Social difficulties in youth with autism with and without anxiety and ADHD symptoms

Alana J. McVey, M.S.[1], **Hillary K. Schiltz, M.S.**[1], **Angela D. Haendel, M.S., CCC-SLP**[1], **Bridget K. Dolan, Ph.D.**[1], **Kirsten S. Willar, Ph.D.**[2], **Sheryl S. Pleiss, Ph.D.**[3], **Jeffrey S. Karst, Ph.D.**[1], **Mary Carlson, Ph.D.**[4], **Wendy Krueger, M.S., CCC-SLP**[4], **Christina C. Murphy, M.S.**[4], **Christina L. Casnar, Ph.D.**[4], **Brianna Yund, M.S.**[5], and **Amy Vaughan Van Hecke, Ph.D**[5]

[1]Bridget K. Dolan's current affiliation is Medical College of Wisconsin, 8701 Watertown Plank Road, Milwaukee, WI 53226.

[2]Kirsten S. Willar's current affiliation is Stanford University, 401 Quarry Road, Stanford, CA 94304.

[3]Sheryl S. Pleiss' current affiliation is Great Lakes Neurobehavioral Center, 7373 France Avenue South, Suite 302, Edina, MN 55435.

[4]Christina L. Casnar's current affiliation is Alpert Medical School of Brown University, Clinical Psychology Training Consortium, Providence, Rhode Island 02912.

[5]Brianna Yund's current affiliation is University of Wisconsin – Milwaukee, 2441 E Hartford Avenue, Milwaukee, WI 53211.

Abstract

Social difficulties inherent to autism spectrum disorder are often linked with co-occurring symptoms of anxiety and ADHD. The present study sought to examine the relation between such co-occurring symptoms and social challenges. Parents of adolescents with autism ($N = 113$) reported upon social challenges via the Social Responsiveness Scale (SRS) and anxiety and ADHD symptomatology via the Child Behavior Checklist (CBCL). Results revealed differences in SRS scores across co-occurring symptom subgroups (Anxiety, ADHD, Both, Neither) – namely, adolescents with autism and anxiety as well as those with autism, anxiety, and ADHD showed greater scores on the SRS than the other groups. Implications for research and clinical practice are discussed and recommendations are offered.

Lay Summary:

Anxiety and ADHD symptoms are related to greater social challenges for adolescents with autism spectrum disorder. The present study found that autism with anxiety and autism with anxiety and ADHD, was related to greater social difficulties than autism alone. Findings provide further support for the intertwined nature of anxiety and ADHD symptoms in autism. What this may mean for research and clinical practice is considered and recommendations are suggested.

Keywords

Difficulties navigating social relationships are not uncommon, though may be especially pronounced among people with autism spectrum disorder. Adolescence can be a particularly challenging developmental stage for the formation of meaningful connections with others, and youth with autism often struggle in this arena. An escalation in social expectations during this time may affect development into adulthood, impacting both social and adaptive functioning for people with autism (Picci & Scherf, 2015). Furthermore, the very symptoms that classify people with autism – social and communication challenges (American Psychiatric Association, 2013) – may contribute to symptoms of social anxiety and result in greater social withdrawal among these youth (Wood & Gadow, 2010). Social isolation, in turn, has been linked with loneliness, anxiety, and depression (Locke, Ishijima, Kasari, & London, 2010; White & Roberson-Nay, 2009). This process significantly impacts social relationships for youth with autism. Similarly, overeager approach-related behaviors, such as those seen among youth with Attention Deficit Hyperactivity Disorder (ADHD; Nijmeijer et al., 2008), have been linked with poorer social relationships and greater rates of social rejection (Hoza, Gerdes, et al., 2005). Additionally, there is a robust co-occurrence of ADHD and autism symptoms, wherein ADHD has been found to commonly co-occur with autism (Leitner, 2014), and symptoms of autism are prevalent among samples of youth with ADHD (Mulligan et al., 2009).

Given these associations between co-occurring symptoms of anxiety and ADHD in autism, it is important to consider to what extent a widely-used measure of autism severity may differ for youth with autism alone versus those with co-occurring anxiety and/or ADHD symptoms.

Anxiety and ADHD in Autism

Nearly half of young people with autism meet criteria for an anxiety disorder (van Steensel, Bögels, & Perrin, 2011; White, Oswald, Ollendick, & Scahill, 2009), compared to between 3 and 28.8% among neurotypical youth (Cartwright-Hatton, McNicol, & Doubleday, 2006; Kessler et al., 2005). In addition to characteristic symptoms of anxiety, including distressing fear and worry (American Psychiatric Association, 2013), the combined presentation of autism and anxiety is thought to constitute separate and additional difficulties (Kerns & Kendall, 2012; Renno & Wood, 2013; van Steensel et al., 2011) and has been empirically linked with higher levels of self-injury and depressive symptoms (Kerns et al., 2015), negative thoughts (Farrugia & Hudson, 2006), more stereotyped behaviors (Sukhodolsky et al., 2008), and irritability (Mayes, Calhoun, Murray, Ahuja, & Smith, 2011) compared to autism alone. Narrowing in on social behavior, greater social anxiety in autism has been associated with less assertiveness, empathy, and responsibility in social situations (Bellini, 2006; Chang, Quan, & Wood, 2012) as well as poorer social communication (Duvekot, Ende, Verhulst, & Greaves-Lord, 2017). Clinical evidence suggests that the awareness of one's own social challenges (or merely the perception of social difficulties; Bellini, 2006;

Gillott, Furniss, & Walter, 2001) and resulting worry about negative social evaluation may contribute to symptoms of anxiety among youth with autism (Kuusikko et al., 2008; White, Scahill, & Ollendick, 2016). Furthermore, and perhaps regardless of perceived or actual social struggles, anxiety in autism has been thought to lead to greater fear and avoidance of social situations, resulting in poorer social skills utilized during such interactions – and/or fewer opportunities to practice (White et al., 2014) – which perpetuates avoidance behaviors (Wood & Gadow, 2010). Although the directionality of these processes is not well-understood, it is clear that the presence of anxiety in autism is linked with substantive social challenges.

Difficulties related to attention are also common for people with autism, either as a core feature (i.e., lack of joint attention; Mundy, 2016) or additive concern (i.e., ADHD; Leyfer et al., 2006). Similar to autism, ADHD is a chronic neurodevelopmental disorder that can significantly impact multiple domains of functioning (American Psychiatric Association, 2013) and may even share neurobiological (Di Martino et al., 2013; Park et al., 2018) and genetic (Lichtenstein, Carlström, Råstam, Gillberg, & Anckarsäter, 2010; Stergiakouli et al., 2017) roots with autism. The co-occurrence of ADHD in autism is profound; studies suggest that between 30 and 85% of youth with autism meet diagnostic criteria for co-occurring ADHD (Gadow, Devincent, Pomeroy, & Azizian, 2005; Leitner, 2014; Leyfer et al., 2006; Mattila et al., 2010; Sinzig, Walter, & Doepfner, 2009). This rate is substantially greater than worldwide estimates for youth without autism, which have been reported at approximately 3.5% (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). Central challenges faced by youth with autism, namely, navigating social interactions, also frequently affect youth with ADHD (Cantwell, 1996; Friedman et al., 2003; Leitner, 2014; Nijmeijer et al., 2008). Evidence suggests that less developed social cognition (e.g., theory of mind and empathy; Uekermann et al., 2010) and executive function (e.g., planning and inhibitory control; Happé, Booth, Charlton, & Hughes, 2006; Toplak, Bucciarelli, Jain, & Tannock, 2008) frequently accompany ADHD. Furthermore, youth with the joint presentation of autism and ADHD have been found to experience greater rates of bullying and victimization than youth with either ADHD or autism alone (Montes & Halterman, 2007). Thus, the current body of literature indicates that, combined with autism, ADHD symptoms are likely to result in less adaptive behavior and greater social difficulties and, in turn, exacerbated autism symptoms (Ames & White, 2011; Leitner, 2014; Rao & Landa, 2014; Sikora, Vora, Coury, & Rosenberg, 2012).

Measurement of Social Behavior

One tool, the Social Responsiveness scale (SRS; Constantino & Gruber, 2002) is widely used by both researchers and clinicians to assess for autism severity. A growing body of literature has begun to identify concerns pertaining to the specificity of the SRS across child and adult versions of the questionnaire, with studies demonstrating that the measure may be picking up on anxiety symptoms (Settipani, Puleo, Conner, & Kendall, 2012; South, Carr, Stephenson, Maisel, & Cox, 2017), with higher scores seen for youth with autism and anxiety (Factor, Ryan, Farley, Ollendick, & Scarpa, 2017). Studies of youth with ADHD have found endorsement of autism symptoms via the SRS (e.g. Reiersen, Constantino, Volk, & Todd, 2007), and scores on the SRS have been shown to be inflated for youth with a

combined autism and ADHD presentation (Factor et al., 2017; Sprenger et al., 2013). Furthermore, the presence of both internalizing and externalizing symptoms have been found to result in higher scores on the SRS among children with and without autism (Hus, Bishop, Gotham, Huerta, & Lord, 2013). In fact, the SRS has been found to show good sensitivity but poor specificity (Moul, Cauchi, Hawes, Brennan, & Dadds, 2015), suggesting that it may be susceptible to the endorsement of symptoms that extend beyond core autism.

Despite this growing evidence, only one known study to date has examined the influence of clinically-significant anxiety and ADHD on scores of the SRS (Factor et al., 2017). This study utilized a wide age-range (3–17), had a sample of 57 youth, and utilized only the SRS total and original five subscale scores. Recent work has demonstrated two indices that show empirical support on the SRS (Frazier et al., 2014, 2012). Therefore, because the findings from this study are important, further replication is merited.

In sum, given the significant, albeit complex, connections between autism and symptoms of anxiety and ADHD, better understanding how social difficulties among these three disorders may be captured via parent-report is crucial for research and clinical practice. Therefore, the present study evaluated this commonly-used tool of autism-related symptoms, the SRS, while considering clinically-significant anxiety and ADHD symptoms, via the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001).

Summary and Aims of the Current Study

There is growing evidence to support associations between co-occurring symptoms of anxiety and ADHD and autism symptoms. The current study sought to add to this body of work by replicating a recent study examining these links utilizing the SRS and CBCL (Factor et al., 2017). Further, the present study aimed to extend these results by utilizing a more focused age-range (11–16 years), a larger sample, and by examining the empirically-supported two-factor indices (Frazier et al., 2014, 2012) in addition to the total and subscale scores on the SRS. It was expected that, across SRS scales, symptoms of anxiety and ADHD would be positively related to autism severity among a sample of adolescents with autism, and that youth with a combined presentation would show significantly greater scores on the SRS than youth with autism alone.

Method

Participants

Adolescents in this *post hoc* study were recruited at a private university in a midsized Midwestern city. Adolescents were presenting for treatment as part of a larger randomized controlled trial (RCT) (registered with ClinicalTrials.gov, Identifier: NCT02680015). See Schohl et al. (2014) for details on inclusion criteria and participant selection. Adolescents must meet criteria for Autism or Autism Spectrum on the Autism Diagnostic Observation Schedule, Generic (ADOS-G; Lord, Rutter, DiLavore, & Risi, 2002) and have a Verbal or Composite IQ of 70 or greater on the Kaufman Brief Intelligence Test, 2nd Edition (KBIT-2; Kaufman & Kaufman, 2004) to participate. Demographics for the current study are presented in Table 1.

Data presented here were collected within designated clinical research space and the primary investigator's laboratory from January 2013 through August 2017. The IRB at Marquette University reviewed and approved this study prior to advertisement and data collection. Informed consent and assent were obtained from all parents/guardians and adolescents in the study, respectively. Power analyses were conducted for the largest MANOVA (the five SRS subscales) in G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) using the effect size of the MANOVA from the study to be replicated (Factor et al., 2017), with an $\alpha = .05$ and Power = 0.95. Results indicated that a total sample of 24 participants, across the four groups, would be needed for adequate power. Therefore, the present sample of 113 youth was deemed more than satisfactory.

Measures

Demographic—Parents completed a demographic form. Adolescents were administered two diagnostic assessments: the ADOS-G (Lord et al., 2002), to confirm the presence of autism, and the KBIT-2 (Kaufman & Kaufman, 2004), to assess IQ. Parents and adolescents completed a battery of measures before and after the intervention; the present study utilized measures at pretest only, with applicable measures for this study described below.

Social Behavior—Parents completed the Social Responsiveness Scale School-Age form (SRS; Constantino & Gruber, 2002). The SRS is a 65-item parent-reported questionnaire commonly used to assess severity of autism symptomatology (Bruni, 2014). Each item is rated on a scale from 0 (never true) to 3 (almost always true). The SRS produces a Total score and five subscale scores: Social Awareness, Social Cognition, Social Communication, Social Motivation, and Autistic Mannerisms. Recent psychometric evaluation, however, has provided empirical support for a two-factor structure (Social Communication and Repetitive Behavior Indices; Frazier et al., 2012, 2014). Therefore, the total score, subscale scores, and the two empirically-supported indices were examined in the present study. As indicated as the preferred method for research (Constantino & Gruber, 2012), raw scores were used here. The measure boasts high internal consistency (.93-.97; Constantino & Gruber, 2012). For the present study, the internal consistency estimates were excellent for the Total score ($\alpha = .93$), poor for the Social Awareness subscale ($\alpha = .52$), acceptable for the Social Cognition subscale ($\alpha = .73$), good for the Social Communication Subscale ($\alpha = .81$), acceptable for the Social Motivation subscale ($\alpha = .77$), good for the Autistic Mannerisms subscale ($\alpha = .80$), excellent for the Social Communication Index ($\alpha = .91$), and good for the Repetitive Behavior Index[1] ($\alpha = .80$).

Anxiety and ADHD Symptoms—Symptoms of anxiety and ADHD were measured using the Child Behavior Checklist (CBCL; Achenbach, McConaughy, & Howell, 1987). The CBCL includes 20 competence items and 118 specific problem items; only the latter were obtained for the purpose of the present study. The CBCL is a parent-reported broadband measure that assesses for both internalizing and externalizing symptoms. The version for ages 6–18 years, the School-Age form (Achenbach & Rescorla, 2001), was

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[1]Note that the Repetitive Behavior Index is comprised of the same items as the Autistic Mannerisms subscale, therefore, the internal consistency value is the same.

utilized for the present sample. For the specific problem items, respondents are asked to rate each item as 0 (not true), 1 (somewhat/sometimes true), or 2 (very/often true). Anxious symptoms were measured using the Anxiety Problems subscale and ADHD symptoms with the ADHD Problems subscale. The CBCL uses *t* scores, with a mean of 50 and a standard deviation of 10. Per interpretation guidelines, subscale scores less than 65 represent the non-clinical range, while scores between 65 and 69 fall into the borderline clinically-significant range, and scores of 70 or more represent clinically-significant elevated symptoms (Achenbach & Rescorla, 2001). As in the Factor and colleagues (2017) study, symptoms were considered present for those adolescents with *t* scores of 65 or greater on each subscale. Therefore, subgroups for the present study were determined by the presence or absence of clinically-significant levels of anxiety and ADHD symptoms on the CBCL. For the present study, internal consistency was acceptable for the Anxiety Problems subscale (a = .76) and good for the ADHD Problems subscale (a = .80).

Analytic Strategy

All statistical analyses were conducted using SPSS 24.0 (IBM Corp., 2017) with an alpha level of .05 for the significance criterion for hypothesis tests. Data were screened for normality, impossible values, and univariate and multivariate outliers and found to be within normal limits. Primary hypotheses were examined utilizing bivariate correlations and MANCOVAs to preserve statistical power and control for experiment-wise error rate.

Results

All adolescents ($N = 113$) had complete data – there was no missing data to address. Adolescents were recruited from January 2013 through August 2017. Demographic characteristics for the sample are presented in Table 1.

Sample Characterization and Identification of Covariates

Bivariate correlations were conducted to examine relations between demographic characteristics and subscales of the CBCL and SRS and, thus, determine other necessary covariates in subsequent analyses. See Table 2. Age was negatively related to ADOS-G Total score ($t(99) = -0.20$, $p < .05$). Composite IQ was negatively related to ADOS-G Total score ($t(99) = -0.26$, $p < .01$) and positively related to the Social Awareness subscale ($t(99) = 0.30$, $p < .01$). The Anxiety Problems and ADHD Problems subscales were positively related to one-another ($t(99) = 0.43$, $p < .01$). Finally, all of the SRS subscales and indices were positively intercorrelated (r values ranged from .46 to .93, p's < .01). In order to examine possible differences based on gender and ethnicity, independent samples *t* tests were conducted for each of the subscales of the CBCL and SRS. Results revealed a significant difference by gender for the CBCL ADHD Problems subscale; $t(111) = -2.15$, $p = .034$. No other significant differences were found for gender or ethnicity. Based on these results, gender and Composite IQ were included as covariates in the analyses that follow. Furthermore, as the CBCL Anxiety Problems and ADHD Problems subscales demonstrated interrelations, the adolescents in this study were clustered into four distinct subgroups based on the presence of clinically-elevated co-occurring symptoms: Anxiety (autism and only

anxiety; $n = 25$), ADHD (autism and only ADHD; $n = 10$), Both (autism with both anxiety and ADHD; $n = 43$), Neither (autism alone; $n = 35$).

Links Between Social Behavior and Anxiety/ADHD Symptoms

First, to determine relations between social behavior and each anxiety and ADHD symptoms and for replication purposes, bivariate correlations (described above and depicted in Table 2) were conducted. The CBCL Anxiety Problems subscale was positively related to all five SRS subscales, both indices, and the Total score (p's < .01), while the ADHD Problems subscale was positively related to four SRS subscales and both indices (p's < .01) but not the Social Motivation subscale or the Total score (p's > .05).

Second, to examine differences in SRS scores based on the presence of anxiety and/or ADHD symptoms via subgroups *à la* Factor and colleagues (2017), a MANCOVA was conducted with the five SRS subscales as outcome measures. Results of the omnibus MANCOVA were significant (Pillai's Trace = 0.38, $F(15, 315) = 3.09$, $p < .001$, $\eta_p^2 = .13$) and univariate analyses demonstrated significant differences in all five subscales across subgroups. Specifically, the subgroups differed in Social Awareness ($F(3, 107) = 3.37$, $p = .021$, $\eta_p^2 = .09$), Social Cognition ($F(3, 107) = 8.10$, $p < .001$, $\eta_p^2 = .19$), Social Communication ($F(3, 107) = 5.96$, $p = .001$, $\eta_p^2 = .14$), Social Motivation ($F(3, 107) = 7.42$, $p < .001$, $\eta_p^2 = .17$), and Autistic Mannerisms ($F(3, 107) = 8.41$, $p < .001$, $\eta_p^2 = .19$). Given that the Total score on the SRS is comprised of the items that load into the subscale scores, a separate ANCOVA was conducted and results demonstrated a significant difference across the four subgroups in the Total Score ($F(3, 107) = 9.65$, $p < .001$, $\eta_p^2 = .21$). Pairwise comparisons revealed differences between the Both versus Neither subgroups (Both > Neither) across all but the Social Motivation subscale, between the Anxiety versus Neither subgroups (Anxiety > Neither) across all but the Social Awareness and Social Cognition subscales, between the Both versus ADHD subgroups (Both > ADHD) for the Social Motivation subscale and the Total Score, and between the Anxiety versus ADHD subgroups (Anxiety > ADHD) on the Social Motivation subscale. See Table 3. Based on these results, the adolescents with autism and anxiety and those with autism, anxiety, and ADHD demonstrated higher scores (i.e., more autism symptoms) across SRS subscales compared to the adolescents with autism alone, and on some subscales, the adolescents with autism and ADHD.

To extend this work, a second MANCOVA was conducted with the two empirically-supported SRS indices across the four subgroups. Results of this MANCOVA were also significant (Pillai's Trace = 0.25, $F(6, 214) = 5.032$, $p < .001$, $\eta_p^2 = .12$). Univariate analyses showed group differences for both the Social Communication Index ($F(3, 107) = 8.55$, $p < .001$, $\eta_p^2 = .19$) and the Repetitive Behavior Index ($F(3, 107) = 9.15$, $p < .001$, $\eta_p^2 = .20$). Here, pairwise comparisons demonstrated differences between the Anxiety versus Neither subgroups (Anxiety > Neither) and between the Both versus Neither subgroups (Both > Neither) for both indices. There were no significant differences between the Anxiety and ADHD or Both and ADHD subgroups. These results indicate that the adolescents with anxiety or anxiety and ADHD symptoms showed higher SRS scores than the adolescents with autism alone. See Table 4.

Discussion

The present study sought to replicate and extend previous work (Factor et al., 2017) by examining differences in autism severity as measured by the SRS across subgroups of adolescents with autism and clinically-elevated co-occurring symptoms of anxiety and ADHD. Results of the current study aligned with that of Factor and colleagues (2017) in the use of the SRS and CBCL Anxiety Problems and ADHD Problems subscales. Youth aged 11–16 were included here, rather than the 3–17 year age-range utilized by Factor and colleagues (2017). Scores of Composite IQ here were comparable to those in the original study, though Factor and colleagues (2017) did not employ a cutoff, as youth in their sample were taken from an assessment database, not an intervention with specific inclusion criteria. Extension of the Factor and colleagues (2017) study included a larger sample size, a more focused age-range, and the use of the empirically-supported two-factor structure of the SRS.

Hypotheses for this study were broadly supported. Anxiety and ADHD symptoms, as measured by the CBCL, were highly correlated with SRS subscale scores, the Total score, as well as the two empirically-supported indices. The sole exception was that the ADHD Problems subscale was not correlated with the Social Motivation subscale. A similar pattern was uncovered by Factor and colleagues (2017); the CBCL Anxiety Problems subscale was positively linked with four of the five SRS subscales and the Total score, while the ADHD Problems subscale was positively associated with three of the subscales and the Total score. Together, these findings further highlight the potential difficulty of disentangling core autism symptoms from those of co-occurring conditions.

In the present study, adolescents with clinically-elevated anxiety or anxiety and ADHD symptoms showed significantly higher scores on the SRS than those with autism alone or, for the Social Motivation subscale and the Total score, autism with ADHD. One possible interpretation is that anxiety, perhaps more so than ADHD, is linked with greater parent-report of autism severity. An alternative interpretation is also possible. Because the adolescents with autism and anxiety and those with autism, anxiety, and ADHD showed the greatest elevations in SRS scores, it might be that autism with anxiety or the confluence of *both* anxiety and ADHD in autism result in higher symptom endorsement on the SRS, above and beyond autism alone or autism with ADHD. Broadly, Factor and colleagues (2017) found a similar pattern among the youth in their sample; those with autism, anxiety, and ADHD tended to show greater elevations on the SRS than other groups, in particular, than the autism alone group. These findings have several important considerations.

At face value, if youth with a combined presentation of autism and anxiety or autism, anxiety, and ADHD are experiencing greater social difficulties, this may be indicative of compounding effects. As has been described in past research (e.g., Factor et al., 2017), it may be that anxiety and ADHD symptoms add to autism severity. Considering anxiety, it might be that core autism challenges contribute to symptoms of anxiety, which may, in turn, lead to avoidance, as posited by Wood and Gadow (2010). Additionally, ADHD symptoms likely negatively impact social encounters (as they have been shown to do in typical development; Hoza, Mrug, et al., 2005), which may contribute to other concerns including loneliness and depression among those with autism (Locke et al., 2010; White & Roberson-

Nay, 2009). Therefore, youth with anxiety and ADHD, in addition to autism, may be more likely to have multiplicative social difficulties that extend beyond those of youth with autism alone or autism with ADHD.

On the other hand, scores on the SRS may be artificially inflated because the measure taps into symptoms of other co-occurring conditions (i.e., symptoms that do not directly pertain to autistic behavior). As discussed above, studies have shown that the SRS is sensitive but not specific (Moul et al., 2015), and it may be susceptible to picking up on symptoms of both anxiety (Hus et al., 2013; Settipani et al., 2012; South et al., 2017) and ADHD (Hus et al., 2013; Reiersen et al., 2007; Sprenger et al., 2013). In fact, the manual states that caution should be employed when evaluating presenting concerns that may impact social communication or behavioral flexibility, as scores may be inflated (Constantino & Gruber, 2012, p. 18). Co-occurring anxiety and ADHD are certainly likely to influence these domains, and, as is recommended in the manual (Constantino & Gruber, 2012, p. 18) and other research to date (South et al., 2017), these symptoms should be carefully considered in both research and clinical practices utilizing the SRS.

In addition, it is also worthwhile to consider effects the reporter may be contributing to these results. Given that parents and youth with autism have been shown to disagree on reports of anxiety (Meyer, Mundy, Van Hecke, & Durocher, 2006; Ooi et al., 2016; Schiltz et al., under review), there may be concerns regarding the accuracy of parent-reported symptoms. Because comprehensive diagnostic evaluation for children can often rely heavily on parent-report and anxiety disorders have been shown to be difficult to diagnose in autism (Kerns et al., 2016; Mazefsky, Pelphrey, & Dahl, 2012; South & Rodgers, 2017; White et al., 2014), it is important to consider the ways in which parents may be biased and/or limited reporters. First, autism symptoms may present to parents as symptoms of anxiety or ADHD. For instance, social isolation may be misconstrued by parents as shyness and more similar to social anxiety. Repetitive behaviors may be viewed as fidgetiness or restlessness indicative of ADHD. The opposite is also possible; parents may view anxiety or ADHD symptoms as indicative of autism. A lack of eye contact due to social anxiety may be a red flag for autism to a parent, or hyperactivity may spark the concern that a child is exhibiting repetitive behaviors. It is also worth noting that anxiety and ADHD, specifically inattentive-type, can be challenging for parents and clinicians to discern. Many of these intricate diagnostic challenges are described in the differential diagnosis sections of the DSM-5 (American Psychiatric Association, 2013). It is possible, then, that results of the present study may instead indicate an overestimation of symptoms per parent report. As such, clinicians and researchers should employ careful consideration in interpreting elevated symptoms of social difficulties among youth and utilize other tools to disentangle autism, anxiety, and ADHD. As such, while the CBCL is commonly used as part of a more comprehensive assessment battery, clinically-elevated scores on this measure alone do not constitute a diagnosis of anxiety or ADHD, generally, nor in this sample. More comprehensive assessment, including gold-standard clinical interviews, is needed in future research studies and in clinical practice to best conceptualize such intricate and intersecting diagnostic presentations.

Perhaps regardless of interpretation, youth with autism and anxiety and/or ADHD, or youth with autism with especially high SRS scores, are likely to experience unique and additive

difficulties above youth with autism alone, or youth with relatively lower SRS scores. In fact, research shows that youth with autism and anxiety (Farrugia & Hudson, 2006; Kerns et al., 2015; Mayes et al., 2011; Renno & Wood, 2013; Sukhodolsky et al., 2008; van Steensel et al., 2011) and those with autism and ADHD (Ames & White, 2011; Leitner, 2014; Rao & Landa, 2014; Sikora et al., 2012) experience a multitude of complex and additive challenges that extend beyond those that youth with autism alone encounter. Aside from the study replicated here (Factor et al., 2017), no other known work has examined the multiplicative effects for youth with autism, anxiety, and ADHD. These findings highlight the need for researchers and clinicians to be astutely aware of the compounding challenges of anxiety and ADHD among youth with autism for diagnostic assessment as well as intervention development and delivery.

Considering these findings in the broader context, it has been posited that there may be many syndromes of autism guised under the current conceptualization of a single heterogeneous disorder (McPartland & Pelphrey, 2012). Studies such as this one may aid the field in gaining a clearer understanding of possible syndromes that would allow for the identification of challenges associated with various presentations, which, in turn, may lead to the development of more specific and effective interventions (Lerner, White, & McPartland, 2012).

The present study is not without its limitations. First, the study relied on only parent-report of autism, anxiety, and ADHD symptoms. Self- and teacher- (or other third-party-) reports may have demonstrated similar or different results. A second limitation is the use of a single outcome measure of autism symptoms. It is possible that other measures may demonstrate differing results, or they may provide additional evidence of the findings reported here. Third, a number of factors limit the generalizability of the findings. Because the current sample was comprised of youth aged 11–16, results cannot be generalized to other developmental stages. Further, the present sample was rather homogenous, that is, mostly White, mostly non-Latinx, of higher social class, and mostly male, which also limits the generalizability of the findings. Furthermore, because of the IQ requirement of the intervention, the current findings also cannot be generalized to those with autism of lower IQ.

Conclusion

In sum, in the current study, the presence of anxiety and ADHD symptoms in autism were associated with more significant social behavioral challenges on a commonly-used measure of autism severity, the SRS. Better parsing apart common co-occurring symptoms in autism, such as anxiety and ADHD, is crucial for autism research and clinical practice.

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Table 1

Demographics

	N = 113	
	M (sd)	Range
Age	13.47 (1.41)	11–16
KBIT-2 Composite IQ	103.81 (18.38)	68–144
ADOS-G Total	12.06 (4.07)	7–13
Gender		
% Male	87.6	
% Female	12.4	
Race		
% White	81.4	
% Asian	5.3	
% Black	5.3	
% Biracial/Multiracial	6.2	
% Not reported	1.8	
Ethnicity		
% Non-Hispanic/Latinx	92	
% Hispanic/Latinx	4.4	
% Not reported	3.5	
Household income		
% Under 25K	9.7	
% 25–50K	5.3	
% 50–75K	17.7	
% 75–100K	21.2	
% > 100K	43.4	
% Not reported	2.7	
Primary parent education		
% Some high school	1.8	
% High school completion	3.5	
% Vocational/technical training	5.3	
% Some college	13.3	
% Associate's degree	8.8	
% Bachelor's degree	35.4	
% Master's degree	29.2	
% Doctoral degree	2.7	

Table 2

Bivariate correlations among study variables

Study Variables	1	2	3	4	5	6	7	8	9	10	11	12
1 Age	--											
2 Composite IQ	−.054	--										
3 ADOS-G Total	−.204 *	−.264 *	--									
4 CBCL Anxiety Problems	−.043	.014	.053	--								
5 CBCL ADHD Problems	−.156	.149	−.041	.433 **	--							
6 SRS Awareness	−.084	.286 **	−.133	.301 **	.271 **	--						
7 SRS Cognition	−.153	−.005	−.056	.442 **	.312 **	.531 **	--					
8 SRS Communication	−.073	.183	−.014	.393 **	.361 **	.665 **	.615 **	--				
9 SRS Motivation	.098	.153	.047	.436 **	.068	.469 **	.499 **	.674 **	--			
10 SRS Autistic Mannerisms ¥	−.053	.127	−.069	.486 **	.351 **	.584 **	.657 **	.708 **	.464 **	--		
11 SRS Total	−.063	.171	−.042	.504 **	.340 **	.750 **	.798 **	.922 **	.765 **	.840 **	--	
12 SRS SCI	−.062	.174	−.031	.477 **	.315 **	.753 **	.790 **	.929 **	.810 **	.735 **	.986 **	--
13 SRS RRBI ¥	−.053	.127	−.069	.486 **	.351 **	.584 **	.657 **	.708 **	.464 **	1.00 **	.840 **	.735 **

SCI = Social Communication Index; RRBI = Repetitive Behavior Index

*
$p < .05$

**
$p < .01$

¥Values for the SRS Autistic Mannerisms and RRBI are the same.

Table 3

SRS scores for youth with autism by co-occurring anxiety and ADHD subgroups

SRS Subscale	Anxiety ($n = 25$) M (sd)	ADHD ($n = 10$) M (sd)	Both ($n = 43$) M (sd)	Neither ($n = 35$) M (sd)	F	p	η_p^2
Social Awareness [f]	13.16 (3.16)	11.90 (2.88)	13.77 (2.85)	11.49 (4.13)	3.37	.021	.086
Social Cognition [cf]	20.88 (5.83)	16.30 (5.08)	21.53 (4.69)	16.31 (5.27)	8.10	<.001	.185
Social Communication [f]	36.52 (8.51)	34.00 (7.42)	39.35 (7.65)	31.09 (9.87)	5.96	.001	.143
Social Motivation [acd]	18.84 (5.13)	11.50 (4.72)	18.23 (5.76)	14.80 (5.33)	7.42	<.001	.172
Autistic Mannerisms [cf]	21.44 (5.83)	17.90 (6.37)	22.09 (4.98)	15.89 (6.45)	8.41	<.001	.191
Total Score [cdf]	110.84 (22.82)	91.60 (22.13)	114.98 (19.73)	89.57 (26.27)	9.65	<.001	.213

Controlling for Composite IQ and gender. Significant group differences ($p < .05$):

[a] Anxiety versus ADHD

[b] Anxiety versus Both

[c] Anxiety versus Neither

[d] ADHD versus Both

[e] ADHD versus Neither

[f] Both versus Neither.

Table 4

SRS index scores for youth with autism by co-occurring anxiety and ADHD subgroups

SRS Index	Anxiety ($n = 25$) M (sd)	ADHD ($n = 10$) M (sd)	Both ($n = 43$) M (sd)	Neither ($n = 35$) M (sd)	F	p	η_p^2
Social Communication[c,f]	89.40 (18.53)	73.70 (17.15)	92.88 (16.29)	73.69 (21.19)	8.55	<.001	.193
Repetitive Behavior[c,f]	21.44 (5.83)	17.90 (6.37)	22.09 (4.98)	15.89 (6.45)	9.15	<.001	.204

Controlling for Composite IQ and gender. Significant group differences ($p < .05$):

[a] Anxiety versus ADHD

[b] Anxiety versus Both

[c] Anxiety versus Neither

[d] ADHD versus Both

[e] ADHD versus Neither

[f] Both versus Neither.