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Reliability and Validity of the Pediatric Anxiety Rating Scale Modified for Autism Spectrum Disorder

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Abstract

Anxiety often co-occurs with autism spectrum disorder (ASD), yet there are few valid and reliable instruments for measuring anxiety in youth with ASD. This paper describes the modification of the Pediatric Anxiety Rating Scale for youth with ASD (PARS-ASD) and systematic psychometric evaluation in a well-characterized sample of 116 youth (age 5-17 years) with ASD and a range of anxiety symptoms. The clinician-administered PARS-ASD was modified with input from parents of children with ASD and an expert panel. Unlike many other anxiety measures, the PARS-ASD is more focused on behavioral manifestations of anxiety, versus verbal expression. Results provide preliminary support for the psychometric properties of the PARS-ASD. The internal consistency of the PARS-ASD was 0.90. The PARS-ASD was strongly correlated with parent-report anxiety measures ($r_s = .62-.68$), supporting convergent validity. In support of divergent validity, correlations between the PARS-ASD and parent ratings of ASD symptoms, social withdrawal, stereotypy, hyperactivity, inappropriate speech, and repetitive behaviors were low ($r_s = .13-.32$). The PARS-ASD was moderately correlated with parent-reported irritability ($r = .52$). The PARS-ASD showed good test-retest reliability (ICCs = .75-.82) and inter-rater reliability (ICCs = .70-.92). Overall, results support the use of the PARS-ASD for assessing anxiety in youth with ASD.

Lay Abstract

Many youth with autism spectrum disorder (ASD) have anxiety, but it can be difficult to assess anxiety with existing measures. We modified the Pediatric Anxiety Rating Scale for youth with ASD (PARS-ASD) and tested the new measure in a group of 116 youth (age 5-17 years) with

ASD. The PARS-ASD is an interview that a clinician usually completes with the child and parent together. We modified the interview questions and scoring instructions based on feedback from parents of children with ASD and from a panel of experts in ASD and anxiety. Unlike many other anxiety measures, the PARS-ASD relies less on a child's verbal expression of anxiety and more on signs that a parent can easily observe. Training clinicians to administer and score the PARS-ASD was uncomplicated, and raters showed excellent agreement on video-recorded interviews. Youth who were not currently in treatment for anxiety had stable PARS-ASD scores with repeat measurement over a one-month period. The PARS-ASD is a useful clinician-rated measure of anxiety in youth with ASD and fills a gap for assessing anxiety in this population.

Keywords

autism spectrum disorder; anxiety; assessment; Pediatric Anxiety Rating Scale; validity; reliability

Anxiety is among the most common co-occurring psychiatric features in youth with autism spectrum disorder (ASD), with significantly higher rates than the general pediatric population (van Steensel & Heeman, 2017; White, Oswald, Ollendick, & Scahill, 2009). Based on a meta-analysis of 31 studies, approximately 40% of youth with ASD have at least one anxiety disorder (van Steensel, Bogels, & Perrin, 2011). Co-occurring anxiety in youth with ASD is associated with additional social impairment, self-injurious behavior, depressive symptoms, gastrointestinal problems, and parental stress (Kerns et al., 2015a; Mazurek et al., 2013; Sukhodolsky et al., 2008). However, despite the high prevalence and associated impairment of co-occurring anxiety, there is an acknowledged dearth of valid and reliable anxiety measures for youth with ASD (Lecavalier et al., 2014). Better outcome measures are needed to make progress in intervention research for youth with ASD and anxiety (Lecavalier et al., 2014). Currently, the two most common types of anxiety outcome measures are parent and clinician ratings. In a prior report, we presented evidence supporting the reliability and validity of a new parent-rated measure of anxiety (Scahill et al., 2019). Here we focus on the psychometrics of a modified version of the clinician-administered Pediatric Anxiety Rating Scale (PARS; RUPP Anxiety Study Group, 2002).

The original PARS was developed by the RUPP Anxiety Study Group (2002) to build a clinician-rated outcome measure for treatment studies of anxiety in children and adolescents age 6 to 17 years. The PARS is a semi-structured interview designed to collect information on the current severity of anxiety from the child and parent. The information gathered allows the clinician to consider symptom severity against other youth with anxiety. Thus, it can be used to complement parent- and self-reported ratings. In youth with anxiety disorders ascertained from the general population, the PARS is reliable, valid, and sensitive to change with treatment (e.g., Ginsburg, Keeton, Drazdowski, & Riddle, 2011; RUPP Anxiety Study Group, 2001, 2002; Walkup et al., 2008).

The original PARS has been used as an outcome measure in several anxiety treatment studies in youth with ASD and average or above average IQ (Storch et al., 2013; Storch et al., 2015; White et al., 2013; Wood et al., 2015; Wood et al., 2019). To date, only one study has examined the psychometric properties of the PARS in youth with ASD (Storch et al.,

2012). In that study of 72 youth with ASD without intellectual disability (age 7-17 years) seeking treatment for anxiety, the PARS demonstrated excellent inter-rater reliability and test-retest reliability. Internal consistency was 0.59; convergent validity with the parent-rated Multidimensional Anxiety Scale for Children (MASC-P; March, 1998) was modest ($r=0.40$), and results for divergent validity were mixed. In addition, in a sample of 36 non-treatment-seeking youth with ASD, Kerns et al. (2015b) reported low sensitivity of the unmodified PARS for detecting clinically significant anxiety, concluding that the original PARS often misses cases of anxiety disorders in youth with ASD.

These results suggest that the standard version of the PARS may not be well-suited for assessing anxiety in youth with ASD. First, the original PARS is highly reliant on language, making it difficult to assess youth with limited expressive language skills. Even when relying on the parent as the primary informant, the parent may not know how to answer interview questions that depend on verbal expressions of anxiety by youth with ASD. Second, anxiety disorders and ASD may show symptom overlap and may be difficult to disentangle (Bearss et al., 2016; Kerns & Kendall, 2012). For example, concern about changes in routine is common in youth with ASD. Hypervigilance about changes in routine, however, may reflect anxiety about immediately upcoming events. This nuance may not be captured by the original PARS. These measurement challenges are not unique to the PARS; they apply to the majority of anxiety measures used with youth with ASD (Lecavalier et al., 2014).

Based on these considerations, and with the permission of the original PARS developers, we modified the PARS for youth with ASD (PARS-ASD). Modifications were guided by findings from six focus groups with 48 parents of children with ASD and anxiety that explored the behavioral manifestations of anxiety in youth with ASD (Bearss et al., 2016). In addition, a panel of experts in ASD and anxiety, with input from the original PARS developers, reviewed the modifications to advise and maintain the content validity of the PARS. The purpose of the current study was to evaluate the psychometric properties, by examining the internal consistency, convergent and divergent validity, test-retest reliability, and inter-rater reliability of the modified PARS for ASD. Specifically, we evaluated convergent validity with two parent-rated measures of anxiety and divergent validity with parent-rated measures of general behavior problems, repetitive behavior, and overall ASD symptoms. We hypothesized that the correlations between the PARS-ASD and other anxiety measures, measured via parental report rather than interview like the PARS-ASD, would be strong and statistically significant. Conversely, we hypothesized low, non-significant correlations between the PARS-ASD and measures of general behavior problems, repetitive behavior, and ASD symptoms.

Methods

Study Design and Procedures

This study used data from a multi-site, multi-stage measure development project to advance anxiety measurement in youth with ASD (Bearss et al., 2016; Scahill et al., 2019). The sites were Emory University, Ohio State University, and the Children's Hospital of Philadelphia. The institutional review boards at each site approved the study. We recruited participants

through website postings at each institution, flyers to parent support groups in each region, parents of children who received clinical care within each site, and families who participated previously in research and agreed to be re-contacted. Each site enrolled youth (age 5 to 17 years) with ASD to participate in a detailed clinical assessment at Time 1. A subset of participants returned for two additional visits, each 7 to 21 days apart, to evaluate the test-retest reliability of the PARS-ASD. All parents signed the consent document, and youth who were able provided assent to participate. Parents were the primary informants for the PARS-ASD interviews. Approximately 75% of the interviews included the parent and the youth participant in a joint interview; in approximately 25% of cases, the interview was conducted with the parent only (e.g., young children and participants with cognitive limitations). For additional information about the study design, see Scahill et al. (2019).

The clinician who led the PARS-ASD modifications (LS) trained study clinicians on the PARS-ASD to reliability. Training included attending a teleconference to become familiar with the instrument, watching a training video followed by group discussion for calibration, and scoring additional video-recorded interviews to demonstrate reliability. Total training time was less than four hours. To meet the reliability standard, each clinician independently rated two PARS-ASD interviews, each of which was within 12.5% of the trainer's total score. To evaluate inter-rater reliability, six clinicians trained to reliability independently rated 30 video-recorded PARS-ASD interviews. These interviews (approximately 25% of total of Time 1 interviews) were randomly selected from each site. Recordings with poor quality audio were excluded and the next interview from that site was used.

Measures

Pediatric Anxiety Rating Scale for Autism Spectrum Disorder (PARS-ASD).—

The original PARS is a semi-structured interview designed to assess the severity of anxiety in youth aged 6-17 years over the previous week (RUPP Anxiety Study Group, 2002). It was not designed as a diagnostic measure. The interview, which usually includes the parent and child, begins with a symptom checklist with items reflecting social anxiety, separation anxiety, generalized anxiety, specific phobia, and panic. Endorsed symptoms are then rated on seven dimensions (number of symptoms, frequency, distress, physical symptoms, avoidance, interference at home, and interference outside of home) from 0 to 5, with higher scores reflecting greater severity. For these seven dimensions, the total score ranges from 0 to 35. By convention, however, the Number of Symptoms and Physical Symptoms dimensions are not included in the total score, resulting in a total score ranging from 0 to 25 for the remaining five dimensions (RUPP Anxiety Study Group, 2001; Storch et al., 2012; Walkup et al., 2008; Wood et al., 2015). This convention is based on concerns that 1) the Number of Symptoms dimension may be highly skewed and not related to overall severity of anxiety (e.g., if symptoms are numerous, but mild), and 2) the Physical Symptoms dimension may be confounded by common side effects of anxiety medications, such as restlessness and insomnia (RUPP Anxiety Study Group, 2001). Thus, the Number of Symptoms and Physical Symptoms dimensions were not included in the modified PARS.

Revisions to the original PARS symptom checklist were guided by themes and content from six parent focus groups (Bearss et al., 2016) in a series of teleconference discussions with a

panel of investigators. The work group made use of these qualitative findings to reduce dependence on youth verbal expression in favor of behavioral manifestations of anxiety. For example, we removed the item about nightmares with a separation theme and the item about expressed fear in anticipation of separation. We added items based on themes in the focus group such as excessive worry about time (e.g., being late) and being highly vigilant about changes in routine.

The work group also reviewed the anchor points for rating the five anxiety severity dimensions. The anchor points provide guidance for scoring each dimension. For example, the dimension on distress (*Pervasiveness of Anxiety*) in the PARS-ASD includes additional details about length of anxiety episodes (e.g., only a few seconds, several minutes) to help the clinician make an accurate rating. Revisions of the symptom checklist and severity anchor points were then reviewed with our expert panel for clarity and to ensure that revisions were consistent with manifestations of anxiety rather than ASD. Overall, we maintained the basic structure (i.e., symptom checklist followed by anxiety severity dimensions) and scoring (i.e., a single score to reflect total anxiety severity) of the original PARS. Also in keeping with the original PARS, the front page for clinician instructions noted that if the life circumstances of the past week were unusual (e.g., family vacation or natural disaster), the clinician should inquire about the period immediately preceding the unusual circumstance. On average, the PARS-ASD takes no more than 20 minutes to administer. Readers who are interested in the PARS-ASD can contact the senior author (LS).

We selected the following measures for analyzing divergent validity:

Aberrant Behavior Checklist (ABC; Aman & Singh, 2017).—The ABC is a 58-item, informant-based measure for assessing treatment effects in people with developmental disabilities. Each item is scored as 0 (not at all a problem), 1 (slight problem), 2 (moderately serious problem), or 3 (severe problem). We chose the ABC as a measure of divergent validity because it is a widely used measure of behavior problems in children with developmental disorders, but does not have a specific focus on anxiety. It also demonstrates good psychometric properties in children with ASD (Kaat, Lecavalier, & Aman, 2014). The ABC has five subscales: Irritability (15 items), Lethargy/Social Withdrawal (16 items), Stereotypic Behaviors (7 items), Hyperactivity/Noncompliance (16 items), and Inappropriate Speech (4 items).

Children's Yale-Brown Obsessive-Compulsive Scale for Autism Spectrum Disorder (CYBOCS-ASD; Scahill et al., 2006).—The CYBOCS-ASD is a reliable and valid semi-structured interview designed to rate the current severity of repetitive behavior in children and adolescents with ASD or other developmental disorders. Once the current repetitive behaviors are identified, they are rated on: Time Spent, Interference, Distress, Resistance, and Control. Each of these items is scored from 0 to 4, yielding a total score from 0 to 20, with higher scores indicating greater severity.

Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003).—The SCQ is a 40-item measure of ASD symptoms, based on the Autism Diagnostic Interview (LeCouteur et al., 1989). Participants' parents completed the Lifetime version, which

focuses on the child's entire developmental history. The recommended SCQ cutoff score to indicate ASD is 15 (Rutter et al., 2003), although other studies have adopted a lower cutoff score of 11 to maximize sensitivity and specificity (e.g., Schendel et al. 2012; Wiggins et al. 2015).

We selected the following measures for analyzing convergent validity:

Parent-Rated Anxiety Scale for Autism Spectrum Disorder (PRAS-ASD; Scahill et al., 2019).—The PRAS-ASD is a 25-item, parent-reported measure of anxiety symptoms in youth with ASD (age 5-17 years). Parents rate the frequency and impairment of anxiety symptoms on a 4-point scale (0 = not present; 1 = present sometimes, not a real problem; 2 = often present and a problem; 3 = very frequent and a major problem) over the past two weeks. The items were developed from a bank of items generated from the series of focus groups with parents discussing anxiety in youth with ASD (Bearss et al., 2016). This was followed by a large-scale online survey of parents with factor and item response theory analyses resulting in a 25-item measure with a single factor (Scahill et al., 2019). It was an integral component of the detailed clinical assessment and test-retest evaluation that included the PARS-ASD.

Screen for Child Anxiety Related Emotional Disorders (SCARED; Birmaher et al., 1999).—Parents completed the SCARED, a 41-item measure of childhood anxiety disorders, including general anxiety disorder, separation anxiety disorder, panic disorder, social anxiety disorder, and school phobia. Each item is scored as 0 (not true or hardly ever true), 1 (somewhat true or sometimes true), or 2 (very true or often true). The SCARED has shown acceptable reliability, validity, sensitivity, and specificity in cognitively able youth with ASD (Stern, Gadgil, Blakeley-Smith, Reaven, & Hepburn, 2014).

We used the following measures to characterize the sample (in addition to the SCQ, described above):

Parent-Rated Vineland Adaptive Behavior Scales, 2nd edition (Vineland-II; Sparrow, Cicchetti, & Balla, 2005).—The parent-rated Vineland-II is a standardized assessment of adaptive behaviors in three domains: Socialization, Communication, and Daily Living. Higher standard scores ($M = 100$; $SD = 15$) indicate better adaptive skills.

Stanford-Binet Intelligence Scales, 5th edition (SB-5; Roid, 2003).—The SB-5 is a widely used standardized test of cognitive ability. Participants completed the abbreviated battery as an estimate of full scale IQ. The abbreviated battery includes one nonverbal subtest (object series/matrices) and one verbal subtest (vocabulary).

Participants

Participants included children between the ages of 5 and 17 years, with a diagnosis of ASD (based on expert clinical opinion supported by the Autism Diagnostic Observation Schedule [ADOS; Lord et al., 2000] and SCQ), and with at least mild anxiety via parent-report. Participants were on no medication or stable medication (minimum of 6 weeks on same dose with no planned changes in the next 6 weeks). Children who needed immediate treatment for

a psychiatric condition or serious behavioral problem (based on the study assessment) were excluded from further participation the study and referred to an appropriate clinical service.

Community Involvement

We did not have study funds allocated for community involvement, so we were unable to directly involve community stakeholders. We have invited people with autism and their family members to help us develop our dissemination strategy for study results. In addition, the principal investigators at all three sites are involved with the clinical assessment and treatment of children with autism and anxiety, as well as with parent groups to support parents of children with autism. They brought these experiences to the design and conduct of the study.

Analyses

Analyses were performed in SAS v.9.4 (Cary, NC) or R v.3.5 (Vienna, Austria), and statistical significance was evaluated at the $p = 0.05$ level. First, we estimated the internal consistency of the PARS-ASD with Cronbach's alpha. Next, the validity of the PARS-ASD was assessed by calculating the Pearson correlations between the PARS-ASD total score and other measures of anxiety (PRAS-ASD and SCARED) for convergent validity and with the CYBOCS-ASD, ABC subscales, and SCQ for divergent validity. Differences in PARS-ASD correlations with measures of anxiety versus PARS-ASD correlations with other measures were tested using Fisher's r -to- z transformation. Third, we analyzed the test-retest reliability using intraclass correlation coefficients (ICC) in a subset of participants who returned for visits at Time 2 and Time 3. Finally, we examined the PARS-ASD inter-rater reliability using ICC analyses in 30 video-recorded PARS-ASD interviews independently rated by six clinicians. All ICCs were calculated using single rater, two-way mixed effects models assessing absolute agreement. After completing the analyses with the full sample, we repeated most analyses (with the exception of the inter-rater reliability analysis due to small sample size) with subsets of the sample to examine whether the results differed based on participant IQ (< 70 vs. ≥ 70) or age (< 12 vs. ≥ 12).

Results

One hundred and twenty-nine children were screened in-person for the study; 121 met eligibility criteria and were enrolled (the remaining eight children did not meet diagnostic criteria for ASD as determined by the study clinicians). Five eligible participants had incomplete data and were excluded from analyses. Thus, Time 1 data included 116 participants (see Table 1). Almost all (95%) of participants fell above the SCQ cutoff score of 11. Forty-eight participants were assessed at Emory University, 38 were assessed at the Children's Hospital of Philadelphia, and 30 were assessed at Ohio State University. PARS-ASD total scores did not differ by site ($p = .18$). In the full sample of 116 children, 53 were on at least one psychotropic medication: monotherapy $n = 24$; two medications $n = 21$; three medications $n = 8$. The stated reason for medication treatment varied. Anxiety was stated as the target in 24 participants. Stimulant was the most commonly reported class of medication either as monotherapy or in combination ($n = 27$). The second most common class of medication was SSRI ($n = 16$). In terms of anxiety severity at Time 1, 25 of the participants

scored at least one standard deviation above the published mean on the PRAS-ASD (Scahill et al., 2019); 13 participants scored at least 1.5 standard deviations above this mean.

At Time 1, the PARS-ASD demonstrated excellent internal consistency ($\alpha = .90$). Table 2 shows Pearson correlations between the PARS-ASD and other study measures. Correlations ranged from r values of .13 to .68. The PARS-ASD showed the strongest correlations with the PRAS-ASD ($r = .68$) and SCARED total score ($r = .62$). These r values between the PARS-ASD and anxiety measures were significantly higher than the correlations between the PARS-ASD and parent-rated ABC subscales, parent-rated SCQ, clinician-rated CYBOCS-ASD (all p values $< .01$ on r -to- z transformation). The PARS-ASD was moderately correlated with the ABC Irritability subscale ($r = .52$). This pattern of results was largely consistent across IQ and age subgroups.

Of the 116 participants at Time 1, 62 (49 males, 13 females; mean age of 11.23 ± 3.29 years) returned for Time 2 after a mean of 12.37 ± 2.64 days (range 7 to 20) and Time 3 after a mean of 12.03 ± 2.89 days (range 7 to 17). Common reasons for non-participation in the repeat visits included scheduling conflicts and perceived burden due to distance to the medical center. As shown in Table 3, the test-retest ICC values were .78 (from Time 1 to Time 2), .82 (from Time 2 to Time 3), and .75 (from Time 1 to Time 3). This general pattern of test-retest reliability results held across IQ and age subgroups.

Table 4 shows the inter-rater reliability for the six raters on 30 video-recorded PARS-ASD interviews. All ICC values across the five PARS-ASD dimensions and the total score were in the good or excellent range (Cicchetti, 1994), showing a high degree of reliability across the raters: Frequency of Anxiety Symptoms ICC = .92; Pervasiveness of Anxiety ICC = .86; Avoidance ICC = .70; Interference Inside Home ICC = .87; Interference Outside Home ICC = .74; Total Score ICC = .88.

Discussion

This paper describes the modification of the PARS for youth with ASD and systematic psychometric evaluation in a well-characterized sample of youth with ASD and varying levels of anxiety. The results provide preliminary support for the validity and reliability of the PARS-ASD based on indices of internal consistency, convergent and divergent validity, test-retest reliability, and inter-rater reliability. Strengths of the study include a relatively large sample of youth with ASD with a range of anxiety symptoms ascertained in a multi-site study. The PARS-ASD was modified with input from focus groups with parents of children with ASD and with a panel of experts in ASD and anxiety.

The internal consistency of 0.90 for the PARS-ASD Total Score was excellent, demonstrating better internal consistency than the original PARS with youth without ASD (RUPP, 2002) and with ASD (Storch et al., 2012). The high internal consistency value is particularly impressive given the small number of PARS-ASD severity items that compose the Total Score. An alpha value higher than .90 would suggest that some items may be redundant and the scale could be shortened (Tavakol & Dennick, 2011).

As expected, the PARS-ASD showed the strongest correlations with the two parent-report measures of anxiety, the PRAS-ASD and the SCARED, which supports convergent validity. The r values of .68 and .62, respectively, indicate that the PARS-ASD may provide unique and complementary information beyond the PRAS-ASD and SCARED. A potential strength of a clinician-administered interview over a parent-reported questionnaire is the opportunity for the clinician to gather additional information to distinguish anxiety symptoms and ASD. In support of divergent validity, correlations between the PARS-ASD and parent ratings on the ABC Social Withdrawal, Stereotypy, Hyperactivity, and Inappropriate Speech subscales were low, although still statistically significant. The non-significant correlation between the PARS-ASD and CYBOCS-ASD ($r = .13$) was lower than expected, given other research showing a relationship between anxiety and repetitive behaviors (e.g., Rodgers, Glod, Connolly, & McConachie, 2012). The non-significant correlation between the PARS-ASD and SCQ ($r = .24$) aligns with prior research supporting the independence of anxiety severity and ASD symptom severity in youth with ASD (e.g., Renno & Wood, 2013). The moderate correlation between the PARS-ASD and the ABC Irritability subscale ($r = .52$) is not surprising, given parental impressions that emotional outbursts and anxiety are often related for their children on the spectrum (Bearss et al., 2016). Recent research also links emotion regulation difficulties (which the ABC Irritability subscale may capture to a degree) and anxiety in individuals with ASD (Conner, White, Scahill, & Mazefsky, 2020; Mazefsky et al., 2013).

Similar to the original PARS with youth with ASD reported by Storch and colleagues (2012), the PARS-ASD showed good to excellent test-retest reliability and inter-rater reliability. The impressive test-retest values across three visits indicate that the PARS-ASD is not vulnerable to random fluctuation in scores, which is critical for detecting treatment effects in a clinical trial (Kraemer, 1991). Future research could examine the sensitivity of the PAS-ASD to detect change in an anxiety treatment trial. Training clinicians to reliability on the PARS-ASD was not time-consuming, which is also promising for future trials.

Psychometric studies of the original PARS excluded children with IQ scores < 70 (RUPP, 2002; Storch et al., 2012). In these prior studies, the high reliance on the child's verbal abilities to report anxiety symptoms to parents or clinicians was not an issue. The modifications of the PARS-ASD reduce reliance on language in favor of observable behavioral manifestations of anxiety in children with ASD, which is consistent with findings from parent focus groups (Bearss et al., 2016). These modifications may be especially relevant for younger children and youth with intellectual disability. A strength of the current study is that our sample included children with IQ scores ranging from 47 to 133, with 24% having an IQ < 70 . The PARS-ASD also includes several items to help distinguish anxiety from core ASD behaviors. Thus, the sensitivity of the PARS-ASD in detecting anxiety symptoms may be improved from the original PARS, which showed low sensitivity in a small sample of youth with ASD, although this still needs to be tested in future studies (Kerns et al., 2015b). Validating measures that can disentangle overlapping symptoms between anxiety and ASD was recently named a top priority for advancing research in this field (Vasa, Keefer, Reaven, South, & White, 2018).

As with the original PARS, the PARS-ASD aims to assess overall anxiety severity, without being tied to a specific anxiety disorder. Given that many children with ASD present with more than one anxiety disorder, this approach could be useful for tracking treatment progress and outcome (Leyfer et al., 2006; Simonoff et al., 2008). In keeping with the practical demands of clinical trials, the PARS-ASD is relatively brief to administer and score. When assessing anxiety in youth with ASD, a multi-informant, multi-method approach is recommended (e.g., Vasa et al., 2016). Therefore, although the PARS-ASD is not a diagnostic instrument, it could complement parent-rated and self-reported measures of anxiety in children with ASD, such as the PRAS-ASD (Scahill et al., 2019) and the Anxiety Scale for Children-ASD (ASC-ASD; Rodgers et al., 2016), respectively.

Several study limitations deserve mention. Although we deliberately included youth with a range of anxiety symptoms, this was a sample of convenience that may not be representative of all youth with ASD. Indeed, based on the reported level of maternal education, most participants were Caucasian from higher socioeconomic backgrounds. In addition, the study did not include a diagnostic assessment of co-occurring psychiatric conditions, which limits the characterization of our sample. Conclusions about convergent and divergent validity are limited by the sole reliance on parent-report measures; future psychometric evaluations of the PARS-ASD should include self-report, teacher-report, and behavioral observational measures. In particular, the divergent validity of the PARS-ASD should be further examined for constructs such as irritability and emotion regulation difficulties.

Despite these limitations, this study supports the utility of the PARS-ASD in assessing anxiety in youth with ASD. A brief, valid, and reliable anxiety measure for children with ASD fills a gap in research and clinical practice. The modified PARS-ASD relies primarily on behavioral manifestations of anxiety. As a clinician-administered measure, it is well-suited for placebo-controlled pharmacological studies or psychosocial trials using masked assessment of treatment outcome.

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Table 1

Demographic and Clinical Characteristics of Youth with ASD (n = 116)

Characteristic	n (%)
Sex	
Female	24 (20.7)
Male	92 (79.3)
Race	
White	78 (67.2)
Black or African American	22 (19.0)
Asian	3 (2.6)
Multiracial	13 (11.2)
Ethnicity	
Hispanic or Latino	14 (12.1)
Non-Hispanic or Latino	99 (85.3)
Unknown/Not Reported	3 (2.6)
Age at Assessment (years) (Mean ± SD)	11.8 ± 3.2
Educational Placement	
Regular class public or private school	65 (56)
Regular class + special education	25 (21.6)
Special education program	14 (12.1)
Home school	12 (10.3)
Maternal education	
High School Graduate/GED	9 (7.8)
Some college/Associate degree	34 (29.3)
Bachelor Degree	45 (38.8)
Graduate/Professional Degree	28 (24.1)
At least one parent in home (n = 115)	112 (97.4)
Vineland Adaptive Behavior Scales, 2nd edition	
Vineland - Daily Living Skills (n = 112)	76.9 ± 14.0
Vineland - Socialization (n = 111)	69.1 ± 15.0
Vineland - Communication (n = 112)	76.2 ± 14.6
Stanford-Binet Abbreviated Battery IQ Standard Score (n = 115)	89.3 ± 23.5 (range = 47-133)
Social Communication Questionnaire Total Score	20.1 ± 6.6
Aberrant Behavior Checklist (ABC) (n = 115)	
ABC-Irritability	12.1 ± 9.9
ABC-Social Withdrawal	11.4 ± 8.3
ABC-Stereotypy	6.0 ± 5.2
ABC-Hyperactivity	16.8 ± 11.3
ABC-Inappropriate Behavior	4.5 ± 3.5
PARS-ASD Total Score	11.6 ± 5.4
Parent-Rated Anxiety Scale for ASD Total Score	31.0 ± 15.6
SCARED Total Score (n = 115)	23.2 ± 14.6

Characteristic	n (%)
CYBOCS-ASD (n = 115)	12.6 ± 3.2

Note. CYBOCS-ASD = Children's Yale-Brown Obsessive Compulsive Scale-ASD; PARS-ASD = Pediatric Anxiety Rating Scale modified for ASD; SCARED = Screen for Child Anxiety Related Disorders.

Table 2

Correlations between the PARS-ASD Total Score and Other Clinical Measures

Measure	N	Pearson <i>r</i> (95% CI) with PARS-ASD
PRAS-ASD	116	0.68 (0.57, 0.77) **
SCARED Total Score	115	0.62 (0.49, 0.72) **
ABC – Irritability	115	0.52 (0.37, 0.64) **
ABC – Social Withdrawal	115	0.32 (0.14, 0.47) *
ABC – Stereotypy	115	0.30 (0.12, 0.46) *
ABC – Hyperactivity	115	0.32 (0.14, 0.47) *
ABC – Inappropriate Speech	115	0.30 (0.12, 0.46) *
SCQ	116	0.24 (0.06, 0.40)
CYBOCS-ASD	115	0.13 (–0.06, 0.30)

Note. ABC = Aberrant Behavior Checklist; CYBOCS-ASD = Children's Yale-Brown Obsessive Compulsive Scale-ASD; PARS-ASD = Pediatric Anxiety Rating Scale modified for ASD; PRAS-ASD = Parent-Rated Anxiety Scale for ASD; SCARED = Screen for Child Anxiety Related Disorders; SCQ = Social Communication Questionnaire.

**
 $p < .001$

*
 $p < .01$.

Table 3

Test-Retest Intraclass Correlation Coefficients for PARS-ASD across Three Visits (n = 62)

	PARS-ASD Total Score	Test-Retest Correlation Matrix	
	Mean (SD)	Total Score Time 1	Total Score Time 2
Time 1	12.89 (4.98)	--	--
Time 2	12.16 (4.96)	0.78, $p < 0.001$	--
Time 3	11.03 (5.16)	0.75, $p < 0.001$	0.82, $p < 0.001$

Note. PARS-ASD = Pediatric Anxiety Rating Scale modified for ASD. The right side of the table contains the test-retest intraclass correlations in matrix form.

Table 4

Inter-Rater Reliability of PARS-ASD Dimensions and Total Score (n = 30)

PARS-ASD	ICC (Single)
Frequency	0.916
Pervasiveness	0.856
Avoidance	0.701
Interference inside the home	0.873
Interference outside of home	0.742
Total score	0.882

Note. ICC = Intraclass Correlation Coefficient; PARS-ASD = Pediatric Anxiety Rating Scale modified for ASD.