD displayed significantly higher activation in two key emotion and emotion regulation structures – amygdala and orbitofrontal cortex. This finding suggests that the existence of comorbid anxiety may help explain discrepant findings on amygdala function in ASD. Further, the finding of increased activation in orbitofrontal cortex underscores the putative role of abnormal emotion regulation processes in the clinical picture of anxiety in ASD.

136.007 Bottom-up or Top-Down? : An Investigation of Perceptual Processing In ASD Using Dichotic Pitch. V. Lodhia*[1], C. Nelumdeniya[1], J. P. Hamm[1], B. W. Johnson[2], J. Brock[2] and M. J. Hautus[1], (1)*University of Auckland*, (2)*Macquarie University*

Background: Various visual studies have indicated bottom-up and top-down processing difficulties in Autistic Spectrum Disorder (ASD). If the auditory system is analogous to the visual system, then we would expect to see similar impairments in the auditory domain in bottom-up and top-down tasks. Time-shifted Dichotic Pitch (DP) (Dougherty et al., 1998) is an effective way to measure bottom-up and top-down mechanisms. Our previous research using DP demonstrated the presence of Object Related Negativity (ORN) and Positive 400 (P400) components in the auditory event related potential (AERP) (Hautus & Johnson, 2005). An ORN is elicited when two auditory objects are concurrently perceived – indexing perceptual segregation of concurrent sounds (Alain, Arnott & Picton, 2001; Hautus & Johnson, 2005; Johnson, Hautus, Duff & Clapp, 2007). The ORN occurs irrespective of attention and is driven by the sequence of the incoming auditory information (i.e. bottom-up) (Alain et al., 2001; Hautus & Johnson, 2005; Johnson, et al., 2007).The P400 component is indexed when participants are actively attending to stimuli and is thought to reflect decision-making processes about the sound heard in concurrent stream-segregation tasks. The P400 is a controlled process that uses prior knowledge about the auditory information to extract meaning about incoming auditory data (i.e. top-down) (Alain et al., 2001; Hautus & Johnson, 2005; Johnson, et al., 2007).

Objectives: To see whether components of interest (ORN & P400) are indexed in the auditory AERP of ASD individuals using DP stimuli, and to determine whether or not there are differences in amplitude and/ or latency for these components between ASD and control individuals.

Methods: AERPs were determined for 32 adult participants (16 ASD, 16 matched controls), listening to DP stimuli. A mixture of lateralized DP, centralized DP, target (two objects), and control (one object) stimulus types were presented. Participants indicated via button press whether one or two auditory objects were heard in each trial.

Results: Only the control group obtained an ORN, which occurred at a latency of 150 – 250 ms. The P400 component was indexed at a latency of 400 – 500 ms for both groups ($p < 0.0005$). Both groups showed significant differences in amplitude between target and control conditions for the P400 ($p < 0.0005$).

Conclusions: The lack of ORN for the ASD group suggests difficulty in bottom-up processing, related to segregating concurrent sound objects using time-based cues. The presence of the P400 component indicates no deficits in top-down processing for the ASD group. The findings from this study will expand our knowledge on how the brain systematically organises simultaneous incoming auditory information and allow for greater understanding about perceptual processing in ASD.

136.008 Brain Network-Based Analysis of Autism Using Diffusion Tensor Imaging. H. Li*[1], Z. Xue[1], T. M. Ellmore[2], R. E. Frye[2], B. Malmberg[2] and S. T. Wong[1], (1)*The Methodist Hospital Research Institute, Weill Cornell Medical College*, (2)*University of Texas Houston Health Science Center*

Background: In addition to connectivity among different brain regions, brain network topology acts as an important characteristic for Autism Spectrum Disorder (ASD). Previous studies have suggested that ASD can be characterized by increased local and decreased long-range connectivity. As a new MR modality to track white matter fiber bundles, Diffusion Tensor Imaging (DTI) can be effectively used to quantify the structural connectivity network of human brains, thereby define neuroimaging biomarkers using network-based analysis for ASD.

Objectives: To define brain connectivity network and compare the network characteristics between high-functioning ASD and typically developing (TD) controls.

Methods: Ten high functioning autistics (aged 7-14) and 10 typically-developing matched subjects were studied. All subjects underwent a single MR imaging session at 3T (Philips Intera), including T1-weighted MRI (sagittal, TR/TE=8.4/3.9ms;FA=8 degrees; slice thickness = 1.0 mm) and a 32-direction diffusion imaging sequence (high angular resolution, overplus on, TR/TE=8500/67 ms; FA=90 degrees; 2 mm axial slice thickness, max. b-value of 800 s/mm^2).After applying eddy current correction, tensor calculation and tissue segmentation, an elastic registration was utilized to align the JHU-DTI-MNI atlas onto each subject to automatically label the brains. Then, an improved tensor-based fast marching method was employed to simulate water diffusion dynamics to define the connectivity strengths among different neuroanatomical regions. According to our algorithm, the marching speed is faster for higher diffusion, thus the result indicates denser, highly oriented fibers, or stronger connectivity between different regions. Finally, the connectivity strengths among 46 selected anatomical regions overlapping the cortical surface were quantified to construct the brain neuroanatomical connectivity network and the network-based analysis. The Clustering coefficient (CC) and characteristic path length (CL) for the entire networks were quantified for each group. Further, the CC and CL of each sub-network associated with each anatomical region were also calculated.

Results: Statistical analysis showed that autistics have higher CC (0.18 ± 0.01 vs. 0.16 ± 0.01, two sample single-tailed t-test, p-value=0.002) and lower CL (1.71 ± 0.05 vs. 1.75 ± 0.04, p-value=0.03) compared with controls, indicating stronger local connectivity and shorter network connection paths between regions in ASD as compared to TD controls. For sub-network analysis, the CC and CL of the sub-networks connected to each anatomical region are calculated, and the anatomical regions with significant different local network characteristics (higher CC and lower CL) included left and right supramarginal, superior occipital, middle occipital, angular gyri, and the left pre-cuneus. Interestingly, these regions are associated with visual and multimodal integration.

Conclusions: The brain network-based analysis revealed that children with high-functioning ASD have stronger local connectivity among brain regions as compared to TD children. Significantly different local network characteristics were found in visual and multimodal integration regions. The method may open up a new vista to decode the mystery of ASD at the neuroanatomical level.

Treatments Program
137 Interventions: Behavioral, CAM and Psychopharmacology Treatments
Moderator: C. Kasari *University of California, Los Angeles*

137.001 Intervention Research with Toddlers at High Risk for Autism: Lessons Learned by the Autism Speaks Toddler

Treatment Network. L. Morgan*[1], L. Turner-Brown[2], M. J. Siller[3], G. T. Baranek[4] and C. Kasari[5], (1)*Florida State University*, (2)*University of North Carolina*, (3)*Hunter College of the City University of New York*, (4)*University of North Carolina at Chapel Hill*, (5)*University of California, Los Angeles*

Background: During the last decade, research on Autism Spectrum Disorder (ASD) has made tremendous progress with regard to early screening and diagnosis. For the first time, it is feasible to reliably identify red flags for autism in children under age 2 (APA, 2006). Even though prompt access to intense early intervention services is generally viewed as critical for the well-being of children with ASD and their parents (NRC, 2001), state-of-the art treatment research for toddlers with ASD is limited. The Autism Speaks Toddler Treatment Network (ASTTN) is a consortium of 8 multi-site research projects, most of which received funding in 2006 through a special RFA released to determine the efficacy of intervention for toddlers under 24 months who are at 'high risk' for ASD.

Objectives: The purpose of this presentation is to utilize baseline data from the ASTTN to convey similarities and differences across sites in methodologies used to generate subject referrals, identify and recruit participants, communicate diagnosis or risk status to families, and deliver parent-mediated interventions.

Methods: Cross-site baseline data will be presented on the children enrolled in these studies in combination with results from a survey completed by the principal investigators of each research site. This survey and follow-up interview probed topics related to the techniques and challenges associated with the different methodologies used.

Results: Researchers in the ASTTN sought to find toddlers under age 2 at risk for ASD in several ways, including recruiting from pediatricians, statewide EI programs, community providers, child care organizations, as well as through community-wide screening. Results revealed interesting patterns across sites that were associated with the age of participants (e.g., under or over 18 months), geographic area, and recruitment method. Approximately half of the toddlers across sites were not yet enrolled in any form of early intervention when they enrolled in the research intervention, and this percentage was over 80% for toddlers under 18 months at enrollment. A variety of methods for communicating with families about risk or diagnosis of ASD in toddlers under age 2 and about promoting buy-in for participation were utilized. Two primary strategies for determining study eligibility were utilized: (1) risk status for ASD or (2) clinical diagnosis of ASD. The risk status strategy was used by a majority of research sites and involved several different combinations of assessment results to make a determination of risk. The treatments evaluated as part of the ASTTN were parent-mediated. Approaches differed significantly in terms of orientation, teaching strategies, skills targeted, and setting. Moreover, the tested interventions included adaptations of several branded interventions.

Conclusions: The collective experiences of the ASTTN in conducting treatment research with toddlers and their families provides a wealth of information with respect to recruitment and enrollment efforts and delivery of parent-mediated intervention. Discussion will focus on the many challenges ahead in working with infants and toddlers at risk for autism and their families in the context of growing early identification efforts.

137.002 Treatment as Usual In Early Intervention: Control Group or Legitimate Contender?. A. M. Steiner*, A. Snow and K. Chawarska, *Yale University School of Medicine*

Background: Research on the effects of early intervention in autism is often complicated by a number of methodological factors, including the selection of an appropriate control group. With the increasing dissemination of empirically supported treatments (ESTs) and integration of practice guidelines into legislature, "treatment as usual" (TAU), may be becoming something quite different than once assumed. Currently, there is limited investigation into the nature of TAU, how these services compare with recommended standards, and outcomes observed in children receiving TAU (McLennan, 2008; Stahmer, 2007).

Objectives: This study describes the characteristics and outcomes of TAU services in the Tri-State area in a cohort of toddlers presenting for the first differential diagnosis from 2006-2010. We also compare the outcomes of children in our cohort to outcomes reported in recent clinical trials of early intervention services.

Methods: Forty-four consecutive referrals of children with an ASD received a comprehensive developmental evaluation between 14-26 months (T1) and were re-evaluated at approximately 36 months (T2) of age. Detailed parental report of intervention services was collected at T1 and 2, and cross-referenced with IFSPs and other documentation to promote accuracy. Evaluations at T1 and 2 included the Mullen Scales of Early Learning (Mullen), the Autism Diagnostic Observation Schedule (ADOS-G, Modules 1 & 2), the Vineland Adaptive

Behavior Scales-II (VABS-II), and a best estimate clinical diagnosis from an experienced clinician.

Results: Analyses suggest that there is significant variability in the programming children received, although it was broadly consistent with practice parameters specified by local service agencies. On average, children received approximately 16.5 hrs/wk of total programming (SD=8.5), including 1.9 hrs/wk of speech therapy (SD=1.1), 0.9 hrs/wk of occupational therapy (SD=0.7), and 10.3 hrs/wk of early intervention services (SD=7.1). In general, children who presented with higher ADOS severity scores received more intensive programs ($r=.32$, $p<.04$), although there was still significant variability within this group. Despite this variability, results suggest that, as a group, children who received community-based services made substantial developmental gains on the Mullen between T1 and T2, with 1.4 SD ($t=6.1$; $p<.001$; $d=.88$) and 1.6 SD ($t=7.8$; $p<.001$; $d=1.0$) gain in Receptive and Expressive Language, respectively. Improvements in Visual Reception were more modest (0.5 SD; $t=2.5$; $p<.02$) while ADOS severity scores were stable across time. In addition, as a group, children evidenced significant improvements on the VABS in Communication (0.7 SD; $t=4.7$; $p<.001$) and there was no decline in standard scores in other domains.

Conclusions: Although there was significant variability in TAU services, children made significant gains in these programs, particularly with regard to language and communication. These gains were comparable to those reported in more specialized programs (e.g., Dawson et al., 2010). On average, children in TAU were enrolled in programs broadly consistent with local practice guidelines. These results suggest that there is potentially successful dissemination of ESTs and translation of research into practice in some community settings. As such, this may present significant challenges for researchers conducting intervention studies in areas in which TAU services may begin to bridge the research to practice gap.

137.003 Early Intervention and Its Effects on the Development of Infant Siblings of Children with Autism. S. L. Marshall*[1], K. Gillespie-Lynch[1], G. Park[2], 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: Early intervention can scaffold improvement in abilities of autistic children (Rogers, 1996). Improvements following intervention led to an assertion that intervention can help children "recover" from autism (Lovaas, 1987). Stability of diagnosis within the first two years of life may be low in high-risk populations (Ozonoff et al., 2011). Some infant siblings meet criteria for autism early in development, but no longer meet criteria later, though infant characteristics seemingly do not predict such change (Kleinman et al., 2008; Sutera et al., 2007). Only one study has examined the interventions infant siblings receive (Regehr & Feldman, 2009) and none has examined the impact of intervention on their development.

Objectives: 1) Determine whether infant siblings who met criteria for ASD on the ADOS by 24 months, but not at 36 months, received more intervention than infants who met criteria at 36 months, and those who never met criteria. 2) Determine whether early intervention yields increases in scores on the Mullen Scales of Early Learning (MSEL) in infant siblings.

Methods: Twenty low-risk infants (LR) and 57 high-risk infant siblings (HR) were assessed at 6, 12, 18, 24, and 36 months. At each time point, parents were interviewed about therapy and enrichment activities (e.g., "Mommy and Me") their child participated in since the previous assessment. Intensity of therapy and enrichment activities was calculated by multiplying total hours of participation by the teacher/child ratio. The MSEL were administered at each assessment. Administration of the ADOS began at 18 months. Infants who met criteria for ASD on the ADOS at 18 or 24 months, but not 36 months, were classified as "false-positive" (FP). Four LR and 4 HR infants were classified as FP. One LR and 8 HR infants were classified as "ASD" at 36 months. The remaining 45 infant siblings were classified as "HR-Non-ASD".

Variables for intensity of therapy and enrichment activities, as well as change in MSEL scores, were calculated from 6 to 18 months and from 18 to 36 months. Gender, income, and outcome grouping (LR, HR-Non-ASD, FP, ASD) were entered into all univariate analyses.

Results: ASD infants received more therapy, but not more enrichment, than FP, HR-Non-ASD, and LR infants from 18 to 36 months ($p<.001$). There were no such group differences from 6 to 18 months.

From 6 to 18 months: No effects of intervention on change in MSEL scores were apparent. From 18 to 36 months: Therapy predicted change in Receptive Language scores($p=.006$). Therapy ($p<.001$) and outcome grouping ($p<.001$) predicted change in Expressive Language scores. Enrichment ($p=.016$) predicted change in Fine Motor scores. There were no relationships between intervention and change in Visual Reception scores.

Conclusions: While early therapy scaffolds the linguistic development of infant siblings, it does not appear to help infants move off the spectrum by 36 months of age. Infants who met criteria for ASD at 36 months received more intervention than "False-Positive" infants and infants who never met criteria for ASD. Infants later diagnosed with autism are being targeted early for intervention. Therapy and enrichment activities differentially improve developmental trajectories.

137.004 Accelerating the Pace of Treatment Research In Autism Spectrum Disorder. L. A. Vismara*[1], G. S. Young[2] and S. J. Rogers[1], (1)*UC Davis MIND Institute*, (2)*UC Davis M.I.N.D. Institute*

Background: There are various challenges to delivering health care to families with Autism Spectrum Disorder (ASD) with long waiting lists and few specialist services. Barriers to service delivery and utilization are even more exacerbated for families living in rural or remote areas, often resulting in limited access to preventative mental health services in general and parenting ASD interventions in particular. Telemedicine, or using technology to deliver treatment, can support long-distance clinical health care; however there is little information as to how this resource may translate into practice for families with ASD.

Objectives: The current pilot study examined a manualized, telemedicine-delivered parent-implemented intervention to families of toddler-aged children with ASD. The aim was that telemedicine as a teaching modality would optimize parenting intervention strategies for supporting children's social, affective, communicative, and play development.

Methods: Ten families received 12 weekly one-hour sessions of direct coaching and instruction of the Early Start Denver Model (ESDM) Parent Delivery Model through an Internet-based video conferencing program. Each week parents were coached on a specific aspect of the intervention through video conferencing program and webcam, allowing parent and therapist to see, hear, and communicate with one another. Parents were taught how to integrate the ESDM into natural, developmentally and age-appropriate play activities and caretaking routines in their homes. Video data were recorded within a single subject design from 10 minutes of parent-child interaction at the start of each session and coded by two independent raters blind to the order of sessions and hypotheses of the study.

Results: Findings suggested that integrating telemedicine as a teaching modality facilitated: (a) parents to implement the ESDM more skillfully after coaching; (b) an increase in the number of children's spontaneous words, gestures, and imitative behaviors; and (c) perceived satisfaction and a sense of connection with remote coaching and transfer of skills.

Conclusions: The findings provide initial support of telemedicine as an effective teaching modality for transferring an evidence-based, comprehensive early intervention model into parents' homes to be delivered within typical parent-child activities. Additional research is needed to confirm the promise and utility of telemedicine for transporting services to families with limited access.

137.005 Designing Social Competence Interventions for Adolescents with Autism: The SCI Project. J. P. Stichter*, K. Lierheimer, T. R. Schultz and M. Herzog, *University of Missouri*

Background:

Youth with autism spectrum disorders (ASDs) 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 or can become socially withdrawn, which negatively impacts their quality of life and can lead to other developmental skill deficits.

Objectives:

This project developed a curriculum, the Social Competence Intervention (SCI), designed to impact social competence performance for a specific ASD subtype characterized by a diagnosis of an ASD, a full scale IQ of 70+, and access to general education curriculum for at least one hour a day. The curriculum utilizes primarily cognitive-behavioral intervention within an applied behavior analysis structure. The curriculum targets social cognition deficits as characterized by deficits in theory of mind (ToM), executive function (EF) and recognizing emotions.

Methods:

The SCI includes five units (each comprised of approximately 4 hours of content), which are typically delivered in consecutive two-week increments (i.e., 1 hour twice a week for 10 weeks). Each unit focuses on a different critical aspect of social competence. Foci include: (a) recognizing facial expressions, (b) sharing ideas, (c) turn taking in conversations, (d) recognizing feelings and emotions of self and others, and (e) problem solving. Within each unit, the delivery of the content is done using a consistent structure of (a) reviewing a previously learned skill and introducing a new skill in an instructional and

group discussion format, (b) skill modeling, (c) providing opportunities to practice the skill in structured and naturalistic activities, and (e) engaging in various closing activities or review.

An interdisciplinary research agenda has been executed to identify the programmatic effectiveness of the curriculum across ages, settings and stakeholders. All related research has employed a multi-faceted assessment methodology to determine programmatic effectiveness, and the impact of the intervention curriculum on functional characteristics of the subtype. Common screening and standardized tools designed to assess ToM, EF and facial recognition are administered via parent ratings and student performance pre and post. This initial investigation focused on the curriculum for 11-14 year old group (SCI-A) in an after school delivery (Stichter et al, 2010).

Results:

Results from a sample of boys (n = 27, M_{age} = 12.57yrs) supported the hypothesis that the SCI-A program improved outcomes in the three targeted core deficits. Specifically, student performance improved on measures of facial expression recognition ($p < .05$), ToM ($p < .05$), and EF as indicated on a problem solving instrument ($p < .001$). Additionally, parents reported improvement in EF ($p < .001$) and overall social behaviors/interactions ($p < .001$).

Conclusions:

Results indicate support for the hypothesis that participation in the SCI program is accompanied by positive change in several measures related to social competence. Extension of the curriculum to additional age groups, settings and the use of additional measures, controls, are forthcoming.

137.006 Supplemental Melatonin Decreases Time to Fall Asleep IN Children with AUTISM. B. A. Malow*[1], S. G. McGrew[2], C. P. Burnette[3], K. Adkins[1], S. E. Goldman[1], D. Wofford[1], K. L. Surdyka[1], D. Fawkes[1] and L. Wang[4], (1)*Vanderbilt Medical Center*, (2)*Monroe Carell Children's Hospital at Vanderbilt*, (3)*University of New Mexico*, (4)*Vanderbilt University*

Background: Retrospective and small prospective studies have shown that supplemental melatonin promotes sleep in children with autism spectrum disorders (ASD). However, most studies have not used objective measures of sleep or have limited their samples to subsets of ASD (e.g., Asperger syndrome).

Objectives: In preparation for a large multicenter randomized controlled trial, we carried out a pilot study of supplemental melatonin in children with ASD using actigraphy to measure changes in sleep parameters.

Methods: Children were ages 3-10 years, with a clinical diagnosis of ASD based on DSM-IV-TR criteria. Diagnosis was confirmed by the Autism Diagnostic Observation Schedule and by either clinical interview or the Autism Diagnostic Interview-Revised. All children had sleep delay, defined as inability to fall asleep within 30 minutes at least 3 nights a week. Medical causes of insomnia and primary sleep disorders were addressed prior to enrollment. Children on medications which affect melatonin pharmacokinetics were excluded. Parents were instructed in optimizing sleep habits and bedtime routines prior to treatment. Objective measures of sleep were measured over 17 weeks with actigraphy (Phillips/Respironics/Mini Mitter) in conjunction with sleep diaries. All children received two weeks of an inert flavored liquid 30 minutes before bedtime, to acclimate them taking a liquid medication at bedtime. At week 3, children began 1 mg of supplemental melatonin (Natrol ®). The child's response to melatonin was reevaluated every three weeks based on mean sleep latency (SL), defined as time to fall asleep from lights out. Dose was increased every three weeks (from 1 mg, to 3 mg, to 6 mg, to 9 mg) until the child reached a satisfactory response (SAT-R), defined as SL within 30 minutes on 5 or more nights in the week. Once a SAT-R was achieved, the child remained on that melatonin dose for the remainder of the 17 weeks.

Results: Twenty-one children were included, two girls and 19 boys, with a mean age of 6 years [standard deviation (SD) = 2.2]. A SAT-R was reached in five children at 1 mg, 14 children at 3 mg, and two children at 6 mg. Mean sleep latency improved with treatment (EOS) compared to baseline; Wilcoxon-signed rank test. Improvements were also noted in sleep efficiency and total sleep time. Fragmentation index, a measure of movement/restless sleep, did not improve. Actigraphy parameters did not change from the time a SAT-R was achieved as compared to the end of study. There were no adverse effects related to melatonin.

Actigraphy Parameter	At Baseline Mean (SD)	At SAT-R Mean (SD)	At EOS Mean (SD)	p-va EO
Sleep Latency (min)	41.0 (33.9)	25.3 (26.4)	24.8 (21.6)	<0.
Sleep Efficiency (sleep time/time in bed)	73.9 (9)	77.1 (9.2)	78.3 (7.5)	0.0
Total Sleep Time (min)	430.4 (73.1)	461.5 (77.2)	460.5 (66.5)	0.0
Fragmentation Index	38.7 (14.4)	37.4 (14.1)	34.4 (13.8)	0.8

Conclusions:

In this pilot work, we documented, with actigraphy, that supplemental melatonin decreases sleep latency and improves other sleep parameters, with stability over several weeks. Randomized clinical trials of supplemental melatonin appear warranted.

137.007 Persistence of Complementary and Alternative Medicine (CAM) Use In ASD. S. L. Hyman*[1], L. Cole[2], A. M. Reynolds[3], T. Clemons[4] and D. L. Coury[5], (1)*University of Rochester School of Medicine*, (2)*University of Rochester*, (3)*University of Colorado Denver*, (4)*EMMES Corp*, (5)*Nationwide Children's Hospital*

Background: Complementary and alternative medicine (CAM) treatments are widely used as an adjunct to conventional medical treatment for many conditions. CAM treatments are often recommended by parents, medical providers, and paraprofessionals as potential components of an overall treatment plan but their therapeutic effects have not had careful evaluation.

Objectives:

The objective of this study is to determine characteristics surrounding CAM use in a large ASD registry, and identify factors associated with the ongoing use of CAM treatments including ASD diagnosis, type of CAM and ongoing use of CAM treatments.

Methods:

The study population consisted of children and adolescents ages 2 – 18 years entered in the Autism Treatment Network (ATN) Registry. The ATN collects data on children with ASD at fourteen sites across the US and Canada. Children with a diagnosis of ASD (autism, Asperger disorder, or PDD-NOS), as determined by comprehensive multidisciplinary evaluation, including ADOS, were included in this analysis. Upon entry into the registry, parents completed a medical history questionnaire that includes questions about use of CAM treatments, GI symptom inventory, Children's Sleep Habits Questionnaire (CSHQ), and demographic data. Longitudinal data are collected through annual visits or by phone or mail contact with the family.

Results: Special diets were the most frequent form of CAM treatment. Overall, 449 (18%) of 2,489 enrolled children were on special diets as part of their treatment plan. Data at 1 year follow up are available for 568 children. Of these, 106 (19%) were on special diets with non-significant variation by ASD type (autism, 16%; Asperger disorder. 11%; PDD/NOS, 14%). The most common diets were "other" (64%), casein free (48%), and gluten-free (47%). At follow up, the most common diets were "other" (61%), gluten free (50%), and casein free (49%). Of the 568 children with follow-up data, 45 (8%) children not on a special diet at baseline were on a special diet at their first annual visi ($p<.0001$). Conversely, 25 of the children on a special diet at baseline had discontinued by their first annual visit ($p<.0001$). Of the 568 children, 57 children not receiving CAM treatments at baseline were receiving CAM at their first annual visit ($p<.0001$). Conversely, 36 of the children receiving CAM at baseline were no longer receiving CAM at their first annual visit ($p<.0001$).

Conclusions:

CAM treatments in the form of special diets are commonly used. Families appear to persist in use of CAM, with 5-10% of CAM families discontinuing use annually. A similar percentage of families not using CAM will begin use over the course of a year, most of these using special diets. Health care providers should be aware of the use of CAM among families with a child with ASD, and the trend for families to add or drop these treatments over time. Educational efforts are important for child health providers to monitor the nutritional concerns of this large group of children.

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137.008 Effects of STX209 (arbaclofen) on Social and Communicative Function In ASD: Results of An 8-Week Open-Label Trial. P. Wang*[1], C. A. Erickson[2], L. Ginsberg[3], B. Rathmell[4], M. Cherubini[5], P. Zarevics[1] and B. King[6], (1)*Seaside Therapeutics*, (2)*Indiana University School of Medicine*, (3)*Red Oak Psychiatry Associates*, (4)*Seaside Therapeutics, LLC*, (5)*Seaside Therapeutics, Inc.*, (6)*University of Washington and Seattle Children's Hospital*

Background: STX209 (arbaclofen) is an orally-administered GABA-B agonist and is the active isomer of racemic baclofen. Results of a placebo-controlled Phase 2 trial suggest that it may decrease social withdrawal and improve adaptive social function in Fragile X syndrome. In addition, there are anecdotal reports in autism spectrum disorders (ASD) of improvement in social, communicative, and anxiety-related symptoms after treatment with racemic baclofen. The hypothesized mechanisms of action of STX209 include augmentation of

inhibitory neurotransmission (excitation:inhibition imbalance theory of autism), and modulation of synaptic plasticity (mGluR theory, via GABA suppression of glutamate release).

Objectives: To evaluate the safety and efficacy of STX209 in pediatric patients with ASD.

Methods: An 8-week, open-label trial was conducted at 8 sites in the U.S.A. Enrollment criteria included a diagnosis of autistic disorder or PDD-NOS, age 6 – 17 years, and an Aberrant Behavior Checklist-Irritability score (ABC-I) > 16. Concomitant anti-psychotic medications were not allowed, but up to 2 other concurrent psychoactive medications were permitted at stable doses. A flexible dose titration was employed, with a starting dose of 1 mg BID, titrating every 3-4 days to a maximum of 10 mg TID (or 10 mg BID for subjects below age 12 years).

An extensive battery of outcome measures was administered, including the ABC, CGI-I, CGI-S, Social Responsiveness Scale, CASI-Anxiety scale, CY-BOCS-PDD, Repetitive Behavior Scale, ADHD-IV Rating Scale, Vineland Adaptive Behavior Scales, and the Leiter Brief IQ. Standard safety assessments were performed.

Results: 32 children (29 male) were enrolled, with 27 meeting DSM-IV criteria for Autistic Disorder, and 5 PDD-NOS. Their mean age was 12 ± 3 (mean ± SD), and mean IQ was 56 ± 4. Twenty-five of 32 subjects completed the study, with 2 discontinuing due to adverse events and 5 for other reasons. STX209 was well-tolerated. There was 1 serious adverse event (increased aggression), which occurred during down-titration of study medication.

In the ITT population, there was significant improvement on the primary endpoint, the ABC-I, from 24.7 ± 8.3 at baseline, to 17.3 ± 10.5 at Week 8 ($p<0.001$). Subjects also showed significant improvements on the ABC-Social Withdrawal scale (from 18.1 ± 8.2 to 12.6 ± 9.3, $p=0.001$), the CGI-I ($p<0.05$), the CGI-S ($p<0.001$), and on most of the other outcome measures, including the Communication domain standard score on the Vineland (from 61.4 ± 10.5 to 65.4 ± 9.5, $p<0.01$).

The most common adverse events were agitation (22%), irritability (22%), fatigue (16%), psychomotor hyperactivity (16%), insomnia (13%) and diarrhea (13%). Many of these events resolved without dose changes and may reflect spontaneous variability in underlying symptoms. Clinical laboratory assessments did not show any potential treatment associated abnormalities.

Conclusions: STX209 showed broad beneficial effects in this open-label study, notably on core symptoms in the social and communication domains. A double-blind, placebo-controlled trial is planned to begin early in 2011.

Cognition and Behavior Program
138 Infants with Autism and Infant Siblings
Moderator: L. Zwaigenbaum *University of Alberta*

138.001 A Comparison of Behavioral Markers Of ASD in a High-Risk Infant Cohort Based on Cognitive Level at 3 Years. L. Zwaigenbaum*[1], S. E. Bryson[2], I. M. Smith[2], P. Szatmari[3], J. Brian[4], W. Roberts[4], C. Roncadin[5] and T. Vaillancourt[6], (1)*University of Alberta*, (2)*Dalhousie University/IWK Health Centre*, (3)*Offord Centre for Child Studies, McMaster University*, (4)*Holland Bloorview Kids Rehabilitation Hospital*, (5)*Peel Children's Centre*, (6)*University of Ottawa*

Background: Prospective studies of high-risk infants provide opportunities to characterize the earliest signs of ASD using direct observational data. While such data can help inform early detection, possible variation in early markers related to clinical heterogeneity in ASD (e.g., with respect to cognitive functioning) has received relatively little attention.

Objectives: Using longitudinal data from a high-risk cohort to identify behavioral markers in the first year predictive of ASD, and to assess whether these markers vary between children with ASD based on the presence/absence of intellectual delays, as assessed at age 3 years.

Methods: Participants included 277 high-risk infants (HR; younger siblings of children with ASD) and 99 low-risk comparison infants (LR) followed from age 6 months to 3 years. Early markers of ASD were assessed using the Autism Observation Scale for Infants (AOSI) at 6 and 12 months. Outcomes assessed at 3 years included ASD diagnosis determined using the ADI-R, ADOS and DSM-IV-TR blind to prior assessments, and cognitive level, using the Mullen Scales of Early Learning composite score (MSEL-ELC). AOSI item scores were compared in high-risk infants diagnosed with ASD (HR-ASD), high-risk infants not diagnosed with ASD (HR-N), and LR infants using Chi-squared or Fisher exact tests. Further comparisons were completed with the HR-ASD group stratified by cognitive level (IQ <70 vs. ≥70, indexed by the MSEL-ELC).

Results: Of 277 high-risk infants, 71 were diagnosed with ASD at 3 years, including 19 with IQ < 70 and 52 with IQ ≥ 70. HR-ASD infants as a group, compared to HR-N and LR groups, had a higher frequency at 6 months of reduced motor control, and

at 12 months of atypicalities in visual tracking, orienting to name, social babbling, eye contact, social interest and affect, social referencing, response to transitions, general behavioral reactivity, and repetitive motor and sensory-oriented behaviors (all p<.05). A subset of these atypicalities were more common in the HR-ASD group with IQ<70 (vs. IQ ≥70): reduced visual tracking (26.4% vs. 9.4%, respectively; p=.029), and extreme behavioral reactivity (21.0% vs. 3.7%; p=.031). As well, reduced imitation skills, which did not distinguish HR-ASD as a group from HR-N, was more frequent among HR-ASD with IQ<70 compared to those with IQ ≥70 (38.9% vs. 5.6%; p=.002), and distinguished the former from the HR-N and LR groups. For these 3 AOSI items (visual tracking, behavioral reactivity and imitation), children in the HR-ASD group with IQ ≥70 had a similar frequency of atypicalities as the HR-N group. In contrast, IQ was not a significant modifier for other group differences identified in the initial comparison of HR-ASD with HR-N, and LR groups.

Conclusions: Several behavioral markers observed in the first year in this high-risk cohort were associated with ASD risk and robust to IQ differences, including decreased motor control at 6 months, and atypicalities in social-communication, response to transitions and repetitive behaviors at 12 months. Atypicalities in visual tracking, general behavioral reactivity, and imitation were predictive only for children with ASD and IQ<70, thus highlighting heterogeneity in early signs related to later IQ.

138.002 Stability of AUTISM Spectrum Diagnoses within A High-RISK Longitudinal Cohort. W. Roberts*[1], L. Zwaigenbaum[2], J. A. Brian[3], S. E. Bryson[4], I. M. Smith[4], P. Szatmari[5] and C. Roncadin[6], (1)*University of Toronto*, (2)*University of Alberta*, (3)*Bloorview Research Institute* , (4)*Dalhousie University/IWK Health Centre*, (5)*Offord Centre for Child Studies, McMaster University*, (6)*Peel Children's Centre*

STABILITY OF AUTISM SPECTRUM DIAGNOSES WITHIN A HIGH-RISK LONGITUDINAL COHORT

Wendy Roberts, Susan Bryson, Isabel Smith, Jessica Brian, Caroline Roncadin, Tracy Vaillancourt, Peter Szatmari, & Lonnie Zwaigenbaum

Background: Longitudinal studies of clinically-referred children indicate a high level of stability of autism spectrum disorder (ASD) diagnoses, with over 80% of children diagnosed with ASD at age 2 years having these diagnoses confirmed independently at age 3. However, the sensitivity and specificity of early ASD diagnoses may be influenced by ascertainment biases, whereby children with more severe symptoms and/or language impairment are referred earlier.

Objectives: Our goal is to examine the stability of diagnostic classification in a high-risk cohort of younger siblings of children with ASD, followed prospectively from infancy.

Methods: ASD symptoms were assessed prospectively in 246 high-risk infants using the Autism Observation Scale for Infants (AOSI) at 6, 12 and 18 months, and using the Autism Diagnostic Observation Schedule (ADOS) at 18, 24 and 36-42 months. The Autism Diagnostic Interview – Revised (ADI) was administered routinely at 36-42 months (hereafter, 3 years), and earlier for selected participants with suspected ASD. Clinical diagnoses were assigned based on expert judgment using the ADI-R (if available), ADOS and DSM-IV-TR. Other aspects of development were assessed using the Mullen Scales of Early Learning (MSEL) at each time point.

Results: Of the 42 clinical ASD diagnoses that were established by age 24 months, 36 were confirmed independently (i.e., blind to prior assessments) at 3 years (85.7%). Six children were noted to have other clinical concerns at 3 years (including 2 with language delays) but were subthreshold for ASD. An additional 28 children who had not been identified at 24 months, were diagnosed with ASD at 3 years. Thus, the specificity of a 24-month ASD diagnosis relative to 3-year diagnosis was very high (96.7%), with a positive predictive value of 85.7%; however, sensitivity was relatively low (56.2%). Children not diagnosed until 3 years were less likely than those diagnosed by 24 months to meet full criteria for autistic disorder, more likely to have phrase speech, and had more advanced cognitive skills as indexed by MSEL at 3, and had fewer symptoms of ASD at age 12 and 18 months.

Conclusions: In our prospective high-risk cohort, 85.7% of ASD diagnoses established at 24 months were confirmed independently at age 3. However, the sensitivity of 24-month diagnostic assessment, relative to independent ASD diagnoses at age 3 years, was only 56.2%. The later-diagnosed group, most of whom had diagnostic subtypes other than autistic disorder, was more likely to have more advanced cognitive and language development than children diagnosed by 24 months. The later diagnosed group also had fewer symptoms at age 12 and 18 months, consistent with previous reports that early detection, screening and diagnosis may be a particular challenge for higher-functioning children with ASD. Ongoing follow-up for this high-risk cohort may identify children with even milder manifestations of ASD.

138.003 Intact Early Gaze Following In Infants at High Risk for Autism Spectrum Disorders. R. Bedford*[1], M. Elsabbagh[2], A. Senju[2], T. Gliga[2], A. Pickles[3], T. Charman[1], M. H. Johnson[4] and .. The BASIS Team*[5], (1)*Institute of Education*, (2)*Centre for Brain and Cognitive Development, Birkbeck*, (3)*Institute of Psychiatry*, (4)*Centre for Brain and Cognitive Development, Birkbeck, University of London*, (5)*BASIS*

Background:

Across different studies, impairments in joint attention (JA) behaviours characterise young children with autism (Elsabbagh & Johnson, 2007). Charman (2003) notes that the majority of studies based on retrospective parental report show that JA difficulties are likely to be the best 'discriminators' of autism in infants between 12 and 18 months. Whilst JA impairments in autism have been widely studied, little is known about the development of the precursor abilities of following gaze. Typically developing human infants are highly sensitive to eye-gaze cues and consistently follow someone's gaze in the latter half of the first year of life. In order to study the early development of gaze following we investigated this behaviour in infants at risk for autism spectrum disorder (ASD).

Objectives:

To explore the early development of gaze following in the broader autism phenotype (BAP) our study examined the direction of 'first look' and the amount of 'looking time' to the gazed-at object. Our participants were a longitudinal sample of infants aged 7 and 13 months at high risk for autism (due to having an older sibling with autism) and low-risk controls. We aimed to establish whether any early differences in gaze following behaviour in at-risk infants might contribute to subsequent social and communication difficulties at 24 months.

Methods:

Participants were 35 infants at high risk for ASD and 38 low-risk controls recruited through the British Autism Study of Infant Siblings (BASIS).

We employed Tobii eye-tracking techniques to record gaze behaviour. Infants were shown 12 short videos of a female model turning to look at one of two objects. We compared high-risk and low-risk groups and also 'sibs-low ADOS' and 'sibs-high ADOS' split on the basis of the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2000), which was administered at 24 months.

Results:

No differences between the at-risk and control group were found, either in terms of gaze following or subsequent attention to the gazed-at object. Further, at both visits sibs-low ADOS and sibs-high ADOS followed the model's gaze and performance improved over time. However despite orienting correctly, by the second visit at-risk infants who went on to show social communication difficulties (sibs-high ADOS) spent less time looking to the correct object.

Conclusions:

This study provides evidence that the basic orienting mechanism for early gaze following behaviour is intact in at-risk infants. However, the emergence of reduced looking time to the correct object in those who later show social communication difficulties, suggests that having decoded gaze direction these children may not use it to learn about the gazed at object. This has implications in terms of understanding the nature of autistic social impairments. It may be that it is not gaze following per se but rather understanding its function that is problematic in this population.

* The BASIS Team in alphabetical order: S. Baron-Cohen, P. Bolton, S. Chandler, J. Fernandes, H. Garwood, K. Hudry, L. Tucker, A. Volein.

138.004 Diagnostic Indicators of Autism Spectrum Disorders In the First Six Months of Life. A. Klin* and W. Jones, *Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine*

Background:

Although early intervention is a strong positive predictor of long-term outcome in Autism Spectrum Disorder (ASD), the condition is rarely diagnosed before 2 years.

Objectives:

To measure social visual engagement using eye-tracking methods in a longitudinal cohort of infants at risk for autism with the goal to assess their diagnostic value in the first year of life.

Methods:

In a longitudinal, prospective design, we used risk-based cohorts to ascertain case-control samples of infants with ASD and typically-developing controls, charting developmental course of visual attention to other people from 2 until 24 months of age. Experimental measures were densely sampled, with 10 data collection sessions per child, 5 of which occurred between months 2 and 6.

Results:

From at least 2 months of age, infants with ASD follow a significantly different developmental trajectory in their visual attention to other people, with decline in fixation on others' eyes and increased fixation on body and object areas. Longitudinal change in fixation to eye and mouth regions is highly correlated with severity of clinical outcome at 24 months: $r = -.83$, $p=.002$ and $r = .88$, $p<.001$, respectively. In addition, based only on data collected in the first 6 months of life, rate of change in eye fixation predicts diagnostic outcome with 78% se and 67% sp, while change in body fixation predicts outcome with 89% se and 79% sp.

Conclusions:

In a cohort of children tested repeatedly and intensively from month 2 until month 24, we have identified diagnostic markers during the first 6 months of life that differentiate infants with ASD from controls. This represents a crucial first step in advancing the earliest identification of ASD, a key factor in promoting optimal long-term outcome.

138.005 The Development of Multimodal Communication In Infants at High Risk for Autism Spectrum Disorders. M. V. Parladé*, K. Schuessler and J. M. Iverson, *University of Pittsburgh*

Background: The ability to coordinate communicative expressions from different behavioral modalities (e.g., vocal, gestural) is a crucial component of communication (e.g., Crais et al., 2009). In addition to impairments in gesture, pre-verbal speech sounds, and expressive language, children with autism spectrum disorders (ASD) have difficulty producing these behaviors in coordination (e.g, Stone et al., 1997). This study compared the development of multimodal communication in infants at heightened ASD risk (later-born siblings of children with autism; HR) to that of infants with low ASD risk (infants with a negative family history of ASD; LR) to determine whether HR infants demonstrate communicative coordination delays and whether such impairments are related to a later ASD diagnosis.

Objectives: To investigate developmental trajectories in the production and temporal coordination of communicative behaviors from 8 to 18 months in HR and LR infants.

Methods: Forty-seven HR infants (43% male) and 29 LR infants (45% male) were observed at home for 30 minutes during everyday household activities and play with a primary caregiver. The 8, 10, 12, 14, and 18 month observations were coded for communicative gestures, words, and non-word vocalizations produced by the infant. Coordinated bouts of communicative behaviors (i.e., instances in which gestures overlapped in time with non-word vocalizations or words) were identified. At 36 months, HR infants were administered the ADOS-G (Lord et al., 2000); to date, six infants have received an ASD diagnosis (HR-ASD). The remaining HR and LR infants did not meet ASD criteria (No Diagnosis; HR-ND, LR-ND).

Results: Preliminary analyses were conducted using Hierarchical Linear Models (Bryk & Raudenbush, 1992). Unconditional and conditional growth models were estimated separately for Overall Communicativeness (the total number of all gestures and vocalizations produced in a given session) and Coordinated Bouts (the total number of all gesture-vocalization coordinations). A one parameter (slope only) linear model adequately represented the individual growth data collected in this study. After controlling for gender, Overall Communicativeness growth trajectories for the LR-ND, HR-ND, and HR-ASD groups were positive (increasing) but not significantly different from one another. However, relative to the LR-ND group, Coordinated Bouts grew at a slower rate (i.e., .79 bouts slower per month) in the HR-ND group ($p = .028$). This pattern was more pronounced for the HR-ASD infants, who, on average, gained 1.60 bouts fewer per month than LR-ND infants ($p = .000$). Over time, this slower growth rate translated into progressively larger standard deviation differences between the LR-ND and HR-ASD groups. At 12 months, scores for the HR-ASD infants fell on average 10.53 SD below those for LR-ND infants, but by 18 months the difference had more than doubled, with HR-ASD infants scoring 26.32 SD below LR-ND infants.

Conclusions: There is a broad pattern of delay in the production of temporally coordinated communicative behaviors among HR infants that cannot be simply attributed to a delay in the overall production of communicative acts. This delay appears to be more pronounced in HR infants who eventually receive an ASD diagnosis, suggesting that multimodal communication may be an early behavioral marker of ASD.

138.006 Maternal Responses to Vocal Bids of Infants at High Versus Low Risk for Autism. D. M. Butler*, N. B. Leezenbaum, J. B. Northrup, S. Campbell and J. M. Iverson, *University of Pittsburgh*

Background: Maternal responsiveness to infant vocal behavior is associated with language development (Tamis-LeMonda, Bornstein, & Baumwell, 2001). In addition, research suggests that maternal responses to infants' vocalizations vary based on developmental status (e.g., vocalizations vs. words; Gros-

Louis, West, Goldstein, & King, 2006). While relations between caregiver input and infant communication development have been well-documented in typically-developing infants, relatively little is known about caregivers' responses to children at-risk for autism. By examining the communicative relationship between mothers and their infants at high-risk (HR infants: later-born sibling of child with autism), we may be able to identify consistent patterns of maternal responsiveness that play a role in the process of language acquisition.

Objectives: To examine how mothers of HR infants and mothers of low-risk infants (LR infants: later-born siblings of typically-developing children) respond to their 18 month-old infants' vocalizations and words.

Methods: 12 HR (5 males) and 13 LR (6 males) infants and their mothers (HR mothers, LR mothers) were filmed at home for 45 minutes. The visit consisted of 15 minutes of naturalistic observation, 15 minutes of semi-structured toy play, and 15 additional minutes of naturalistic observation. For the purposes of this study, only spontaneous vocal communication produced by the infant that was directed toward the mother was coded (e.g., child made eye contact with mother while vocalizing). Infant vocal productions were then classified as either non-word vocalizations (i.e., vowel strings, reduplicated and variegated babbling) or words (i.e., actual English words or word approximations). Maternal responses produced at any time following the onset and within two seconds of the offset of the infant's bids were coded (Gros-Louis et al, 2006).

Results: HR mothers showed lower responsiveness to infant vocalization (M = .591, SD = .083) as compared to LR mothers (M = .839, SD = .076), but the groups did not differ in their responsiveness to words (M = .742, SD = .062; M = .768, SD = .057, respectively). This was reflected in a significant interaction (F = 4.55, p = .044) between infant risk status (HR vs. LR) and type of infant vocal communication (non-word vocalization vs. word) illustrating that HR mothers responded differently to non-word vocalizations than to words, while mothers of LR infants did not.

Conclusions: The finding of an interaction effect suggests that the HR mothers' rates of responsivity vary according to the quality of their infant's vocal communication more so than for LR mothers. HR mothers may be more focused on their infants' developmentally-advanced vocalizations (words) at the expense of less developmentally-advanced vocalizations whereas the LR mothers respond to all infant vocal bids at a similar rate. Future studies might include longitudinal observations from a younger age and develop measures that explore the developmental impact of variation in caregiver responses on communicative development of infants at-risk for autism.

138.007 Reduced Attention to Social Content In Preverbal Infants at Risk for Autism. S. P. Johnson*[1], K. Gillespie[2], M. C. Frank[3], W. Frankenhuis[1], S. S. Jeste[4], M. Dapretto[2] and T. Hutman[4], (1)*UCLA*, (2)*University of California, Los Angeles*, (3)*Stanford University*, (4)*UCLA Center for Autism Research and Treatment*

Background: Does reduced attention to biological motion and faces by 9 months distinguish between the infant siblings of children with autism and low-risk infants? Preferential attention to biological motion and faces is typically observed soon after birth (Johnson et al., 1991; Simion et al., 2008). The absence of this preference in toddlers and older individuals with autism may limit opportunities for social learning (Klin et al., 2009; Osterling & Dawson, 1994). Neural evidence suggests that infant siblings process faces relative to objects differently than low-risk infants by 10 months (McCleery et al., 2009). Orienting towards faces may support cortical specialization for social stimuli (Morton & Johnson, 1991).

Objectives: The current study examines whether infant siblings orient to faces and low-level biological motion less than low-risk infants. Reduced orienting to social stimuli in infancy would restrict opportunities to learn about social interaction very early in the development of infant siblings.

Methods: In the Animacy task, infants viewed eight side-by-side presentations of video displays consisting of two dots moving within a pair of 10 x 10 cm regions. The dots moved either in a contingent fashion, judged by naive adult observers to be "chasing" (Animate displays) or in random fashion (Inanimate displays). Eye movements were recorded with a Tobii T60 eye tracker. In the Face Detection task, infants viewed two 4-min video segments taken from a cartoon (A Charlie Brown Christmas) or from a children's television program (Sesame Street). Videos were matched for duration, action sequences, motion, social interactions, and musical and linguistic content. Eye movements were recorded with a Tobii T60 eye tracker.

The at-risk group consisted of infants between 6 and 9 months of age who were younger siblings of children previously diagnosed with autism (Animacy task N = 7, Face Detection task N = 8). The control groups (N = 21 and 24, respectively) were in a similar age bracket and came from families who did not report autism in first-, second-, or third-degree relatives.

Results: Infants in the control group showed a strong preference for Animate displays, $t(20) = 7.38$, $p < .0001$. In contrast, at-risk infants showed no consistent preference, $t(6) = 1.48$, ns. Similarly, infants in the control group looked overall more at the faces in the cartoon relative to at-risk infants, $t(30) = 4.85$, $p < .0001$, and at the faces in the children's television program, $t(30) = 3.74$, $p < .001$.

Conclusions: Infant siblings of children with autism showed less interest in social content available in video stimuli. The effect generalized to real faces, cartoon faces, and abstract motion displays in which adults detected contingent interaction between two dots. These results imply that behavior in preverbal infants, younger than the conventional age of diagnosis of autism, may reveal subtle signs of risk status in vulnerable populations.

138.008 Joint Attention Predicts Adaptive Behavior Development In Infants with and without ASD. T. Hutman*[1], L. Gomez[1], K. Gillespie-Lynch[2], A. Rozga[3], M. Sigman[1] and S. P. Johnson[1], (1)*University of California, Los Angeles*, (2)*UCLA*, (3)*Georgia Institute of Technology*

Background:

Children with autism and their siblings who do not develop autism exhibit reduced adaptive behaviors and joint attention skills relative to typically developing controls (Freeman et al., 1991; Rozga et al., 2010; Toth et al., 2007; Yoder et al., 2009). Szatmari and colleagues (2009) proposed that a single mechanism such as joint attention may underlie language and adaptive-skill impairment and variability in severity of autism. Treatment targeting joint attention impacts language, social skills, and other symptoms of autism (Kasari et al., 2008; Kasari & Rotheram-Fuller, 2005). Language skills at 12 months are related to changes in adaptive behaviors between 12 and 36 months (Gomez et al., 2009), but the relationship between joint attention during infancy and later adaptive behavior has not been evaluated.

Objectives:

1. Compare development of adaptive skills between infants later diagnosed with autism (ASD), non-autistic siblings of children with autism (HR-non-ASD), and low-risk controls (LR).

2. Determine if RJA or IJA is associated with change in adaptive behaviors.

Methods:

Twenty-nine LR, 42 HR-non-ASD, and 10 ASD infants were assessed at 12, 18, and 36 months. Adaptive behaviors were assessed through parental interview using the Vineland Adaptive Behavior Scales (VABS; Sparrow et al., 1984). The Early Social Communication Scales (Mundy et al., 2003) were administered at 12 and 18 months, yielding measures of proximal RJA (following points to pictures in a book) and distal RJA (gaze/point following to posters on the wall) and frequencies of low-level IJA (eye contact/gaze alternation) and high-level IJA (pointing/showing). Univariate analyses examined change in VABS scores in relation to joint attention.

Results:

VABS raw scores for daily living skills (DLS; $p = .005$), social ($p=.04$), and communication skills ($p <.001$) changed less from 12 to 36 months among infants later diagnosed with ASD than HR-non-ASD and LR infants.

Neither high- nor low-level IJA predicted change in VABS scores. When gender, verbal and nonverbal mental age, and diagnostic outcome were included in analyses, proximal but not distal RJA at 12 months predicted change in DLS from 12 to 36 months $F(1,74)=4.981$, $p =.029$. Distal but not proximal RJA at 18 months predicted change in DLS from 18 to 36 months $F(1,70)=6.931$, $p =.01$. ASD diagnosis did not moderate the relationship between RJA and change in DLS. RJA was not related to changes in social, communicative, or motor skills as measured by the VABS.

Conclusions:

RJA predicted change in DLS, over and above effects associated with IQ and autism. Baseline IQ predicted improvement in DLS (Freeman et al., 1999; Sigman & McGovern, 2005) in individuals with autism. But DLS appears to be less impaired than other adaptive skills among people with autism (Carter et al., 1998). As RJA skills extended to more distal targets from 12 to 18 months, the distal measure became a better predictor of adaptive skills. These results suggest that the ability to understand referential acts supports the acquisition of a variety of other skills including language, personal care, and self-help. This study affirms the importance of targeting RJA in early intervention programs.