Published in final edited form as:

J Autism Dev Disord. 2017 November ; 47(11): 3550–3561. doi:10.1007/s10803-017-3255-5.

Screening for Autism with the SRS and SCQ: Variations across Demographic, Developmental and Behavioral Factors in Preschool Children

Eric J. Moody[1], **Nuri Reyes**[1], **Caroline Ledbetter**[2], **Lisa Wiggins**[3], **Carolyn DiGuiseppi**[2], **Amira Alexander**[4], **Shardel Jackson**[4], **Li-Ching Lee**[5], **Susan E. Levy**[6], and **Steven A. Rosenberg**[1]

[1]Departments of Psychiatry and Pediatrics, University of Colorado Anschutz Medical Campus, Mailstop C234, 13121 E 17th Ave, Aurora, CO 80045, USA

[2]Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

[3]Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities, Atlanta, GA, USA

[4]Centers for Disease Control and Prevention, Office for State, Tribal, Local and Territorial Support, Atlanta, GA, USA

[5]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

[6]University of Pennsylvania at The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Abstract

The Social Communication Questionnaire (SCQ) and the Social Responsiveness Scales (SRS) are commonly used screeners for autism spectrum disorder (ASD). Data from the Study to Explore Early Development were used to examine variations in the performance of these instruments by child characteristics and family demographics. For both instruments, specificity decreased as maternal education and family income decreased. Specificity was decreased with lower developmental functioning and higher behavior problems. This suggests that the false positive

Correspondence to: Eric J. Moody.

Author Contributions EJM developed the analysis idea, coordinated analysis and writing activities, oversaw development of the manuscript. NR conducted literature reviews, participated in writing and conceptual development of the analysis. CL conducted the analyses, and contributed to writing the manuscript. LW participated in the design of the analysis, oversaw data collection from one of the sites and contributed to the writing of the manuscript. CD participated in the design of the analysis, oversaw data collection from one of the sites and contributed to the writing of the manuscript. AA contributed to the initial design of the analysis, and contributed to the writing of the manuscript. SJ contributed to the initial design of the analysis, and contributed to the writing of the manuscript. LL participated in the design of the analysis and contributed to the writing of the manuscript. SEL participated in the design of the analysis and contributed to the writing of the manuscript. SAR participated in the design of the analysis and contributed to the writing of the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Each participating site (California, Colorado, Georgia, Maryland, North Carolina & Pennsylvania) each obtained Institutional Review Board approval separately from their home institutions before any data were collected.

rates of the SRS and the SCQ are associated with child characteristics and family demographic factors. There is a need for ASD screeners that perform well across socioeconomic and child characteristics. Clinicians should be mindful of differential performance of these instruments in various groups of children.

Keywords

Autism; Screener; Demographics; Maternal education; Development

Introduction

The American Academy of Pediatrics (AAP) recommends that all children be screened for autism spectrum disorder (ASD) in early childhood (Johnson and Myers 2007). Indeed, early identification of children with ASD is critical as it facilitates referral for early intervention services, which have been shown to improve outcomes (Connor 1998; Rogers 1998) and reduce the long term cost of care (Jacobson et al. 1998; Peters-Scheffer et al. 2012). However, there is little information about the performance of screeners for ASD in young children across demographic variables or by child characteristics.

Both the Social Communication Questionnaire (SCQ; Rutter et al. 2003) and Social Responsiveness Scale (SRS; Constantino and Gruber 2005) are questionnaires designed for detecting risk for ASD. The SCQ was originally designed as a screening tool for children 4 years of age or older enrolled in epidemiological research or for studies comparing individuals with ASD and other clinical groups (Berument et al. 1999; Rutter et al. 2003), and it is now used clinically. It was derived from the Autism Diagnostic Interview-Revised (ADI-R; Lord and Rutter 1994), a parent interview used to diagnose ASD in combination with other measures. The SCQ is strongly correlated with the ADI-R ($r = .71$, $p < .001$; Berument et al. 1999). The SRS is often used to identify the presence and severity of ASD-related behaviors (Constantino and Gruber 2005; Constantino et al. 2003a, 2004; Constantino and Todd 2005; Duvall et al. 2007; Frazier et al. 2014; Virkud et al. 2009).

Both the SCQ and SRS have good overall psychometric properties. The SCQ has high internal consistency (Cronbach's alpha = 0.87; Rutter et al. 2003). It also has good discriminative validity when distinguishing between children with ASD and non-ASD diagnoses at all intelligence quotient levels, but particularly when used with children 4 years of age or older and children from clinical populations (Berument et al. 1999). The sensitivity of the SCQ, or ability to correctly classify children with ASD, is about 96% in samples of children without intellectual disability. The specificity of the SCQ, or ability to correctly classify children without ASD, is about 80% in samples of children without intellectual disability (Rutter et al. 2003). Specificity of the SCQ drops considerably when used with children who have intellectual impairments (Berument et al. 1999).

The SRS has high internal consistency (Cronbach's alpha = 0.76), and has good discriminant validity (Constantino 2002). Sensitivity and specificity are 0.85 and 0.75, respectively, when the SRS total score of 75 is used as the cutoff (Bölte et al. 2011; Constantino 2002). Previous research also suggests that the SRS could be a cost-effective assessment for

measuring ASD symptoms in school and clinical settings. Specifically, the SRS has been found to be useful at differentiating between children with ASD and those without ASD (Cholemkery et al. 2014; Wang et al. 2012). The SRS has also been used to track the severity of ASD symptoms over time (Constantino et al. 2009; Ho et al. 2005), and it has been found to be useful for assessing response to interventions (Constantino et al. 2009, 2007; Constantino and Todd 2003; Pine et al. 2006). However, SRS scores are known to increase in the presence of some child behavior challenges, such as Attention Deficit/Hyperactivity Disorder (Reiersen et al. 2007), and mood disorders (Pine et al. 2008). Further, child behavior problems as measured by the Child Behavior Checklist (CBCL; Achenbach and Rescorla 2001) account for a large proportion of the variance in SRS scores (Constantino et al. 2003b) suggesting that behavior problems may impact screening performance.

Although the SCQ performs well overall, there are variations in performance depending on child age and the cutoff score used. For instance, the SCQ has been found to be less effective when the recommended cutoff of ≥ 15 is used to differentiate children younger than 4 years of age with and without ASD (Allen et al. 2007; Corsello et al. 2007; Eaves et al. 2006; Snow and Lecavalier 2008; Wiggins et al. 2007), and may have a high false positive rate (Oosterling et al. 2010a). The performance of the SCQ seems to improve when a cutoff score of ≥ 11 or ≥ 13 is used in samples of young children (Allen et al. 2007; Corsello et al. 2007; Oosterling et al. 2010b; Snow and Lecavalier 2008; Wiggins et al. 2007). Because using a cut off of ≥ 11 has been shown to maximize sensitivity and specificity in younger children (Wiggins et al. 2007), this lower cut off has often been adopted by large public health research studies (Schendel et al. 2012; Wiggins et al. 2015). Also, most studies report that the SCQ shows an acceptable sensitivity (≈80%) and less than optimal specificity (≈60%) when used to distinguish children with ASD and other developmental disabilities (Allen et al. 2007; Eaves et al. 2006; Snow and Lecavalier 2008; Witwer and Lecavalier 2007).

Likewise, SRS scores are associated with variations in performance across child factors. Specifically, higher SRS scores suggest more risk for ASD and are associated with increased non-ASD behavior problems, older age, and more impaired language, and cognitive skills in children with ASD (Hus et al. 2013). Further, in a German sample, SRS scores were higher when used with children with conduct disorder and attention-deficit/hyperactivity disorder (Bölte et al. 2008). These findings suggest that behavior problems, increased age, and expressive language or cognitive level might reduce the specificity for these instruments (Charman et al. 2007). However, it is not known whether the SRS shows variability in performance by age as does the SCQ (Wiggins et al. 2007).

The current study expands upon past research by exploring the psychometric properties of the SCQ and the SRS in young children enrolled in the Study to Explore Early Development (SEED). Specifically, the sensitivity and specificity of the SCQ and SRS were estimated in this large community-based sample, and the relationships of SCQ and SRS to child and family demographic factors assessed. Child variables included several behavior problems as measured by the Child Behavior Checklist (Achenbach and Rescorla 2001) and developmental levels as measured by the Mullen Scales of Early Learning (Mullen 1995). Family characteristics included household income, maternal education, and maternal race

and ethnicity. Based on research that has found variability in the performance for the SCQ and SRS, described above, as well as variability in the performance of other autism screeners (e.g., Scarpa et al. 2013) we expect to find that both child characteristics and family characteristics will impact screening performance of the SCQ and SRS.

Method

Participants

Data for this analysis come from phase I of SEED; data were collected from January 2003 to December 2005. SEED is a large case-control study of the risk factors associated with ASD that included children with ASD, or developmental delays, and children from the general population. Children with ASD and other developmental delays were recruited from a variety of clinical and educational sources. Population comparison children were recruited from a random sample of birth records. Potential participants were screened for eligibility and ASD risk by phone. They then completed paper-and-pencil questionnaires by mail and a detailed exposure history by phone prior to in-person evaluation for ASD. See Schendel et al. (2012) for complete details about this study, including eligibility, recruitment, case ascertainment and study procedures.

Participating families had children 30–68.9 months old and came from catchment areas in six states: California, Colorado, Georgia, Maryland, North Carolina, and Pennsylvania. California and Colorado were the only sites to recruit Spanish-speaking families; all interviews and questionnaires were conducted in either English or Spanish at the preference of the family. Informed consent was obtained from all caregivers who participated in the study. The current analysis included only those children who completed their developmental assessment and for whom a valid Mullen Scales of Early Learning (MSEL) was obtained (see measures below), and whose parents completed SCQ, SRS and Child Behavior Checklist (CBCL). The Ohio State University (OSU) Autism Rating Scale (OARS; used as our analytic “gold standard”), was used as a measure of clinical judgment about presence of ASD (OARS-4; The OSU Research Unit on Pediatric Psychopharmacology 2005). Children whose parents chose not to complete measures of developmental level or behavior challenges were not included in those stratified analyses. The final sample sizes are reported with each analysis.

Measures

Demographics—Demographic characteristics were collected during a standardized interview with the primary caregiver. Interviewers were trained and ongoing quality control assessments ensured reliability (see Schendel et al. 2012). The current analysis used sex of child, maternal race, ethnicity, and education, as well as household income as reported by the primary caregiver.

Social Communication Questionnaire-Current (SCQ; Rutter et al. 2003)—All children were screened for ASD with the SCQ upon entry into SEED. The SCQ has 40 items and is appropriate for both verbal and non-verbal children. Total scores range from 0 to 39 with higher scores representing more social communication impairment. The sensitivity and

specificity of the SCQ is maximized at lower cut offs when used with younger children (Wiggins et al. 2007) and the SEED used a cutoff score of 11 points to indicate risk for ASD (Wiggins et al. 2015). Therefore, the current analysis explored performance of the SCQ when cutoff scores of 11, 13 and 15 were used to explore how its performance is affected at different cut points.

Social Responsiveness Scale (SRS; Constantino 2002)—The SRS is a 65-item parent report measure. The preschool version was used in SEED (Schendel et al. 2012). It has five treatment subscales, which can be useful in clinical settings or for developing treatment plans (i.e., autistic mannerisms, social awareness, social cognition, social communication, and social motivation). Higher SRS scores represent more ASD-related behaviors. We used a cutoff T score of 60 as an indication of mild to moderate risk for ASD for this analysis. This cutoff results in a 96.8% likelihood of a later clinical diagnosis of ASD (Constantino et al. 2007). Although Schanding et al. (2012) did explore optimal cut offs for the SRS, this study's sample had a very large age range. Therefore, we explored only the cut off reported in the manual in the current analysis.

OARS-IV (The OSU Research Unit on Pediatric Psychopharmacology 2005)—The OARS-IV is an instrument that rates the number of ASD symptoms present, the severity of ASD symptoms, the clinician degree of certainty that the child has ASD, and the degree of impairment associated with ASD. The OARS-IV was completed by the clinician who evaluated the child (see Classification of Case Status below for details of evaluation process). Clinical judgment was determined by the clinician degree of certainty the child had ASD. Out of a total of five points, scores of four or five indicated ASD, and scores of one, two, or three indicated non-ASD.

Mullen Scales of Early Learning (MSEL; Mullen 1995)—The MSEL is a measure of early learning abilities. The MSEL produces an early learning composite and four domain scores: expressive language, fine motor, receptive language, and visual reception. MSEL domain t-scores were categorized as *Not Below Average* (40 and above for t-scores and a standard score of 85 and above for the Early Learning Composite) and *Below Average* (below 40 for t-scores and a standard score of below 85 for the Early Learning Composite).

Child Behavior Checklist, Age 1½–5 (CBCL; Achenbach and Rescorla 2001)—The CBCL measures behavioral and emotional problems in children. It includes seven syndrome scales: aggressive behavior, anxious depressed, attention problems, emotionally reactive, sleep problems, somatic complaints, and withdrawn, each of which was examined in our analyses. CBCL syndrome domain t-scores were categorized as *Clinical* (60 or greater) and *Non-Clinical* (less than 60).

Classification of Case Status

Data collection procedures were standardized across all sites and were rigorously monitored for quality control. All participants began with an eligibility screener and the SCQ administered by phone to their primary caregiver. Additional phenotypic information for the sampled child, including the CBCL and SRS, were collected by mail or at the in-person

clinic visit. Questionnaires that were completed by mail were typically returned within 1–2 months after the SCQ, but some allowances were made to accommodate the needs of the family. Study protocol required all study steps to be completed within 6 months after enrollment.

Children were then seen by research-reliable clinicians (administrators who have completed advanced training for the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000) and ADI-R and achieved 80 and 90% scoring reliability on those instruments, respectively) who conducted a clinic visit to determine case status. Children with lower risk for ASD (e.g., SCQ score of ten or less points) were administered the MSEL only, unless the child had a previous diagnosis or educational identification of ASD. Children with risk for ASD (e.g., SCQ score of 11 or more points) received a full autism assessment [ADOS, ADI-R, MSEL, and Vineland Adaptive Behavior Scales—Second Edition (Sparrow et al. 2005)].

Children were classified as ASD or non-ASD based on the results of the ADOS, ADI-R and clinical judgment, as measured by the OARS-IV described previously. See Wiggins, et al. (2015) for complete details about the classification of study participants. Note that not all children received an ADOS and ADI-R to determine case status. However, all children in this analysis received an in-person developmental evaluation by a trained clinician which was the basis for the OARS-4 rating used as our gold standard. Moreover, if after working with a child, the clinician believed that a child displayed significant signs of ASD, a full evaluation, including the ADOS and ADI-R, could be performed even if the child scored low on the SCQ. Per study protocol, this decision was made based on the clinician's judgment after interacting with the child and occurred only three times. Clinicians at all sites had advanced degrees and expertise in evaluating autism. All clinicians participated in pre-data collection exercises to establish reliability and then participated in quarterly exercises to maintain scoring reliability and yearly exercise to maintain administration fidelity. See Wiggins et al. (2015) for further details.

Analysis Plan

The overall sample was first characterized using descriptive statistics. To determine the performance of the SRS and SCQ as screeners for ASD, we calculated their sensitivity (number of true positive/[true positive + false negative]) and specificity (number of true negative/[true negative + false positive]) overall and, for the SCQ, at multiple cutoff points. This was computed for the total sample first, and then stratified by demographic variables and CBCL and MSEL domains. Confidence intervals (95% CIs) were computed for each sensitivity and specificity statistic. We used the common formula to calculate CIs for binomial proportions: $p \pm 1.96\sqrt{\frac{p(1-p)}{n}}$, where n equals the sample size (for sensitivity this equals the number of children with ASD and for specificity, the number of children without ASD). In cases where the sample sizes were too small to use this formula (i.e., n < 5) we calculated exact confidence intervals using PROC freq in SAS 9.3.

Previous research as suggested that sensitivity should be between 0.70 and 0.80, and specificity should be about 0.8 to be considered an effective screener (e.g., Glascoe 2005).

Therefore, we used these benchmarks to indicate adequacy of the screening performance. However, given that sensitivity and specificity are continuous measures, we use categorical descriptions of performance cautiously. Further, assessing change in sensitivity and specificity was conducted based on confidence intervals around the point estimate. In general, CIs provide much more information than do significance tests (Cumming 2014) and a statistically conservative approach in comparing proportions is to assess whether CIs overlap. If they do not, one can assume they are significantly different; although, the inverse is not necessarily true (Andrade 2015).

Results

Sample Characteristics

There were 3769 children enrolled in SEED, and 2600 who completed an in person developmental assessment. For the purposes of this analysis, children were classified as either ASD or non-ASD. Those classified as non-ASD included both children from the general population and children who had developmental challenges other than ASD. This analysis included 2317 children with completed clinic visit, OARS, SCQ and SRS assessments. The average age of the sample was 55.9 months at the time of consent and only 346 (14.9%) were below 4 years of age. The average age at the time of data collection for each of the instruments was 55.0 months for the SCQ, 56.8 months for the Mullen, 58.8 months for the CBCL and 60.4 months for the SRS. Stratified calculations for the MSEL and CBCL included only those children who also completed those additional measures. Table 1 shows sample characteristics. Note that all analyses were re-run excluding children with non-ASD developmental challenges and those who were under 4 years of age. Results did not change remarkably for either of these sensitivity analyses and all relationships reported here remained.

Sensitivity and Specificity

Table 2 reports the overall sensitivity and specificity for the whole sample, as well as stratified results based on demographic characteristics, with corresponding 95% CIs. Overall, sensitivity and specificity were adequate for both measures. SCQ performance varied based on the cutoff used. In stratified analyses, there were notable drops in specificity for both the SCQ and SRS with lower family income, less maternal education, and African American race and Hispanic ethnicity of the mother. As expected due to the known tradeoff between sensitivity and specificity, sensitivity was reduced as income increased, and this was especially pronounced for SCQ cutoffs of 13 and 15.

Tables 3 and 4 report sensitivity and specificity for the SCQ and SRS stratified by MSEL and CBCL domains. There were notable drops in specificity for both instruments when children were classified as having below average MSEL performance or behavior problems on the CBCL. As expected, sensitivity was reduced for children with average or better MSEL language, motor, and visual reception abilities and fewer CBCL behavior problems.

Discussion

This analysis found important differences in how the SRS and SCQ performed across several child and family characteristics. Specifically, both the SCQ and SRS instruments became less specific and more sensitive as maternal education and household income decreased. These relationships occurred at all cutoffs used for the SCQ. This adds to a growing body of literature that shows that ASD screener scores are associated with a number of child characteristics (Constantino et al. 2003b; Oosterling et al. 2010a; Pine et al. 2008; Reiersen et al. 2007) and that they may perform poorly in those from lower socioeconomic status (SES) backgrounds (Scarpa et al. 2013). Importantly, in the case of the SCQ, higher cutoffs resulted in somewhat higher specificity, but did not completely mitigate this problem. Specificity also dropped for children of non-white mothers; this was particularly pronounced for children of African American mothers as indicated by the non-overlapping CIs.

There were also noticeable drops in SCQ and SRS's specificity for children with developmental or behavioral challenges as measured by the MSEL and CBCL as indicated by the non-overlapping CIs in Tables 3 and 4. That is, for every MSEL and CBCL subscale/composite score, the SRS and the SCQ showed reduced specificity for children who scored below average or in the clinical range relative to those who scored average or above. When stratified on MSEL scales, the SCQ with a cutoff of 15 had somewhat better performance in those children with below average development, with most sensitivities and specificities in the 70s. However, there was still an average drop of 19.5 percentage points in specificity relative to children without developmental challenges. By contrast, the SRS had specificities in the upper 40s to mid-50s and an average drop of 35 percentage points between those with and without developmental challenges. In the presence of some developmental challenge, both instruments seemed to capture those challenges as indicating ASD. Also, even though lower cutoffs on the SCQ have been shown to maximize sensitivity and specificity overall, we found that specificity suffered more at lower cutoffs. Those using the SCQ with lower cutoffs should, therefore, expect higher false positive rates in those with developmental concerns.

Similarly, when stratified on CBCL subscales, there were substantial drops in specificity and gains in sensitivity for both the SRS and for all cutoffs of the SCQ. The SRS showed the largest drop in specificity with most values in the 20s and 30s for children with CBCL scores in the clinical range (there were no overlapping CIs in this analysis). The average drop in specificity between the non-clinical and clinical groups was approximately 50 percentage points. The SCQ also had significant drops. Like the results stratified on the MSEL, the average drops in specificity were smaller for the cutoff of 15, and greater for cutoffs of 13 and 11. As expected, sensitivity tended to be lower and specificity was higher for children whose CBCL scores were in the non-clinical range. Thus, these screeners may be less able to identify children with ASD who score in the non-clinical range.

Taken together, these findings suggest that the SRS and SCQ effectively detect developmental and behavioral challenges, but may not reliably differentiate them from ASD. Screening individuals from minority and lower socioeconomic backgrounds is also problematic, as these screeners are likely to have unsatisfactory rates of false positives for

these groups. If these screeners are routinely used with large populations of minority and low-income families, the likely high false positive rate could tax limited resources. Similarly, if these screeners are used for research, high false positive rates in these subgroups could skew results, or necessitate additional testing to exclude children who do not have ASD, again diverting scarce resources. This problem is particularly interesting given the known disparities in ASD identification for many minority groups (Autism and Developmental Disabilities Monitoring Network 2016). One could argue that higher false-positive rates are acceptable when used with under identified groups so as to increase detection of the condition. However, that we continue to observe these disparities suggests that additional research is needed to determine how to better identify ASD in diverse populations.

These findings do not mean that the SRS and SCQ are ineffective screeners when used in the general population. Rather, these data highlight the challenges of successfully identifying young children at risk for ASD from low SES backgrounds, as well as those with developmental or behavioral challenges. Indeed, these analyses revealed that both the SCQ and SRS performed adequately for the combined sample and equally well for both boys and girls overall. However, refining these screeners to be more effective, regardless of the child's behavioral presentation and across cultures, could help reduce the impact of false positives.

Further, when used in clinical settings, additional testing is needed to inform the differential diagnosis. Likewise, researchers may want to avoid relying on screening results alone to confirm diagnosis, especially when cognitive impairment or co-occurring behavioral issues are present. Indeed, there has been a longstanding awareness that screening and monitoring for ASD is only the first step in the diagnostic process (Filipek et al. 1999). These results further highlight the need for a robust clinical evaluation following a positive screening that assesses multiple domains of functioning and includes a child observation and parent interview (Huerta and Lord 2012). Moreover, the impact of cultural variations and clinician interpretation on the clinical findings should be studied further given that the clinician's judgement appears to be formed by more than just core ASD symptoms (Wiggins et al. 2017).

Limitations

Although these analyses were conducted on a large, diverse sample, there are important sample characteristics to consider. In particular, the population-based control group in SEED, unlike the ASD and developmental delay groups, over represents white families with higher incomes and education, (DiGuiseppi et al. 2016). Given that the population-based control group accounted for most of the true negatives, we cannot rule out an upward bias of specificity for the White group, and as income and education increase. It is unclear to what extent this impacts our results or the generalizability of the findings.

Also, due to the nature of our enrollment criteria, we only included children aged 30–68.9 months. Both instruments have been validated on much larger age ranges than used here, and it is possible that these measures could perform differently with older children. Further, the SCQ has not been validated on children under 4, and our sample includes 14.9% of such children. However, our findings are not sensitive to the inclusion of young children and our findings are noteworthy given that current recommendations suggest screening of infants and

young children. That our findings converge with other research that has found demographic variability suggests that additional work is needed to determine how best to screen children from these groups.

Finally, the SEED protocol permitted up to 6 months to collect all data. While it rarely took this long, there is the possibility that some children matured significantly between when the SCQ was collected as a screener, and the later instruments (i.e., Mullen, CBCL and SRS). However, given that the average age at each of these data collection points was relatively close to each other, we do not expect that this impacted our results significantly. Nonetheless, some degree of development between data collection points cannot be ruled out.

Conclusion

Although both the SCQ and SRS are validated ASD screeners, research and clinical programs that rely on these measures should recognize the potential for false positives. Specifically, high false positive rates could lead to misclassification if additional diagnostic testing is not performed. These challenges could be particularly problematic for community settings that have high proportions of minority families or families with low income or low maternal education. Our findings underscore the need to refine existing measures or develop new instruments to ensure they perform well across all groups.

Acknowledgments

Funding This research is supported by the Centers for Disease Control and Prevention, Centers for Autism and Developmental Disabilities Research, Study to Explore Early Development through six cooperative agreements: Cooperative Agreement Number U10DD000180, Colorado Department of Public Health/University of Colorado School of Medicine; Cooperative Agreement Number U10DD000181, Kaiser Foundation Research Institute (CA); Cooperative Agreement Number U10DD000182, University of Pennsylvania; Cooperative Agreement Number U10DD000183, Johns Hopkins University; Cooperative Agreement Number U10DD000184, University of North Carolina at Chapel Hill; and Cooperative Agreement Number U10DD000498, Michigan State University. Additional support came in part from core grants awarded to JFK Partners, the University Center for Excellence in Developmental Disabilities at the University Colorado School of Medicine from the U.S. Department of Health and Human Services, through the Administration on Developmental Disabilities Grant #90DD0561.

References

Autism and Developmental Disabilities Monitoring Network. 2016. Retrieved from http://www.cdc.gov/ncbddd/autism/addm.html

Achenbach, TM., Rescorla, LA. Manual for the ASEBA school-age forms & profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families; 2001.

Allen C, Silove N, Williams K, Hutchins P. Validity of the social communication questionnaire in assessing risk of autism in preschool children with developmental problems. Journal of Autism and Developmental Disorders. 2007; 37(7):1272–1278. [PubMed: 17080270]

Andrade C. A primer on confidence intervals in psychopharmacology. The Journal of Clinical Psychiatry. 2015; 76(2):228–231.

Berument SK, Rutter M, Lord C, Pickles A, Bailey A. Autism screening questionnaire: Diagnostic validity. British Journal of Psychiatry. 1999; 175:444–451. [PubMed: 10789276]

Bölte S, Poustka F, Constantino JN. Assessing autistic traits: Cross-cultural validation of the social responsiveness scale (SRS). Autism Research. 2008; 1(6):354–363. [PubMed: 19360690]

Bölte S, Westerwald E, Holtmann M, Freitag C, Poustka F. Autistic traits and autism spectrum disorders: The clinical validity of two measures presuming a continuum of social communication

skills. Journal of Autism and Developmental Disorders. 2011; 41(1):66–72. DOI: 10.1007/s10803-010-1024-9 [PubMed: 20422277]

Charman T, Baird G, Simonoff E, Loucas T, Chandler S, Meldrum D, Pickles A. Efficacy of three screening instruments in the identification of autistic-spectrum disorders. The British Journal of Psychiatry. 2007; 191(6):554–559. [PubMed: 18055961]

Cholemkery H, Kitzerow J, Rohrmann S, Freitag CM. Validity of the social responsiveness scale to differentiate between autism spectrum disorders and disruptive behaviour disorders. European Child & Adolescent Psychiatry. 2014; 23(2):81–93. [PubMed: 23719758]

Connor M. A review of behavioural early intervention programmes for children with autism. Educational Psychology in Practice. 1998; 14:109–117.

Constantino, J., Gruber, C. Social responsiveness scale. Los Angeles: CA: Western Psychological Services; 2005.

Constantino, JN. The social responsiveness scale. Los Angeles, CA: Western Psychological Services; 2002.

Constantino JN, Abbacchi AM, Lavesser PD, Reed H, Givens L, Chiang L, Todd RD. Developmental course of autistic social impairment in males. Development and Psychopathology. 2009; 21(01):127–138. [PubMed: 19144226]

Constantino JN, Davis SA, Todd RD, Schindler MK, Gross MM, Brophy SL, Reich W. Validation of a brief quantitative measure of autistic traits: Comparison of the Social Responsiveness Scale with the Autism Diagnostic Interview-Revised. Journal of Autism and Developmental Disorders. 2003a; 33(4):427–433. [PubMed: 12959421]

Constantino JN, Gruber CP, Davis S, Hayes S, Passanante N, Przybeck T. The factor structure of autistic traits. Journal of Child Psychology and Psychiatry. 2004; 45(4):719–726. [PubMed: 15056304]

Constantino JN, Hudziak JJ, Todd RD. Deficits in reciprocal social behavior in male twins: Evidence for a genetically independent domain of psychopathology. Journal of the American Academy of Child & Adolescent Psychiatry. 2003b; 42(4):458–467. DOI: 10.1097/01.CHI.0000046811.95464.21 [PubMed: 12649633]

Constantino JN, LaVesser PD, Zhang Y, Abbacchi AM, Gray T, Todd RD. Rapid quantitative assessment of autistic social impairment by classroom teachers. Journal of the American Academy of Child & Adolescent Psychiatry. 2007; 46(12):1668–1676. [PubMed: 18030089]

Constantino JN, Todd RD. Autistic traits in the general population: A twin study. Archives of General Psychiatry. 2003; 60(5):524–530. [PubMed: 12742874]

Constantino JN, Todd RD. Intergenerational transmission of subthreshold autistic traits in the general population. Biological Psychiatry. 2005; 57(6):655–660. [PubMed: 15780853]

Corsello C, Hus V, Pickles A, Risi S, Cook EH, Leventhal BL, Lord C. Between a ROC and a hard place: Decision making and making decisions about using the SCQ. Journal of Child Psychology and Psychiatry. 2007; 48(9):932–940. [PubMed: 17714378]

Cumming G. The new statistics: Why and how. Psychological Science. 2014; 25(1):7–29. DOI: 10.1177/0956797613504966 [PubMed: 24220629]

DiGuiseppi CG, Daniels JL, Fallin DM, Rosenberg SA, Schieve LA, Thomas KC, Schendel DE. Demographic profile of families and children enrolled in the Study to Explore Early Development (SEED): A case-control study of autism spectrum disorder. Disability Health Journal. 2016; 64:332–341.

Duvall JA, Lu A, Cantor RM, Todd RD, Constantino JN, Geschwind DH. A quantitative trait locus analysis of social responsiveness in multiplex autism families. American Journal of Psychiatry. 2007; 164(4):656–662. [PubMed: 17403980]

Eaves LC, Wingert HD, Ho HH, Mickelson EC. Screening for autism spectrum disorders with the social communication questionnaire. Journal of Developmental & Behavioral Pediatrics. 2006; 27(2):S95–S103. [PubMed: 16685191]

Filipek PA, Accardo PJ, Baranek GT, Cook EH, Dawson G, Gordon B, Volkmar FR. The screening and diagnosis of autistic spectrum disorders. Journal of Autism and Developmental Disorders. 1999; 29(6):439–484. DOI: 10.1023/a:1021943802493 [PubMed: 10638459]

Frazier TW, Ratliff KR, Gruber C, Zhang Y, Law PA, Constantino JN. Confirmatory factor analytic structure and measurement invariance of quantitative autistic traits measured by the Social Responsiveness Scale-2. Autism: The International Journal of Research and Practice. 2014; 8(1): 31–44. DOI: 10.1177/1362361313500382

Glascoe FP. Screening for developmental and behavioral problems. Mental Retardation and Developmental Disabilities Research Reviews. 2005; 11(3):173–179. DOI: 10.1002/mrdd.20068 [PubMed: 16161092]

Ho A, Todd RD, Constantino JN. Brief report: Autistic traits in twins vs. non-twins—a preliminary study. Journal of Autism and Developmental Disorders. 2005; 35(1):129–133. [PubMed: 15796128]

Huerta M, Lord C. Diagnostic evaluation of autism spectrum disorders. Pediatric Clinics of North America. 2012; 59(1):103–111. DOI: 10.1016/j.pcl.2011.10.018 [PubMed: 22284796]

Hus V, Bishop S, Gotham K, Huerta M, Lord C. Factors influencing scores on the social responsiveness scale. Journal of Child Psychology and Psychiatry. 2013; 54(2):216–224. [PubMed: 22823182]

Jacobson JW, Mulick JA, Green G. Cost-benefit estimates for early intensive behavioral intervention for young children with autism—general model and single state case. Behavioral Interventions. 1998; 13(4):201–226.

Johnson CP, Myers SM. Identification and evaluation of children with autism spectrum disorders. Pediatrics. 2007; 120(5):1183–1215. [PubMed: 17967920]

Lord C, Risi S, Lambrecht L, Cook EH Jr, Leventhal BL, DiLavore PC, Rutter M. The Autism Diagnostic Observation Schedule-Generic: A standard measure of social and communication deficits associated with the spectrum of autism. Journal of Autism & Developmental Disorders. 2000; 30(3):205–223. [PubMed: 11055457]

Lord C, Rutter M. Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. Journal of Autism & Developmental Disorders. 1994; 24(5):659–685. [PubMed: 7814313]

Mullen, EM. Mullen scales of early learning. Circle Pines, MN: AGS; 1995. p. 58-64.

Oosterling I, Rommelse N, de Jonge M, van der Gaag RJ, Swinkels S, Roos S, Buitelaar J. How useful is the Social Communication Questionnaire in toddlers at risk of autism spectrum disorder? Journal of Child Psychology and Psychiatry. 2010a; 51(11):1260–1268. DOI: 10.1111/j.1469-7610.2010.02246.x [PubMed: 20626528]

Oosterling IJ, Wensing M, Swinkels SH, Van Der Gaag RJ, Visser JC, Woudenberg T, Buitelaar JK. Advancing early detection of autism spectrum disorder by applying an integrated two-stage screening approach. Journal of Child Psychology and Psychiatry. 2010b; 51(3):250–258. [PubMed: 19843319]

Peters-Scheffer N, Didden R, Korzilius H, Matson J. Cost comparison of early intensive behavioral intervention and treatment as usual for children with autism spectrum disorder in the Netherlands. Research in Developmental Disabilities. 2012; 33(6):1763–1772. DOI: 10.1016/j.ridd.2012.04.006 [PubMed: 22705454]

Pine DS, Guyer AE, Goldwin M, Towbin KA, Leibenluft E. Autism spectrum disorder scale scores in pediatric mood and anxiety disorders. Journal of the American Academy of Child & Adolescent Psychiatry. 2008; 47(6):652–661. DOI: 10.1097/CHI.0b013e31816bffa5 [PubMed: 18434923]

Pine E, Luby J, Abbacchi A, Constantino JN. Quantitative assessment of autistic symptomatology in preschoolers. Autism: The International Journal of Research and Practice. 2006; 10(4):344–352. [PubMed: 16908478]

Reiersen AM, Constantino JN, Volk HE, Todd RD. Autistic traits in a population-based ADHD twin sample. Journal of Child Psychology and Psychiatry. 2007; 48(5):464–472. DOI: 10.1111/j.1469-7610.2006.01720.x [PubMed: 17501727]

Rogers SJ. Empirically supported comprehensive treatments for young children with autism. Journal of Clinical Child Psychology. 1998; 27(2):168–179. [PubMed: 9648034]

Rutter, M., Bailey, A., Lord, C. Social communication questionnaire. Los Angeles, CA: Western Psychological Services; 2003.

Scarpa A, Reyes NM, Patriquin MA, Lorenzi J, Hassenfeldt TA, Desai VJ, Kerkering KW. The modified checklist for autism in toddlers: Reliability in a diverse rural american sample. Journal of Autism and Developmental Disorders. 2013; 43(10):2269–2279. DOI: 10.1007/s10803-013-1779-x [PubMed: 23386118]

Schanding GT Jr, Nowell KP, Goin-Kochel RP. Utility of the social communication questionnaire-current and social responsiveness scale as teacher-report screening tools for autism spectrum disorders. Journal of Autism and Developmental Disorders. 2012; 42(8):1705–1716. DOI: 10.1007/s10803-011-1412-9 [PubMed: 22143742]

Schendel D, DiGuiseppi C, Croen L, Fallin MD, Reed P, Schieve L, Yeargin-Allsopp M. The Study to Explore Early Development (SEED): A Multisite Epidemiologic Study of Autism by the Centers for Autism and Developmental Disabilities Research and Epidemiology (CADDRE) Network. Journal of Autism and Developmental Disorders. 2012; 42(10):2121–2140. DOI: 10.1007/s10803-012-1461-8 [PubMed: 22350336]

Snow AV, Lecavalier L. Sensitivity and specificity of the Modified Checklist for Autism in Toddlers and the Social Communication Questionnaire in preschoolers suspected of having pervasive developmental disorders. Autism: The International Journal of Research and Practice. 2008; 12(6): 627–644. DOI: 10.1177/1362361308097116 [PubMed: 19005032]

Sparrow, SS., Balla, DA., Cicchetti, D. Vineland adaptive behavior scales. Circle Pines, MN: American Guidance Service; 2005.

The OSU Research Unit on Pediatric Psychopharmacology. OSU Autism Rating Scale-DSM-IV (OARS; Adapted for SEED). 2005. Retrieved from http://psychmed.osu.edu/resources.htm

Virkud YV, Todd RD, Abbacchi AM, Zhang Y, Constantino JN. Familial aggregation of quantitative autistic traits in multiplex versus simplex autism. American Journal of Medical Genetics Part B: Neuropsychiatric Genetics. 2009; 150(3):328–334.

Wang J, Lee L-C, Chen Y-S, Hsu J-W. Assessing autistic traits in a Taiwan preschool population: cross-cultural validation of the Social Responsiveness Scale (SRS). Journal of Autism and Developmental Disorders. 2012; 42(11):2450–2459. [PubMed: 22407579]

Wiggins LD, Bakeman R, Adamson LB, Robins DL. The utility of the Social Communication Questionnaire in screening for autism in children referred for early intervention. Focus on Autism and Other Developmental Disabilities. 2007; 22(1):33–38.

Wiggins LD, Barger B, Moody E, Soke G, Pandey J, Levy S. Brief report: The ados calibrated severity score best measures autism diagnostic symptom severity in pre-school children. Journal of Autism and Developmental Disorders. 2017; 28265795. doi: 10.1007/s10803-017-3072-x

Wiggins LD, Reynolds A, Rice CE, Moody EJ, Bernal P, Blaskey L, Levy SE. Using standardized diagnostic instruments to classify children with autism in the study to explore early development. Journal of Autism and Developmental Disorders. 2015; 45(5):1271–1280. [PubMed: 25348175]

Witwer AN, Lecavalier L. Autism screening tools: An evaluation of the social communication questionnaire and the developmental behaviour checklist–autism screening algorithm. Journal of Intellectual and Developmental Disability. 2007; 32(3):179–187. [PubMed: 17885895]

Table 1

Sample characteristics

	N Total	%	N ASD[a]	%	N Not ASD	%
			616		1701	
Sex						
Female	791	34	106	17	685	40
Male	1526	66	510	83	1016	60
Race[b]						
African American	401	18	119	20	282	18
Other	174	8	67	11	107	7
White	1615	74	400	68	1215	76
Ethnicity[c]						
Hispanic	273	12	76	12	197	12
Not Hispanic	2025	88	535	88	1490	88
Education[d]						
High school or less	355	15	103	17	252	15
Some college	627	27	190	31	437	26
Bachelor's degree	739	32	188	31	551	33
Post graduate degree	571	25	128	21	443	26
Income[e]						
<$10,000	165	7	43	7	122	8
$10,000–$30,000	289	13	98	16	191	12
$30,000–$50,000	275	12	82	14	193	12
$50,000–$70,000	299	14	95	16	204	13
$70,000–$90,000	306	14	75	13	231	14
$90,000–$110,000	278	13	65	11	213	13
>$110,000	602	27	136	23	466	29

[a] ASD = autism spectrum disorder

[b] Missing = 127

[c] Missing = 19

[d] Missing = 25

[e] Missing = 103

Table 2

Sensitivity and specificity overall, and stratified by demographic factors

	N ASD	N Not ASD	Sensitivity				Specificity			
			SRS (95% CI)	SCQ 11 (95% CI)	SCQ 13 (95% CI)	SCQ15 (95% CI)	SRS (95% CI)	SCQ 11 (95% CI)	SCQ 13 (95% CI)	SCQ15 (95% CI)
Total	616	1701	85 (82–88)	87 (84–90)	75 (72–78)	63 (59–67)	77 (75–79)	81(79–83)	86(84–88)	91 (90–92)
Sex										
Female	106	685	90 (84–96)	89 (83–95)	79 (71–87)	68 (59–77)	79 (76–82)	84 (81–87)	89 (87–91)	93 (91–95)
Male	510	1016	85 (82–88)	86 (83–89)	74 (70–78)	62 (58–66)	76 (73–79)	78 (75–81)	84 (82–86)	89 (87–91)
Race										
African American	119	282	89 (83–95)	90 (85–95)	81 (74–88)	69 (61–77)	59 (53–65)	55 (49–61)	66 (60–72)	76 (71–81)
White	400	1215	84 (80–88)	85 (82–88)	72 (68–76)	60 (55–65)	82 (80–84)	87 (85–89)	91 (89–93)	94 (93–95)
Other	67	107	84 (75–93)	88 (80–96)	76 (66–86)	64 (53–75)	79 (71–87)	84 (77–91)	88 (82–94)	89 (83–95)
Ethnicity										
Hispanic	76	197	86 (78–94)	92(86–98)	79 (70–88)	71 (61–81)	69 (63–75)	74 (68–80)	78 (72–84)	87 (82–92)
Not Hispanic	535	1490	85 (82–88)	86 (83–89)	74 (70–78)	61 (57–65)	78 (76–80)	81 (79–83)	87 (85–89)	91 (90–92)
Education										
High school or less	103	252	91 (85–97)	96 (90–99)	84 (77–91)	80 (72–88)	56 (50–62)	59 (53–65)	67 (61–73)	76 (71–81)
Some college	190	437	83 (78–88)	87 (82–92)	75 (69–81)	62 (55–69)	70 (66–74)	71 (67–75)	80 (76–84)	87 (84–90)
Bachelor’s degree	188	551	86 (81–91)	86 (81–91)	77 (71–83)	62 (55–69)	84 (81–87)	88 (85–91)	93 (91–95)	95 (93–97)
Post graduate degree	128	443	82 (75–89)	78 (71–85)	63 (55–71)	52 (43–61)	88 (85–91)	93 (91–95)	95 (93–97)	97 (95–99)
Income										
<$10,000	43	122	84 (73–95)	95 (84–99)	93 (81–99)	77 (64–90)	53 (44–62)	52 (43–61)	61 (52–70)	72 (64–80)
$10,000–30,000	98	191	87 (80–94)	92 (87–97)	84 (77–91)	71 (62–80)	58 (51–65)	59 (52–66)	67 (60–74)	75 (69–81)
$30,000–50,000	82	193	87 (80–94)	88 (81–95)	72 (62–82)	67 (57–77)	73 (67–79)	76 (70–82)	82 (77–87)	91 (87–95)
$50,000–70,000	95	204	84 (77–91)	88 (81–95)	72 (63–81)	57 (47–67)	76 (70–82)	81 (76–86)	86 (81–91)	91 (87–95)
$70,000–90,000	75	231	89 (82–96)	88 (81–95)	79 (70–88)	63 (52–74)	84 (79–89)	89 (85–93)	94 (91–97)	96 (93–99)
$90,000–110,000	65	213	83 (74–92)	89 (81–97)	68 (57–79)	57 (45–69)	86 (81–91)	90 (86–94)	94 (91–97)	96 (93–99)
>$110,000	136	466	83 (77–89)	75 (68–82)	67 (59–75)	55 (47–63)	87 (84–90)	91 (88–94)	95 (93–97)	97 (95–99)

SRS Social Responsiveness Scale, *SCQ* Social Communication Questionnaire

Table 3

Sensitivity and specificity stratified by Mullen scores

	N ASD	N Not ASD	Sensitivity				Specificity			
			SRS (95% CI)	SCQ 11 (95% CI)	SCQ 13 (95% CI)	SCQ15 (95% CI)	SRS (95% CI)	SCQ 11 (95% CI)	SCQ 13 (95% CI)	SCQ15 (95% CI)
Visual reception										
Not below average	256	1305	76 (71–81)	77 (72–82)	58 (52–64)	42 (36–48)	85 (83–87)	88 (86–90)	92 (91–93)	95 (94–96)
Below average	354	384	92 (89–95)	94 (92–96)	86 (82–90)	78 (74–82)	51 (46–56)	55 (50–60)	66 (61–71)	76 (72–80)
Fine motor										
Not below average	176	1188	72 (65–79)	74 (68–80)	57 (50–64)	41 (34–48)	87 (85–89)	89 (87–91)	93 (92–94)	96 (95–97)
Below average	432	499	91 (88–94)	91 (88–94)	82 (78–86)	72 (68–76)	54 (50–58)	61 (57–65)	70 (66–74)	79 (75–83)
Receptive language										
Not below average	182	1207	72 (65–79)	73 (67–79)	54 (47–61)	38 (31–45)	89 (87–91)	92 (90–94)	94 (93–95)	97 (96–98)
Below average	425	477	91 (88–94)	92 (89–95)	83 (79–87)	73 (69–77)	49 (45–53)	54 (50–58)	66 (62–70)	77 (73–81)
Expressive language										
Not below average	135	1147	69 (61–77)	69 (61–77)	55 (47–63)	40 (32–48)	89 (87–91)	92 (90–94)	95 (94–96)	97 (96–98)
Below average	472	537	90 (87–93)	92 (90–94)	80 (76–84)	69 (65–73)	53 (49–57)	58 (54–62)	68 (64–72)	78 (74–82)
Early learning standard score										
Not below average	152	1168	67 (60–74)	69 (62–76)	50 (42–58)	36 (28–44)	90 (88–92)	92 (90–94)	95 (94–96)	97 (96–98)
Below average	454	516	91 (88–94)	92 (90–94)	83 (80–86)	72 (68–76)	50 (46–54)	56 (52–60)	67 (63–71)	77 (73–81)

Table 4

Sensitivity and specificity stratified by CBCL domains

	N ASD	N Not ASD	Sensitivity				Specificity			
			SRS 95% CI	SCQ 11 (95% CI)	SCQ 13 (95% CI)	SCQ 15 (95% CI)	SRS (95% CI)	SCQ 11 (95% CI)	SCQ 13 (95%CI)	SCQ15 (95% CI)
Attention problems										
Non-clinical	348	1427	78 (74–82)	79 (75–83)	63 (58–68)	50 (45–55)	85(83–87)	87 (85–89)	92 (91–93)	95 (94–96)
Clinical	256	222	95 (92–98)	96 (94–98)	91 (87–95)	79 (74–84)	26 (20–32)	36 (30–42)	49 (42–56)	62 (56–68)
Anxious depressed										
Non-clinical	520	1525	84 (81–87)	85 (82–88)	71 (67–75)	60 (56–64)	81 (79–83)	84 (82–86)	89 (87–91)	92 (91–93)
Clinical	84	124	95 (88–99)	96 (90–99)	95 (88–99)	81 (73–89)	22 (15–29)	36 (28–44)	50 (41–59)	66 (58–74)
Emotionally reactive										
Non-clinical	381	1461	80 (76–84)	82 (78–86)	67 (62–72)	54 (49–59)	83 (81–85)	85 (83–87)	90 (88–92)	93 (92–94)
Clinical	223	188	95 (92–98)	95 (92–98)	88 (84–92)	77 (71–83)	30 (23–37)	46 (39–53)	56 (49–63)	69 (62–76)
Somatic complaints										
Non-clinical	430	1466	81 (77–85)	84 (81–87)	70 (66–74)	56 (51–61)	81 (79–83)	84 (82–86)	89 (87–91)	93 (92–94)
Clinical	174	183	95 (92–98)	93 (89–97)	86 (81–91)	80 (74–86)	40 (33–47)	50 (43–57)	58 (51–65)	69 (62–76)
Withdrawn										
Non-clinical	217	1436	66 (60–72)	74 (68–80)	49 (42–56)	36 (30–42)	85 (83–87)	87 (85–89)	92 (91–93)	95 (94–96)
Clinical	387	213	96 (94–98)	94 (92–96)	89 (86–92)	77 (73–81)	20 (15–25)	34 (28–40)	46 (39–53)	60 (53–67)
Sleep problems										
Non-clinical	512	1532	85 (82–88)	86 (83–89)	73 (69–77)	59 (55–63)	80 (78–82)	83 (81–85)	88 (86–90)	92 (91–93)
Clinical	92	117	88 (81–95)	92 (86–98)	86 (79–93)	80 (72–88)	31 (23–39)	38 (29–47)	51 (42–60)	64 (55–73)
Aggressive behavior										
Non-clinical	431	1497	81 (77–85)	83 (79–87)	68 (64–72)	55 (50–60)	82 (80–84)	85 (83–87)	90 (88–92)	93 (92–94)
Clinical	173	152	96 (93–99)	97 (93–99)	91 (87–95)	81 (75–87)	25 (18–32)	36 (28–44)	47 (39–55)	61 (53–69)

J Autism Dev Disord. Author manuscript; available in PMC 2017 December 26.