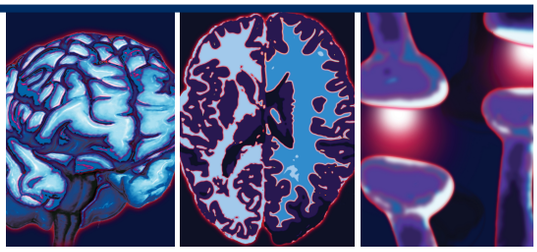
RESEARCH ARTICLE



Clinical characteristics of high-functioning youth with autism spectrum disorder and anxiety

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Practice points

- Clinically significant anxiety is common in youth with autism spectrum disorder (ASD) and exacerbates the severity of ASD core symptoms, in addition to family, school and social functioning.
- Anxiety in youth with ASD presents heterogeneously, differing in its nature, severity and associated impairment.
- Distinguishing anxiety symptoms versus characteristics of ASD is necessary to appropriately treat the respective symptom dimension.
- Given the heterogeneous presentation of anxiety in youth with ASD, tailoring treatment to patient characteristics will likely enhance outcomes and intervention acceptability.
- When assessing anxiety in youth with ASD, clinicians should be aware of the potential for discrepancies between child and parent reports of anxiety presence and severity due to reasons such as limited child insight, cognitive and communication deficits, overlapping symptomology, and parents' awareness of their children's internal states.
- In addition to anxiety, comorbid diagnoses (e.g., oppositional defiant disorder and ADHD) are common in youth with ASD. Behavioral problems frequently occur in youth with ASD and can compromise treatment efficacy.
- Research is needed to examine potential moderators of treatment outcome in anxious youth with ASD.

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SUMMARY **Aim & methods:** Clinical characteristics were examined in 108 high-functioning youth (children with a full IQ scale of at least 70) with an autism spectrum disorder (ASD; aged 7–15 years) who were presenting for inclusion in one of four clinical trials examining the efficacy of cognitive behavioral therapy in youth with ASD and anxiety. **Results:** We present baseline characteristics of this cohort, including prevalence rates of anxiety and comorbid disorders, and correlates of anxiety (e.g., comorbid diagnoses, impairment, anxiety severity and mental health services received) as a function of age and ASD diagnosis in treatment-seeking youth. Primary anxiety disorders were: 41.7% (n = 45) social phobia, 25.9% (n = 28) generalized anxiety disorder, 15.7% (n = 17) separation anxiety disorder, 12.0% (n = 13) obsessive–compulsive disorder and 4.6% (n = 5) specific phobia. Overall, 91.6% of participants (n = 99) met criteria for two or more anxiety disorders. Parents reported considerable functional impairment as measured by the Columbia Impairment Scale and anxiety severity as measured by the Pediatric Anxiety Rating Scale; this did not statistically differ as a function of ASD diagnosis or age. Anxiety severity, the number of comorbid anxiety diagnoses and total comorbid diagnoses were directly associated with parent-reported child impairment. Youth with ASD and anxiety present as a heterogeneous cohort with significant impairments and complex diagnostic presentations. **Conclusion:** These data provide information about the nature of anxiety in youth with ASD, which may foster the development of tailored treatment protocols.

Autism spectrum disorder (ASD), comprised of autistic disorder, Asperger's syndrome and pervasive developmental disorder not otherwise specified, is a chronic and debilitating neuropsychiatric disorder affecting as many as one in 88 youth in the USA [1]. Characterized by social and/or communication deficits and restricted interests/repetitive behaviors, affected individuals can vary widely in the presentation and severity of core ASD symptoms and comorbid conditions, and the degree to which autism symptoms and comorbid conditions impair family, school and social functioning [2]. Approximately 50% of youth with ASD experience clinically significant anxiety that impairs functioning above and beyond the impact of core ASD symptomology [2–4]. In addition to the possibility of shared pathophysiology of ASD and anxiety [5–8], this cohort may be particularly prone to experiencing clinically significant anxiety given findings that youth with ASD experience heightened sensory sensitivity, difficulty understanding social cues and regulating emotions, and communication deficits [9–12].

Anxiety disorders are more prevalent in youth with ASD than in typically developing children and have been associated with impairments above and beyond ASD symptomology [8,13]. Common comorbid anxiety disorders reported in children and adolescents with ASD include obsessive–compulsive disorder (OCD; 17–37%), separation anxiety disorder (SAD; 9–38%), specific phobia (26–57%), social phobia (13–40%), panic disorder (2–25%) and generalized anxiety disorder (GAD; 15–35%) [4,13–16]. Anxiety in youth with ASD has been linked with increased difficulties across several domains including social reciprocity, behavior problems, sleep disturbances, family conflict, stereotyped behaviors and ASD symptomology [8,13,17]. Some evidence suggests that the presentation, frequency and severity of anxiety symptoms in youth with ASD may differ as a function of age and ASD diagnosis. For example, older versus younger youth with ASD are more likely to report anxiety symptoms and be diagnosed with an anxiety disorder [4]. Youth with Asperger's syndrome and pervasive developmental disorder not otherwise specified who are characterized as having higher adaptive functioning and fewer cognitive impairments may experience greater anxiety than youth with autistic disorder [18]. These youth may have greater levels of insight and interest in socially interacting with others, but have difficulty with implementation, leading to the development of social anxiety [14,19]. Poor pragmatic language use and deficits in verbal and nonverbal social reciprocity (e.g., taking phrases or common sayings literally) may also contribute to anxiety [19]. For example, these youth may not be able to correctly interpret conversations directed towards them, which causes confusion and/or interpersonal problems, and leads to increased anxiety symptoms.

At present, the clinical characteristics associated with anxiety in youth with ASD require further exploration. In the present report, we describe the phenomenology (i.e., gender, age,

ethnicity, frequency and type of anxiety disorders, anxiety severity, functional impairment, behavioral problems and mental health services received) of treatment-seeking youth with ASD (conducted immediately prior to beginning treatment). We had three primary research questions. First, what is the frequency and type of primary anxiety disorder and comorbid disorders in high-functioning youth with ASD presenting for anxiety treatment? Second, what is the association between anxiety severity and functional impairment? Finally, what is the association between comorbid anxiety diagnoses and functional impairment, and does this vary by age and ASD diagnosis?

There are several implications of this study. First, rates of anxiety disorders and level of anxiety severity in anxious youth with ASD obtained in our study may provide an initial framework for evaluating anxiety in treatment-seeking cohorts of youth with ASD and anxiety. Second, in the same light, the results of this study may help to highlight the clinical complexity of youth with ASD, which may help shape protocols to target anxiety symptoms and impairment. Finally, this study will inform how impairment associated with anxiety and ASD symptoms can vary according to age and ASD diagnoses, which may help us to individualize treatment and increase treatment efficacy.

Methods

A total of 108 children and adolescents between the ages of 7 and 15 years (mean: 10.95; standard deviation [SD]: 2.07) were enrolled in one of four randomized, controlled trials examining the efficacy of cognitive behavioral therapy for anxiety in youth with ASD. All studies were approved by the local institutional review board, parents consented and youth with ASD assented to their participation in these studies. Participants were enrolled at two sites, the Universities of South Florida (n = 86; FL, USA) and California, Los Angeles (n = 22; CA, USA), through a variety of recruitment strategies, including phone interviews and referrals. At the baseline visit, independent evaluators queried parents and youth on a number of measures to establish clinician ratings. Upon completion of parent, child and clinician questionnaires, participants were randomized to receive weekly cognitive behavior therapy or to the control group [20].

Inclusion and exclusion criteria were largely consistent across studies. In this report, participants were between the ages of 7 and 15 years, had a confirmed ASD diagnosis made by a certified rater through the Autism Diagnostic Interview-Revised and an observational measure (e.g., Autism Diagnostic Observation Schedule and Childhood Autism Rating Scale), met DSM-IV diagnostic criteria for a primary non-ASD diagnosis of an anxiety disorder (e.g., SAD, GAD, social phobia, panic disorder or OCD) and had an IQ equal to or above 70. Participants were excluded if they met criteria for bipolar disorder, schizophrenia or schizoaffective disorder, endorsed clinically significant suicidality or engaged in suicidal behaviors within the last 6 months, had a significant and/or unstable medical illness, initiated an antidepressant within 10–12 weeks preceding study enrollment or an antipsychotic within 6–8 weeks prior to study enrollment, or made any changes in established psychotropic medications (e.g., antidepressants and anxiolytics) within 6–8 weeks before study enrollment (6 weeks for antipsychotic), or made any changes in alternative medications that might have behavioral effects within 4–6 weeks prior to the study baseline assessment.

Independent evaluators

Anxiety measures were administered by independent evaluators who were blind to the child's eventual study treatment allocation. Independent evaluators were doctoral students in clinical psychology who were trained under the supervision of licensed clinical psychologists. Training included observations, video training, inter-rater reliability checks and case conferences. Weekly supervisory meetings with a licensed clinical psychologist were held to discuss ratings.

Clinician-administered measures

Autism Diagnostic Interview-Revised

The Autism Diagnostic Interview-Revised [21] is a standardized semistructured clinical diagnostic interview for assessing ASD in children and adults based on the diagnostic criteria for autism in the DSM-IV-TR [22]. The Autism Diagnostic Interview-Revised focuses on behaviors in the three content areas or domains: quality of social interaction (e.g., emotional sharing, social smiling and responding to other children); communication and language (e.g., stereotyped utterances and social use of language); and repetitive, restricted and stereotyped interests and behavior

(e.g., unusual preoccupations, and hand and finger mannerisms) [21].

Autism Diagnostic Observation Schedule – Module 3

The Autism Diagnostic Observation Schedule – Module 3 is a structured observation assessment used to elicit atypical language use, social interaction and stereotyped behaviors of individuals suspected of having ASD [23]. The Autism Diagnostic Observation Schedule has demonstrated strong psychometric properties, including test–retest reliability, inter-rater reliability and discriminant validity [23,24]. In this study, a trained clinician administered the Autism Diagnostic Observation Schedule to aid ASD diagnosis.

Anxiety Disorders Interview Schedule for the DSM-IV – Parent & Child versions

The Anxiety Disorders Interview Schedule for the DSM-IV – parent and child versions [25] is a clinician-administered, structured interview used to assess the presence, severity and level of interference of anxiety disorders and common disorders in youths based upon the criteria set by the DSM-IV-TR [22]. Final diagnosis is determined by the clinician after separate interviews with the parent and child. Clinical diagnoses reflect endorsement of symptoms and a severity rating (patient impairment/distress) of at least 4 on a 0–8 scale. The anxiety diagnosis with the highest severity rating was labeled as the primary anxiety diagnosis and all other anxiety diagnoses were considered secondary. If two or more anxiety diagnoses had the same highest severity rating, the clinician determined the primary anxiety diagnosis based upon parent and child report, and their gestalt impression regarding which disorder was more problematic. Such a distinction between primary and secondary diagnoses is essential because the primary diagnosis that is the most problematic for the youth and their family is often the target of treatment and used to tailor treatment protocols to meet the unique needs of the youth. Moreover, the Anxiety Disorders Interview Schedule for the DSM-IV – parent and child versions has demonstrated strong psychometric properties in typically developing youth, including test–retest reliability [26], inter-rater reliability [27] and concurrent validity [28]. In a recent study conducted in our clinic, inter-rater reliability of primary diagnoses and secondary diagnoses were good to excellent [Ung D, Arnold EB, De Nadai AS *et al.* Inter-rater reliability of the Anxiety Disorders Interview Schedule for DSM-IV in high functioning youth with autism spectrum disorder (2013), Submitted].

Clinical Global Impressions Scale – Severity

The Clinical Global Impressions Scale – Severity (CGI-S) is a clinician-rated scale of global psychopathology severity rated on a 7-point Likert scale from 0 (no illness) to 6 (extremely severe) [29]. Clinicians rate the severity of a patient's illness by comparison with their experiences with other patients with the same illness. The CGI-S has been used as measures of global syndrome severity, and treatment response and efficacy.

Pediatric Anxiety Rating Scale

The Pediatric Anxiety Rating Scale (PARS) [30] is a 66-item clinician-rated scale assessing anxiety symptom presence and the associated severity in children over the past week. Scores on the PARS Severity Scale range from 0 to 30, with scores greater than 13 consistent with clinically significant levels of anxiety [30]. Final PARS scores are determined by the clinician after separate interviews with the parent and child. The PARS (five-item) total score was used for our estimate of anxiety severity. The five items included questions that addressed frequency and severity of anxiety symptoms, avoidance caused by anxiety symptoms and level of interference in/outside of the home caused by anxiety symptoms. Clinicians rated these questions on a 5-point Likert scale from 0 (no symptoms) to 5 (extreme).

Service Assessment for Children & Adolescents

The Service Assessment for Children and Adolescents is a standardized interview for parents, documenting the use of mental health services including outpatient, inpatient and school based [31]. Parents are asked if they have received assistance for their child's behavioral or emotional problems, the type of assistance their child has received (e.g., assessment, individual therapy, group therapy or medication) and the number of hours spent using these services.

■ Parent & patient report measures

Child Behavior Checklist

The Child Behavior Checklist is a parent-rated questionnaire consisting of 118 items that assesses the intensity and frequency of behavioral and emotional problems exhibited by children

within the past 6 months [32]. The Child Behavior Checklist produces nine clinical syndrome scales: withdrawn, anxious–depressed, social problems, thought problems, attention problems, delinquent behavior, aggressive behavior, internalizing dysfunction and externalizing dysfunction. Each item is rated on a 3-point Likert scale: not at all (0), sometimes (1), all the time (2).

Columbia Impairment Scale – Parent & Child versions

The Columbia Impairment Scale (CIS) – Parent (CIS-P) and Child (CIS-C) versions [33] are psychometrically sound 13-item parent-report and child-report scales that assess impairment in several domains of functioning, including school/work, social and home/family [34]. Each item is rated on a 4-point Likert scale that ranges from no problem (0) to a very bad problem (4). The CIS total score was used for our estimates of parent-reported child functional impairment.

■ Data analysis

Data were analyzed and reported through the use of frequencies, percentages, means, SDs, correlations and one-way analysis of variance to explore the association between ASD diagnosis and functional impairment. Through the use of a computer program, hot deck imputation was used to address missing data [35]. This imputation substitutes missing values using other similar observations (i.e., variables) in the sample that are specified by the user.

Results

■ Demographic characteristics

The average age was 10.95 years (SD: 2.07; range: 7–15 years). There were approximately four-times more males (n = 86) than females (n = 22). The average age of the males was 11.01 years (SD: 2.08) and the average age of the females was 10.82 years (SD: 2.02; p-value not significant). The ethnic/racial distribution was 84.3% (n = 91) Caucasian, 7.4% (n = 8) Hispanic/Latino, 4.6% (n = 5) Asian and 3.7% (n = 4) other/mixed.

■ ASD distribution

The ASD distribution was as follows: 42.6% (n = 46) were diagnosed with an autistic disorder, 32.4% (n = 35) were diagnosed with Asperger's disorder and 25.0% (n = 27) were diagnosed with pervasive developmental disorder not otherwise specified.

■ Anxiety diagnoses, symptoms & comorbid conditions

The distribution of primary anxiety, secondary anxiety and comorbid diagnoses are summarized in Table 1. Regarding primary anxiety diagnoses, 41.7% (n = 45) presented with social phobia, 25.9% (n = 28) presented with GAD, 15.7% (n = 17) presented with SAD, 12.0% (n = 13) presented with OCD and 4.6% (n = 5) presented with specific phobia. Overall, 91.6% (n = 99) met criteria for two or more anxiety disorders. Of these, 28.3% (n = 28) had two anxiety disorders, 27.8% (n = 30) had three anxiety disorders and 38.0% (n = 41) had four or more anxiety disorders.

In addition to meeting a diagnosis of an anxiety disorder, 75.0% (n = 81) met criteria for one or more comorbid nonanxiety disorders (i.e., oppositional defiant disorder, ADHD inattentive/hyperactivity/combined type, depressive disorders, selective mutism, sleep terror and enuresis). Of the most common comorbid

Table 1. Primary anxiety diagnoses, secondary anxiety diagnoses and other DSM-IV comorbidities diagnostic summary.

Diagnosis type	n	%
Primary anxiety diagnosis		
Social phobia	45	41.67
Generalized anxiety disorder	28	25.93
Separation anxiety disorder	17	15.74
Obsessive–compulsive disorder	13	12.04
Specific phobia	5	4.63
Nonprimary anxiety diagnosis		
Specific phobia	61	56.48
Generalized anxiety disorder	53	49.07
Social phobia	51	47.22
Obsessive–compulsive disorder	27	25.00
Separation anxiety disorder	23	21.30
Post-traumatic stress disorder	3	2.78
Panic disorder	2	1.85
Agoraphobia	1	0.93
Other DSM-IV diagnosis		
ADHD combined type	37	34.26
Oppositional defiant disorder	32	29.63
ADHD inattentive type	31	28.70
Dysthymia	10	9.26
ADHD hyperactivity type	7	6.48
Major depressive disorder	4	3.70
Conduct disorder	3	2.78
Enuresis	3	2.78
Sleep terrors	3	2.78
Selective mutism	1	0.93

nonanxiety disorders diagnosed, 34.3% (n = 37) presented with ADHD combined type, 29.6% (n = 32) presented with oppositional defiant disorder and 28.7% (n = 31) presented with ADHD inattentive type. Of the participants who met criteria for a comorbid nonanxiety disorder, 28.7% (n = 31) met criteria for two nonanxiety comorbid diagnoses, 5.6%(n = 6) met criteria for three diagnoses and 1.9% (n = 2) met criteria for four or more diagnoses.

Table 2 summarizes parent- and child-reported measures (e.g., Child Behavior Checklist, CIS-P and CIS-C) and clinician-administered measures (i.e., CGI-S, Anxiety Disorders Interview Schedule for the DSM-IV – parent and child versions, and PARS). Results revealed a PARS (five item) mean score of 16.44 (n = 108; SD: 2.39), corresponding to moderate anxiety severity, a CGI-S mean score of 3.77 (n = 108; SD: 0.74), corresponding to moderate to moderate-to-severe anxiety symptoms, a CIS-P mean score of 23.06 (n = 108; SD: 8.87), corresponding to little-to-moderate functional impairment and a CIS-C mean score of 14.47 (n = 106; SD: 9.13), corresponding to little functional impairment. Parents reported higher functional impairment than their children on the CIS-P and CIS-C (mean: 22.94 vs 14.47; n = 106; t = 8.36; $p < 0.001$).

Anxiety severity was directly associated with parent-reported child functional impairment as measured by the CIS-P ($r = 0.22$; $p < 0.05$). Number of comorbid anxiety diagnoses and total comorbid diagnoses were directly associated with parent-reported child functional impairment ($r = 0.26$, $p < 0.01$; $r = 0.48$, $p < 0.001$, respectively).

■ Obtained services & medication history

Overall, 82.4% of the parents (n = 89) in the sample reported receiving one or more mental health service for their child prior to presentation (mean: 1.95; SD: 1.42; range: 0–6) including individual treatment/therapy, psychiatric medication management, or family treatment or education. Approximately 62.9% (n = 68) received psychiatric services involving medication management, 36.1% (n = 39) participated in individual psychotherapy, 24.1% (n = 26) received rehabilitative services (n = 19), 22.2% (n = 24) attended a special school or special classroom for students with problems with behaviors or feelings, and 23.1% (n = 25) received counseling or therapy in school. Of the youth who were taking medication (n = 68): 33.3% (n = 36) were taking antidepressants, 20.4% (n = 22) were taking antipsychotics, 10.2% (n = 11) were taking an antidepressant and antipsychotic, and 20.4% (n = 22) were taking stimulants (the total exceeds 68 as some children were taking multiple medicines). There were no significant differences on anxiety severity associated with

Table 2. Sample clinical characteristics.

Measure	n	Mean	SD
Clinician report			
PARS total score	108	16.44	2.39
CGI-severity	108	3.77	0.74
Highest ADIS CSR	108	5.67	0.85
Parent report			
CIS-P	108	23.06	8.87
CIS-C	106	14.47	9.13
SACA	108	1.95	1.42
CBCL anxious/depressed (t-score)	108	71.33	8.72
CBCL withdraw (t-score)	108	66.94	8.63
CBCL somatic (t-score)	108	63.77	10.4
CBCL social (t-score)	108	70.63	9.19
CBCL thought (t-score)	108	70.56	8.29
CBCL attention (t-score)	108	72.44	11.54
CBCL rule breaking (t-score)	108	58.87	7.82
CBCL aggressive (t-score)	108	64.41	12.10

ADIS CSR: Anxiety Interview Schedule Clinician Severity Rating; CBCL: Child Behavior Checklist; CGI: Clinical Global Impressions; CIS-C: Columbia Impairment Scale – Child Version; CIS-P: Columbia Impairment Scale – Parent Version; PARS: Pediatric Anxiety Rating Scale; SACA: Service Assessment for Children and Adolescents; SD: Standard deviation.

any psychiatric medication use (t[106] = 0.81; p = 0.42), antidepressant use (t[106] = 1.03; p = 0.30), antipsychotic use (t[106] = -0.62; p = 0.54) or stimulant use (t[106] = 1.82; p = 0.07).

■ Anxiety diagnoses, DSM-IV diagnoses, anxiety severity & impairment

Age

Age was dichotomized into childhood (ages 7–11 years) and early adolescence (ages 12–15 years). There were no significant differences between participants aged 12–15 years (n = 46) and participants aged 7–11 years (n = 62) for anxiety diagnoses (t[106] = 1.02; p = 0.31), DSM-IV diagnoses (t[106] = 0.07; p = 0.95), anxiety severity (t[106] = -1.30; p = 0.20) and functional impairment (t[106] = -0.49; p = 0.62).

ASD diagnoses

There were no statistically significant differences by ASD diagnosis found for anxiety diagnoses (F[2105] = 0.59; p = 0.55), comorbid diagnoses (F[2105] = 2.70; p = 0.07), anxiety severity (F[2105] = 0.77; p = 0.47) and functional impairment (F[2105] = 0.80; p = 0.45).

Discussion

This study examined the clinical characteristics associated with anxiety in high-functioning youth with ASD. Multiple anxiety disorders were common in this sample with over 90% of the sample reporting two or more anxiety disorders. The most common primary anxiety diagnoses were social phobia (41.7%), GAD (25.9%), SAD (16.6%), OCD (12.0%; diagnostic criteria for one of the clinical trials excluded OCD as a primary diagnosis, consequently, rates of primary diagnoses may not be representative of this population) and specific phobia (4.6%). By comparison, with clinical studies that have investigated anxiety in youth with ASD [20] and typically developing youth [36,37], similar rates of individual anxiety disorders and comorbid diagnoses were found. For example, in a clinical study investigating anxiety in youth with ASD, Wood and colleagues reported that 87.5% of their sample had a diagnosis of social phobia that is comparable with 88.9% of our sample that had a diagnosis of social phobia [20]. Rates of OCD were modest in this sample compared with other anxiety disorders. In addition to being a result of the exclusion of children with OCD from one of the studies, we carefully assessed OCD caseness to be consistent with the current diagnostic system. It is relevant to note that the classification of primary and secondary diagnoses may not translate well into the real world, where the clinician is faced with evaluating and treating a child with clinically significant anxiety that may not fit into a clear diagnostic profile. Indeed, the high comorbidity rate suggests the presence of a common anxiety condition that presents in multiple forms.

Higher rates of comorbid psychopathology in youth with ASD may reflect biological underpinnings (e.g., neurological findings of amygdala abnormalities and serotonin neurotransmission abnormalities in youth with ASD and anxiety) [5–7] and/or may be the result of common characteristics found in youth with ASD that increase the risk of developing clinical anxiety and comorbid psychopathology (e.g., heightened sensory sensitivity, difficulty understanding social cues and regulating emotions and communication deficits) [9–12]. The elevated incidence of anxiety disorders in this treatment-seeking sample may also be indicative of symptom overlap between diagnoses and the difficulty teasing apart diagnoses in this sample.

In addition to meeting criteria for an anxiety disorder, nearly 75% of participants met criteria for one or more nonanxiety diagnoses (i.e., oppositional defiant disorder, ADHD and depressive disorders), which is comparable with previous reports [13]. Notably, oppositional defiant disorder and symptoms consistent with ADHD were prevalent (29.6 and 63%, respectively). One possible explanation is that deficits inherent in ASD symptomology may increase the risk of behavior problems. For example, social and cognitive deficits may lead to difficulty with emotion regulation when frustrated or distressed [11]. Anxiety symptoms may also manifest themselves as oppositional behaviors (e.g., temper tantrums and aggression) in efforts to avoid anxiogenic triggers [38]. This interplay among anxiety and disruptive behavior in youth with ASD may complicate diagnosis and treatment course. For example, an anxious youth with ASD who is oppositional may refuse to participate in therapy sessions because he/she does not feel that a problem exists and does not understand the need for intervention. It may be necessary to target comorbid conditions

prior to or in conjunction with the treatment of anxiety symptoms to maximize treatment adherence and efficacy [39]. For example, treating ADHD symptoms or oppositionality prior to anxiety may increase a youth's ability to focus and engage in treatment more effectively.

The presence of an anxiety disorder and comorbid DSM-IV diagnoses was directly associated with functional impairment. Youth who had greater ASD symptomology and youth who had greater anxiety severity were reported to have greater levels of functional impairment, which is consistent with previous findings [8]. In addition to the burden and stress associated with ASD symptomology [40], an additional diagnosis of an anxiety disorder may increase the overall degree of impairment experienced by the child [8, 41]. Our findings suggest that the number and severity of anxiety disorders in youth with ASD is associated with increased risk of child impairment. Consequently, by targeting and treating anxiety in youth with ASD, associated impairments may significantly decrease and improve quality of life.

Consistent with previous findings [8], anxiety presentation did not differ as a function of age or ASD diagnosis, suggesting that these factors may not play a significant role in determining anxiety severity and functional impairment. It would be of interest for future research to examine how anxiety may differentially present as a function of other possible moderating factors such as intelligence, level of social relations and comorbidity [8,42,43].

Some limitations to the present study should be noted. First, our study reported prevalence rates of youth with ASD who were seeking treatment for anxiety at one of two clinical sites. Consequently, rates of anxiety diagnoses should not be taken as representative of the greater population of youth with high-functioning ASD, but rather as a sample of anxious youth seeking treatment via clinical research studies at academic specialty clinics. Second, our sample consisted largely of Caucasian males, limiting the generalizability of our results. Third, all diagnoses were based solely on structured interviews without individual evaluations by expert clinicians (despite senior clinician overseeing the results/recordings of diagnostic interviews). Consequently, the subtle differentiation between psychiatric disorders with similar/overlapping symptoms may have been missed and more subject to parent/child bias.

Conclusion

Youth with ASD and anxiety present as a heterogeneous population with significant levels of functional and social impairment. The present data highlight the complexity of comorbid psychopathology and associated impairments in youth with ASD seeking anxiety treatment. To date, treatment options for anxiety in ASD are limited, although improving. Although antidepressants are widely used in youth with ASD [44], there are few corresponding efficacy data. By contrast, cognitive behavioral therapy has shown promising results [20,45], and is safe and acceptable to families. To date, it is unclear which and for whom intervention approaches work best. Consequently, individualized treatment based on clinical characteristics of the youth with ASD (e.g., ASD severity, anxiety severity, level of impairment, level of insight and motivation) may result in greater treatment adherence and efficacy [11,19].

Future perspective

Youth with ASD are frequently diagnosed with anxiety disorders, causing great concern for clinicians and parents. There are a number of ways for the field to move forward. First, knowledge about how anxiety symptoms differ as a function of varying clinical characteristics may inform treatment aims and intervention specificity, thereby increasing treatment efficacy. In this study, age and ASD diagnosis did not moderate anxiety severity. Future research is needed to explore other clinical characteristics and how they may moderate anxiety severity (e.g., social relations, intelligence and ASD severity). Second, attention should be given to differentiating anxiety symptoms from ASD symptoms to inform treatment protocols and assist in targeting specific areas of impairment. For example, although previous findings have shown that serotonin reuptake inhibitors decrease obsessive–compulsive symptoms in youth with ASD [46–48], King *et al.* found that citalopram did not significantly decrease repetitive behaviors in youth with ASD, which may be because repetitive behaviors fundamentally differ from obsessive–compulsive symptoms [49]. This study highlights the need for the creation of or refinement of existing assessment tools to differentiate anxiety symptoms from ASD symptoms. Third, future research is needed to understand how anxiety and comorbid disorders may interfere or hinder therapy for youth with ASD. Treating these psychiatric comorbid

conditions prior to treatment entry for anxiety diagnoses may increase treatment efficacy by allowing clinicians to focus their attention on the presenting problems rather than diverting their attention to problematic comorbid conditions. Finally, although empirical data exist for the efficacious treatment of anxiety in youth with ASD, efforts to disseminate these treatments have been lacking. Consequently, future research is needed to investigate how efficacious treatment for youth with ASD and anxiety can be disseminated to the population, and practiced among healthcare providers.

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Ethical conduct of research

The authors state that they have obtained appropriate institutional review board approval or have followed the principles outlined in the Declaration of Helsinki for all human or animal experimental investigations. In addition, for investigations involving human subjects, informed consent has been obtained from the participants involved.

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Papers of special note have been highlighted as:

■■ of considerable interest

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