# **REVIEW**



# Managing anxiety comorbidity in with autism spectrum disorders

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# **Practice points**

- Anxiety disorders occur at a higher prevalence among children with autism spectrum disorders (ASD) than typically developing children, with a substantial overlap between anxiety and core ASD symptom presentation and severity.
- Youth with ASD and comorbid anxiety exhibit some unique anxious triggers, physical presentation and expression of anxiety relative to typically developing children.
- Adaptations are necessary to implement cognitive-behavioral therapy for anxiety among the pediatric ASD population.
- Treatment outcome studies including several randomized clinical trials have yielded empirical evidence that adapted cognitive-behavioral therapy for the treatment of anxiety in youth with ASD meets 'probably efficacious' status at this time.
- Limited evidence with mixed results suggests that pharmacological interventions merit only 'experimental' status for treatment of anxiety in youth with ASD at this time.
- Future research is needed to examine mediators and moderators of treatment, augmentation strategies aimed at increasing techniques for lower functioning and younger populations, and efficacy of pharmacological treatments alone and in combination with psychosocial treatments.

**SUMMARY** Anxiety is a frequent and impairing problem among children and adolescents with autism spectrum disorders (ASD). The current review discusses the phenomenology and presentation of comorbid anxiety and ASD symptomology, identifies and evaluates the evidence base of current treatment approaches for managing anxiety among the pediatric ASD population, and provides recommendations for future research to better understand and address anxiety comorbidity.

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Anxiety is a common and impairing problem among many children and adolescents with autism spectrum disorders (ASD) [1,2], which has driven increasing efforts to better understand and address this comorbidity pattern, particularly in the past decade. Therefore, the current review aims to synthesize the growing body of information by: discussing the phenomenology and presentation of comorbid anxiety and ASD symptomology; identifying and describing current approaches for managing anxiety among children and adolescents with ASD; evaluating the available information about the efficacy of these treatments; and providing future research recommendations.

#### Anxiety in ASD Prevalence

Anxiety disorders occur at a higher prevalence among children with ASD than typically developing children, affecting approximately 40-55% of youth with ASD [1,2]. The most commonly diagnosed anxiety disorders among the pediatric ASD population are specific phobias (30–44%), obsessive-compulsive disorder (17-37%), social phobia (17-30%) and generalized anxiety disorder (15-35%), followed by separation anxiety disorder (9-38%), agoraphobia (1-17%) and panic disorder (1-2%), with the majority of children meeting criteria for more than one disorder [1,3,4]. Specific reasoning behind elevated anxiety prevalence among youth with ASD has yet to be fully understood, with some suggestion that varying assessment methodologies and chosen populations (e.g., help-seeking populations) may lead to artificial elevations [1]; however, shared characteristics (as mentioned below) point to an increase of anxiety prevalence among the pediatric ASD population [1,2,5]. Given the increasing prevalence of children diagnosed with ASD (one in 88) [6], together with the high incidence of comorbid anxiety, attention to management of anxiety among this population is needed.

# Etiology, phenomenology & conceptualization

Anxiety and ASD symptomology have many overlapping characteristics that complicate assessment and differential diagnosis [7], including social avoidance, repetitive behaviors, communication difficulties and emphasis on rituals and routine [8]. Anxiety presence is directly associated with age [1], functioning status [2], communication skills [9] and intelligence [2,10]. However, evidence for these factors is mixed, with some studies suggesting that severity of anxiety symptoms fluctuates throughout the lifespan [11] and may be moderated by ASD subtype [9], and individuals who are mid-to-lower functioning may be similarly susceptible [1].

#### Anxiety & ASD symptom severity

The etiology and maintenance of anxiety in youth with ASD is probably multidetermined by various, reciprocally related contributing factors [8]. Anxiety and ASD symptomology are directly linked, with the experience of greater anxiety symptoms being associated with greater ASD symptoms, in particular social deficits and repetitive behaviors [5,12]. Among higher functioning (i.e., higher cognitive functioning and fewer communication deficits) youth, anxiety occurs, in part, as a downstream consequence of ASD symptoms in which stress generation from feedback related to ASD core symptomology influences mood dysregulation and anxiety, which then affects the expression of core and associated ASD deficits [8].

#### Anxiety & ASD core features

Children with ASD who experience anxiety demonstrate higher levels of total restricted/repetitive behaviors, sameness behaviors, circumscribed interests and sensory-motor behaviors than their nonanxious counterparts [13-15], with particularly strong associations between insistence on sameness [13] and symbolically enacted restricted interests [14]. Anxiety, particularly social anxiety, also increases barriers to social engagement, creating a cycle through which fear and avoidance limit social awareness and lead to limited opportunities to practice skills (e.g., assertiveness and responsibility), which further impairs social functioning [8,16,17]. Moreover, anxiety in youth with ASD has also been linked to sensory over-responsitivity [18] and, not surprisingly, decreased overall quality of life [12].

#### Family impact

Parental state and trait anxiety correlate highly with parent and self-report of anxiety among children with ASD [19], implicating similar biological and environmental correlates to those found in the literature regarding anxiety presentation in typically developing children [5,20-22]. Anxiety comorbidity clearly impairs individual and family functioning among the pediatric ASD population, inciting the need for empirically supported, safe and effective treatments to manage anxiety symptomology specifically for these children.

# Presentation

#### Antecedents & triggers

Along with the influence of anxiety on core ASD symptomology and overall functioning, it is important to understand how anxiety presents among youth with ASD. Although many antecedents to anxiety overlap among the two populations [1,23], it is likely that youth with ASD and comorbid anxiety exhibit some unique anxious triggers and physical presentation relative to typically developing children [24,25]. Ozsivadjian et al. identified the following common triggers across children with ASD: situational change or change in routine; social or language-related difficulties; specific fears; sensory issues; obsessions; and high expectations in performance or organization [24]. Among the most common triggers for anxiety occurrence are situational change/change in routines and social situations.

#### Expression

Ozsivadjian et al. identified five common categories for the way that anxiety is expressed across youth with ASD: challenging behaviors/tantrums; avoidance/escape; hyperactivity/heightened arousal; sensory behaviors; and increased repetitive behaviors; with challenging behaviors being the most pervasive [24]. Anxiety presentation overlaps with typically developing children in some respects (e.g., avoidance/escape, increased arousal and tantrums) [1,23], yet the expression of anxiety among youth with ASD may be unique at times (e.g., sensory related, language related, rigidity related to routines and change, and more extreme challenging behaviors) and involve the appearance or engagement of more core ASD deficits (e.g., sensory or repetitive behaviors) [24,25]. Furthermore, in youth with ASD, anxiety is reportedly noticed less pre-emptively (i.e., before situations and/or behavioral expressions occur) and instead more when it is expressed in the form of maladaptive coping behaviors, and caregivers often mistake core ASD traits with symptoms of anxiety (e.g., rigidity and inflexibility), which complicates differentiation. Therefore, awareness of common triggers and symptoms, as well as ASD-specific anxiety expression, should be taken into consideration when attempting to treat anxiety symptomology as a clinician as well as when training parents to understand and manage anxiety among the ASD pediatric population. A

more thorough discussion of how to specifically manage these triggers and behavioral expressions is beyond the scope of this paper; however, some general recommendations for treatment modifications are noted below.

#### **Treatment approaches**

Identifying efficacious treatment strategies to manage anxiety in youth with ASD is important given the associated impairment and morbidity. Psychosocial/behavioral interventions and pharmacological interventions are the most utilized options for treatment; however, varying degrees of efficacy data are available for each approach, respectively.

#### Psychosocial/behavioral interventions

Cognitive-behavioral therapy (CBT) is an empirically supported treatment for pediatric anxiety [26-28] that addresses problematic anxiogenic thoughts and distress-reducing behaviors by challenging distorted cognitions, and teaching coping skills for feared situations [29]. Systematic exposure to anxiety-provoking stimuli without escape or ritual engagement is the most critical component of CBT for anxiety [21]. Exposure promotes habituation to maladaptive physiological responses by teaching that without escape from the anxiety-provoking situation or stimulus, anxiety will decrease over time and will provide in vivo practice of newly learned coping skills and cognitive restructuring techniques [27]. At present, individualized CBT (also known as personalized or adapted CBT) has shown promise for addressing anxiety among the pediatric ASD population. Individualized CBT - hereafter referred to only as CBT for the purposes of this paper – is defined here as a variant of CBT that involves exposure to anxiety-provoking stimuli with important modifications for ASD (e.g., increased parent involvement, modules designed to target core deficits of ASD, and the use of more concrete, behaviorally based techniques - see the 'Treatment modifications summary' section for more details). The following is a review of the extant literature regarding treatment efficacy and adaptations to CBT protocols for use with youth with ASD and anxiety (see Table 1 for an overview of clinical trial findings for CBT).

#### Individual therapy

The majority of studies conducted have examined individual CBT treatment protocols for

# **REVIEW** Rudy, Lewin & Storch

Table 1. Adapted cognitive–behavioral therapy: clinical trial findings summary.				
Study (year)	Trial type	Sample characteristics (based on treatment completers)	Findings	Ref.
Individual C	ВТ			
Wood et al. (2009)	RCT: CBT or waiting list	High functioning ASD <sup>+</sup> One or more anxiety disorder diagnosis (n = 36; CBT = 14; waiting list = 22)	CBT (active): 92.9% demonstrated positive treatment response; 64.3% diagnosis free at post-treatment Waiting list: 9.1% diagnosis free after post-treatment waiting period Large treatment effect (d = 1.23)	[36]
Storch <i>et al.</i> (2013)	RCT: CBT or TAU	High functioning ASD <sup>+</sup> One or more anxiety disorder diagnosis (n = 45; CBT = 24; TAU = 21)	CBT (active): 75% demonstrated positive treatment response; 38% (primary) diagnosis free at post-treatment TAU: 14% demonstrated positive treatment response; 5% diagnosis free (primary) at post-treatment Large treatment effects for each of three clinician-rated primary outcome measures (d = 1.03, 1.06 and 0.84)	[38]
Sung <i>et al.</i> (2011)	RCT: CBT or SR intervention	High functioning ASD <sup>+</sup> Clinical elevations of anxiety (n = 64; CBT = 33; SR = 31)	Clinical ratings – CGI 'normal range' CBT: pretreatment = 6.06%; post-treatment = 21.21%; 6-month follow-up = 28.57% SR: pretreatment = 0%; post-treatment = 6.45%; 6-month follow-up = 37.04% No significant group differences at 6-month follow-up Child report of anxiety symptom decreases yielded negligible treatment effect (d = 0.07)	[39]
Group CBT				
Sofronoff <i>et al.</i> (2005)	Clinical trial – not blinded: ICBT, FCBT or waiting list	AS Clinical elevations of anxiety (n = 66; child only = 22; parent + child = 24; waiting list = 20)	Active treatment conditions demonstrated significant decreases in anxiety as compared with waiting list: ICBT > waiting list (d = 0.48; small effect) FCBT > waiting list (d = 0.65; moderate effect) FCBT > ICBT (d = 1.3; large effect)	[41]
Chalfant <i>et al.</i> (2007)	RCT: CBT or waiting list	HFA or AS One or more anxiety disorder diagnosis (n = 47; CBT = 28; waiting list = 19)	CBT (active): 71.4% diagnosis free at post-treatment Waiting list: 0% diagnosis free at post-treatment Parent report (d = 4.27) and child report (d = 2.76) yielded large treatment effects	[42]
Reaven <i>et al.</i> (2009)	Clinical trial – no random assignment: CBT or waiting list	High functioning $ASD^{\dagger}$ Clinical elevations of anxiety (n = 31; CBT = 10; waiting list = 21)	CBT (active) group demonstrated significant decreases in parent-reported anxiety as compared with waiting list (d = 0.88; large effect); however, child report yielded no differences (d = 0.3; small effect)	[43]
Reaven et al. (2012) <sup>†</sup> For samples wi	RCT: CBT or TAU	High functioning ASD <sup>+</sup> One or more anxiety disorder diagnosis (n = 43; CBT = 20; TAU = 23) diagnosis, all participants gualified for a	CBT (active): 50% demonstrated response to treatment TAU: 8.7% demonstrated response to treatment Significant differences in symptom severity between groups (clinician rated) present with medium-to-large effect sizes (d = 0.66–0.87) my of the following diagnoses: autistic disorder. AS or pervasive developmental disorder-n	[44]
otherwise speci	fied.	strum disorders: CBT: Cognitive_bebavi	oral therapy: CGI: Clinical Global Impression: d: Cohen's d (effect size): ECRT: Eamily CRT:	

HFA: High functioning autism; ICBT: Individual CBT; RCT: Randomized clinical trial; SR: Social–recreational; TAU: Treatment as usual.

treating anxiety. Initially, case studies demonstrated promising results for CBT to treat anxiety in youth with ASD using varying approaches and pioneering many of the modifications (e.g., increased parent involvement, visual aids, incorporation of child-specific interests, emphasis on social skills and token economies) that are now considered standard in adapted CBT protocols for this population [30–35]. Building on these studies, the efficacy of CBT protocols for treatment of anxiety disorders in youth with ASD have been examined via several randomized clinical trials (RCTs). Wood *et al.* conducted a waiting list-controlled RCT for treatment of anxiety in 40 children with high functioning ASD [36]. An adapted modular treatment CBT protocol incorporating exposure to anxious/feared stimuli was utilized with modifications such as an emphasis on parent involvement and parent training, as well as modules to address core deficits (e.g., social skills and communication) and adaptive deficits [37]. Of treatment completers (n = 36), 13 out of 14 (92.9%) participants who received CBT demonstrated positive treatment response, with nine out of 14 (64.3%) no longer meeting criteria for any anxiety disorder as compared with two out of 22 (9.1%) controls. In addition, parent report of anxiety symptom decreases between groups yielded a large treatment effect (Cohen's d [d] = 1.23), but child report yielded no treatment effect (d = 0.03).

Storch et al. [38] compared the Wood et al. [36] CBT protocol for anxiety to treatment as usual in 45 children with high functioning ASD and a comorbid anxiety disorder diagnosis. Eighteen out of 24 children (75%) who received CBT responded to treatment, with nine out of 24 children (38%) achieving clinical remission of their primary anxiety diagnosis as compared with only three out of 21 children (14%) and one out of 21 children (5%) who received usual care, respectively. Gains were maintained at 3-month follow-up for CBT responders. In addition, three clinician-rated primary outcome measures of anxiety symptom decreases each yielded large treatment effects between groups (d = 1.03, 1.06 and 0.84, respectively).

Finally, Sung et al. compared CBT for anxiety to a social-recreational (SR) intervention program [39]. All children (n = 70) who met criteria for ASD were high functioning and demonstrated clinical elevations of anxiety (no anxiety disorder diagnosis given). Of treatment completers (n = 64), clinician ratings (Clinical Global Impression [CGI] Severity [40]) yielded significant decreases in anxiety severity for those who received CBT (CGI 'normal range': pretreatment: 6.1%; post-treatment: 21.2%; 6-month follow-up: 28.6%) as well as those who received SR (CGI 'normal range': pretreatment: 0%; post-treatment: 6.5%; 6-month follow-up: 37.0%), with no significant differences between groups at 6-month followup. Child report ratings of anxiety symptom decreases (primary outcome) yielded significant within group differences from pre- to posttreatment and follow-up, but no significant differences between the CBT and SR groups (d = 0.07). Collectively, the clinical trials for individual CBT protocols were efficacious in decreasing anxious symptomology, superior to

waiting list and usual care, and equivalent to SR interventions.

#### Group therapy

Several studies have indicated that groupformatted CBT may be beneficial for reducing anxiety among youth with ASD. Sofronoff et al. examined a brief (six sessions) group CBT protocol for treating clinical anxiety elevations (no anxiety diagnosis given) in 71 children with Asperger's syndrome across three groups (child only: n = 23; parent plus child: n = 25; and waiting list: n = 23) [41]. Of treatment completers (n = 66), parent report of anxiety severity indicated no significant differences between groups at post-treatment; however, at the 6-week followup, relative to waiting list controls, those who received child-only CBT (d = 0.48; small effect) and parent plus child CBT (d = 0.65; moderate effect) experienced significant decreases in parent-reported anxiety symptoms. Furthermore, the parent plus child intervention demonstrated significantly greater effects than the child-only intervention (d = 1.3; large effect).

Chalfant *et al.* similarly compared groupformat CBT to a waiting list control [42]. Fortyseven children with high functioning autism or Asperger's syndrome who met criteria for one or more anxiety disorder(s) received a group CBT protocol. Their parents also participated in adapted parent-only group sessions weekly. Twenty out of 28 (71.4%) children who received CBT no longer met criteria for any anxiety disorder as compared with zero out of 19 controls. In addition, parent report (d = 4.27) and child report (d = 2.76) of anxiety symptom decreases yielded large between-group treatment effects.

Reaven *et al.* conducted a nonrandomized pilot clinical trial comparing group CBT with waiting list controls [43]. Thirty-three children with high functioning ASD who demonstrated clinical anxiety elevations (no anxiety disorder diagnosis given) participated. Of treatment completers (n = 31), those who received group CBT (n = 10) demonstrated significantly greater parent-reported anxiety symptom decreases (d = 0.88; large effect) as compared with waiting list controls (n = 21). Groups did not differ on child report of anxiety severity (d = 0.30; small effect).

In an RCT, Reaven *et al.* compared group CBT to usual care (treatment as usual) for treatment of anxiety disorders in 50 children with high functioning ASD [44]. Of treatment completers (n = 43), ten out of 20 (50%) participants who received CBT demonstrated positive treatment responses as compared with two out of 23 (8.7%) of those who received usual care (d = 1.03; large effect), with significant differences in clinician ratings of symptom severity between the groups yielding medium-to-large effect sizes (d = 0.66–0.87). Collectively, results from the group-formatted CBT protocol trials suggest that CBT demonstrates efficacy in decreasing anxious symptomology and is superior to waiting list and usual care, with the inclusion of more robust parent components yielding enhanced results.

#### Treatment modifications summary

Although to date no studies exist directly comparing adapted and nonadapted treatment protocols, a limitation of our knowledge of the treatment of comorbid anxiety and ASD, adaptations are suspected to be necessary, at least theoretically, to implement CBT techniques in treating anxiety among the pediatric ASD population. The most commonly utilized, and therefore highly recommended, modifications in the aforementioned clinical trials were as follows: use of concrete visual aids/material, targeting ASD core deficits, such as social skills and communication, increased parental involvement, incorporation of child-specific interests, and greater use of external reinforcement, such as a token economy [45-47]. Furthermore, although most protocols were 12-16 sessions, similar to traditional CBT, many indicated using extended sessions (e.g., 90 minutes), booster sessions, and adding additional parent sessions or parent modules [36,38,41-44]. These modifications have repeatedly demonstrated success and have now become somewhat standard for use with comorbid anxiety and ASD. Several manuals have been, or are currently being, put forth to incorporate these empirically supported modifications for dissemination and clinical use [37,48].

#### CBT treatment efficacy

Chambless *et al.* published guidelines stating that to qualify for 'well-established' treatment status, a treatment must be demonstrated as equivalent to an established treatment or superior to another treatment or placebo, using a well-controlled RCT by two independent research teams [49]. To qualify for 'probably efficacious' status a treatment must be demonstrated as superior to a waiting list control using a well-controlled RCT by two independent research teams or meet criteria of 'wellestablished' status by one research team. As described above, several RCTs have demonstrated CBT for anxiety in youth with ASD to be superior to waiting list and usual care. To date, there have not been any RCTs comparing CBT to an established treatment or credible control (e.g., usual practice psychotherapy) by two separate research teams. Therefore, CBT for treatment of anxiety in youth with ASD meets 'probably efficacious' status at this time. It should be noted that all of the above-mentioned studies were conducted with youth who were higher functioning and, therefore, this efficacy status may not be generalized to other populations of youth with ASD (e.g., those who are lower functioning, those who have intellectual disability or younger children). Future research is needed to examine efficacy among these populations (see below).

#### Pharmacological interventions

Approximately a third to a half of individuals with ASD are prescribed psychotropic medications to manage associated behavioral symptoms, including anxiety, disruptive behavior, inattention/hyperactivity and sleep difficulties, among other problems [50,51]. Basic guidelines for implementation of pharmacotherapy across varying anxiety disorders in youth with ASD have been put forth [52], but controlled research studies are few in number. Medications such as serotonin reuptake inhibitors, anxiolytics and benzodiazepines, among others, have shown preliminary promise in case series, open trials or retrospective chart reviews for reduction of various symptoms of anxiety (e.g., sertraline [53-55], buspirone [56]; fluoxetine [57] and citalopram [58]); however, the majority of studies, particularly those with pediatric populations, have methodological limitations, and reports of success with decreasing anxiety are mixed [2]. When targeting repetitive behaviors, citalopram was not significantly different from the placebo in a large cohort of youth with ASD [59].

An overarching issue in the pharmacological literature is that studies have used various methods of assessment without consistent or predetermined targets of symptom reduction, and have often failed to control for concurrent psychosocial and related treatments. Thus, conclusions about efficacy are difficult to tease out at this time. It is also likely that medication management may differ in those with ASD versus typically developing youth. For example, compared with typically developing youth, children with ASD may demonstrate a narrower therapeutic window and may be more sensitive to medications and associated side effects [52,60]. Information about tolerability and acceptability should also be further studied. Systematic data regarding if side effects, such as increased anxiety/irritability, upset stomach, drowsiness, insomnia, dry mouth and changes in appetite and weight, occur with greater frequency than typically developing youth are needed.

#### Pharmacological treatment efficacy

As noted, virtually no well-controlled clinical trials exist that examine the efficacy of psychotropic medication for anxiety among youth with ASD. Accordingly, at this time pharmacological treatment with antidepressant medications for anxiety in youth with ASD would qualify for 'experimental' status according to Chambless *et al.* [49]. Although a number of promising studies hint at the potential efficacy of psychotropic medication, further research is needed to examine the use of psychotropic medication for children with comorbid anxiety and ASD.

#### Conclusion

Anxiety is common among youth with ASD with prevalence rates estimated at appproximately 50% [1,3] and is involved with the experience and expression of core deficits, including restrictive repetitive behaviors, restricted interests and social skill deficits. Anxiety presentation may appear somewhat differently among youth with ASD as compared with typically developing children (e.g., more challenging behaviors, increased hyperactivity, sensory behaviors and increased repetitive behaviors) and may have unique and core deficit-related ASD-specific triggers (e.g., change of routines, social or language-related difficulties and sensory issues).

Best practice recommendations for management of anxiety among youth with ASD involve empirically supported psychosocial/behavioral treatments with substantial parent involvement as well as off-label use of pharmacological interventions that consider the presentation of the individual child. Adapted CBT is the only treatment with proven efficacy via RCTs, earning the 'probably efficacious' status. Unfortunately, treatment response outcomes have been mixed [36,38,42]. While parent report of diagnostic remission (examined via effect sizes) appear mostly comparable with RCTs examining treatment of anxiety in typically developing children, treatment response (i.e., symptom reduction) is typically lower than typically developing children, with some studies reporting only modest responses (e.g., 29% reduction in anxiety symptom severity) [38] and many treatment challenges have yet to be addressed empirically. Although frequently used for anxiety, psychotropic medications have yet to be researched via RCTs with anxiety as the primary target and merit only 'experimental' status at this time. Below are recommendations for future research regarding managing anxiety symptoms among youth with ASD.

#### Future direction

The following recommendations for future research are posited for consideration. First, although a full discussion of assessment strategies is beyond the scope of this paper, it is notable that current assessment methods and measures for determination of the presence of anxiety vary greatly among the ASD population. This variability probably contributes to the elevated prevalence, as discussed above, as well as affecting progress monitoring and outcomes of clinical trials. Few measures specifically designed and standardized (normed) for detecting anxiety among youth with ASD are available, and the general practice is to use measures designed and standardized (normed) for youth who are typically developing. This may be problematic, however, given the differing presentation and overlap of core characteristics of anxiety and ASD. Therefore, more stringent measurement development and psychometric validation of current measures, specifically with the ASD population, is necessary to better understand the presence of anxiety in those with ASD, as well as the effects of current treatment practices.

Second, while CBT is a viable approach to treatment with the pediatric ASD population, there is room for improvement in the management of anxiety symptoms among this population. Clinical trials are needed to examine mediators and moderators of treatment participation and response (e.g., parental stress and anxiety, effects of core deficits, level of functioning and family motivation/engagement), as well as which components of CBT are the most effective with the pediatric ASD

population, which aspects of anxiety (i.e., cognitive, behavioral and physiological) are most targeted/addressed by CBT, and the potential effects of anxiety treatment (i.e., CBT) on ASD core symptoms. Multiple mediators and moderators (e.g., parental anxiety, family motivation and exposure as a critical component to treatment) have been successfully examined and used to increase treatment effects among typically developing children; however, such data are not yet consistently available with the ASD population and, therefore, cannot be discussed in more detail at this time. Future studies should focus on presenting and examining data regarding variables that may affect treatment participation and response.

Third, development of augmentation strategies to enhance the effects of CBT among youth with ASD is also important given the modest accompanying anxiety reductions (e.g., 29%) [38]. Such strategies may include a heavier focus on core ASD deficits that are most associated with anxiety or even having a longer duration of CBT. Some novel research in typically developing individuals suggests that targeting fear extinction with D-cycloserine may augment exposure therapy for anxiety [61]. This approach may also have utility in youth with ASD and anxiety.

Fourth, treatment protocols for lower functioning and younger pediatric ASD populations must also be explored. Youth with ASD who are lower functioning may be similarly susceptible to anxiety compared with those who are higher functioning [1], and prevalence rates for anxiety symptoms among children with comorbid ASD and intellectual disability (32.6%) [47] are comparable to those without intellectual disability; yet, the majority of research for psychosocial and pharmacological treatments has been conducted with youth who are higher functioning. Even a modified version of CBT, as described above, may not be beneficial for children with greater intellectual and adaptive deficits, as well as those who are developmentally immature. Behavioral techniques have demonstrated preliminarily efficacy among younger children who are typically developing [62] and similar approaches have been suggested for those with intellectual and developmental disabilities [63]. More research is needed to explore psychosocial intervention efficacy and adapted techniques to treat anxiety in lower functioning and younger children with ASD.

Fifth, as previously noted, there has not been adequate research examining the efficacy of pharmacotherapy for anxiety symptoms among youth with ASD. It is necessary to conduct well-controlled clinical trials to examine the efficacy of psychotropic medications for reducing anxiety symptoms in youth with ASD, given the elevated rates at which these medications are prescribed, as well as known medication sensitivities, side effects and narrow therapeutic windows for effectiveness.

Finally, dissemination of best practice treatment for anxiety among youth with ASD is problematic. Finding providers with expertise in evidence-based CBT for anxiety can be challenging in its own right - even fewer can claim proficiency in treating anxiety in youth with ASD. Furthermore, reductions in symptoms are modest when compared with youth without ASD and protocols may require longer visits, additional sessions and increased parent involvement. Pharmacotherapy, non-CBT psychotherapies or community interventions that do not specifically target anxiety (e.g., occupational or language therapy) may be the only resources available. As a result, there are delays in access, substantial family burden (missed work and travel) and the potential for extra cost. Consequently, researching factors that expedite CBT and improve access are needed.

#### Future perspective

In the past decade, research concerning the management of anxiety symptoms has made significant strides; yet, there is significant room for improvement. We must improve our understanding of the concurrent and reciprocal nature of anxiety and ASD core symptoms, as well as find more effective and efficient methods of treatment. If we maintain our commitment to understanding and managing comorbid anxiety and ASD symptomology, we will be able to potentially implement preventative strategies, as well as more efficiently identify, address and alleviate anxiety symptoms among youth with ASD within the next decade, improving quality of life among the pediatric ASD population.

#### Financial & competing interests disclosure

AB Lewin has received grant funding in the last 2 years from the NIH, Agency for Healthcare Research and Quality, CDC, National Alliance for Research on Schizophrenia and Affective Disorders, and International

future science group fsg

### Managing anxiety comorbidity in youth with autism spectrum disorders **REVIEW**

OCD Foundation. AB Lewin is a consultant for Prophase, Inc. EA Storch has received grant funding in the last 2 years from the NIH, CDC, Agency for Healthcare Research and Quality, National Alliance for Research on Schizophrenia and Affective Disorders, International OCD Foundation, Tourette Syndrome Association and Janssen Pharmaceuticals. EA Storch receives textbook honorarium from Springer publishers, American Psychological Association and Lawrence Erlbaum. EA Storch has been an educational consultant for Rogers

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Memorial Hospital. EA Storch is a consultant for Prophase, Inc. and CroNos, Inc., and is on the Speaker's Bureau and Scientific Advisory Board for the International OCD Foundation. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

No writing assistance was utilized in the production of this manuscript.

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## **REVIEW** Rudy, Lewin & Storch

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## Managing anxiety comorbidity in youth with autism spectrum disorders **REVIEW**

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