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Social anxiety is associated with poorer peer functioning for girls but not boys with ADHD

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ABSTRACT

There is mixed evidence for whether or not co-occurring anxiety is associated with poorer peer functioning in children with attention-deficit/hyperactivity disorder (ADHD), which may be partly due to studies typically using a global measure of anxiety and failing to consider possible sex differences. The present study examined child-reported social anxiety in relation to peer functioning and whether this association differs by sex in 93 children (66% male; ages 8–12) with ADHD. Children, parents, and teachers completed a measure of social acceptance, and teachers also completed measures of asociality, peer exclusion, peer dislike, and peer ignoring. Regression analyses examined the interaction between social anxiety and sex in relation to the peer functioning variables, with age, race, ADHD subtype, and oppositional defiant disorder symptoms included as covariates. Social anxiety was associated with lower parent-reported social acceptance, with no sex differences in the association. However, significant interaction effects were found for child- and teacher-rated social acceptance, as well as peer exclusion and peer ignoring such that social anxiety was associated with less competence, more exclusion, and greater ignoring for girls but not boys. Findings indicate that social anxiety is associated with poorer peer functioning for girls more so than boys with ADHD.

1. Introduction

Although prevalence rates of attention-deficit/hyperactivity disorder (ADHD), estimated to fall between 5.29 and 7.1% of the population worldwide, have not changed in the last 30 years (Polanczyk et al., 2007; Willcutt, 2012), rates of internalizing disorders appear to be increasing among female (but not male) children and adolescents (Bor et al., 2014). It is estimated that 25–40% of children with ADHD experience co-occurring anxiety (Jarrett and Ollendick, 2008; Tung et al., 2016). As children with ADHD experience a range of peer difficulties, including greater peer rejection, fewer dyadic friendships, and general social impairment (Gardner and Gerdes, 2015; McQuade and Hoza, 2008), there is ongoing interest in the extent to which anxiety is related to poorer peer functioning in children with ADHD (Becker et al., 2012; Bishop et al., 2019). A recent systematic review identified 31 studies on this topic and found some evidence for anxiety symptom severity to be associated with poorer social functioning in youth with ADHD, though findings varied widely across studies (Bishop et al., 2019). The authors noted the need for studies examining specific facets of anxiety, considering sex differences, and using multiple informants of social functioning especially since teachers are especially likely to observe children spending significant time interacting with peers (Bishop et al., 2019). Accordingly, the current study examined social anxiety in relation to child-, parent-, and teacher-reported peer functioning and whether associations differed for boys and girls with ADHD.

1.1. Anxiety and peer functioning in children with ADHD

Studies examining anxiety in relation to peer functioning in children with ADHD have reported mixed findings (for reviews, see (Becker et al., 2012; Bishop et al., 2019). Two recent studies both found anxiety to be associated with more parent-reported peer problems, but not teacher-reported peer problems in children with ADHD, though anxiety was also unassociated with parent-reported peer problems in analyses that controlled for relevant variables such as age, sex, and disruptive behaviors (Mulraney et al., 2018; Sciberras et al., 2014). Lee et al. (2012) also concluded that anxiety did not contribute to social problems in children with ADHD. Of note, each of these studies assessed anxiety using diagnoses based on clinical interviews conducted with the child's parent.

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The association between anxiety and peer impairment may be clearer when dimensional measures of anxiety are used. An early study found child-reported anxiety symptoms to be associated with global social problems as rated by both parents and teachers (Karustis et al., 2000). In addition, above and beyond demographic covariates and oppositional defiant disorder (ODD), Mikami et al., 2011) found a composite of parent- and teacher-rated anxiety symptoms to be associated with more parent- and teacher-reported social problems, lower parent- and teacher-reported social skills, and lower teacher-reported peer status in children with ADHD.

Very few studies have examined specific facets of anxiety in relation to the peer functioning of youth with ADHD. Longitudinal evidence suggests that social problems may be particularly associated with social anxiety disorder in youth with ADHD (Bagwell et al., 2006). Similarly, Becker and colleagues (Becker et al., 2015) examined different dimensions of self-reported anxiety in relation to self- and parent-reported social functioning in young adolescents with ADHD. Controlling for ADHD and ODD symptoms, as well as demographic characteristics, social anxiety specifically was associated with poorer self-reported social skills and lower self- and parent-reported social acceptance (Becker et al., 2015). The mixed findings reported in previous studies examining anxiety and peer functioning in children with ADHD may be partly due to failure to examine specific facets of anxiety. Accordingly, based on extant research (Bagwell et al., 2006; Becker et al., 2015), the current study focused on examining social anxiety in relation to multiple domains of peer functioning in children with ADHD.

1.2. Sex differences in the relation between anxiety and peer functioning in children with ADHD

It is also important to examine whether associations between anxiety and peer functioning differ for boys and girls with ADHD. Drawing from both developmental and clinical research, it can be hypothesized that the association between social anxiety and peer difficulties is stronger for girls with ADHD compared to boys with ADHD. First, a large body of developmental research indicates that females are more interpersonally oriented than males in a number of contexts, and especially in terms of dyadic relationships, in both social and academic settings (Benenson and Heath, 2006; Feingold, 1994). Likewise, girls' peer groups tend to be more exclusive and smaller than boys' peer groups are (Rose and Rudolph, 2006), and when conflicts arise between female friends it can be especially difficult for females to repair their friendship (Benenson, 2019). Relatedly, even if conflicts do not arise, female friendships require more vigilance and maintenance than male friendships in order to be successful long-term (Benenson, 2019). Further, girls are more likely than boys to blame themselves for social difficulties (Rudolph, 2002), and relationship losses are more strongly associated with internalizing symptoms in girls than boys (Bakker et al., 2010). Given these considerations, it is possible that social anxiety may be especially likely to be associated with poorer peer functioning in girls compared to boys, with empirical evidence supporting this possibility in typically developing youth (La Greca and Lopez, 1998).

In considering ADHD specifically, it is important to note that the male to female ratio of ADHD in community-based samples of children is approximately 3:1 (Willcutt, 2012). It is theorized that a disorder may be more severe in the sex in which least frequently occurs, as these afflicted individuals must overcome the typical social norms for their sex in order to express the psychopathology (Eme, 1992). This would suggest that girls with ADHD tend to have a more severe phenotype than boys with ADHD (Arnett et al., 2015; Gaub and Carlson, 1997). Further, support has been found for the "gender appropriateness hypothesis" whereby peers tolerate higher levels of ADHD symptoms in boys than in girls (Diamantopoulou et al., 2005). In addition, Monuteaux et al. (2010) found that females with ADHD had greater stability in comorbid psychopathology than males with ADHD, leading the authors to conclude that "sex is a critical modifying factor in developmental models of the correlates of ADHD" (p. 239).

With these theoretical and empirical considerations in mind, we hypothesize that social anxiety will be more clearly associated with poorer peer functioning for girls with ADHD compared to boys with ADHD. Since girls' peer groups tend to be smaller and more exclusive, social anxiety may be especially noticeable among peers and contribute to girls with ADHD missing socialization experiences. This may be especially true for girls with ADHD since their behaviors may already be viewed as especially atypical compared to other girls and to their teachers who observe peer interactions. Further, social anxiety may be more stable in girls compared to boys with ADHD (Monuteaux et al., 2010), making it especially difficult for girls with ADHD to experience success in peer relationships. The clearest evidence for this hypothesis comes from a study of school-aged children with ADHD predominantly inattentive presentation which found internalizing symptoms and negative social preference to be associated in girls but not boys with ADHD (Becker et al., 2013). The present study builds upon this research by examining social anxiety specifically and multiple domains of peer functioning.

1.3. The current study

The purpose of the present study was to examine social anxiety in relation to social functioning in children diagnosed with ADHD and, further, to test whether there were sex differences in associations. Given the importance of incorporating youths' own ratings in the assessment of internalizing symptoms (Silverman and Ollendick, 2005), we used a well-validated measure of youth-reported social anxiety. In addition, as there are established differences in peer functioning between ADHD subtypes/presentations (Willcutt et al., 2012) and ODD symptom severity is also associated with poorer social functioning in children with ADHD (Becker et al., 2012; Gardner and Gerdes, 2015), we controlled for these variables in the analyses to ensure that any association between social anxiety and peer functioning could not be attributed to ADHD subtype or ODD symptom severity. Last, we included multiple indicators of peer functioning, including youth-, parent-, and teacher-reported social acceptance, teacher-reported peer isolation (asociality/withdrawal and rejection), and teacher-reported peer status (peer ignoring and dislike). We hypothesized that social anxiety symptoms would be related to lower social acceptance, greater asociality and rejection, and greater peer ignoring and dislike in children with ADHD, and further hypothesized that these associations would be stronger for girls than boys with ADHD.

2. Methods

2.1. Participants

Participants were 93 children (66% male) ages 8–12 years recruited for study conducted through the standard clinical intake flow at an outpatient clinic specializing in pediatric ADHD in the Midwest United States. All participants were being evaluated in the clinic for possible ADHD and meeting full criteria for ADHD was required for inclusion in the current study. All children had an IQ ≥ 80 (Range = 82–129) based on the Kaufman Brief Intelligence Scale, Second Edition (KBIT-2; Kaufman and Kaufman, 2004). Sample characteristics, including ADHD and comorbid diagnoses based on the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Kaufman et al., 1997) interview conducted with the child's caregiver, are provided in Table 1. Among children with ADHD, 9 (9.7%) met criteria for an internalizing disorder diagnosis. Most children (n = 82; 88.2%) were not on psychotropic medications at the time of their evaluation.

Table 1
Sample characteristics (n = 93)

	M ± SD
Age	9.42 ± 1.40
IQ[a]	103.98 ± 12.49
	N (%)
Sex	
Male	61 (65.6%)
Female	32 (34.4%)
Race/Ethnicity	
White	69 (74.2%)
Black	18 (19.4%)
Hispanic	3 (3.2%)
Asian	2 (2.2%)
Native American	1 (1.1%)
ADHD Subtype/Presentation	
Combined	43 (46.2%)
Predominantly Inattentive	50 (53.8%)
Comorbid Internalizing Diagnoses[b]	
Depression/Dysthymia	2 (2.2%)
Generalized Anxiety Disorder	3 (3.2%)
Separation Anxiety Disorder	1 (1.1%)
Social Phobia	5 (5.4%)
Panic Disorder	1 (1.1%)
Obsessive-Compulsive Disorder	0 (0%)
Specific Phobia	0 (0%)
Post-traumatic Stress Disorder	1 (1.1%)
Any Anxiety Disorder	9 (9.7%)
Any Internalizing Disorder	9 (9.7%)
Comorbid Externalizing Diagnoses[b]	
Oppositional Defiant Disorder	32 (34.4%)
Conduct Disorder	1 (1.1%)

Note. ADHD = attention-deficit/hyperactivity disorder.
[a] Intelligence quotient (IQ) determined using the *Kaufman Brief Intelligence Scale, Second Edition* (KBIT-2).
[b] Diagnoses established using the *Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children* (K-SADS) administered to parents.

2.2. Procedures

This study was reviewed and approved by the Institutional Review Board. Families were recruited through the standard clinical intake flow at an outpatient clinic specializing in the diagnosis and treatment of ADHD. Parents provided informed consent and children provided assent.

2.3. Measures

2.3.1. Diagnostic assessment

The K-SADS (Kaufman et al., 1997) is a semi-structured diagnostic interview with good reliability and validity. The disruptive behavior disorder (including ADHD), mood disorder, and anxiety disorder modules were administered to a caregiver of all participants in the present study. If any K-SADS screening item is endorsed as positive, a full module is administered which covers the DSM symptoms of the disorder in question. Included as part of the interview are questions regarding psychosocial functioning, impairment and age of onset, and rule out questions related to medical and other causes, including other mental health disorders. The K-SADS was administered by individuals with master's or doctoral degrees in clinical psychology. All interviewers were trained by experienced interviewers, which included a didactic training focused on DSM nosology and differential diagnosis, scoring a previously recorded interview, observing interviews, and being observed before interviewing independently. In addition, one interview per interviewer was randomly selected to be scored by another interviewer. We achieved 100% reliability between interviewers on this reliability check. ADHD subtype was determined using the K-SADS and used as a covariate in analyses.

2.3.2. Oppositional defiant disorder (ODD) symptoms

The Vanderbilt ADHD Rating Scale (VARS) is a DSM-IV-based scale of that assesses ADHD symptoms and commonly co-occurring psychopathology including ODD symptoms (Wolraich et al., 2013, 2003). Each item is rated on a four-point scale (0 = *never*, 3 = *very often*). Both the parent and teacher versions have demonstrated strong psychometric properties (Wolraich et al., 2013, 2003). In the present study, the eight parent ODD items and the four teacher ODD items were combined into a single scale to control for ODD behaviors in analyses (α = 0.89).

2.3.3. Social anxiety

The Social Anxiety Scale for Children – Revised (SASC-R; La Greca and Stone, 1993) is a 22-item child self-report measure of social anxiety (4 of the 22 items are filler items that are not scored). Each item is rated on a five-point scale (1 = *not at all*, 5 = *all the time*). There is substantial evidence supporting the reliability and validity of the SASC-R (Ginsburg et al., 1998; La Greca and Stone, 1993; Reijntjes et al., 2007). As recommended, a total sum score was used (α = 0.93).

2.3.4. Social acceptance

The Social-Perception Profile for Children (SPPC; Harter, 1985) is a frequently-used measure of self- and other-perceived competence. Using a "some kids/other kids" format, ratings are made on a four-point scale, with higher scores indicating greater perceived competence. The social acceptance subscale was used in the present study and includes items that focus on success in the peer domain (e.g., ability to make and maintain friendships, popularity with peers). The social acceptance subscale has demonstrated acceptable validity and reliability (i.e., internal consistency, test–retest), and significantly correlates with peer and teacher ratings of children's peer acceptance (Cole et al., 1998; Harter, 1985; Muris et al., 2003). In the present study, αs = 0.67, 0.91, and 0.93 for child-, parent-, and teacher-reported social acceptance, respectively.

2.3.5. Peer isolation

The Child Behavior Scale (CBS; Ladd and Profilet, 1996) is a validated teacher-report measure of child behaviors and relations with peers in the school setting. Teachers rate on a three-point scale how applicable the item is for the child (1 = *doesn't apply*, 2 = *applies sometimes*, 3 = *certainly applies*). The asocial with peers (withdrawn behavior) and excluded by peers subscales were used in the present investigation. The asocial subscale measures the degree to which a child chooses solitary rather than social activities in the peer context (6 items; e.g., "prefers to play alone", "keeps peers at a distance", "withdraws from peer activities"). The exclusion scale measures peer-imposed rejection or isolation (7 items; e.g., "peers refuse to let child play with them", "excluded from peers' activities", "not chosen as a playmate by peers"). Average responses to items within each subscale were created with higher scores indicating greater asociality and exclusion. In the present study, αs = 0.92 and 0.91 for asocial and excluded, respectively.

2.3.6. Peer status

Teachers reported on children's peer status using the Dishion Social Acceptance Scale (DSAS; Dishion, 1990). Specifically, teachers rate the percentage of classmates who "dislike/reject" and "ignore" the child using a five-point scale from 1 (*almost none, less than 25%)* to 5 (*nearly all, over 75%)*. This measure of social status has been well validated (Dishion, 1990), and scores have been shown to significantly correlate with peer sociometric nominations (Lee and Hinshaw, 2006). Higher ratings indicate greater levels of rejection and ignoring by the peer group as perceived by the teacher.

2.4. Analytic approach

All analyses were conducted in SPSS©, version 25 for Windows®

(IBM Corporation, Armonk NY, USA). First, zero-order correlation analyses were conducted to examine the intercorrelations among the study variables. Second, we used the PROCESS macro version 3.3 (Hayes, 2017) with nonparametric bootstrapping with 5,000 resamples to examine sex as a moderator of the association between social anxiety and the peer functioning variables. Significant interaction effects were probed with a 95% bias-corrected confidence interval (CI). To visualize significant interactions, they were plotted at −1SD, the mean, and +1SD of social anxiety. In the interaction analyses, age, race (dummy-coded as White vs. non-White), ADHD subtype (dummy-coded as combined vs. predominantly inattentive), and ODD symptoms (a mean score including both parent and teacher ratings) were included as covariates since each of these variables has been shown to be associated with children's peer functioning (Becker et al., 2012; Jackson et al., 2006; McQuade and Hoza, 2008). For all analyses, statistical significance was set at $p < .05$.

3. Results

3.1. Correlation analyses

For all study variables, absolute values of skew and kurtosis were below 1.5. Table 2 provides the descriptive statistics and intercorrelations of the study variables. Social anxiety was significantly associated with lower child self-reported social acceptance ($r = -0.41$, $p < .001$) and parent-reported social acceptance ($r = -0.30$, $p = .004$), but was not significantly associated with teacher-reported social acceptance ($r = -0.16$, $p = .14$). Having ADHD combined presentation was significantly associated with higher ODD symptoms ($r = 0.37$, $p < .001$) and more peer dislike ($r = 0.27$, $p = .01$), whereas having ADHD predominantly inattentive presentation was significantly associated with more asociality ($r = -0.27$, $p = .01$). Sex, age, and race were not significantly associated with social anxiety or any of the peer functioning variables ($ps > .05$).

3.2. Interaction analyses

Results of the analyses examining the interaction between social anxiety and sex in relation to social acceptance are summarized in Table 3. Social anxiety was significantly associated with lower parent-reported social acceptance, above and beyond the covariates included, with no interaction of sex with this association. However, significant interaction effects were found for both child self-reported social acceptance ($b = 0.51$, $p = .002$) and teacher-reported social acceptance ($b = 0.53$, $p = .02$). Conditional effect analyses indicated that social anxiety was associated with significantly lower child-reported social acceptance for girls ($t = -4.89$, $p < .001$, 95% CI: −0.92, −0.39) but not for boys ($t = -1.59$, $p = .12$, 95% CI: −0.32, 0.04). Similarly, social anxiety was associated with significantly lower teacher-reported social acceptance for girls ($t = -3.03$, $p = 0.03$, 95% CI: −0.87, −0.18) but not for boys ($t = -0.01$, $p = 0.99$, 95% CI: −0.23, .23). These conditional effects are plotted in Fig. 1.

Results of the analyses examining the interaction of social anxiety and sex in relation to the other teacher-reported peer variables are summarized in Table 4. Social anxiety was not significantly associated with asocial behaviors, nor was there a significant social anxiety × sex interaction in relation to asocial behaviors. However, significant interaction effects were found between social anxiety and sex in relation to peer exclusion ($b = -0.27$, $p = .03$), peer ignoring ($b = -0.76$, $p = .02$), and peer dislike ($b = -0.53$, $p = .03$). Although the interaction term was significant for peer dislike, conditional effect analyses indicated that social anxiety was not significantly associated with peer dislike for either girls ($t = 1.90$, $p = .06$, 95% CI: −0.02, .74) or boys ($t = -1.28$, $p = .20$, 95% CI: −0.42, 0.09). Conditional effect analyses indicated that social anxiety was associated with significantly greater peer ignoring for girls ($t = 2.26$, $p = .03$, 95% CI: 0.07, 1.08) but not for boys ($t = -1.11$, $p = 0.27$, 95% CI: −0.53, 0.15). Similarly, social anxiety was associated with significantly greater peer exclusion for girls ($t = 2.46$, $p = .02$, 95% CI: 0.05, 0.44) but not for boys ($t = -0.33$, $p = .74$, 95% CI: −0.16, 0.11). These conditional effects are plotted in Fig. 2.

4. Discussion

This is the first study to our knowledge to examine whether the association between anxiety symptoms and peer functioning differs for girls and boys with ADHD. Children with ADHD frequently experience co-occurring anxiety symptoms (Jarrett and Ollendick, 2008; Tung et al., 2016) as well as peer problems (Gardner and Gerdes, 2015; McQuade and Hoza, 2008), making it important to evaluate whether these domains are associated and whether they vary based on sex. Findings largely supported the hypothesis that social anxiety symptoms would be more clearly associated with poorer peer functioning in girls than in boys with ADHD. Specifically, social anxiety was associated with lower child self-reported and teacher-reported social acceptance, as well as greater teacher-reported peer ignoring and dislike, in girls with ADHD, whereas social anxiety was unassociated with these peer domains in boys with ADHD. The only domain for which social anxiety

Table 2
Intercorrelations and descriptive statistics of study variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Sex	–												
2. Race	0.04	–											
3. Age	0.06	−0.16	–										
4. ADHD subtype	0.04	0.01	−0.12	–									
5. ODD symptoms (PR/TR)	0.01	−.31**	0.02	.37***	–								
6. Social anxiety (SR)	−0.14	0.06	−0.14	0.04	0.000	–							
7. Social acceptance (SR)	0.07	−0.09	0.16	0.06	−0.02	−.41***	–						
8. Social acceptance (PR)	0.02	0.02	−0.02	−0.11	−.37***	−.30**	.34**	–					
9. Social acceptance (TR)	−0.04	0.11	−0.004	0.09	−.21*	−0.16	.23*	.51***	–				
10. Asocial (TR)	−0.03	−0.13	0.06	−.27*	−0.10	0.03	−0.13	−.24*	−.49***	–			
11. Excluded (TR)	0.002	−0.16	−0.01	0.08	.33**	0.11	−0.17	−.42***	−.80***	.47***	–		
12. Ignored (TR)	−0.05	−0.19	0.11	−0.01	0.07	0.02	−0.16	−.29**	−.60***	.42***	.67***	–	
13. Disliked (TR)	0.14	−0.11	0.02	.27*	.50***	−0.02	−0.07	−.41***	−.42***	0.04	.58***	.38***	–
Mean	–	–	9.42	–	1.01	2.42	2.85	2.70	2.36	1.46	1.61	2.09	1.68
Standard Deviation	–	–	1.40	–	0.70	0.92	0.72	0.88	0.87	0.53	0.50	1.23	1.05

Note. Sample $N = 93$, with $n = 88$ for correlations using teacher-report variables. For sex, 0 = female, 1 = male. For race, 0 = non-White, 1 = White. For ADHD subtype, 0 = ADHD predominantly inattentive subtype/presentation, 1 = ADHD combined subtype/presentation. ADHD = attention-deficit/hyperactivity disorder. ODD = oppositional defiant disorder. PR = parent-report. SR = child self-report. TR = teacher-report.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3
Analyses examining the interaction of social anxiety and sex in relation to social acceptance in children with ADHD

	Child self-reported social acceptance			Parent-reported social acceptance			Teacher-reported social acceptance		
	Coefficient (SE)	*t*	95% CI	Coefficient (SE)	*t*	95% CI	Coefficient (SE)	*t*	95% CI
	$F(7,85) = 4.62^{***}$, $R^2 = .28$			$F(7,85) = 4.18^{***}$, $R^2 = .26$			$F(7,80) = 2.45^{***}$, $R^2 = 0.18$		
Sex	−1.27 (0.43)	−2.94**	[−2.13, −0.41]	−0.64 (0.54)	−1.19	[−1.71, 0.43]	−1.42 (0.56)	−2.52*	[−2.54, −0.30]
Age	0.06 (0.05)	1.20	[−0.04, 0.16]	−0.04 (0.06)	−0.64	[−0.16, 0.08]	0.01 (0.07)	0.15	[−0.12, 0.14]
Race	−0.23 (0.17)	−1.39	[−0.56, 0.10]	−0.25 (0.20)	−1.25	[−0.66, 0.15]	−0.01 (0.22)	−0.04	[−0.44, 0.42]
ADHD subtype	0.20 (0.15)	1.37	[−0.09, 0.49]	0.11 (0.18)	0.61	[−0.25, 0.47]	0.38 (0.20)	1.96	[−0.01, 0.77]
ODD symptoms	−0.18 (0.11)	−1.57	[−0.40, 0.05]	−0.58 (0.14)	−4.16***	[−0.85, −0.30]	−0.44 (0.15)	−2.86**	[−0.75, −0.13]
Social anxiety	−0.65 (0.13)	−4.89***	[−0.92, −0.39]	−0.46 (0.16)	−2.77**	[−0.79, −0.13]	−0.53 (0.17)	−3.03**	[−0.87, −0.18]
Social anxiety × Sex	0.51 (0.16)	3.14**	[0.19, 0.84]	0.24 (0.20)	1.21	[−0.16, 0.65]	0.53 (0.21)	2.49*	[0.11, 0.95]

Note. Bootstrap samples = 5,000. For sex, 0 = female, 1 = male. For race, 0 = non-White, 1 = White. For ADHD subtype, 0 = ADHD predominantly inattentive subtype/presentation, 1 = ADHD combined subtype/presentation. ADHD = attention-deficit/hyperactivity disorder. ODD = oppositional defiant disorder.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

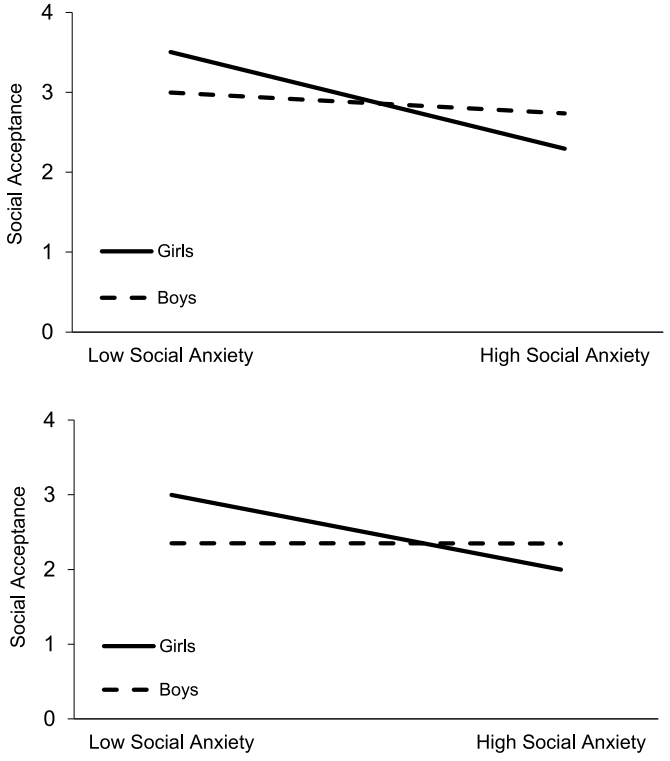

Fig. 1. The association between social anxiety and child-reported social acceptance (top panel) and teacher-reported social acceptance (bottom panel) differs for boys and girls with attention-deficit/hyperactivity disorder (ADHD).

symptoms were associated with poorer peer functioning for both boys and girls with ADHD was parent-reported social acceptance. Together, these findings indicate that social anxiety may be especially relevant to understanding peer difficulties in girls with ADHD.

It is important to note the different findings across different informants of peer functioning in this study. In particular, some previous research has indicated that anxiety may be more clearly associated with poorer peer functioning in children with ADHD when parent but not teacher ratings are used (Lee et al., 2012; Mulraney et al., 2018; Sciberras et al., 2014). Other studies have found anxiety to be associated with poorer teacher-reported peer functioning in children with ADHD (Karustis et al., 2000; Mikami et al., 2011). It may be that the mixed findings reported to date are due in part to previous studies not evaluating sex differences. Teachers have a unique perspective in observing children interacting with peers in unstructured and structured contexts, as well as in smaller and larger groups. In contrast, parents may be more likely to observe sibling relationships and smaller peer groups, typically with peers who have formed friendships. Thus, teachers may be especially likely to see girls with ADHD who have co-occurring social anxiety experience difficulties in their peer relationships. Of note, this seems to be the case for girls themselves as well, as we also found social anxiety to be associated with lower self-reported social acceptance in girls with ADHD but not in boys with ADHD.

In this study we examined social anxiety specifically, which extant research has found to be uniquely related to peer functioning in youth with ADHD (Bagwell et al., 2006; Becker et al., 2015). Research with typically developing children has also shown social anxiety to be more clearly associated with poorer peer functioning for girls than boys (La Greca and Lopez, 1998). Most previous studies examining anxiety and peer functioning in children with ADHD have used global measures of anxiety, which is another factor that may have contributed to mixed findings in this area. For instance, in a large sample of young adolescents with ADHD, a total anxiety score was unassociated with either self- or parent-reported social skills, yet analyses examining separate anxiety dimensions found social anxiety to be uniquely associated with poorer self-reported social skills (Becker et al., 2015). Findings from the current study further support the importance of examining social anxiety specifically in research aiming to understand the interrelations between anxiety and adjustment in children with ADHD. It would be beneficial for future research to examine multiple facets of anxiety to evaluate whether there are sex differences in the link between anxiety dimensions and peer functioning generally, or for only specific dimensions of anxiety.

Analyses conducted in this study controlled for important variables, including ADHD subtype/presentation and ODD symptoms. Although not the focus of this study, a few findings warrant mention. First, ADHD subtype/presentation was generally unassociated with the peer functioning variables, with two exceptions. In bivariate correlation analyses, ADHD combined presentation was associated with greater peer dislike, whereas ADHD predominantly inattentive presentation was associated with greater peer asociality. These differential associations are consistent with meta-analytic findings showing greater peer dislike in children with ADHD combined presentation compared to children with ADHD predominantly inattentive presentation, and more shy and passive behaviors in children with ADHD predominantly inattentive presentation compared to children with ADHD combined presentation (Willcutt et al., 2012). However, in regression analyses in the current study ADHD presentation was no longer associated with peer dislike, yet ADHD predominantly inattentive presentation remained significantly associated with greater asociality. In addition, consistent with previous research (Becker et al., 2012), in both correlation and regression analyses, ODD symptoms were consistently associated with poorer adult-reported peer functioning. Our findings related to social anxiety are especially compelling since the associations were examined

Table 4
Analyses examining the interaction of social anxiety and sex in relation to teacher-reported peer functioning in children with ADHD

	Asocial			Excluded		
	Coefficient (SE)	*t*	95% CI	Coefficient (SE)	*t*	95% CI
	$F(7,80) = 1.33$, $R^2 = .10$			$F(7,80) = 2.52$*, $R^2 = 0.18$		
Sex	0.34 (0.35)	0.97	[−0.36, 1.04]	0.66 (0.32)	2.04*	[0.02, 1.30]
Age	0.002 (0.04)	0.05	[−0.08, 0.08]	−0.01 (0.04)	−0.15	[−0.08, 0.07]
Race	−0.15 (0.14)	−1.12	[−0.42, 0.12]	−0.03 (0.12)	−0.22	[−0.28, 0.22]
ADHD subtype	−0.27 (0.12)	−2.17*	[−0.51, −0.02]	−0.06 (0.11)	−0.55	[−0.29, 0.16]
ODD symptoms	−0.02 (.10)	−0.20	[−0.21, 0.17]	0.29 (0.09)	3.31**	[0.12, 0.47]
Social anxiety	0.12 (.11)	1.10	[−0.10, 0.34]	0.25 (0.10)	2.46*	[0.05, 0.44]
Social anxiety × Sex	−0.13 (.13)	−1.00	[−0.40, 0.13]	−0.27 (0.12)	−2.20*	[−0.51, −0.03]
	Ignored			Disliked		
	$F(7,80) = 1.49$, $R^2 = 0.12$			$F(7,80) = 5.15$***, $R^2 = 0.31$		
Sex	1.79 (0.82)	2.18*	[0.16, 3.42]	1.51 (0.62)	2.45*	[0.28, 2.74]
Age	0.08 (0.10)	0.85	[−0.11, 0.27]	0.02 (0.07)	0.27	[−0.12, 0.16]
Race	−0.35 (.32)	−1.10	[−0.98, 0.28]	0.16 (0.24)	0.67	[−0.31, 0.63]
ADHD subtype	−0.03 (0.29)	−0.10	[−0.60, 0.54]	0.18 (0.21)	0.84	[−0.25, 0.61]
ODD symptoms	0.16 (0.23)	0.71	[−0.29, 0.61]	0.80 (0.17)	4.73***	[0.46, 1.14]
Social anxiety	0.57 (0.25)	2.26*	[0.07, 1.08]	0.36 (0.19)	1.90	[−0.02, 0.74]
Social anxiety × Sex	−0.76 (0.31)	−2.47*	[−1.38, −0.15]	−0.53 (0.23)	−2.27*	[−0.99, −0.07]

Note. Bootstrap samples = 5,000. For sex, 0 = female, 1 = male. For race, 0 = non-White, 1 = White. For ADHD subtype, 0 = ADHD predominantly inattentive subtype/presentation, 1 = ADHD combined subtype/presentation. ADHD = attention-deficit/hyperactivity disorder. ODD = oppositional defiant disorder.
*$p < .05$. **$p < .01$. ***$p < .001$.

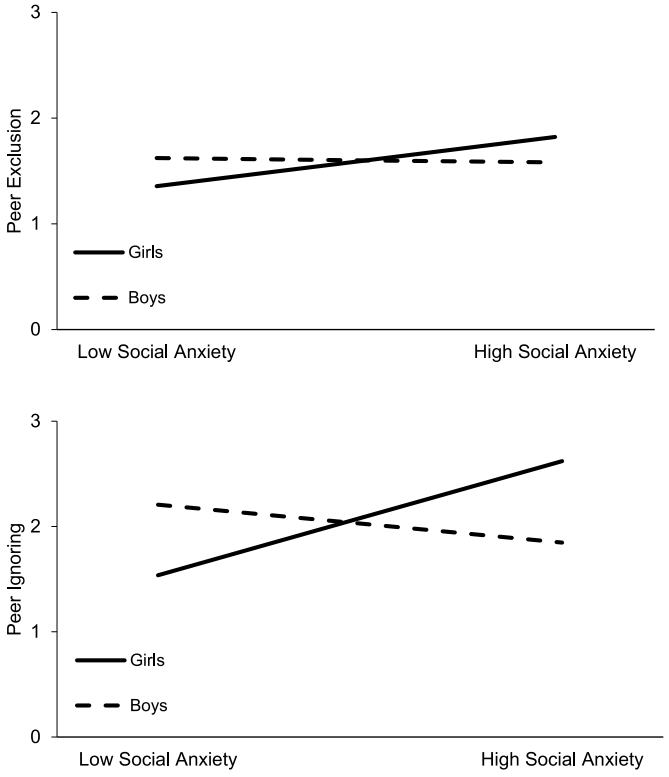

Fig. 2. The association between social anxiety and teacher-reported peer exclusion (top panel) and peer ignoring (bottom panel) differs for boys and girls with attention-deficit/hyperactivity disorder (ADHD).

above and beyond ODD symptoms and also included cross-informant analyses that used child self-reported social anxiety in relation to teacher-reported peer functioning above and beyond a composite of parent/teacher-reported ODD symptoms.

4.1. Limitations and future directions

Strengths of this study include using a clinic-referred sample of children diagnosed with ADHD, multiple informants of peer functioning, and multiple domains of teacher-reported peer functioning. Limitations include the cross-sectional design, which precludes making causal conclusions. Longitudinal studies examining possible bi-directional and cascading effects are needed, particularly given longitudinal findings showing social problems in children with ADHD to predict social anxiety in adolescence (Bagwell et al., 2006). The multi-informant approach could be considered a limitation due to the possibility that results may differ across informants making it difficult to determine a pattern. However, previous research has shown that multiple informants contribute significantly to the understanding of a child's functioning (De Los Reyes et al., 2015). Having multiple informants captures a global picture of peer functioning and helps increase the precision of findings. In addition, although we included multiple measures of teacher-reported peer functioning, we only included a single measure of social acceptance for child- and parent-report. Future studies can build upon our work by incorporating a broader array of peer functioning domains (e.g., victimization) and other methods (e.g., peer nominations). Finally, there is some indication that anxiety may be more strongly associated with peer functioning in children without ADHD relative to children with ADHD (Mikami et al., 2011). Studies that include a comparison sample of children without ADHD are needed, particularly studies with a sufficiently large sample size to examine group and sex differences.

4.2. Conclusion

This is the first study to demonstrate social anxiety to be more clearly associated with girls' but not boys' peer functioning in children with ADHD. Although the significant relation between social anxiety and lower parent-reported social acceptance did not differ for boys and girls with ADHD, significant interaction effects were found for child-reported social acceptance, teacher-reported social acceptance, and teacher-reported peer exclusion and ignoring. In each of these instances, social anxiety was associated with poorer peer functioning in girls but not in boys. Findings underscore the importance of examining

sex differences in studies examining the interrelations between co-occurring psychopathology and adjustment in children with ADHD.

Declaration of Competing Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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