

Exploring anxiety symptomatology in school-aged autistic children using an autism-specific assessment

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Abstract

Background

Accurate assessment of anxiety symptomatology in autistic children can be difficult, in part due to a lack of appropriate assessment tools. The newly-developed Anxiety Scale for Children with Autism Spectrum Disorder (ASC-ASD) is designed specifically for the assessment of anxiety symptomatology in autistic children. The aim of this study is to use the ASC-ASD to explore the profile of typical and atypical anxiety symptomatology in autistic children; to explore associations of anxiety symptomatology with adaptive behaviour and autistic characteristics; and to identify level of agreement between ASC-ASD scores and parent-reported anxiety diagnoses.

Method

100 parents of 9 – 12 year old autistic children completed the ASC-ASD, Vineland Adaptive Behavior Scales – Second Edition, and Social Communication Questionnaire as part of a longitudinal study.

Results

High rates of anxiety symptomatology were found, with 63% of parents rating their children in the clinical range. Atypical symptoms of anxiety were endorsed at high frequency. Items within the Uncertainty subscale were most frequently endorsed, and items within the Anxious Arousal scale were endorsed least often. Children with a parent-reported diagnosis of anxiety disorder scored significantly higher on the ASC-ASD than those without an anxiety diagnosis.

Conclusions

This is one of the first studies to explore anxiety symptomatology in autistic children using an autism-specific measure of anxiety. Findings suggest that the ASC-ASD may be a useful tool for the assessment of anxiety symptomatology in autistic children.

Keywords

Autism spectrum disorder, anxiety, assessment, parent report, Anxiety Scale for Children with Autism Spectrum Disorder

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Research indicates that autistic¹ individuals are at significantly increased risk for mental illness, with approximately 70% of autistic children experiencing at least one comorbid mental health condition, and over 40% experiencing two or more comorbid conditions (Simonoff et al., 2008). Anxiety has been identified as one of the most commonly experienced mental health conditions for autistic children. Prevalence of anxiety as high as 84% has been reported (Muris, Steerneman, Merckelbach, Holdrinet, & Meesters, 1998), but more recent estimates from systematic reviews suggest a prevalence of approximately 40% (van Steensel, Bogels, & Perrin, 2011).

Uncertainty exists regarding the phenomenology of anxiety in autism. Earlier research (Lecavalier, Gadow, DeVincent, & Edwards, 2009; Weisbrot, Gadow, DeVincent, & Pomeroy, 2005) indicated that the pattern and intensity of anxiety symptoms found in autistic children were similar to symptoms identified in non-autistic children, suggesting that autistic children may experience anxiety in similar ways to their non-autistic peers. This was supported more recently by White et al. (2015), who compared autistic and non-autistic youth on the Multidimensional Anxiety Scale for Children and found that the same factors emerged in both groups, suggesting similar underlying anxiety constructs exist in both autistic and non-autistic youth. However, White et al. (2015) also noted that the inter-factor relationships, mean scores, and error variances differed between the autistic and non-autistic groups,

¹ “Autistic person” is the preferred language of many individuals on the spectrum (see Kenny et al., 2016), and will therefore be used throughout this paper.

suggesting that while autistic youth may experience the same anxiety constructs as non-autistic youth, the way(s) in which anxiety manifests may differ between the groups.

Kerns and Kendall (2012) attempted to provide a preliminary resolution to this question about the phenomenology of anxiety in autism, by considering evidence regarding the types and symptoms of anxiety experienced by autistic individuals, the course of anxiety development, and treatment efficacy. Consistent with previous, similar work (Wood & Gadow, 2010), Kerns and Kendall (2012) tentatively concluded that anxiety presents in autistic individuals in ways which are consistent with the presentation of anxiety in non-autistic populations ('typical' anxiety); and also in ways which are unique to the autistic population ('atypical' anxiety).

There are a number of factors that need to be considered when exploring the presentation of anxiety in autistic individuals, one of which is level of adaptive behaviour. There is wide variability in levels of adaptive functioning in autistic people, and this is widely recognised as an important predictor of outcomes in adulthood (e.g., Farley et al., 2009). There has been some research suggesting that autistic children with higher levels of adaptive behaviour tend to display more symptoms of anxiety (Sukhodolsky et al., 2008), however evidence regarding this association remains ambiguous (Magiati et al., 2016), and warrants further investigation. To date, studies examining the link between adaptive behaviour and anxiety have focused only upon the typical forms of anxiety, highlighting the need to explore any relationship between levels of adaptive behaviour and atypical symptoms of anxiety.

Following on from the uncertainty regarding the phenomenology of anxiety in autism, there is also concern about the accurate assessment of anxiety in autistic children. This concern exists largely due to difficulty in differentiating between common behavioural indicators of anxiety and (often very similar) core behavioural characteristics of autism (MacNeil, Lopes, & Minnes, 2009; White, Oswald, Ollendick, & Scahill, 2009), increasing

the risk of diagnostic overshadowing. To date, most assessment tools used for the measurement of anxiety in autistic children have been instruments which were originally designed for use with the non-autistic population. Recent studies have indicated that such assessment tools, when used with autistic children, demonstrate limited sensitivity and specificity in the identification of anxiety, poor inter-rater reliability, and poor agreement with a standardised diagnostic interview (Gjevik, Sandstad, Andreassen, Myhre, & Sponheim, 2015; Kaat & Lecavalier, 2015; Kerns et al., 2015). Further, preliminary research indicates that standard anxiety assessments may not capture the ‘atypical’ symptoms of anxiety which are unique to autistic children (Kerns et al., 2015). In a recent study exploring professionals’ priorities for research on anxiety in autistic youth, the development of new anxiety assessment measures and validation of existing measures for assessing anxiety in this population were endorsed as top priorities for future research, highlighting the need for further work in this area (Vasa, Keefer, Reaven, South, & White, 2018).

In an attempt to address this gap, Rodgers et al. (2016) adapted the Revised Children’s Anxiety and Depression Scale (RCADS, Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) to create the Anxiety Scale for Children with Autism Spectrum Disorder (ASC-ASD), an autism-specific anxiety assessment tool. In adapting the RCADS, the authors developed new items designed to assess anxiety symptoms relating to sensory processing, uncertainty, and phobias. The original RCADS items and the new items were discussed by a focus group comprising parents of autistic children, with items edited for wording and ambiguity. The resulting assessment tool was piloted with a sample of 170 families. Following factor analysis, the 24 items which make up the current ASC-ASD were retained (Rodgers et al., 2016). Self- and parent-report versions of the scale are available, both measuring symptoms of anxiety across four sub-scales (Performance Anxiety, Uncertainty, Anxious Arousal, and Separation Anxiety). Pilot testing of the ASC-ASD found that the

measure has good internal consistency, validity, and test-retest reliability (Rodgers et al., 2016). To date, however, use of this measure has not been explored within a large sample of autistic children other than during initial pilot testing, therefore evidence regarding the pattern of scores and responses on the ASC-ASD is limited.

Given the high prevalence of anxiety in autistic children, it is vital that professionals are able to accurately recognise and assess the symptoms of anxiety in this population. This requires a thorough conceptualisation of the various presentations of anxiety in autistic children; an understanding of potential correlates of anxiety; and assessment tools which accurately measure anxiety in this population. The current study aimed to describe the profile of typical and atypical anxiety symptomatology on the ASC-ASD in an independent sample of autistic children; to explore any association between anxiety symptomatology, level of adaptive behaviour and level of autistic characteristics; to determine if the ASC-ASD adequately discriminates between symptoms of anxiety and autistic characteristics; and to document the level of agreement between ASC-ASD indicative cut-off scores and parent-reported anxiety diagnoses.

Method

The data used in this study were collected as part of the Longitudinal study of Australian Students with Autism (LASA). The LASA is a six-year study designed to investigate educational and participatory outcomes for Australian autistic students. The LASA recruited a self-selected participant group of 272 autistic children and their parents, comprising two cohorts aged 4 – 5 years and 9 – 10 years at the time of recruitment. Participants were recruited primarily through social media, and state and national autism organisations. Parents complete a series of six annual online questionnaires which include various demographic items and standardised assessments. All participant children have a parent-reported diagnosis

of autism (including Autism Spectrum Disorder, Asperger Syndrome, Autistic Disorder, and PDD-NOS). The Social Communication Questionnaire (SCQ) was used to confirm autism diagnosis, and copies of community diagnostic reports were requested from all participants. A detailed description of the LASA methodology is available in Roberts et al. (in press). Ethical approval for the LASA was obtained from participating universities and health authorities, and all participants provided informed consent. This study reports on data from the older cohort of the longitudinal study, obtained through online parent-report questionnaires administered during the second year of the LASA.

Participants

Participants were selected from the older LASA cohort if they had a score above 11 on the SCQ, and a complete dataset available for the ASC-ASD. This resulted in a total sample of 100. The most frequently reported diagnoses were Autism Spectrum Disorder ($n = 51$), and Asperger's Disorder ($n = 25$). More than half (54%) of participants were taking psychopharmacological medication, most commonly treatments for Attention Deficit-Hyperactivity Disorder (ADHD) and / or Selective Serotonin Reuptake Inhibitors (SSRIs). Of the total sample of 100, complete data from the Vineland Adaptive Behavior Scales – Second Edition (VABS-2) was available for 47 participants. Demographic characteristics of the total sample and the subsample with complete VABS-2 data are displayed in Table 1.

Table 1. Participants' demographic characteristics

| | | Mean (SD) / n (%) | |
|--|---|-----------------------------------|--|
| | | Total sample (N = 100) | VABS subsample (n = 47) |
| Child's age (years) | | 11.04 (0.65) | 11.01 (0.65) |
| Child's gender (male) | | 78 (78%) | 35 (75%) |
| Indigenous origin | | 5 (5%) | 1 (2%) |
| Additional diagnosis or medical condition (as reported by parents) | Any additional diagnosis | 66 (66%) | 32 (68%) |
| | ADHD / ADD | 34 (34%) | 18 (38%) |
| | Anxiety | 26 (26%) | 15 (32%) |
| | Intellectual disability / Global developmental delay | 8 (8%) | 5 (11%) |
| | ODD | 7 (7%) | 4 (9%) |
| | Asthma | 6 (6%) | 2 (4%) |
| Child's education setting | Mainstream (with or without support) | 75 (75%) | 34 (72%) |
| | Special school | 14 (14%) | 7 (15%) |
| | Both mainstream and special school | 5 (5%) | 1 (2%) |
| | Other | 6 (6%) | 5 (11%) |
| Informant's education (tertiary) | | 76 (76%) | 38 (81%) |
| Informant's main occupation | Unemployed | 4 (4%) | 2 (4%) |
| | Employed (full or part-time) | 60 (60%) | 29 (62%) |
| | Full-time carer | 30 (30%) | 14 (30%) |
| | Study (full or part-time) | 6 (6%) | 2 (4%) |

Measures

The Anxiety Scale for Children with Autism Spectrum Disorder (ASC-ASD) is a recently developed scale designed to assess symptoms of anxiety in autistic children. This measure was first included in the LASA at the second data collection point (i.e., when the older cohort was aged 10 - 12). The ASC-ASD was adapted from the Revised Children's Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) and is comprised of 12 items retained from the RCADS, three items adapted from the RCADS, and nine new items developed by the ASC-ASD authors (Rodgers et al., 2016). Based upon descriptions by Rodgers et al. (2016) regarding the development of the ASC-ASD, for the purpose of this study the nine newly developed items were considered to measure atypical anxiety symptoms, and the remaining 15 items were considered to measure typical anxiety symptoms. This approach was adopted as the authors of the ASC-ASD state that newly developed items were designed with the specific aim of capturing autism-specific presentations of anxiety (Rodgers et al., 2016), while the original RCADS items were developed for use with non-autistic children and therefore designed to capture typical anxiety symptoms.

The ASC-ASD is available in both parent- and self-report versions; the parent-report version was used in the current study. The ASC-ASD is comprised of 24 items, each measured on a four-point scale ranging from never (0) to always (3), resulting in a maximum possible score of 72. Two indicative cut-off points for the ASC-ASD total scale have been put forward by the authors: Scores ≥ 20 suggest "significant anxious symptomatology", and scores > 24 are considered to be a "more specific indication of significant anxiety" (Rodgers et al., n.d.). The ASC-ASD includes four subscales: Uncertainty (eight items); Performance Anxiety (five items); Separation Anxiety (five items); and Anxious Arousal (six items). Of these subscales, the Uncertainty subscale includes seven items considered to measure atypical

symptoms of anxiety, the Performance Anxiety and Separation Anxiety subscales each include one atypical anxiety item, and the Anxious Arousal scale measures typical anxiety only. The scale has good to excellent reliability and validity, and is significantly correlated with the Screen for Child Anxiety Related Emotional Disorders (Birmaher et al., 1999; Rodgers et al., 2016) In the current study, Cronbach's alpha indicated that internal consistency was good for all subscales: Uncertainty $\alpha = .86$, Performance $\alpha = .89$, Separation $\alpha = .85$, Anxious Arousal $\alpha = .86$; and excellent for the total ASC-ASD, $\alpha = .93$.

The Vineland Adaptive Behavior Scales, Second Edition (VABS-2, Sparrow, Cicchetti, & Balla, 2005) was utilised in the current study to assess each child's level of adaptive behaviour. For children aged 7 years and older, the VABS-2 includes items measuring various adaptive skills across three domains (Communication, Daily Living Skills, and Socialization), with each domain comprised of a number of sub-domains. Respondents rate the participant's ability to perform each adaptive skill on a scale from 0 to 2, where 0 indicates that the participant is unable to perform the skill and 2 indicates that the participant is usually or always able to perform the skill. Higher scores on the VABS-2 indicate more developed adaptive skills. In this study, participants were administered all items within the Communication, Daily Living Skills, and Socialization domains of the VABS-2.

The Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2007) consists of 40 items which ask parents about the current and previous presence of social, communicative, and stereotyped behaviours. Responses are measured on a Yes / No dichotomous scale, with each response scored as either 0 or 1. Item scores are summed to produce a total score, with higher scores indicating more atypical social and communicative behaviours. The SCQ is well-researched and validated as a screening assessment for autism. The recommended cut-off score on the SCQ for this age group is 15, however a cut-off score of 11 has been recommended in younger samples (Lee, David, Rusyniak, Landa, &

Newschaffer, 2007). In this participant group, nine participants had SCQ scores in the range 11 – 15. Community-based documentation confirming autism diagnosis was available for all nine of these participants, therefore a cut-off score of 11 on the SCQ was used as an inclusion criterion for this study.

Pre-existing diagnoses of anxiety disorder were determined based on parents' responses to an online questionnaire item which read "Does your child have other medical conditions / disabilities?" Respondents were asked to enter the specific medical condition or disability in a free-text box. All responses of "anxiety", "anxiety disorder", and specific anxiety disorder diagnoses were considered to indicate the presence of an anxiety disorder. All measures employed in this study were administered to parents through an online questionnaire, with appropriate permissions from publishers where required.

Data analyses

To investigate the nature and frequency of anxiety symptomatology reported by participants, ASC-ASD scores were explored at total scale, subscale, and item levels. As ASC-ASD subscales vary from five to eight items, subscale scores were presented as mean score per item in order to allow for comparison between subscales.

Pearson's correlations were calculated between ASC-ASD scores and SCQ scores, to identify any association between anxiety symptomatology and autistic characteristics. Pearson's correlations were also calculated to explore the relationship between adaptive behaviour and anxiety symptomatology, utilizing VABS-2 scores and ASC-ASD scores. These analyses were intended to investigate the ability of the ASC-ASD to discriminate between characteristics of autism in the absence of anxiety symptoms, and characteristics of autism plus comorbid anxiety symptomatology.

The relationship between parent-reported anxiety diagnosis and ASC-ASD scores was also explored. Participants were divided into two groups on the basis of diagnostic status (those with a parent-reported anxiety diagnosis, and those with no parent-reported anxiety diagnosis), and a MANOVA was utilised to compare these groups on the four subscales of the ASC-ASD as well as the total ASC-ASD. Given the exploratory nature of this study, an alpha level of .05 was used for all analyses, as advocated by Perneger (1998).

Results

Profile of scores on the ASC-ASD

Total scores ranged from 4 ($n = 1$) to 71 ($n = 1$), out of a maximum possible score of 72. Scores on each of the ASC-ASD subscales ranged from the minimum to maximum possible score, with the exception of the Anxious Arousal scale which had a maximum reported score of 17 out of a possible maximum score of 18. Skew and kurtosis were within the range of ± 1 for all subscales and the total scale, with the exception of the Anxious Arousal scale which had slightly positive skew (1.56) and kurtosis (3.10).

The mean score on the ASC-ASD was 26.68 ($SD = 13.86$). Mean scores per item were highest for Uncertainty ($\bar{x} = 1.39$, $SD = 0.68$), followed by Performance Anxiety ($\bar{x} = 1.35$, $SD = 0.86$), then Separation Anxiety ($\bar{x} = 0.99$, $SD = 0.80$), and lowest for Anxious Arousal ($\bar{x} = 0.64$, $SD = 0.58$).

Figures 1 to 4 display the profile of responses given by participants to each item within the ASC-ASD, demonstrating the range and pattern of responses across the scale. The items endorsed most frequently were those within the Uncertainty subscale. Within the Uncertainty subscale, four of the eight items were endorsed as occurring at least sometimes in more than 80% of children, and occurring often or always in more than 40% of children. Of

particular note, 74% of parents endorsed the item “*My child always needs to be prepared before things happen*” as occurring often or always. More than half (51%) of parents indicated that their child often or always worries if they don’t know what will happen next, while 46% of children are often or always afraid of new things, new people, or new places. Comparatively few participants endorsed the two items within the Uncertainty scale which specifically referred to crowded environments; each item was rated as occurring often or always in only 23% and 24% of participants. Of the seven items in the Uncertainty subscale that measure atypical symptoms of anxiety, six were endorsed as occurring at least sometimes by more than 75% of parents.

++Insert Figures 1 – 4 here++

Items within the Performance subscale were endorsed at high rates. Two items (“*My child feels scared when taking a test in case they make a mistake or don’t understand the question*” and “*My child worries when he / she thinks he / she has done poorly at something in case people judge him / her negatively*”) occurred at least sometimes in 80% of participants or more, while the remaining four items in this subscale were all endorsed as occurring at least sometimes in more than 70% of the sample. The one atypical anxiety item in this subscale was highly endorsed, with more than half (51%) of parents indicating that their child often or always worries when they believe they have done poorly at something in case people judge them negatively, and 80% of parents indicating that this occurs at least sometimes.

Anxiety symptomatology measured by the Separation subscale was somewhat less common than symptomatology measured by the Uncertainty and Performance subscales; despite this, all items within the Separation subscale were endorsed as occurring at least sometimes by more than half of participants. Almost three-quarters (72%) of parents reported

that their child worries about being away from them at least sometimes, while two-thirds (66%) of parents indicated that their child worries that something bad will happen to them (the child) at least sometimes. The one atypical anxiety item in this subscale was endorsed relatively infrequently, with just over half (54%) of parents indicating that their child at least sometimes worries in bed at night.

Lowest endorsement rates were for items within the Anxious Arousal subscale. Although 80% of participants indicated that their child “*suddenly gets a scared feeling when there is nothing to be afraid of*”, four of the remaining five items within this subscale occurred in less than half of participants. Of particular note, only 29% of parents indicated that their child trembles or shakes when there is no reason for this, and only 21% indicated that their child becomes dizzy or faint for no reason.

Table 2 shows correlation coefficients between the ASC-ASD subscales and total score, and the SCQ total score for the participant group. The ASC-ASD subscales were moderately correlated with each other and strongly correlated with the ASC-ASD total score. The SCQ was weakly correlated with the Uncertainty and Anxious Arousal subscales of the ASC-ASD only.

Table 2. Pearson's correlations between ASC-ASD subscale and total scores and SCQ total scores

| | Uncertainty | Performance Anxiety | Separation Anxiety | Anxious Arousal | ASC-ASD Total Score |
|------------------------|-------------|------------------------|-----------------------|--------------------|------------------------|
| Performance Anxiety | .46** | - | | | |
| Separation Anxiety | .68** | .53** | - | | |
| Anxious Arousal | .50** | .44** | .56** | - | |
| ASC-ASD Total Score | .86 ** | .75** | .86** | .74** | - |
| SCQ Total Score | .29** | -.02 | .10 | .24* | .20 |

* $p < .05$ ** $p < .01$

Comparison by adaptive behaviour scores

Complete VABS-2 data was available for 47 participants. In order to identify if there is any relationship between specific adaptive behaviour domains and ASC-ASD scores, correlation coefficients are reported in Table 3. The Uncertainty subscale of the ASC-ASD was moderately correlated with the Socialization domain of the VABS-2; no other significant associations were found.

Table 3. Pearson's correlations between ASC-ASD subscale scores and VABS-2 domain standard scores

| | Uncertainty | Performance Anxiety | Separation Anxiety | Anxious Arousal |
|------------------------|-------------|------------------------|-----------------------|--------------------|
| Socialisation | -.428** | -.090 | -.069 | -.211 |
| Daily Living Skills | -.275 | .053 | -.176 | -.231 |
| Communication | -.278 | -.077 | -.104 | -.244 |

** $p < .01$

Comparison by parent-reported anxiety diagnostic status

Within the participant sample, parents of 26 children provided responses to the LASA online questionnaire indicating that their child had a diagnosis of anxiety disorder. A MANOVA was conducted to compare this group with the remaining 74 children who did not have a parent-reported anxiety diagnosis. This revealed a significant main effect of diagnostic status on ASC-ASD subscale scores, $F(4, 95) = 3.75, p = .007$, Pillai's Trace = 0.14. Univariate analyses indicated that significant differences existed between participants with and without a parent-reported anxiety diagnosis on three of the four subscales of the ASC-ASD (Uncertainty $F[1, 98] = 8.13, p = .005$; Separation $F[1, 98] = 10.74, p = .001$; Anxious Arousal $F[1, 98] = 11.96, p = .001$). A significant difference also existed between these groups on the ASC-ASD total score, $F(1, 98) = 12.90, p = .001$. Sub-scale and total scale mean scores per item for the groups with and without a parent-reported anxiety diagnosis are displayed in Table 4.

Table 4. ASC-ASD mean scores per item for participants with and without a parent-reported anxiety diagnosis

| | Parent-reported anxiety diagnosis (n = 26) | No parent-reported anxiety diagnosis (n = 74) |
|-----------------|--|---|
| Uncertainty | 1.71 (0.70)* | 1.28 (0.64)* |
| Performance | 1.63 (0.81) | 1.26 (0.86) |
| Separation | 1.42 (0.87)** | 0.85 (0.72)** |
| Anxious Arousal | 0.96 (0.77)** | 0.52 (0.45)** |
| ASC-ASD total | 1.44 (0.66)** | 0.96 (0.50)** |

* $p \leq .01$ ** $p \leq .001$

ASC-ASD total scale scores were also considered in relation to the indicative clinical cut-off scores for the measure. The number of participants who scored above the primary (20) and secondary (24) cut-offs were identified, and then explored in relation to parent-reported diagnostic status. Table 5 shows that, when using the primary cut-off score of 20, the ASC-ASD correctly identified 85% of children with a parent-reported anxiety diagnosis (scores ≥ 20) and 45% of those who do not have a parent-reported anxiety diagnosis (scores < 20). Using the secondary cut-off score of 24, the ASC-ASD correctly identified 77% of children with a parent-reported anxiety diagnosis (scores > 24) and 62% of those without an anxiety diagnosis (scores ≤ 24).

Table 5. ASC-ASD clinical cut-off ranges for participants with and without a parent-reported anxiety diagnosis

| | Parent-reported anxiety diagnosis (n = 26) | No parent-reported anxiety diagnosis (n = 74) | Total participant group (n = 100) |
|-------------------|--|---|---|
| ASC-ASD score <20 | 4 (15%) | 33 (45%) | 37 (37%) |
| ASC-ASD score ≥20 | 22 (85%) | 41 (55%) | 63 (63%) |
| ASC-ASD score ≤24 | 6 (23%) | 46 (62%) | 52 (52%) |
| ASC-ASD score >24 | 20 (77%) | 28 (38%) | 48 (48%) |

Discussion

This is one of the first studies to examine anxiety symptomatology in school-aged autistic children using an autism-specific measure of anxiety. The high rates of anxiety symptom endorsement within this sample are consistent with previous literature indicating high rates of anxiety in autistic children. In the current sample using an autism-specific measure of anxiety, only 37% of children were rated as not experiencing significant symptoms of anxiety, while 48% were rated above the secondary cut-off for anxiety. In this sample, the mean score on the ASC-ASD was 26.68 (SD = 13.86). This is a very similar outcome to that obtained by the scale developers (Rodgers et al., 2016), who found a parent-reported ASC-ASD mean score of 26.19 (SD = 14.69). This suggests that the anxiety symptomatology measured by the ASC-ASD presents fairly consistently across different cohorts of autistic children. Reliability of the scale was also comparable to that found by Rodgers et al. (2016),

with those authors obtaining a Cronbach's alpha of .94 for the ASC-ASD parent version and the current study obtaining a Cronbach's alpha of .93.

Items within the Uncertainty subscale were endorsed most frequently, with six of the eight items in this subscale endorsed by more than three-quarters of participants; interestingly, all six of these items measured atypical symptoms of anxiety. This finding is similar to that reported by Keen, Adams, Simpson, den Houting, and Roberts (2017) in a younger cohort of autistic children, and therefore provides increasing support for the recent finding that the cognitive construct of intolerance of uncertainty can be identified in samples of autistic children (Hodgson, Freeston, Honey, & Rodgers, 2017). In other relevant work, Boulter, Freeston, South, and Rodgers (2014) proposed a model in which intolerance of uncertainty is said to mediate the relationship between autism and anxiety; although the current study did not examine causal relationships between factors, the frequent endorsement of items within the Uncertainty subscale supports the notion that intolerance of uncertainty is associated with anxiety in autistic children.

Items within the Anxious Arousal subscale were least frequently endorsed, and this was particularly true for items measuring physiological symptoms of anxiety such as dizziness or fainting, trembling or shaking, and breathing difficulties. This may indicate that autistic children primarily experience cognitive symptoms of anxiety, and are less likely to experience physiological symptoms. Alternatively, recent research has suggested that autistic individuals may differ from non-autistic controls in their interoceptive abilities (i.e., the ability to detect one's own physiological state; Garfinkel et al., 2016). It is therefore possible that the infrequent endorsement of items on the Anxious Arousal subscale reflects atypical interoceptive abilities within the current sample, rather than a true lack of physiological symptomatology. Given that this study relies on parent-report, there is also the possibility that

children are experiencing physiological symptoms and are able to identify them, but do not disclose and / or parents do not notice these symptoms.

Given that the ASC-ASD was designed with the intention of measuring autism-specific symptoms of anxiety, it is important to determine whether the measure is truly assessing symptoms of anxiety or is simply capturing autistic characteristics. In the current sample, scores on the ASC-ASD did not correlate with adaptive behaviour as measured by the VABS-2 (with the exception of the Uncertainty subscale), and total scores on the ASC-ASD did not correlate with autistic characteristics as measured by the SCQ. This indicates that the ASC-ASD adequately discriminates the presentation of autism alone, from the presentation of autism with comorbid anxious symptomatology. However, the Anxious Arousal scale of the ASC-ASD was significantly correlated with total scores on the SCQ; and the Uncertainty subscale of the ASC-ASD was significantly correlated with both the SCQ total score and the Socialization domain of the VABS-2, suggesting a relationship between these areas. It could be suggested that a number of the items within the Uncertainty subscale may relate to common core characteristics of autism. However, with the exception of two items (*“My child always needs to be prepared before things happen”* and *“Feeling unsure stops my child from doing most things”*), all items specifically ask whether the child worries about or fears specific events or situations rather than just disliking such situations. Given that parents complete the questionnaire independently, it is unknown how much focus they place on the “worry” aspect of each question compared to the description of the situation. This highlights the difficulty inherent in attempting to differentiate symptoms of anxiety from the core characteristics of autism, a difficulty which is compounded when attempting to assess atypical symptoms of anxiety, which are intrinsically associated with the core characteristics of autism.

When grouped by parent-reported anxiety diagnostic status, those participants with parent-reported anxiety disorder had significantly higher scores than participants with no parent-reported anxiety diagnosis on all ASC-ASD subscales except Performance Anxiety. Using the secondary indicative cut-off, the ASC-ASD correctly identified more than three-quarters of children with a parent-reported anxiety diagnosis as having significant anxiety symptoms, and almost two-thirds of children with no parent-reported anxiety diagnosis as not having significant anxiety symptoms. Although the ASC-ASD is not a diagnostic tool, these results are promising in terms of the measure's ability to discriminate between clinical and non-clinical groups. These scores must be interpreted with caution as the current study relied on parent-report of existing anxiety diagnoses; further research using standardised, reliable and valid anxiety diagnoses is required to confirm the discriminant validity of the ASC-ASD.

Limitations

Although the large sample with a defined age range is a strength of this study in terms of minimising additional variables which may influence anxiety (e.g., transitions, formal examinations), it also limits the extent to which generalisations can be made to other age ranges. Given the longitudinal nature of the study from which this data was drawn, future studies will be able to build upon this paper by exploring the change in anxiety presentation over time.

Data were gathered through an online parent-report questionnaire. This allowed for data to be gathered from a relatively large participant group, but may have resulted in less accurate reporting. Autism diagnostic status was determined based on parent-report, with the SCQ as an additional screening measure, however future studies would benefit from the inclusion of a full autism diagnostic evaluation. This would also be beneficial in allowing more thorough scrutiny of the discriminative ability of the ASC-ASD. Anxiety diagnostic

status was also determined based on parent-report, however future studies including gold-standard diagnostic evaluation for anxiety would be useful in determining the viability of the ASC-ASD as a diagnostic screening instrument.

Participants reported high levels of employment and education, therefore findings may not be generalizable to lower socio-economic groups. Additionally, parents' own mental health was not assessed, therefore it was not possible to determine if parents' level of anxiety impacted on their reporting of child anxiety symptoms.

Implications

This study provides an overview of parent-reported anxiety symptomatology in autistic children, assessed using a newly-developed measure designed specifically for the measurement of anxiety in the autistic population. Findings are consistent with the extensive body of literature which demonstrates high rates of anxiety symptomatology in autistic children. Atypical symptoms of anxiety were endorsed at high frequency, and with the majority of research to date focused on typical symptoms of anxiety, this is an important area for future research. The ASC-ASD is a promising autism-specific anxiety assessment, however as a newly published instrument it requires further validation against existing measures of anxiety. Given the high rates of anxiety symptomatology in the autistic community, and the potentially significant negative consequences of this symptomatology, the accurate assessment of anxiety in autistic individuals is a key area of focus for future research.

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