Published in final edited form as:
J Autism Dev Disord. 2013 September ; 43(9): 2135–2146. doi:10.1007/s10803-013-1767-1.

Discriminant and Convergent Validity of the Anxiety Construct in Children with Autism Spectrum Disorders

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Abstract

Despite reports of high anxiety in children with autism spectrum disorders (ASD), there is controversy regarding differential diagnosis of ASD symptoms and anxiety symptoms. This study examined 88 children, aged 7–11 years, with ASD referred for concerns about anxiety. A multitrait-(social anxiety, separation anxiety, overall anxiety severity, and overall ASD severity), multimethod- (diagnostic interviews, parent-, and child-based measures) analysis was conducted. Results from structural equation modeling suggest statistical discrimination between anxiety and ASD severity and convergence among differing reports of two of the anxiety subdomains (separation anxiety and overall anxiety). These findings suggest that anxiety symptoms experienced by children with ASD are separate from ASD symptom severity and may instead reflect anxiety syndromes (e.g., separation anxiety) similar to those that occur in typically developing children.

Keywords

Anxiety; Autism Spectrum Disorder; Discriminant Validity; Construct Validity

Children with autism spectrum disorders (ASD) are at heightened risk for developing clinical anxiety. While anxiety disorders affect about 10% of typically developing elementary-aged children, rates are significantly higher in children with ASD: between 30% and 84% of children with ASD are also diagnosed with a co-occurring anxiety disorder (de Bruin et al., 2007; Simonoff et al., 2008; Sukhodolsky et al., 2008). Additionally, anxiety in children with ASD has been associated with greater impairments in social responsiveness (Sukhodolsky et al., 2008), social skills deficits (Bellini, 2004; Chang et al., 2012), and repetitive behaviors (Spiker et al., 2011; Sukhodolsky et al., 2008).

Although anxiety disorders seem to occur in individuals with ASD more frequently than in the typically developing population and potentially worsen ASD-related impairments, researchers are still unsure of the relation between anxiety disorders and ASD. Common to all psychiatric symptoms in people with ASD, controversy exists over whether “true” psychiatric syndromes occur in individuals with ASD or if such manifestations are part of the ASD diathesis or predisposition (Gadow et al., 2006; Gillot et al., 2001; Green et al., 2000; Lecavalier et al., 2009; Muris et al., 1998; Wood & Gadow, 2010). Some symptoms of anxiety and ASD may manifest similarly and may be hard to distinguish, clouding differential or dual diagnosis of anxiety disorders and ASD. For example, children may not

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partake in play dates with other peers due to ASD-related social skill deficits or due to anxiety-related social reticence. Further, adherence to particular bedtime routines (e.g., insisting parents remain nearby for all or part of the night) may be symptomatic of either the rigid routines common in ASD, or separation anxiety. In spite of some areas of overlap, other anxiety symptom areas are less ambiguous in terms of possible ASD confound (e.g., panic, hyperarousal, and specific phobia). The concept of diagnostic overshadowing has been used to describe instances when psychiatric symptoms in a person with a developmental disability are mistakenly attributed to the disability or are considered less significant in comparison to the main disability (Mason & Scior, 2004). It is therefore important to examine the degree to which anxiety may manifest as a separable (if related) clinical syndrome within children with ASD.

Neural processes associated with ASD, such as sensory over-responsivity, may also influence anxiety in ASD. Sensory over-responsivity has been linked to anxiety in children with ASD (Ben-Sasson et al., 2008; Liss et al., 2006; Pfeiffer et al., 2005). Green and Ben-Sasson (2010) recently proposed three possible pathways linking anxiety and sensory over-responsivity in children with ASD: (a) anxiety causes sensory over-responsivity, (b) sensory over-responsivity causes anxiety, and (c) anxiety and over-responsivity are causally related by a common third variable such as amygdala dysfunction. Due to the nature of sensory over-responsivity in children with ASD, it may be particularly linked to phobias and panic.

Four possible explanations for the relation between ASD and anxiety have been proposed (Wood & Gadow, 2010). The first possibility is that there is true “comorbidity” of anxiety and ASD, indicating that anxiety experienced by children with ASD is phenotypically and etiologically identical to anxiety disorders that occur in typically developing children. This would indicate, for example, that anxiety symptoms in children with ASD would match features of anxiety disorders as defined in the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*; APA, 2000) and cluster as expected. The second possibility is that true anxiety experienced by children with ASD may be altered by the presence of ASD, resulting in a variant of anxiety unique to ASD. Anxiety altered by ASD would indicate that psychobiogenic variables such as hypersenstivities and atypical ANS responses, associated with the origin and development of ASD, result in a different anxiety syndrome unique to ASD. Here, the pattern of symptom expression and related features might differ from the general population, even though anxious overarousal and threat bias were the underlying cause of the manifest symptoms. An example of a possible variant of anxiety unique to ASD is anxiety related to resistance to change. A third possibility is that anxiety is a manifestation of the ASD diathesis, and that the brain processes that result in ASD also produce heightened anxiety. In this case, higher anxiety would be expected to correspond with greater ASD symptom severity. The fourth possibility is false comorbidity, which would occur from inaccurate differential diagnoses of anxiety and ASD, wherein phenotypic manifestations of ASD (such as insistence on the same bedtime routine; avoidance of peers) are not driven by underlying anxious overarousal, but by the neural processes characteristic of ASD (e.g., impaired social reward processing or poor executive functioning).

The purpose of the current study is to further clarify the relation between anxiety and ASD by pitting the first two scenarios, above, against scenarios that assume that manifest anxiety severity should be correlated with ASD symptom severity (e.g., the false comorbidity hypothesis and the hypothesis that anxiety is endemic to ASD) by examining discriminant and convergent validity of anxiety and ASD symptoms (e.g., Campbell & Fiske, 1959; Byrne, 1994). Discriminant validity is the degree to which traits have independent unique variances. For example, if ratings of anxiety and ASD symptom severity were modestly or weakly related, and had largely independent variances, this would show good discriminant validity. Convergent validity is the degree to which different methods measuring the same

trait correspond with each other. For example, parent and diagnostician reports of separation anxiety that strongly correspond with each other would demonstrate good convergent validity. If anxiety in children with ASD is a separable condition not entirely yoked to ASD itself, anxiety and ASD symptoms should cluster into separate latent factors with strong factor loadings of within-domain indicator variables and modest or weak relations among the latent factors.

While to our knowledge no studies have directly examined discriminant validity for differential diagnoses of anxiety disorders and ASD using a multitrait-multimethod analysis, preliminary studies in the literature have begun to examine the construct validity of psychiatric disorders in people with ASD. Gadow and colleagues (2005) examined the *DSM-IV* attention deficit hyperactivity disorder (ADHD) classification system in children with pervasive developmental disorder (PDD). Using parent and teacher report, the authors compared two samples of children, one PDD sample and one non-PDD sample, on ADHD behaviors. They also looked at differences between children in the PDD sample with and without ADHD behaviors. The authors found preliminary evidence for ADHD as the same disorder in the PDD and non-PDD populations, which suggests ADHD may be a “true” clinical syndrome in children with PDD. Additionally, confirmatory factor analysis conducted by Lecavalier and colleagues (2009) supported the construct validity of ADHD, oppositional defiant disorder (ODD), generalized anxiety disorder, and depression in children with ASD, based on parent and teacher measures. Witwer and Lecavalier (2010) also examined psychiatric symptoms in 61 youth with ASD, and the effect of youth’s IQ and language skills on parent endorsement of symptoms. Authors found that parents of youth with better conversational skills and IQ > 70 reported more psychiatric symptoms in their children than parents of youth with low conversational skills and IQ < 70. The authors suggest *DSM-IV-TR* criteria for all disorders may need to be modified for persons with ASD and lower verbal and cognitive skills. While these studies have begun to examine the construct validity of *DSM-IV-TR* psychiatric disorders in children with ASD, they have not evaluated discriminant validity among ASD severity and anxiety (or ADHD, ODD, generalized anxiety disorder, and depression).

Previous research on child psychiatric symptom agreement from multiple methods has shown mixed findings. In the typically developing literature, correlations between parent- and self-report are often low to moderate, although still statistically significant. Achenbach, McConaughy, and Howell (1987) conducted a meta-analysis examining inter-rater agreement and found the mean correlation between self- and other-report was .22 (self/parent $r = .25$, $p < .001$; self/teacher, $r = .20$, $p < .001$; self/mental health worker, $r = .27$, $p < .001$). Although these correlations were modest, they were all statistically significant at the $p < .001$ level. Recent research in typically developing children has shown evidence for convergent and discriminant validity of the current *DSM-IV* anxiety disorder classification system. Langer and colleagues (2010) used a multitrait-multimethod analysis, which reported evidence of discriminant validity for social phobia, separation anxiety disorder, generalized anxiety disorder, and panic disorder, as well as convergent validity for each disorder among the different raters (self, parent, clinician). Similar to other studies, at the correlation level, there was moderate inter-rater agreement. Model comparisons using confirmatory factor analysis provided additional evidence of convergent validity.

Research in the ASD literature on inter-rater agreement has also shown mixed results. Teachers have rated anxiety symptoms as more severe than mothers in children with ASD (Gadow et al., 2005; Weisbrot et al., 2005). Additionally, White and Roberson-Nay (2009) found trivial correlations between parent and child reports of anxiety in children with ASD. In contrast to these findings, however, Farrugia and Hudson (2006) found that self-reports of anxiety in children with HFA did correlate significantly with parent reports. Varying

accounts of anxiety in children with ASD may be partially due to difficulties in measuring anxiety in children with ASD because of the wide variability of ASD symptomatology (Bellini, 2004). Due to a paucity of research on psychometrically valid measures of anxiety in individuals with ASD, researchers are largely using measures of anxiety commonly used in the typically developing population that have not been validated in people with ASD (White & Roberson-Nay, 2009).

Due to the high prevalence of anxiety-like symptoms in children with ASD, it is important to resolve whether anxiety experienced by children with ASD "travels separately" from (is largely uncorrelated with) ASD severity and if anxiety manifests coherently like anxiety exhibited by typically developing children (wherein different raters converge moderately with one another on ratings of specific anxiety syndromes and total anxiety severity). We hypothesize that there will be evidence of discriminant validity for anxiety in relation to ASD severity. We also hypothesize that there will be evidence of convergence among the multiple methods on both ASD and anxiety symptoms.

Methods

Participants

The sample included 88 children (63 males, 25 females), aged 7–11 years old and their primary parent (defined as parent who was primarily responsible for overseeing child's daily activities). The mean age of the child sample was 9.29 years (SD= 1.65). The sample was 52% Caucasian, 19% mixed/other, 13% Asian, 13% Latino, and 3.5% African American. In addition, 64% of the primary parents had graduated from college and 84% of the families had an income of over $40,000 a year. Fifty-four percent of the sample had a diagnosis of autistic disorder, 38% had a diagnosis of pervasive developmental disorder-not otherwise specified, and 8% had a diagnosis of Asperger syndrome (percentages based on children with at least one ASD diagnostic assessment from this study; $N = 54$). Of the four anxiety disorders that were assessed (separation anxiety disorder, social phobia, generalized anxiety disorder, and obsessive compulsive disorder), 61% had a clinical diagnosis of separation anxiety disorder, 91% had a clinical diagnosis of social phobia, 61% had a clinical diagnosis of generalized anxiety disorder, and 39% had a clinical diagnosis of obsessive compulsive disorder (comorbidity among the anxiety disorders was common, accounting for the high prevalence of multiple anxiety disorders; see below for description of diagnostic procedures).

Participants were recruited for screening for a randomized controlled trial (RCT) of cognitive behavioral therapy for children with ASD, with treatment targets of anxiety, behavior regulation, social problems, and daily living skills (Wood et al., 2009a). All families that participated in the intake assessment for this trial were included in the present study. Children with ASD were referred to the study by a medical center-based autism clinic, parent support groups, school personnel, and regional centers. Participants had an IQ > 70 and a previous clinical diagnosis of autistic disorder, pervasive developmental disorder-not otherwise specified, or Asperger syndrome. ASD status for the study was confirmed by surpassing clinical cut-off scores on the Social Responsiveness Scale (Constantino & Gruber, 2005), Autism Diagnostic Observation Scale (Lord et al., 2002) and/or the Autism Diagnostic Interview-Revised (Le Couteur et al., 2003) social domain (84% of the sample had valid scores for one of these measures, while the remaining 16% had a previous clinical diagnosis of an ASD but dropped out of the study before undergoing a study-based ASD assessment). An algorithm published by Klin and colleagues (2005) was used to distinguish between autistic disorder, pervasive developmental disorder-not otherwise specified, or Asperger syndrome. Thirteen percent of our sample had data from all three assessments, 32% from two assessments, and 40% had data from one assessment. Sixteen percent of the

sample had data only from the ADI-R, 1% had data from only the ADOS, and 23% had data only from the SRS. This study was approved by the UCLA Institutional Review Board. Participants were assented and consented in accordance with the UCLA Institutional Review Board.

ASD Measures

Autism Diagnostic Interview – Revised (ADI-R; Le Couteur et al., 2003)—The ADI-R is a standardized parent interview with well-established psychometric properties in ASD samples (Lecavalier et al., 2006). It is aimed at obtaining detailed descriptions of child behaviors associated with the diagnostic criteria for ASD. The focus of the interview is on the three main areas affected by ASD: reciprocal social interaction, communication and language, and repetitive, restricted and stereotyped behaviors. The study used the ADI-R "current" (rather than early childhood) ASD symptom ratings to create an ASD severity composite score for hypothesis testing. Current ratings on all algorithm questions were averaged to create a total ASD severity score.

Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2002)—The ADOS is a semi-structured child interview assessing the child's level of social and communication functioning. It has well-established psychometric properties in ASD samples (Lord et al., 2000). The interviewer provides a variety of social presses to elicit certain behaviors relevant to the diagnosis of ASD. The current study used Module 3, which is designed for individuals who are verbally fluent. An ASD symptom severity score was calculated using ADOS ratings for hypothesis testing in this study. The ASD severity score was calculated by summing the social interaction, communication, imagination, and repetitive/restricted interest subscales.

Social Responsiveness Scale (SRS; Constantino & Gruber, 2005)—The SRS is a standardized, 65-item, 4-point Likert style parent-report form assessing children's autism-specific characteristics such as social communication deficits and repetitive behaviors. The SRS provides a total score and five subscales, and has demonstrated robust reliability and validity (Constantino, 2002). The current study used the total score, with an alpha of .94.

Anxiety Measures

Anxiety Disorders Interview Schedule for DSM-IV – Child and Parent (ADIS-C/P; Silverman & Albano, 1996)—The ADIS-C/P is a semi-structured interview done separately with the child and parent in order to assess the child's level of anxiety with regard to several different anxiety disorders. For this study, the separation anxiety, social phobia, generalized anxiety, and obsessive compulsive disorder sections were administered. The ADIS-C/P has favorable psychometric properties (Wood et al., 2002) in the typically developing population with preliminary evidence for acceptable psychometric properties in ASD (Storch et al., 2012a, b; Wood et al., 2009a, b). From the interview, the Clinician's Severity Rating (CSR) scores are generated ranging from 0 to 8 (with higher scores representing more anxiety) for each anxiety disorder diagnosis. A severity score of 4 or greater is deemed as clinically significant. For this study, the ADIS-C/P specified that impairment ratings (required for a diagnosis of an anxiety disorder) had to be separate from the impairment caused by ASD. The current study used the following scores for hypothesis-testing: (a) each participant's highest anxiety diagnosis CSR score, (b) the number of clinically significant anxiety disorders, (c) social phobia CSR score, and (d) separation anxiety disorder CSR score.

Multidimensional Anxiety Scale for Children – Child and Parent (MASC-C/P; March, 1998)—The MASC is a 39-item, 4-point Likert style measure where children and

parents rate the child's level of anxiety. The MASC is composed of four subscales (physical symptoms, social anxiety symptoms, harm/avoidance, and separation/panic). The current study used total scores as well as the parent and child separation/panic and social anxiety subscale scores. The MASC has robust psychometric properties (March et al., 1997) in typically developing samples and has been used in ASD samples (e.g., Bellini, 2004). Alphas on the MASC-C were .86 for the total anxiety scale, .56 for the separation/panic subscale, and .79 for the social anxiety subscale. Alphas on the MASC-P were .86 for the total anxiety scale, .77 for the separation/panic subscale, and .81 for the social anxiety subscale.

Procedure

Research staff contacted families that had called the study phone line and conducted an initial phone screen with the primary caregiver to determine child's age, prior ASD diagnosis, symptoms of anxiety or shyness, and IQ. If the child met basic eligibility criteria based on the phone screen (e.g., age group, ASD diagnosis, some anxiety), families were invited to participate in the intake evaluation. The intake evaluation was conducted over two appointments. Two hundred forty families were phone screened and 88 families participated in the intake evaluation. The MASC-P was mailed to the primary caregivers to complete and return at the intake evaluation. Children completed the MASC-C with a research assistant at the intake evaluation.

Trained doctoral students and clinical psychologists administered the ADOS, ADI-R, and ADIS-C/P. Research staff completed both parent and child interviews individually in private research rooms. The doctoral students and clinical psychologists received appropriate training and certification in administration of the ADOS and ADI-R. The ADIS-C/P training consisted of a presentation on the administration of the interview, observation and coding of a videotaped interview, co-rating multiple live interviews, and conducting one interview under the supervision of a trained diagnostician. Additionally, the diagnostic team reviewed 15% of the ADIS-C/P assessments to ensure inter-rater reliability, which was adequate (see Wood et al., 2009a,b). Participants received a $20-dollar honorarium for participating in the intake assessment.

Analysis

A multitrait (social anxiety, separation anxiety, overall anxiety severity, and overall ASD symptom severity) multimethod (MTMM; psychiatric diagnostic interview measures, parent-report pencil and paper measures, and measures administered directly to the child) analysis was used to examine the discriminant and convergent validity for anxiety and ASD symptoms. While the approach described by Campbell and Fiske (1959) allows for simultaneous evaluation of convergent and discriminant validity, limitations, such as the subjective nature of correlation interpretation as well as the reliance on observed data, have been noted (e.g., Byrne, 1994). The confirmatory factor analysis (CFA) approach to MTMM treats the trait and method factors as latent variables and evaluates convergent and discriminant validity at the model level. The diagnostician's ADIS-C/P CSR scores of social phobia and separation anxiety disorder, as well as the MASC subscales (both parent and child report) for social anxiety and separation anxiety, were used as indicators of social anxiety and separation anxiety. Additionally, the child's total number of anxiety disorders, their highest ADIS-C/P anxiety severity score, and the total raw scores on the MASC-P and MASC-C were used as indicators of total anxiety. Total ASD severity was operationalized as the average "current" autism symptom score from the ADI-R, the child's total score from the ADOS, and the total score on the SRS.

Data were analyzed using EQS version 6.2 (EQS, 2006). Data were checked for outliers and were normally distributed. All subjects were included in analyses regardless of missing data. Rates of missing data varied from 3.4% missing on the MASC-P, 8% missing on the MASC-C, 23.9% missing on diagnostician ADIS-C/P CSR scores, 45.5% missing on the ADI-R, 59.1% missing on the ADOS, and 54.5% missing on the SRS. Missing values were attributable to subject attrition over the two days of assessment. In addition, the SRS measure was not collected for the first 28 participants. It was added as an outcome measure beginning with the 29th child enrolled in the Wood et al. (2009a) RCT. Values for missing data were imputed using Maximum Likelihood (ML) estimation in EQS. Data were assumed to be missing at random (Rubin, 1976). ML estimation is one of two preferred methods for the treatment of missing data (Bentler, 2006; Schafer & Graham, 2002) and has produced accurate fit indices with simulated missing data in the proportions found in this study (Arbuckle, 1996; Enders & Bandalos, 2001). To check for possible differences among those with and without missing data, mean comparisons were performed using ANOVA; however, mean scores on all measures used for hypothesis testing did not differ for those with and without missing data.

A series of models were constructed to test for discriminant and convergent validity as described by Byrne (1994). Model 1, the least restrictive of the models, allowed for method and trait factors to freely correlate (see Model 1). Model 2 contained correlated method factors and no trait factors. Model 3 contained perfectly correlated trait factors and freely correlated method factors. Lastly, Model 4 was composed of freely correlated trait factors and perfectly correlated method factors. Through comparisons of Models 2, 3, and 4 to the least restrictive Model 1, we tested if there was evidence for discrimination among the anxiety subcategories and ASD symptoms. A significant difference in model fit favoring Model 1 (with the trait factors) over Model 2 (with no trait factors) provides evidence of convergent validity (i.e., specifying substantive latent variables for each symptom area—anxiety and ASD—improves model fit compared to merely modeling method variance). Discriminant validity of traits is determined through comparison of Model 1 (with freely correlated traits) and Model 3 (with traits perfectly correlated). This comparison assesses whether model fit is improved when traits are not perfectly correlated, illustrating at least modest distinctness of symptom domains (e.g., anxiety and ASD severity). Lastly, discriminant validity of methods is determined through comparison of Model 1 (with freely correlated methods) and Model 4 (with perfectly correlated methods).

Results

Anxiety and ASD symptoms: Discriminant Validity

Means, standard deviations, and intercorrelations for all study variables used for hypothesis testing are presented in Table 1. The correlation matrix offers preliminary support for discriminant validity for anxiety severity in relation to ASD severity. Ratings of anxiety and ASD severity were not statistically significantly correlated with each other except in two instances, one of which was within the same method. There was a statistically significant relation between diagnostician ratings of ASD (ADI-R) and child ratings of social anxiety (MASC-C; $r = .315$, $p < .05$). However, this hetero-method, hetero-trait correlation was still lower than the magnitude of the other hetero-method, mono-trait correlations with diagnostician ratings of ASD (i.e., ADI-R/ADOS, ADI-R/SRS), consistent with a discriminant validity model. Additionally, there was a statistically significant correlation between parent-rated ASD severity (SRS) and parent-rated social anxiety (MASC-P), although this could be due to method variance (same rater). There was less evidence of discriminant validity among the different anxiety subtypes at the correlational level. In particular, separation anxiety and total anxiety were significantly correlated with each other

in a number of tests. Overall, the correlation matrix offered evidence of discriminant validity among ratings of ASD severity and anxiety severity.

The correlation matrix also offers preliminary evidence of convergent validity for separation anxiety, total anxiety, and ASD severity, but not social anxiety. Parent-report pencil and paper measures, measures administered directly to the child, and psychiatric diagnostic interview measures of separation anxiety correlated statistically significantly with each other (*r*s > .477; see Table 1), suggesting evidence of convergent validity for this anxiety domain. For the most part, reports of total anxiety also correlated significantly with each other (*r*s > .169 and < .344, and all but one *r* > .300; see Table 1). Parent-report pencil and paper measures, measures administered directly to the child, and psychiatric diagnostic interview measures of ASD severity had correlations in the moderate to strong range, though only one of three was statistically significant (*r*s = .832, .289, and .338). Lastly, at the correlation level, there was little evidence of convergence for social anxiety (parent-report pencil and paper measures/psychiatric diagnostic interview measures: $r = .177$, p = n.s.; parent-report pencil and paper measures/measures administered directly to the child: $r = .064$, p = n.s.; measures administered directly to the child/psychiatric diagnostic interview measures: $r = .092$, p = n.s.). The results at the correlation matrix level provide evidence of convergent validity for the separation anxiety, total anxiety, and ASD severity domains, but not for social anxiety.

Results from the confirmatory factor analysis showed moderate to strong factor loadings and low factor intercorrelations between the ASD symptom severity factor and the anxiety factors (see Figure 1). Specifically, the ASD symptom severity latent factor was not significantly correlated with the total anxiety factor ($r = -.01$), social anxiety factor ($r = .20$), or separation anxiety factor ($r = .11$). At the factor level, this pattern offers evidence of discriminant validity among anxiety severity and ASD severity.

Table 2 displays results from the goodness-of-fit indexes for the four CFA models. Model 1, the least restrictive of the models, demonstrated the best fit with a Comparative Fit Index (CFI) of .976 and a Normed Fit Index (NFI) of .890. Model 2, the model with no trait factors, showed the worst fit with a CFI of .824 and a NFI of .720. Model 3, with perfectly correlated traits and freely correlated methods, showed poor fit with a CFI of .853 and a NFI of .773. Lastly, Model 4, with freely correlated traits and perfectly correlated methods, had a CFI of .862 and a NFI of .786, demonstrating poor model fit.

Model comparisons, based on chi-square differences and degrees of freedom, were examined to determine convergent and discriminant validity. A summary of model comparisons is provided in Table 3. A significant chi-square difference between models 1 and 2 was found ($p < .001$). Model 1 with freely correlated traits fit significantly better than model 2 with no trait factors, demonstrating evidence for convergent validity of the symptom areas (ASD severity and the anxiety subtypes). Additionally, a significant chi-square difference between models 1 and 3 offered evidence of discriminant validity for traits ($p < .001$). The model fit significantly better when traits correlated freely with each other than when they were perfectly correlated with each other, suggesting that the different symptom areas (anxiety and ASD severity) separate meaningfully from one another. Lastly, a significant chi-square difference between models 1 and 4 demonstrated discriminant validity among the methods, signifying that unique information was gathered from each of the methods ($p < .001$).

Anxiety in ASD: Convergent and Discriminant Validity of Anxiety Syndromes

A separate set of models was also run to examine the construct validity of the *DSM-IV-TR* classification of anxiety disorders in children with ASD. Findings from the typically

developing literature on anxiety disorders suggest that anxiety disorders cluster into separate anxiety subtypes (e.g., social phobia, separation anxiety disorder) and that different methods converge in estimates of manifestations of anxiety (e.g., Langer et al., 2010). To examine whether distinct social anxiety, separation anxiety, and total anxiety factors characterized the pattern of anxiety manifest by children with ASD, the above CFA models were re-fit without including indicators or a latent factor for ASD severity.

Goodness of fit indices for the four nested CFA models were examined. Model 1 was the least restrictive of the models, and fit well (chi-square = 22.213, df = 19, CFI = .996, and NFI = .942). Model 2, the model with no trait factors, showed poor fit (chi-square = 94.996, df = 32, CFI = .811, and NFI = .748). Model 3, with perfectly correlated traits and freely correlated methods, showed good fit (chi-square = 28.151, df = 22, CFI = .982 and NFI = .925), although it was slightly less well-fitting than Model 1. Lastly Model 4, with freely correlated traits and perfectly correlated methods, demonstrated poor model fit (chi-square = 57.380, df = 22, CFI = .894, and NFI = .848).

Model comparisons based on chi-square differences and degrees of freedom were examined to determine convergent and discriminant validity. A significant chi-square difference between models 1 and 2 was found ($p < .001$). Model 1 with freely correlated traits fit significantly better than model 2 with no trait factors, demonstrating evidence of convergent validity. The chi-square difference between models 1 and 3 approached significance ($p = .11$). The model fit slightly better when traits freely correlated with each other than when they were perfectly correlated with each other, however, not significantly. Lastly, significant chi-square differences between models 1 and 4 demonstrated discriminant validity for the methods, signifying that unique information was gathered from each of the methods ($p < .001$). At the model level, this pattern of results signifies that while different methods converge regarding the relative severity of anxiety that children with ASD exhibit, they may not reliably discriminate among the types of anxiety (e.g., separation vs. social) that are most prominent for a given child.

Discussion

Given the frequency of anxiety symptoms in children with ASD, it is important to resolve whether these symptoms represent “true anxiety” or are simply manifestations of the ASD diathesis or a result of false differential or dual diagnosis. The present study examined the discriminant and convergent validity of anxiety and ASD symptoms in children with high-functioning ASD aged 7–11 years. Findings revealed evidence of discriminant validity for anxiety severity in reference to ASD symptom severity in this sample. That is, children with higher anxiety severity were no more likely to have more severe ASD symptoms than were children with lower anxiety severity, and vice versa, suggesting independence of the anxiety and ASD constructs in this sample. Furthermore, there was evidence of convergent validity for both ASD symptom severity and two of the three aspects of anxiety severity under investigation (separation anxiety and total anxiety). However, there was no evidence of convergent validity for social anxiety. Finally, different methods tended to converge regarding the overall severity of anxiety symptoms for a given child, regardless of the nature of the anxiety in question (e.g., social vs. separation anxiety), but there was little evidence of effective discrimination amongst the anxiety symptom subtypes.

Our findings suggest that in youth with ASD who are seeking treatment, manifest anxiety severity is largely independent of ASD severity, offering preliminary support for the differentiation of anxiety and ASD symptoms in youth diagnosed with an ASD. Using a multitrait-multimethod approach within a latent variable paradigm, we found that anxiety and ASD severity were largely uncorrelated at both the latent variable and simple correlation

level. Regardless of the extent of separation, social, and total anxiety reported by children, parents, or diagnosticians, children varied substantially in their degree of ASD symptom severity on the ADOS, ADI-R, and SRS. Further, our results also suggest two anxiety subtypes (separation anxiety and total anxiety) had a similar degree of coherence in children with ASD as in the otherwise typically developing pediatric population. Specifically, different raters of the separation anxiety and total anxiety converged to a moderate extent with each other, and within-rater estimates of internal consistency were also comparable to what has been reported in the typically developing population (cf. Langer et al., 2010).

However, inter-rater correlations for social anxiety were low and nonsignificant. Many factors may have influenced these findings. Some children may be sensitive about symptoms of social anxiety, feel self-conscious about endorsing them, and may therefore under-report symptoms. Additionally, on self-report questionnaires, social anxiety symptoms may be more abstract (e.g., “feeling shy”) and not as concrete as symptoms of other disorders (e.g., separation anxiety disorder), making them more difficult to understand. Further, diminished insight into social relationships, characteristic of people with ASD, could influence ratings of social anxiety symptoms. It is also possible that different raters interpret symptoms of social anxiety differently (Tyson & Cruess, 2012). Parents may attribute social difficulties to ASD-related deficits and not social anxiety, whereas a diagnostician may be more attuned to differences among the two constructs, leading to less inter-rater agreement. Conversely, it has also been suggested in the literature that diagnosticians may over-identify social anxiety in children with ASD, which would also lead to weaker inter-rater agreement (Mazefsky et al, 2012). While it is possible that diagnosticians over-identified social phobia in our sample, it seems unlikely as diagnosticians were highly trained to distinguish impairment in functioning due to anxiety symptoms from that due to ASD symptoms. Further, for this study, the ADIS-C/P specified that impairment ratings (required for a diagnosis of social phobia) had to be separate from the impairment caused by ASD; and that the social avoidance reported as part of the social phobia section had to be due to fear as opposed to a lack of interest. Although our results do not offer a means of determining why convergence was poor for social anxiety, this pattern of results clearly calls for further research into the nature and expression of social anxiety in children with ASD.

The poor differentiation among the anxiety *subtypes* (e.g., separation anxiety vs. total anxiety) within this sample could be due to the large amount of shared variance among the subtypes. Our sample had high rates of comorbidity among anxiety disorders; 87% of the children had two or more anxiety disorders. High comorbidity among anxiety disorders has also been found in clinical samples of otherwise typically developing children with anxiety disorders (e.g., Kendall et al., 2010). The high level of comorbidity in these samples, while not invalidating the concept of anxiety subtypes with thematic emphasis (e.g., social vs. separation anxiety), also signifies that children with clinical anxiety tend to be susceptible to manifestations of anxiety across the spectrum of symptoms. Potentially, the measures of the anxiety subtypes that were employed (e.g., MASC) lacked sufficient specificity for this population.

Nonetheless, the anxiety subtypes, collectively, were clearly differentiated from ASD symptom severity, a finding which was a product of the primary aim of this study. These findings may have several implications. For children with ASD, anxiety may be a separate clinical problem that varies significantly among affected children and manifests coherently —as seen by different informants—at low, medium, or high levels. As noted above, anxiety may cause additional impairment above and beyond ASD symptoms and may be an important area of treatment (cf. Bellini, 2004; Chang et al., 2012; Spiker et al., 2011; Sukhodolsky et al., 2008). CBT interventions have been developed with evident success in the treatment of anxiety in children with ASD (e.g., Wood et al., 2009a,b). Influential

models of emotional disorders hold that two separate dispositional characteristics (e.g., temperament or personality traits), namely, negative affectivity and effortful control, as well as stressful events, interact to produce a generalized liability for anxiety or depression (e.g., Craske, 1999; Eisenberg et al., 2009). While it is well-established that there is a relative weakness in effortful control/executive functioning in individuals with ASD (Corbett et al., 2009), perhaps related to differences in frontal lobe structure or function (Carper & Courchesne, 2005), there is also significant variability in this trait within the population of people with ASD. Furthermore, there is evidence of greater negative affectivity in individuals with ASD than in the typical population, perhaps related to amygdala dysfunction within ASD (Schwartz et al., 2009) or as a result of failure of the executive functioning system to downregulate the intensity of emotion generated by the limbic system, but nonetheless there is substantial variability in the anxiety trait among individuals with ASD. Stressful events are relatively common in ASD, in part as an effect of the symptoms of ASD (e.g., intolerance of changes in routine), but still affect some children with ASD more than others (Gillott & Standen, 2007). Given the average elevation but wide variability in these three factors within the population of people with ASD, it is theoretically plausible that clinical anxiety would be more common, on average, in individuals with ASD than typically developing individuals, but still vary within the population of those with ASD as a function of the extent to which these three factors are present. Further research may clarify this.

Unfortunately, we did not have clear measures of other *DSM-IV-TR* anxiety disorders from multiple raters to include in this analysis. Further research should examine the construct validity of other anxiety disorders, such as obsessive compulsive disorder, panic disorder/agoraphobia, and specific phobia, in the population of people with ASD, including adults. Additionally, more research should explore the link between sensory over-responsivity and anxiety in individuals with ASD.

It is also important to note that this study used anxiety measures and an anxiety classification system that were originally developed using general clinical samples as well as random population samples, and were not designed specifically for people with ASD. While our use of the *DSM-IV-TR* framework for anxiety disorders presupposed in some ways that anxiety symptom manifestation in the population of people with ASD could be comparable to the typically developing population (e.g., that the same cluster of symptoms defines “social anxiety” in both groups), the model also allowed for the most general structure of the pattern of correlations, which in this case suggested that anxiety might be best conceptualized in this sample, and with these measures, simply as a matter of “more” versus “less” total anxiety. While not repudiating the usefulness of different anxiety subtypes for children with ASD, these findings underscore the need to determine whether anxiety is expressed in unique ways that differ meaningfully in people with ASD. It is possible that biological differences in people with ASD lead to different experiences and patterns of anxiety. Future research should explore the nature and development of clinical anxiety in individuals with ASD.

It would be beneficial to continue to examine the construct validity of anxiety disorders in the context of ASD. Our findings suggest that there is moderate convergence among methods regarding relatively greater and lesser symptom severity, and that the two types of symptoms (anxiety and ASD) are largely independent of one another in children with higher-functioning ASD. The lack of substantial differentiation among the anxiety subtypes in our SEM models suggests that there was not a clear distinction among specific types of anxiety symptoms (e.g., separation, social). This issue requires further consideration in planning for the conceptualization of clinical anxiety in the context of ASD in the forthcoming *DSM-5*.

Acknowledgments

This study was supported by grants awarded to Jeffrey J. Wood from the Cure Autism Now Foundation and the National Institute of Mental Health (MH075806). We are grateful to the participating families.

References

Achenbach TM, McConaughy SH, Howell CT. Child/adolescent behavioral and emotional problems: implications of cross-informant correlations for situational specificity. Psychological Bulletin. 1987; 101(2):213–232. [PubMed: 3562706]

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, D.C: APA Press; 2000. Text Rev

Arbuckle, JL. Full information estimation in the presence of incomplete data. In: Marcoulides, GA.; Schumacker, RE., editors. Advanced structural equation modeling: issues and techniques. Mahwah, NJ: Lawrence Erlbaum; 1996. p. 243-277.

Bellini S. Social skill deficits and anxiety in high-functioning adolescents with autism spectrum disorders. Focus on Autism & Other Developmental Disabilities. 2004; 19:78–86.

Ben-Sasson A, Cermak SA, Orsmond GI, Tager-Flusberg H, Kadlec MB, Carter AS. Sensory clusters of toddlers with autism spectrum disorders: differences in affective symptoms. Journal of Child Psychology and Psychiatry. 2008; 49(8):817–825. [PubMed: 18498344]

Bentler, PM. EQS 6 structural equations program manual. Encino, CA: Multivariate Software, Inc; 2006.

Byrne, BM. Structural equation modeling with eqs and eqs/windows: Basic concepts, applications, and programming. Sage Publications; Beverley Hills: 1994.

Campbell DT, Fiske DW. Convergent and discriminant validation by the multitrait-multimethod matrix. Psychology Bulletin. 1959; 56:81–105.

Carper RA, Courchesne E. Localized enlargement of the frontal cortex in early autism. Biological Psychiatry. 2005; 57:126–33. [PubMed: 15652870]

Chang Y, Quan J, Wood JJ. Effects of anxiety disorder severity on social functioning in children with autism spectrum disorders. Journal of Developmental and Physical Disabilities. 2012; 24:235–245.

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

Constantino, JN.; Gruber, CP. The social responsiveness scale (SRS) manual. Los Angeles: Western Psychological Services; 2005.

Corbett BA, Constantine LJ, Hendren R, Rocke D, Ozonoff S. Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. Psychiatry Research. 2009; 166:210–222. [PubMed: 19285351]

Craske MG, Zucker BG. Prevention of anxiety disorders: a model for intervention. Applied & Preventive Psychology. 2002; 10:155–175.

de Bruin EI, Ferdinand RF, Meester S, de Nijs PF, Verheij F. High rates of psychiatric co-morbidity in PDD-NOS. Journal of Autism and Developmental Disorders. 2007; 37:877–886. [PubMed: 17031447]

Eisenberg N, Valiente C, Spinrad TL, Cumberland A, Liew J, Reiser M, et al. Longitudinal relations of children's effortful control, impulsivity, and negative emotionality to their externalizing, internalizing, and co-occurring behavior problems. Developmental Psychology. 2009; 45(4):988–1008. [PubMed: 19586175]

Enders CK, Bandalos DL. The relative performance of full information maximum likelihood estimation for missing data in structural equation models. Structural Equation Modeling. 2001; 8:430–457.

EQS 6.2 for windows [computer program]. Multivariate Software; Encino: 2006. Version 6.2

Farrugia S, Hudson J. Anxiety in adolescents with Asperger syndrome: negative thoughts, behavioral problems, and life interference. Focus on Autism and Other Developmental Disabilities. 2006; 21:25–35.

Gadow KD, DeVincent CJ, Pomeroy J. ADHD symptom subtypes in children with pervasive developmental disorder. Journal of Developmental Disorders. 2006; 36:271–283.

Gadow KD, Devincent CJ, Pomeroy J, Azizian A. Comparison of DSM-IV symptoms in elementary school-age children with PDD versus clinic and community samples. Autism. 2005; 9(4):392–415. [PubMed: 16155056]

Gillott A, Furniss F, Walter A. Anxiety in high-functioning children with autism. Autism. 2001; 5(3): 277–286. [PubMed: 11708587]

Gillott A, Standen PJ. Levels of anxiety and sources of stress in adults with autism. Journal of Intellectual Disabilities. 2007; 11(4):359–370. [PubMed: 18029412]

Green SA, Ben-Sasson A. Anxiety disorders and sensory over-responsivity in children with autism spectrum disorders: is there a causal relationship? Journal of Autism and Developmental Disorders. 2010; 40:1495–1504. [PubMed: 20383658]

Green J, Gilchrist A, Burton D, Cox A. Social and psychiatric functioning in adolescents with Asperger syndrome compared with conduct disorder. Journal of Autism and Developmental Disorders. 2000; 30:279–293. [PubMed: 11039855]

Kendall PC, Compton SN, Walkup JT, Birmaher B, Albano AM, Sherrill J, et al. Clinical characteristics of anxiety disordered youth. Journal of Anxiety Disorders. 2010; 24:360–365. [PubMed: 20206470]

Klin A, Pauls R, Schultz R, Volkmar F. Three diagnostic approaches to Asperger syndrome: Implications for research. Journal of Autism and Developmental Disorders. 2005; 35:221–234. [PubMed: 15909408]

Langer DA, Wood JJ, Bergman RL, Piacentini JC. A multitrait-multimethod analysis of the construct validity of child anxiety disorders in a clinical sample. Child Psychiatry and Human Development. 2010; 41(5):549–561. [PubMed: 20443053]

Lecavalier L, Aman MG, Scahill L, McDougle CJ, McCracken JT, Vitiello B, et al. Validity of the autism diagnostic interview-revised. American Journal on Mental Retardation. 2006; 111(3):199–215. [PubMed: 16597187]

Lecavalier L, Gadow KD, DeVincent CJ, Edwards MC. Validation of DSM- IV model of psychiatric syndromes in children with autism spectrum disorder. Journal of Autism and Developmental Disorders. 2009; 39:278–289. [PubMed: 18654843]

Le Couteur, A.; Lord, C.; Rutter, M. The autism diagnostic interview-revised. Los Angeles: Western Psychological Services; 2003.

Liss M, Saulnier C, Fein D, Kinsbourne M. Sensory and attention abnormalities in autistic spectrum disorders. Autism. 2006; 10(2):155–172. [PubMed: 16613865]

Lord C, Risi S, Lambrecht L, Cook EH, Leventhal BL, DiLavore PC, et al. *The autism diagnostic observation schedule—generic*: a standard measure of social and communication deficits associated with the spectrum of autism. Journal of Autism and Developmental Disorders. 2000; 30(3):205–223. [PubMed: 11055457]

Lord, C.; Rutter, M.; DilLavore, PC.; Risi, S. Autism diagnostic observation schedule. Los Angeles: Western Psychological Services; 2002.

March, J. Manual for the multidimensional anxiety scale for children. Toronto: Multi-Health Systems Inc; 1998.

March JS, Parker JD, Sullivan K, Stallings P, Conners CK. The multidimensional anxiety scale for children (MASC): factor structure, reliability, and validity. Journal of American Academy of Child and Adolescent Psychiatry. 1997; 36:554–565.

Mason J, Scior K. Diagnostic overshadowing amongst clinicians working with people with intellectual disabilities in the UK. Journal of Applied Research in Intellectual Disabilities. 2004; 17:85–90.

Mazefsky CA, Oswald DP, Day TN, Eack SM, Minshew NJ, Lainhart JE. ASD, a psychiatric disorder, or both? Psychiatric diagnoses in adolescents with high-functioning ASD. Journal of Clinical Child & Adolescent Psychology. 2012; 41(4):516–523. [PubMed: 22642847]

Muris P, Steerneman P, Merckelbach H, Holdrinet I, Meesters C. Comorbid anxiety symptoms in children with pervasive developmental disorders. Journal of Anxiety Disorders. 1998; 12:387–393. [PubMed: 9699121]

Pfeiffer B, Kinnealey M, Reed C, Herzberg G. Sensory modulation and affective disorders in children and adolescents with Asperger's disorder. The American Journal of Occupational Therapy. 2005; 59:335–345. [PubMed: 15969281]

Rubin DB. Inference with missing data. Biometrika. 1976; 63:581–592.

Schafer JL, Graham JW. Missing data: our view of the state of the art. Psychological Methods. 2002; 7:147–177. [PubMed: 12090408]

Shwartz CB, Henderson HA, Inge AP, Zahka NE, Coman DC, Kojkowski NM, et al. Temperament as a predictor of symptomotology and adaptive functioning in adolescents with high-functioning autism. Journal of Autism and Developmental Disorders. 2009; 39:842–855. [PubMed: 19165586]

Silverman, WK.; Albano, AM. The anxiety disorders interview schedule for DSM-IV—child and parent versions. San Antonio, TX: Graywind; 1996.

Simonoff E, Pickles A, Charman T, Chandler S, Loucas T, Baird G. Psychiatric disorders in children with autism spectrum disorders: prevalence, comorbidity, and associated factors in a population-derived sample. Journal of the American Academy of Child and Adolescent Psychiatry. 2008; 47:921–929. [PubMed: 18645422]

Spiker MA, Lin CE, Van Dyke M, Wood JJ. Restricted interests and anxiety in children with autism. Autism. 2012; 16:306–320. [PubMed: 21705474]

Storch EA, Ehrenreich MJ, Wood JJ, Jones AM, De Nadal AS, Lewin AB, et al. Multiple informant agreement on the anxiety disorders interview schedule in youth with autism spectrum disorders. Journal of Child and Adolescent Psychopharmacology. 2012a; 22(4):292–299. [PubMed: 22856332]

Storch EA, Wood JJ, Ehrenreich-May J, Jones AM, Park JM, Lewin AB, et al. Convergent and discriminant validity and reliability of the pediatric anxiety rating scale in youth with autism spectrum disorders. Journal of Autism and Developmental Disorders. 2012b; 42(11):2374–2382. [PubMed: 22395820]

Sukhodolsky DG, Scahill L, Gadow KD, Arnold LE, Aman MG, McDougle CJ, et al. Parent-rated anxiety symptoms in children with pervasive developmental disorders: Frequency and association with core autism symptoms and cognitive functioning. Journal of Abnormal Child Psychology. 2008; 36:117–128. [PubMed: 17674186]

Tyson KE, Cruess DG. Differentiating high-functioning autism and social phobia. Journal of Autism and Developmental Disorders. 2012; 42:1477–1490. [PubMed: 22038291]

Weisbrot DM, Gadow KD, DeVincent CJ, Pomeroy J. The presentation of anxiety in children with pervasive developmental disorders. Journal of Child and Adolescent Psychopharmacology. 2005; 15(3):477–496. [PubMed: 16092912]

White SW, Roberson-Nay R. Anxiety, social deficits, and loneliness in youth with autism spectrum disorders. Journal of Autism and Developmental Disorders. 2009; 39:1006–1013. [PubMed: 19259802]

Witwer AN, Lecavalier L. Validity of comorbid psychiatric disorders in youngsters with autism spectrum disorders. Journal of Developmental and Physical Disabilities. 2010; 22(4):367–380.

Wood JJ, Drahota A, Sze K, Har K, Chiu A, Langer DA. Cognitive behavioral therapy for anxiety in children with autism spectrum disorders: A randomized, controlled trial. Journal of Child Psychology and Psychiatry. 2009a; 50(3):224–234. [PubMed: 19309326]

Wood JJ, Drahota A, Sze K, Van Dyke M, Decker K, Fujii C, et al. Brief report: Effects of cognitive behavioral therapy on parent-reported autism symptoms in school-age children with high-functioning autism. Journal of Autism and Developmental Disorders. 2009b; 39(11):1608–1612. [PubMed: 19562475]

Wood JJ, Gadow KD. Exploring the nature and function of anxiety in youth with autism spectrum disorders. Clinical Psychology: Research and Practice. 2010; 17:281–292.

Wood JJ, Piacentini JC, Bergman RL, McCracken J, Barrios V. Concurrent validity of the anxiety disorders section of the anxiety disorders interview schedule for DSM-IV: child and parent versions. Journal of Clinical Child and Adolescent Psychology. 2002; 31:335–342. [PubMed: 12149971]

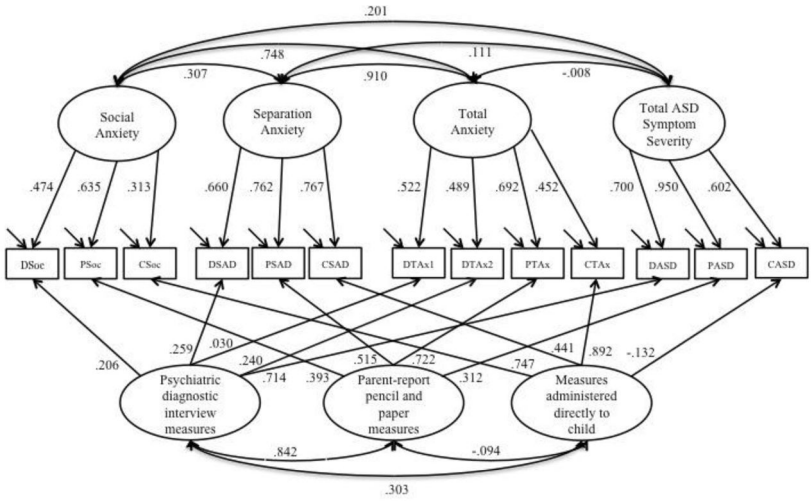

Figure 1.

Main Model (freely correlated traits and methods)

Note: DSoc Psychiatric diagnostic interview of social anxiety; DSAD Psychiatric diagnostic interview of separation anxiety; DTAx1 Psychiatric diagnostic interview of total anxiety from number of anxiety disorders; DTAx2 Psychiatric diagnostic interview of total anxiety from highest severity rating of anxiety disorder; DASD Psychiatric diagnostic interview of ASD symptom severity; PSoc Parent-report pencil and paper measure of social anxiety; PSAD Parent-report pencil and paper measure of separation anxiety; PTAx Parent-report pencil and paper measure of total anxiety severity; PASD Parent-report pencil and paper measure of ASD symptom severity; CSoc Measure administered directly to child of social anxiety; CSAD Measure administered directly to child of separation anxiety; CTAx Measure administered directly to child of total anxiety severity; CASD Measure administered directly to child of ASD symptom severity

Table 1

Correlation Matrix of Study Measures

	DSoc	DSAD	DTotAnx1	DTotAnx2	DASD	PSoc	PSAD	PTotAnx	PASD	CSoc	CSAD	CTotAnx	CASD
DSoc	1												
DSAD	−.010	1											
DTotAnx1	.299*	.420**	1										
DTotAnx2	.104	.652**	.462**	1									
DASD	−.197	−.116	−.067	−.123	1								
PSoc	.177	.071	.091	.003	−.039	1							
PSAD	.106	.584**	.359**	.285*	.038	.244*	1						
PTotAnx	.140	.451**	.343**	.305	.013	.579**	.804**	1					
PASD	.163	−.116	.180	.038	.832**	.405*	.212	.257	1				
CSoc	.092	.060	.105	.103	.315*	.064	.065	.100	.098	1			
CSAD	.095	.467**	.383**	.372**	.156	−.019	.502**	.305**	.019	.429**	1		
CTotAnx	.045	.329**	.313**	.310*	.283	−.055	.276*	.169	.002	.766**	.729**	1	
CASD	.130	−.025	−.055	.028	.338	−.212	.140	−.161	.289	.064	.204	.093	1
Mean	4.36	3.57	2.53	5.24	.902	19.53	17.20	73.12	.902	13.84	13.30	60.64	14.25
SD	1.227	2.002	.959	.630	.397	5.430	5.496	14.584	.397	6.541	5.105	17.506	4.211

Note: SD: Standard deviation; Soc: Social anxiety; SAD: Separation anxiety; TotAnx: Total anxiety severity; TotAnx1: Total anxiety from number of anxiety disorders; TotAnx2: Total anxiety from highest severity rating of anxiety disorder; ASD: Autism spectrum disorder symptom severity; D: Psychiatric diagnostic interview measures; P: Parent-report pencil and paper measures; C: Measures administered directly to the child

* $p < .05$,

** $p < .01$

Table 2

Summary of Goodness-of-Fit Indices for Anxiety and ASD MTMM Models

Model	χ^2	df	CFI	NFI
1 Freely correlated traits, freely correlated methods	52.324	43	.976	.890
2 No traits, freely correlated methods	130.270	62	.824	.720
3 Perfectly correlated trait, freely correlated methods	106.054	49	.853	.773
4 Freely correlated traits, perfectly correlated methods	99.670	46	.862	.786

Note: CFI Comparative fit index; NFI Normed fit index

Table 3

Differential Goodness-of – Fit Indices for Anxiety and ASD MTMM Models

Model Comparisons	Δ χ^2	Δ *df*	P-value	Δ CFI	Δ NFI
Test of Convergent validity					
Model 1 vs. Model 2 (traits)	77.946	19	<.001	.152	.170
Test of Discriminant validity					
Model 1 vs. Model 3 (traits)	53.730	6	<.001	.123	.117
Model 1 vs. Model 4 (methods)	47.346	3	<.001	.114	.104

Note: CFI Comparative fit index; NFI Normed fit index