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ORIGINAL PAPER

Parent and Teacher Reports of Comorbid Anxiety and ADHD Symptoms in Children with ASD

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Abstract
This study examined the prevalence of ADHD symptoms and anxiety as reported by parents and teachers for 180 preschool children (ages 4–5) and school-aged children (ages 6–7) with ASD using the Child Behavior Checklist—Parent and Teacher Report Forms (Achenbach and Rescorla, Manual for ASEBA school-age forms & profiles, Research Center for Children, Youth, and Families, University of Vermont, Burlington, VT, 2001). Parents reported elevated anxiety symptoms in 31% of preschool children and 50% of school-aged children, while teachers reported lower rates of 5 and 30%, respectively. Parents reported elevated ADHD symptoms in 22% of preschool children and 45% of school-aged children, while teachers reported elevations in 20 and 24%, respectively. There was low concordance between parents and teachers, with teachers reporting fewer problems overall. Specific behaviors endorsed by parents and teachers are also discussed.

Keywords Autism · Anxiety · ADHD · Comorbidity

Introduction

The increasing rate of ASD in the community means that schools must rise to the challenge of meeting the diverse educational needs of these children, which is complicated by their other co-occuring disorders (Baio et al. 2018). Individuals with ASD are more likely to have comorbid psychiatric disorders compared to typically developing (TD) peers and even peers with intellectual disabilities (e.g., Brereton et al. 2006). Simonoff et al. (2008) found 70% of ASD youth had a comorbid psychiatric disorder and that 41% had two or more co-occurring disorders. The most common psychiatric disorders affecting children with autism were attention-deficit/hyperactivity disorder (ADHD) and social anxiety disorder (Simonoff et al. 2008). The current study examines prevalence of ADHD and anxiety symptoms among young preschool and school-aged children with ASD and considers the specific symptoms that are most prevalent as rated by parents and teachers.

Prevalence and Presentation of ADHD

ADHD is one of the most common co-occurring diagnoses associated with ASD (American Psychiatric Association 2013), with anywhere from 16 to 80% of youth with ASD also meeting clinical criteria for ADHD (Baker and Blacher 2015; Hanson et al. 2013; Leyfer et al. 2006; Simonoff et al. 2008; Van der Meer et al. 2012). However, the prevalence varies depending on the age of the child. Sikora et al. (2012) found that among their sample of over 3000 children with ASD, parents of school age children reported significantly more ADHD symptoms than parents of preschool children. This finding is consist with research conducted with non-ASD populations, where ADHD was found to be most prevalent in children aged 9–13 and least prevalent in children ages 4–8 (Cuffe et al. 2005).

Individuals with ASD often present with increased levels of inattention, hyperactivity, and impulsivity that is characteristic of ADHD. Sinzig et al. (2009) proposed a five-group model for integrating ADHD and ASD. They posited that the five groups were (1) those with pure ADHD, (2) those with pure ASD, (3) those with ASD and ADHD, (4) those with ADHD and some sub-clinical autistic symptoms, and (5)

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those with ASD and sub-clinical ADHD symptoms. Using this framework, Van der Meer et al. (2012) used latent class analysis on data from the Social Communication Questionnaire (SCQ) and Conners' Parent Rating Scale (CPRS-R:L) that parents completed for 644 children and adolescents ages 5–17. They found three patient classes: an ADHD only subgroup, an ASD group with clinically-elevated ADHD symptoms, and an ADHD group with clinically-elevated ASD symptoms. However, they did not find evidence for an ASD only subgroup because all children who presented with ASD also exhibited some ADHD behavior. This may indicate that ADHD is universally present in ASD. Therefore, these disorders, whose symptoms seem to overlap a great deal, may be more interconnected than distinct, unrelated disorders.

Sinzig et al. (2009) also offered a conceptual explanation for the overlap between ADHD and autistic symptoms, based on the observed prevalence of hyperactivity symptoms among children with language delay; they argued that children who had difficulty communicating their needs, including those with the language delays common in ASD, might resort to hyperactive behaviors to attract adult attention. The investigators also purported that children with ASD show higher levels of inattention symptoms because some symptoms of autism present as inattention (e.g., stereotyped behaviors may prevent them from paying attention to their environment). This was supported by a recent study testing the factor structure of the ADHD Rating Scale IV (ADHD-RS-IV), in a sample of children with ASD ages 7–17 (Yerys et al. 2017). The scale did not adequately fit the expected two-factor structure (inattention and hyperactivity), suggesting that the scale does not adequately separate the constructs of inattention and hyperactivity/impulsivity in ASD. This is because some Inattention items were cross-loaded. Yerys and colleagues believe that this may be the result of the symptom overlap between ASD symptoms and ADHD behaviors (e.g., "Doesn't listen when spoken to directly"). They recommend caution in interpreting ratings of ADHD symptoms in youth with ASD.

From a clinical perspective, Pliszka (2003) argued that it is not adequate to simply give a child with ASD the diagnosis of ADHD inattentive type without looking at the potential cause of the inattentive behavior; clinical outcomes and treatment recommendations may differ depending on whether the inattention appeared to be elicited or exacerbated by the restrictive, repetitive behaviors that are a hallmark symptom of ASD. These authors suggest that, not only will rates of ADHD symptoms be higher for children with ASD, but that the particular presentation of ADHD might differ, with certain symptoms showing up more often for children with ASD than for those without.

While there have been few studies examining the specific symptoms of ADHD most prevalent in children with ASD, the prevalence of particular subtypes has been examined. Both Leyfer et al. (2006) found that the inattentive subtype was the most common, which differed from their TD sample, where the hyperactive type was most common. Sinzig et al. (2009) also found that the inattentive subtype was most common amoung youth with ASD, but they also noted that younger children (between the ages of 5 and 7) were more likely to be diagnosed with the hyperactive subtype than older children. Gadow et al. (2004) found that among their sample of preschool children (ages 3–5 years), the inattentive subtype was also the most common, followed by the combined type, and then the hyperactive type. The combined and hyperactive type were also associated with aggressive and oppositional behaviors. Ronald et al. (2014) found further support for the link between ASD and inattention when examining symptoms of ASD and ADHD in a population-based twin cohort of over 17,000 children ages 9–12. Although their sample did not explicitly include individuals diagnosed with ASD, these researchers found that inattention was more highly correlated with ASD symptoms than hyperactivity. These studies indicate that inattention is likely the most common symptom of ADHD among children with ASD.

Prevalence and Presentation of Anxiety Disorders

In addition to being at risk for ADHD and externalizing behavior problems, children with ASD also experience high levels of internalizing behavior problems, such as anxiety. Van Steensel et al. (2011) conducted a meta-analysis looking at anxiety in children with ASD and found that across studies, 40% of children had at least one comorbid anxiety disorder. Similarly, Simonoff et al. (2008) found that in their epidemiological, population-derived sample, anxiety was the most common comorbid disorder among those with ASD, with 42% of participants meeting clinical criteria for at least one type of anxiety disorder. Social anxiety, specifically, affected 29% of the sample. However, social avoidance is a hallmark characteristic of ASD and can be often confused with social anxiety. Indeed, when Leyfer et al. (2006) modified the definition of social anxiety to exclude social avoidance, they reported that only 7% of their sample of children with ASD suffered clinical levels of social anxiety. However, they found high levels of specific phobias (44%). Across studies, the meta-analysis conducted by Van Steensel et al. (2011) revealed that 30% of children met clinical criteria for specific phobia, 17% for OCD, and 17% for social anxiety. While rates of anxiety are much higher in ASD samples than in TD samples, the most frequent anxiety disorders among TD children and adolescents are also specific phobia (10%), followed by separation anxiety disorder (2.8–8%) and social phobias (7%; Beesdo et al. 2009). Due to the high prevalence of anxiety disorders in children with ASD, it is important to analyze the different symptoms of anxiety that are most

likely to manifest in children with ASD in order to inform treatment.

Sukhodolsky et al. (2008) examined the specific symptoms of anxiety most frequency reported by parents. Their sample, which consisted of 172 children ages 5–17 all met DSM-IV criteria for autism spectrum disorder. Using the Child and Adolescent Symptom Inventory (CASI; Gadow and Sprafkin 1998), a DSM-IV referenced rating scale, Sukhdolsky et al. found that the anxiety symptoms with the highest mean parent ratings included restlessness, social anxiety, sleep difficulties, tenseness, fear of specific objects, and separation anxiety. Per parent report, 73% of the children in the sample met CASI screening cut-off scores for an anxiety disorder, with 34% meeting the cut-off for social phobia and 31% for simple phobia.

Weisbrot et al. (2005) conducted a similar study examining the specific symptoms of anxiety, but their study included teacher report as well as parent report. They examined mean parent and teacher ratings of 182 preschool children ages 3–5 and 301 school-aged children ages 6–12 diagnosed with pervasive developmental disorder (PDD). Parent-reported anxiety symptoms with the highest mean score in preschool children included compelled to perform unusual habits (compulsions), irritability (GAD), and avoids school to stay with parents. Like parents, teachers also reported high levels of compulsions in preschool children, but they also reported higher levels of withdrawal in social situations (social phobia) and excessive fear of objects (specific phobia). In school-aged children, parent-reported anxiety symptoms with the highest mean score included excessive fear of specific objects (specific phobia). However, when rating school-aged children, teachers had higher mean scores for withdrawal in social situations (social anxiety), difficulty controlling worries (GAD), and avoiding contact with strangers (social phobia). Comparing parent and teacher reports, Weisbrot et al. found some disagreements. In the preschool children, teachers rated compulsions and two GAD symptoms (irritability, low energy level) more severely than parents. In the school-aged children, teachers rated two GAD items (unable to relax, low energy level) more severely than parents, but parents rated specific phobia more severely than teachers. Their study indicates that there is variability in the anxiety symptoms reported by parents and teachers. The present study hopes to add to the findings of Weisbrot et al. by examining a well-defined sample of children with ASD, the majority of whom had IQ in the typical range.

Multi-informant Reports of ADHD and Anxiety Symptoms

Parents and teachers frequently differ in their behavioral ratings, which may affect rates of identification of risk for anxiety disorders or ADHD. Looking at TD samples, De Los Reyes et al. (2015) conducted a meta-analysis to examine cross-informant correspondence and found low-to-moderate agreement across informant pairs, with greater correspondence for ratings of externalizing behavior (mean $r = .30$) than ratings of internalizing behavior (mean $r = .25$) across raters. The literature is similar for children with ASD. Stratis and Lecavalier (2015) conducted a meta-analysis examining informant agreement for youth with ASD or intellectual disability (ID). They found that, for both groups (ASD and ID), parents and teachers demonstrated moderate levels of informant agreement and that agreement was higher for externalizing problem behaviors ($r = .42$) than for internalizing behaviors ($r = .35$). The correlational studies reviewed above suggest an inconsistency in parents and teachers rating the same children, perhaps due to differences in contextual factors between home and school (e.g., task demands and structure of the school day). In addition, these meta-analyses also reported a consistent pattern of teachers reporting fewer behavior problems than parents.

Looking at parent and teacher ratings of ADHD- and anxiety-related behaviors in preschool children, Gadow et al. (2004) found that teachers rated children with PDD as having more severe anxiety symptoms than parents while parents rated hyperactivity and other disruptive behaviors as more severe than teachers. When examining parent and teacher agreement of ADHD symptoms and subtypes, Gadow et al. (2006) found little overlap in teacher- and parent-reported ADHD symptom groupings in children with PDD. For preschoolers (ages 3–5), parents and teacher agreement was low for both the inattentive subtype (7.5%), the hyperactive type (2.7%) and the combined type (3.4%). For the school-aged group (ages 6–12), parent and teacher agreement was higher for the inattentive subtype (18%) but low for the hyperactive (0.4%) and the combined subtype (5.6%). Therefore, it is clear that parents and teachers frequently disagree about both the presence of ADHD and anxiety as well as the specific symptom presentation in children preschool and young school-aged children with ASD.

Current Study

The aim of the current study is to address gaps in the current literature by focusing on the prevalence and presentation of specific symptoms of ADHD and anxiety, as reported by both parents and teachers, in a well-characterized sample of young children with ASD. Differences in informant reports were also of interest, particularly regarding whether or not parents and teachers agreed about presence of elevated levels of anxiety or ADHD problems, as well as differences in the rank order of anxiety and ADHD symptoms most frequently reported by parents and teachers.

Prior research that has focused on children with ASD included wide age ranges (e.g. 4–18 or 5–17; Brereton et al. 2006; Hanson et al. 2013; Leyfer et al. 2006) or older youth

(e.g., 10–14; Simonoff et al. 2008). Even studies focusing on young children with ASD included samples with wide ranges of intellectual functioning (Gadow et al. 2006; Weisbrot et al. 2005). However, studying behavioral symptoms in preschool and early school-aged children with ASD is critical to understanding the challenges faced by youth and their families as they transition to school. Even TD children who begin kindergarten and the early school years experience new academic, social, emotional, and behavioral demands (Rimm-Kaufman and Pianta 2000; Pianta et al. 1999). The transition to school can be even more challenging for children with ASD, who are at risk for school problems, disruptive behavior problems, and social rejection (Ashburner et al. 2010). Understanding the prevalence and presentation of ADHD and anxiety problems in children with ASD as they transition to school will provide a better idea of the needs of children during a critical time in their development, when early identification and intervention may improve long-term positive school outcomes. Here we examine ADHD and anxiety symptoms separately within preschool (4–5 years) and early elementary (6–7 years) ages, noting any differences in prevalence of anxiety and ADHD problems reported by parents and teachers within these two age groups.

Methods

Participants

Participants in this study included 180 children with ASD ages 4–7 years old (147 boys, 33 girls), and their parents and teachers, who were participating in a larger longitudinal study across two sites in Southern California and Massachusetts. The purpose of the larger study was to examine factors that lead to successful school adaptation for young children with ASD. Participants ($N = 257$) were recruited to the study through local service agencies, schools, and state regional centers. In order to achieve a desired sample size, three annual cohorts of students were recruited, and all participations were subject to the same recruitment, eligibility and study procedures. Of the subjects recruited, 208 children met the larger study's eligibility criteria, described below, and 184 children and their families participated during the first assessment. There were no differences on any of the current variables of interest between eligible participants who exited the study after the eligibility assessment and those who continued to participate.

Inclusion/Exclusion Criteria

Eligible participants for the larger study (as well as the current study) were those who (a) scored in the autism or autism spectrum range on the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 1999), (b) earned an estimated IQ score of 50 or higher on the Wechsler Preschool and Primary Scales of Intelligence (WPPSI-III; Wechsler 2002), (c) either had received a previous diagnosis of ASD from a non-school based clinician or scored in the autism or autism spectrum range on the Autism Diagnostic Interview—Revised (ADI-R; Lord et al. 1994), and (d) were ages 4–7 years and entering elementary school or their final year of pre-K in the fall. All children were administered the ADOS. In cases where children had not already received a diagnosis of ASD from a non-school professional, the ADI-R also was administered to the parent. Participants had a mean FSIQ score of 87.71 (SD = 17.73) on the WPPSI-III, although 17.8% had IQ below 70. Table 1 shows participant demographics.

Procedure

The Institutional Review Boards of the participating universities approved study procedures. Informed consent forms were mailed home, reviewed with parents and collected on the day of the child's eligibility visit, after reviewing the form again. In nearly all cases (88.3%), the participating

Table 1 Participant demographics

Variable	ASD ($n = 180$) M (SD)
Child characteristics	
Age	5.0 (1.0)
WPPSI FSIQ	87.7 (17.7)
% FSIQ > 70	82.2%
Gender (% Male)	81.7%
Race (% Caucasian)	62.8%
SRS Total Score	79.81 (10.86)
SRS Autistic Mannerisms	79.97 (11.63)
ADOS RRB Score	4.13 (2.031)
CBCL 1.5–5 years Anxiety Clinical Scale	60.73 (11.33)
CBCL 1.5–5 years ADHD Clinical Scale	59.06 (8.17)
CBCL 6–18 years Anxiety Clinical Scale	62.69 (8.72)
CBCL 6–18 years ADHD Clinical Scale	63.34 (8.44)
Special education placement	
General education all day	39.9%
All or most of the day in special education	46.2%
Special education all day	13.9%
Mothers	
Income (% > $65,000)	40.3%
Mother's education (% college degree or higher)	63.9%
Teachers	
Number of years teaching	14.2 (9.2)

9.4% Latino, 7.7% Asian, 4.1% African American, and 1.7% Alaskan Native/Native American/ or Indigenous, .6% Pacific Islander/Native Hawaiian, 4.4% Multiracial

parent was mother. Once deemed eligible, children were assessed during the fall (Time 1) and spring (Time 2) of the same school year, and the winter (Time 3) of the following school year. The current study utilizes behavioral information collected at Time 2, 6–8 months into the school year, in order to maximize the amount of time teachers had to get to know the child. The rate of attrition was very low, with only 2% of participants ($N = 4$) leaving the study between the first and second time points. Parents completed measures of social skills and child behavior problems prior to or during each assessment visit. During the visits, parents were also asked to give consent to their child's teacher to provide information about the child's behavior, social skills and his or her school environment. Once consent and contact information were obtained, teachers were mailed measures to complete. Both parents and teachers received a small honorarium for their time ($50 for parents and $25 for teachers).

Measures

Parents and teachers completed a demographic questionnaire, which provided background information about the child's family and school context.

Eligibility: Autism Diagnostic Observation Schedule (ADOS; Lord et al. 1999)

The ADOS is a standardized, semi-structured play-based observation of child behavior in situations that elicit autistic tendencies. Based on scoring protocols utilized by trained assessors, individual children were placed into one of three categories resulting from this score: autism, autism spectrum, or not on the autism spectrum. The ADOS has demonstrated good reliability and validity in samples of children with a diagnosis of autism (Lord et al. 1999). It has high discriminative validity with high sensitivity (97, 95, and 90% across Modules 1–3, respectively) and specificity (94, 87, and 94%, across Modules 1–3, respectively) in discriminating between children with ASD and children without a spectrum disorder.

Eligibility: Wechsler Preschool and Primary Scale of Intelligence, Second Edition (WPPSI-III; Wechsler 2002)

Children's cognitive skills were measured with the WPPSI-III, an instrument intended for use with children 2:6 to 7:3 years of age. For this study, a calculated Full Scale IQ (FSIQ) score was computed from an abbreviated measure of cognitive functioning, which included three subtests: block design, matrix reasoning and vocabulary subscales. The selection of these three subtests was based on their established reliability ($r = .95$) and high predictive validity in gaining an estimate of cognitive ability (Sattler and Dumont 2004).

Achenbach System of Empirically Based Assessment (ASEBA)—Parent and Teacher Reports (CBCL and TRF; Achenbach and Rescorla 2001)

Behavior problems were measured using parent and teacher report on the Child Behavior Checklist—Parent Report and the Teacher Report Form (CBCL and TRF; Achenbach and Rescorla 2001). The CBCL and TRF are widely used by both clinicians and researchers in the screening and assessment of psychiatric symptoms. Higher scores on subscales indicate greater levels of problematic behaviors. Parents and teachers were asked to complete items describing their child's behavioral functioning on a three point Likert scale (0 = Not true, 1 = Somewhat or sometimes true, and 2 = Very true or often true). Depending on the child's age, parents were either administered the CBCL for ages 1.5–5, or for ages 6–18. Teachers were administered the TRF for 1.5–5, or for ages 6–18. For the purposes of this study, only the attention deficit/hyperactivity problems and Anxiety problems clinical scales obtained from parents and teachers at Time 2 were used. These clinical scales were developed to reflect DSM-IV diagnostic criteria. The attention deficit/hyperactivity problems scale combines diagnostic criteria for the inattentive and hyperactive subtypes and the Anxiety Problems scale combines diagnostic criteria for Generalized Anxiety Disorder (GAD), Separation Anxiety Disorder (SAD), and Specific Phobia. However, we note that this is not a full clinical assessment of ASD and anxiety, but elevated scores indicate increased risk for these disorders.

A *t*-score of 69 or above indicated that the child is showing clinically elevated levels of ADHD and anxiety symptoms while a *t*-score of 65–68 indicated a borderline clinical elevation. Children with a score of 65 or above on the attention deficit/hyperactivity problems and/or Anxiety problems clinical scales were considered to have "elevated" levels of ADHD and/or anxiety symptoms. The use of the borderline clinical elevation cut-off score was based on literature suggesting that teachers tend to report fewer problem behaviors, especially when rating internalizing behaviors (Stanger and Lewis 1993, Berg-Nielsen et al. 2012; Kanne et al. 2009; Stratis and Lecavalier 2015). Thus, "elevated" scores (i.e. scores above the borderline range cut-off) were likely more sensitive to teacher-reported ADHD and anxiety problems.

The CBCL and TRF have good psychometric properties. The CBCL and TRF demonstrate strong discriminant, convergent, and predictive validity as well as construct validity with the BASC-2 (ADHD Problems: r's = .67–.81; Anxiety Problems: r's = .46–.55). Test–retest reliability ranges from .74 to .95 for the ADHD Problems scale and .57 to .86 for the Anxiety Problems scale. Internal consistency was good

for the ADHD Problems scale (α's = .78–.94) and adequate for the Anxiety Problems scale (α's = .63–.73).

Results

Prevalence of ADHD and Anxiety

Parent-Reported Prevalance Rates

The first goal of the study was to determine the prevalence of elevated ADHD and anxiety symptoms among a sample of young children using the parent reports on the CBCL. Parent-reported rates of elevation are summarized in Table 2. Among pre-school aged children (ages 4–5), 31.4% of parents reported that their child was experiencing elevated (i.e. above the borderline score cut-off) anxiety problems and 22.1% reported elevated ADHD symptoms.

For slightly older children at the beginning of school (ages 6–7), a full 50% reported that their child was experiencing elevated levels of anxiety symptoms. An increasing number of parents also reported symptoms of ADHD, with 44.7% reporting scores in the borderline or clinically significant range. Taken together, the majority (63%) of parents of young children with ASD (ages 4–7) reported that their child had elevated levels of at least one comorbid mental health problem—elevated ADHD and/or anxiety, based on the instrument used.

Teacher-Reported Prevalance Rates

Using the TRF, teachers also reported the prevalence of ADHD and anxiety symptoms in children with ASD. Teacher reported rates of elevation are summarized in Table 3. Among pre-school aged children, only 4.7% reported that the child was experiencing elevated anxiety problems. However, 20.3% of teachers reported that the child was experiencing elevated ADHD symptoms. Among children who were in their early school years (above 5 years of age), 30.8% reported that their student had elevated anxiety problems and 24.3% of teachers reported that their student had elevated levels of ADHD symptoms.

Table 2 Parent-reported prevalence rates of borderline- and clinically-elevated anxiety and ADHD

		ADHD *n* (%)	Anxiety *n* (%)
Children ages 5 and under ($N=86$)	Borderline	5 (5.8%)	7 (8.1%)
	Clinical	14 (16.3%)	20 (23.3%)
Children ages 6 and over ($N=94$)	Borderline	19 (20.2%)	19 (20.2%)
	Clinical	23 (24.5%)	28 (29.8%)

Elevated levels of ADHD and/or anxiety were defined as T-scores of 65 or above on the TRF attention deficit/hyperactivity problems and/or anxiety problems clinical scales

Table 3 Teacher-reported prevalence rates of borderline- and clinically-elevated anxiety and ADHD

		ADHD *n* (%)	Anxiety *n* (%)
Children ages 5 and under (Total $N=64$)	Borderline	7 (10.9%)	2 (3.1%)
	Clinical	6 (9.4%)	1 (1.6%)
Children ages 6 and over (Total $N=78$)	Borderline	16 (20.5%)	15 (19.2%)
	Clinical	3 (3.8%)	9 (11.5%)

Elevated levels of ADHD and/or anxiety were defined as T-scores of 65 or above on the TRF attention deficit/hyperactivity problems and/or anxiety problems clinical scales

There low rates of agreement between the parent- and teacher-reported rates of ADHD and anxiety problems. When reporting ADHD symptoms, parents and teachers agreed that a child had elevated ADHD symptoms 29% of the time. When reporting anxiety problems, parents and teachers only agreed that a child had elevated levels of anxiety 19% of the time. Correlations between parent- and teacher-reported ADHD symptoms were modest for preschool children ($r = .31$; $p = .02$); and weak but approaching significance for school-age children ($r = .19$; $p = .10$). Parent- and teacher-reports of anxiety symptoms were also uncorrelated (preschool children: $r = -.11$, $p = .40$; school-aged children: $r = .15$, $p = .20$).

Presentation of ADHD and Anxiety

Next, this study sought to explore how anxiety and ADHD manifest in preschool and in the early school grades as reported by both parents and teachers. To examine this question, the sample was limited to preschool and school-aged children identified by their parents or teachers with elevated (i.e. above the borderline elevation cut-off) anxiety or ADHD symptoms using the CBCL and TRF. The individual items that made up the scales were examined. A rank ordering of each of the items was performed. To determine the rank order of the items on each scale, the items were dichotomized ("0, not true" = not reported or "1, sometimes or very true" = reported) for each respondent. Each item was ranked from the most frequently reported to the least frequently reported. In addition to ranking the items in each scale, Spearman's rank order correlation was performed comparing the common parent and teacher items to determine if parents and teachers were consistent with each other in rating some items more frequently than others.

Parent-Reported Anxiety Items

As shown in Table 4, based on the rank ordering of the Anxiety Problems scale items, parents reported that their preschool children with elevated anxiety problems most frequently exhibited the following behaviors: being too fearful, being too dependent, fearing certain animals, situations, or places, and being nervous. Similarly, as shown in Table 5, a rank ordering of the anxiety scale items completed by parents of school-aged children with anxiety revealed that the same four items were the most frequently reported, albeit with slight differences in the rank ordering of the four items. Therefore, across age groups, fearfulness, phobic reactions, nervousness, and dependence seems to be the most commonly reported behaviors by parents with respect to their young children with ASD experiencing elevated anxiety. Across age groups, parents report worries, fears school, fears leaving the home, and separation anxiety as the least common anxiety symptoms.

Teacher-Reported Anxiety Items

In examining the rank order of the anxiety items for children whom they did rate as having elevated anxiety, as shown in Table 5, teachers reported the same four items that were most frequently reported by parents of preschool and school-aged children with elevated anxiety: dependence, nervousness, fearfulness, and fears of certain animals, situations, and places. Similar to parents, they also reported that fearing school and separation anxiety as the least common symptoms of anxiety.

The rank order of anxiety items reported by teachers of school-aged children with anxiety revealed that nervousness was the most commonly reported behavior, as shown in Table 5. The rank order revealed that worries was the item second most likely to be reported by teachers, even though it was less frequently reported by parents of school-aged children.

Table 4 Rank order of items on the CBCL and TRF anxiety clinical scales among preschool children with elevated anxiety

Rank order of CBCL anxiety items (1.5-5 years)	% Parents reporting sometimes/very true	Rank order of TRF anxiety items (1.5-5 years)	% Teachers reporting sometimes/very true
1. **Too fearful**	96.3	1. **Too dependent** **Nervous**	100
2. **Too dependent**	92.6	2. **Too fearful**	66.7
3. **Fears of animals, situations, or places**	88.9	3. **Fears of animals, situations, or places**	66.7
4. **Nervous**	88.9	4. **Worries**	66.7
5. Doesn't want to sleep alone	81.5	5. **Gets upset when separated from parents**	33.3
6. Panic	66.7		
7. Nightmares **Worries**	66.7		
8. Doesn't want to go out of the home	55.6		
9. **Gets upset when separated from parents**	55.6		

Common parent and teacher items are bolded

Table 5 Rank order of items on the CBCL and TRF anxiety clinical scales among school-aged children with elevated anxiety

Rank order of CBCL anxiety items (6–18 years)	% Parents reporting sometimes/very true	Rank order of TRF anxiety items (6–18 years)	% Teachers reporting sometimes/very true
1. **Nervous**	91.5	1. **Nervous**	94.4
2. **Fears of animals, situations, or places**	85.1	2. **Worries**	77.8
3. **Too fearful**	83	3. **Too fearful** **Too dependent**	72.2
4. **Too dependent**	88.9	5. **Fears of animals, situations, or places**	33.3
5. **Worries**	81.5	6. **Fears school**	16.7
6. **Fears school**	66.7		

Common parent and teacher items are bolded

Parent-Reported ADHD Items

Based on the rank ordering of the ADHD items, as shown in Table 6, parents of preschool children with ADHD most frequently reported poor concentration, hyperactivity, and difficulty waiting. Similarly, as shown in Table 7, when the ADHD scale items rated by parents of school-aged children with ADHD were ranked, parents reported poor concentration, hyperactivity, and impulsivity most frequently. Tables 6 and 7 display the rank ordering of the CBCL scales for preschool and school-aged children.

Teacher-Reported ADHD Items

Teacher-reported ADHD behaviors in preschool children with elevated ADHD symptoms displayed a similar rank-order to parent-reported items, as shown in Table 4. Teachers were most likely to report poor concentration, difficulty waiting, and difficulty following directions. A rank ordering of items from teacher reports of school-aged children with ADHD revealed the three most commonly reported items were difficulty following directions, inattention, and difficulty concentrating, as shown in Table 5.

Table 6 Rank order of items on the CBCL and TRF attention deficit/hyperactivity clinical scales among preschool children with elevated ADHD

Rank order of CBCL ADHD items (1.5–5 years)	% Parents reporting sometimes/very true	Rank order of TRF ADHD items (1.5–5 years)	% Teachers reporting sometimes/very true
1. **Can't concentrate** **Can't sit still** **Can't stand waiting**	100	1. **Can't concentrate**	100
2. **Demands must be met immediately**	94.7	2. **Can't stand waiting** Difficulty following directions	100
3. **Quickly shifts**	89.5	3. **Can't sit still**	92.3
4. **Gets into everything**	84.2	4. **Demands must be met immediately**	92.3
		5. Daydreams	84.7
		6. Disturbs other children	84.7
		7. **Quickly shifts**	76.9
		8. **Gets into everything**	69.2

Common parent and teacher items are bolded

Table 7 Rank order of items on the CBCL and TRF attention deficit/hyperactivity clinical scales among school-aged children with elevated ADHD

Rank order of CBCL ADHD items (6–18 years)	% Parents reporting sometimes/very true	Rank order of TRF ADHD items (6–18 years)	% Teachers reporting sometimes/very true
1. **Can't concentrate**	100	1. Difficulty following directions	100
2. **Can't sit still**	100	2. **Inattentive**	93.4
3. **Impulsive**	100	3. **Can't concentrate**	93.3
4. **Inattentive**	97.6	4. Fidgets	93.3
5. **Fails to finish**	95.2	5. **Can't sit still**	93.3
6. **Unusually loud**	88.1	6. **Impulsive**	93.3
7. **Talks too much**	69	7. Talks out	86.7
		8. **Fails to finish**	86.6
		9. Fails to carry out assigned work	73.3
		10. Disturbs other children	66.7
		11. Disrupts class discipline	66.7
		12. **Unusually loud**	60
		13. **Talks too much**	60

Common parent and teacher items are bolded

Parent- and Teacher-Report Differences

Visual examination of observed prevalence findings shows that teachers were less likely to report problem behaviors than parents, particularly in preschool children. This is demonstrated by the percentage of children (ages 4–7) identified by parents and teachers as having elevated (i.e. above borderline score cut-off) symptoms of ADHD (Parents: 33.9%; Teachers: 25%) or anxiety (Parents: N = 41.1%; Teachers: 19%). In addition, when examining ratings of anxiety in preschool children, we found that teachers only identified three preschool children with elevated anxiety, none of whom overlapped with parent-identified children with anxiety. This means that parents and teachers did not agree on their ratings of a single preschool child in our sample.

To further analyze differences between parent- and teacher-reported ADHD and anxiety behaviors, Spearman's rank-order correlation, ρ, was used to compare the rank order of common items of the parent and teacher versions of the ADHD and anxiety clinical scales for preschool and school-aged children. Among preschool and school-aged children identified with elevated levels of ADHD, parent and teacher ranking of behaviors were highly correlated (Preschool: $\rho = .94$, $p = .005$; School-aged: $\rho = .79$, $p = .03$). However, parent and teacher rankings of anxiety-related behaviors were uncorrelated for both preschool and school-aged children (Preschool: $\rho = .67$, $p = .15$; School-aged: $\rho = .46$, $p = .35$).

Discussion

This study provided a detailed account of ADHD and anxiety symptoms in young children with ASD (ages 4–7 years), the majority of whom had cognitive abilities in the typical range. The first aim of this study was to determine the prevalence of parent- and teacher-reported elevated ADHD and anxiety symptoms using the CBCL and TRF, respectively. As expected based on previous research (Brereton et al. 2006; Simonoff et al. 2008), a large proportion of children in this study experienced emotional and behavioral difficulties, with 42 and 48% of children experiencing elevated ADHD or anxiety symptoms, respectively, according to at least one reporter. Both parents and teachers reported that anxiety and ADHD problems were more prevalent for school-aged children than for pre-school children. This is may be due to the increased task demands associated with schooling, as well as developmental manifestation of anxiety symptoms (Beesdo et al. 2009).

The second aim of the study was determine how ADHD and anxiety manifest for preschool and young school-aged children with ASD. When looking at students who had elevated scores on the ADHD clinical scales, parents and teachers most frequently reported inattention, hyperactivity, and impulsivity. The rank order of parent and teacher reports of specific symptoms revealed that they were identifying similar behaviors in children with ASD and comorbid ADHD across the home and school environments. However, there was little consensus between parents and teachers about the types of anxiety-related behaviors that are more or less frequent in children with ASD, as indicated by the differences in the rank ordering of anxiety symptoms. One reason might be that teachers are less sensitive to child anxiety symptoms in the classroom, where internalizing behaviors frequently go unnoticed. (Jepsen et al. 2012). When internalizing behaviors are noticed by parents and teachers, symptoms appear to include being too dependent, being too fearful, nervousness, and fears of certain animals, situations, or places. These findings are in accord with previous research which showed high rates of specific phobias among children with ASD (Leyfer et al. 2006; Van Steensel et al. 2011) and are age-appropriate (Weems and Costa 2005).

In addition, when comparing parent and teacher reports of child anxiety- and ADHD-related behaviors, teachers were considerably less likely to report behavior problems than parents, particularly in preschool children with anxiety. Indeed, across the age groups, teachers identified children as having elevated ADHD and anxiety symptoms at about half the rate of parents.

The low concordance between parent and teacher report found in the present study for young children with ASD is consistent with previous research that found similar disparities using samples of children with ASD from wider age ranges. For instance, Kanne et al. (2009) found a disparity in parent- and teacher-reported problem behaviors in children with ASD ages 3–18 on the CBCL and TRF (Kanne et al. 2009). A meta-analysis by Stratis and Lecavalier (2015) examined the informant agreement for youth with ASD or intellectual disability (ID) and TD youth. They found that, for all groups, parents and teachers demonstrated low levels of agreement, but that agreement was higher for externalizing problem behaviors than for internalizing behaviors. The findings of the current study are congruent with this meta-analysis; the correlations between parent and teacher reports of ADHD symptoms (which include more observable externalizing behaviors) were higher than the (non-significant) correlations between parent and teacher reports of anxiety concerns, which include more internalizing behaviors. This finding is also congruent with the extensive research literature that shows teachers have more difficulty identifying students who are at risk for internalizing behavior problems than those at-risk for externalizing behavior problems (Pearcy et al. 1993; Stanger and Lewis 1993; Jepsen et al. 2012; De Los Reyes et al. 2015).

Informant discrepancies between parents and teachers could be due to multiple factors. Kanne et al. (2009)

compared inter-rater agreement between parents and teachers of youth with ASD and their TD siblings. They found much higher inter-rater agreement between parents and teachers when rating TD youth but not when rating ASD youth, suggesting that rater bias may not have accounted for the inter-rater discrepancies in the youth with ASD. As Kanne et al. argued, such a pattern of findings may suggest that, for youth with ASD more so than for TD youth, problem behaviors are manifested differently across environmental contexts. Applied to the current study, our findings suggest that young children with ASD may be exhibiting different behaviors at home and at school. It might also be the case that regular education teachers, 86.1% of whom had the children in our sample for all or part of the day, may not be as familiar with ASD and its symptoms and, therefore, may have more difficulty in rating the behavior of children with ASD.

There are several limitations that must be considered when interpreting the results of the current study. First, the current study utilized only one measure of ADHD and anxiety, the clinical scales included in the Child Behavior Checklist (CBCL) and corresponding Teacher Report Form (TRF). Although we had both a parent- and teacher-report of these clinical scales based on DSM-IV-TR criteria, a more comprehensive rating scale and a parent and teacher interview could have identified children who met diagnostic criteria for an anxiety disorder or ADHD. The CBCL and TRF merely identified children at risk for these disorders. Second, the CBCL and TRF do not break down the Anxiety Problems clinical scale into specific anxiety disorders, such as specific phobias, social anxiety, or separation anxiety. Future researchers focusing on specific anxiety disorders may want to utilize a different measure that looks at specific anxiety disorders. Similarly, the attention deficit/hyperactivity problems scale does not specify whether children have the inattentive, hyperactive, or combined presentation of ADHD, which may be of interest in future studies. Despite these limitations, several studies examining psychiatric comorbidity in ASD samples have utilized global measures and/or problem behavior checklists (Brereton et al. 2006; van der Meer et al. 2012), including the CBCL and TRF (Hanson et al. 2013).

Finally, because the study included a sample of young children, many of whom had IQ in the typical range (mean IQ = 88; with 17.8% below 70), these findings apply primarily to children on the autism spectrum whose IQ is in the TD range. Thus, while there is much to be learned from the studies that examined psychiatric comorbidity in children with ASD using samples of children from a wide variety of ages and IQ levels (i.e. 4–18 or 10–14; Brereton et al. 2006; Simonoff et al. 2008), our study's focus on a narrower age range (4–7 years) and primarily falling in the typical IQ range provides greater precision in the generalization of our findings. Indeed, there appears to be substantial age-based variation in prevalence of ADHD and anxiety symptoms, even between the 4–5 year olds and the 6–7 year olds in our study, speaking to the value of analyses within a focused age range. These developmental periods in early childhood appear to reflect rapid increases in the prevalence of ADHD and anxiety symptoms for children with ASD.

In conclusion, as students with ASD transition to early schooling, they are faced with increased task demands; these demands increase as they progress through the elementary years, possibly leading to behavioral challenges. In the current study, the increase in behavior problems seen across the age preschool (4–5 years) and school-aged (6–7 years) groups may be due to the higher expectations placed upon students with ASD as progress through the early school years. Future work should examine developmental trajectories of behavior problems, including increases symptoms between preschool and early school-aged children with ASD. Long-term developmental trajectories examining behavior across later childhood and adolescence should also be examined. In addition, the current study found that teachers reported far fewer symptoms of anxiety and ADHD than parents. This disparity between parent and teacher reports was even greater when rating anxiety symptoms and was more pronounced for preschool children. Due to the increasing prevalence of ASD, teachers are more likely to encounter young students with ASD in their classrooms and must be prepared to recognize the symptoms of anxiety and ADHD to meet the needs of these students. Future work should examine ways of improving teacher recognition of anxiety, particularly in young children. Because children with ASD are particularly at risk for early school problems, accurate identification of ADHD and anxiety problems will ensure that these students receive intervention to improve long-term positive outcomes.

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Author Contributions EL conceived of the current study, performed the statistical analyses, and drafted the manuscript; The current study utilized data collected as part of a larger study conceived by JB and AE; JB participated in the design of the current study, and assisted in the interpretation of the data; AE participated in the design of the current study; KS participated in the design of the current study and interpretation of the data; All authors read and approved the final manuscript.

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