Running head: SOCIAL ANXIETY + ADHD AND PEER-RELATED IMPAIRMENTS

When Adolescents Experience Co-Occurring Social Anxiety and ADHD Symptoms: Links with Social Skills When Interacting with Unfamiliar Peer Confederates

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CITATION

Greenberg, A., & De Los Reyes, A. (2022). When adolescents experience co-occurring social anxiety and ADHD symptoms: Links with social skills when interacting with unfamiliar peer confederates. *Behavior Therapy*. Advance online publication. https://doi.org/10.1016/j.beth.2022.04.011

FUNDING INFORMATION

Efforts by the second author were supported by a grant from the Institute of Education Sciences (R324A180032; National Center for Special Education Research).

Abstract

Adolescents with elevated social anxiety commonly experience peer-related impairments—particularly with same-age, unfamiliar peers—stemming from their *avoidant behaviors*. Yet, peer-related impairments are not unique to social anxiety. For example, adolescents who experience social anxiety may also experience symptoms of attention deficit/hyperactivity disorder (ADHD), which also increase risk for peer-related impairments. Relative to social anxiety, peer-related impairments linked to ADHD symptoms more likely stem from hyperactivity (i.e., *approach behaviors*). These distinct pathways point to adolescents with elevated social anxiety and ADHD symptoms (i.e., *social anxiety + ADHD*) experiencing particularly high peer-related impairments, which commonly manifest as behavioral displays of low social skills when interacting with unfamiliar peers. We tested this notion in a mixed-clinical/community sample of 134 14-to-15-year-old adolescents and their parents. Adolescents participated in a series of social interaction tasks designed to simulate how adolescents interact with same-age, unfamiliar peers. Trained observers independently rated adolescents on observed social skills within these interactions. Both parents and adolescents completed parallel surveys of social anxiety and ADHD symptoms, which we used to identify social anxiety + ADHD adolescents as well as other combinations of social anxiety and ADHD symptoms (i.e., neither, elevated on one but not the other). Adolescents with social anxiety + ADHD displayed significantly lower social skills, relative to all other groups. Among adolescents, social anxiety + ADHD may have a compounding effect on social skills. As such, therapists working with social anxiety + ADHD adolescents should probe for peer-related impairments and factors implicated in the development and maintenance of these impairments.

Keywords: ADHD; Adolescence; Impairment; Social Anxiety; Unfamiliar Peer Paradigm

Social anxiety is characterized by intense fear or anxiety across situations in which the affected individual may be negatively evaluated by others (American Psychiatric Association [APA], 2013). This fear provokes behavioral patterns of avoidance that traverse multiple domains (e.g., declining to attend social events, eye-gaze aversion; APA, 2013). Social anxiety disorder is fairly common among adolescents, as approximately 10% of adolescents in the United States experience social anxiety disorder at some point during development (Burstein et al., 2011). Further, adolescents affected by social anxiety disorder may experience significant impairments when interacting with same-age peers, including establishing and maintaining positive peer relationships (i.e., *peer-related impairments*; Alfano & Beidel, 2011; APA, 2013; Beale et al, 2018; Hofmann et al., 1999). Among adolescents who meet criteria for a diagnosis of social anxiety disorder, the majority will meet criteria for another mental health disorder (e.g., Epkins & Heckler, 2011; Jarrett & Ollendick, 2008, 2012; Koyuncu et al., 2019). Thus, a key goal of evidence-based assessments of social anxiety should involve not only understanding social anxiety symptoms and impairments, but also those linked to commonly co-occurring conditions.

Historically, the literature on conditions that co-occur with social anxiety has largely focused on understanding how and under what circumstances social anxiety co-occurs with other conditions on the internalizing spectrum (e.g., Epkins & Heckler, 2011). Such a focus makes sense given that conditions on the same spectrum (e.g., anxiety and depression) tend to co-occur more often than conditions on two different spectra (e.g., depression and conduct problems; APA, 2013). Yet, what this also means is that, in the case of anxiety conditions, the nature of their co-occurrence with externalizing disorders has been largely overlooked (Becker et al., 2014). This is a key gap in the literature on social anxiety, given

that 25-40% of adolescents with social anxiety disorder also meet criteria for attention deficit/hyperactivity disorder (ADHD; APA, 2013; Jarrett & Ollendick, 2008).

As with social anxiety, those affected by ADHD experience peer-related impairments (APA, 2013), including greater peer rejection and fewer friendships (Gardner & Gerdes, 2015; McQuade & Hoza, 2008). In fact, for both social anxiety and ADHD, interventions designed to address concerns with peer-related impairments often focus on improving behaviors linked to processes thought to contribute to the development and maintenance of these impairments, namely social skills (see Alfano & Beidel, 2011; Evans et al., 2018). Yet, the core features of social anxiety and ADHD might indicate that these peer-related impairments and their contributing factors (i.e., social skills) manifest via distinct pathways. Specifically, socially anxious individuals may become avoidant of social situations when anxiety symptoms rise, and this elevated avoidance results in fewer opportunities to "practice" socially skilled behaviors, thus posing barriers to initiating and maintaining positive peer relationships (e.g., Beidel et al., 2000). In contrast, the hyperactive and impulsive behaviors that characterize ADHD might contribute to maladaptive social behaviors, which peers tend to find aversive (e.g., APA, 2013; Whalen & Henker, 1992). That is, whereas peer-related impairments stemming from social anxiety appear to manifest via *avoidant behaviors*, *approach behaviors* like those typified by hyperactivity and impulsivity appear to explain a significant portion of these same kinds of impairments among those who experience ADHD.

Taken together, ADHD and social anxiety might result in peer-related impairments via distinct pathways. If so, then there is reason to believe that when these conditions co-occur, the peer-related impairments resulting from them may *compound* on one another. In fact,

there is increasing interest in how co-occurring social anxiety and ADHD (i.e., *social anxiety + ADHD*) impacts social functioning generally (see Bishop et al., 2019). Yet, tests of the effects of social anxiety + ADHD on psychosocial impairments have been largely mixed (cf. Armstrong et al., 2015; Becker et al., 2014; Bowen et al., 2008; Hoza et al., 2005; Karustis, et al., 2000; Mikami et al., 2011). Some have posited that the mixed findings stem from the fact that studies varied on (a) sample size and (b) use of multi-informant, multi-modal measures (see Becker et al., 2012; Jarrett & Ollendick, 2008).

One element of the designs of these studies that has received relatively little attention is that they tend to involve samples with wide age ranges (e.g., 6-10 years in Mikami et al., 2011; 5-13 years in Armstrong et al., 2015). This characteristic might have important implications for understanding links between social anxiety + ADHD and impairments of any kind, including peer-related impairments. Specifically, a study that uses a large age range when testing links between social anxiety + ADHD and psychosocial impairments may be highly unlikely to assess impairment domains relevant to all youth in the sample. For example, the impairments linked to social anxiety and ADHD—and importantly, the contexts in which they manifest (e.g., home, school, peer interactions)—might operate quite differently for a participant in middle childhood than they do for a participant in late-adolescence (see also Alfano & Beidel, 2011). In this respect, we must consider the age range of the sample to select measures that capitalize on specific, developmentally appropriate contexts where youth experience impairments.

One way to address this issue is to test questions about links between social anxiety + ADHD and psychosocial impairments in samples focused on a specific developmental period. For instance, relative to younger children, adolescents spend a greater amount of

time in non-home contexts (e.g., Smetana 2008). In fact, prior work indicates that among adolescents who experience social anxiety, many of their symptoms and associated impairments manifest within social situations that involve interacting with same-age, unfamiliar peers (e.g., Deros et al., 2018; Glenn et al., 2019). Thus, a study testing links between social anxiety + ADHD and psychosocial impairments among adolescents might be particularly well-positioned to detect these links if the domains of impairment assessed were localized to those that manifest within unfamiliar peer interactions. Along these lines, a key aim of this study involved testing links between social anxiety + ADHD and adolescents' impairments linked to unfamiliar peer interactions, using an innovative laboratory paradigm designed to simulate the social interactions that adolescents often have with same-age, unfamiliar peers (i.e., Unfamiliar Peer Paradigm; see Cannon et al., 2020).

Purpose

The purpose of the present study was to test the degree to which adolescents who experience social anxiety + ADHD display greater levels of impaired social functioning, relative to adolescents who experience clinically elevated symptoms in only one of these domains. We leveraged a multi-informant, multi-modal approach to assessing these domains in a mixed-clinical/community sample of adolescents and their parents. We tested two hypotheses. First, we hypothesized that we would observe a subgroup of adolescents who display clinically elevated social anxiety + ADHD. Second, we expected this subgroup to display elevated peer-related impairments—namely low social skills within unfamiliar peer interactions (see Cannon et al., 2020)—relative to other adolescents in the sample (e.g., ADHD only, social anxiety only, neither ADHD nor social anxiety). Further, as a test of the sensitivity of effects observed for tests of our second hypothesis, we conducted a

secondary analysis, namely an examination of links between social anxiety + ADHD and direct survey reports of adolescents' psychosocial impairments.

Method

Participants and Procedure

Participants for this study consisted of 134 adolescents and their parents, who we recruited as part of a well-characterized study (Cannon et al., 2020; De Los Reyes et al., 2019; Makol et al., 2020). We recruited participants using two sets of advertisements targeting parents who sought to participate in (a) a social anxiety evaluation for "shy" adolescents (clinic-referred adolescents) or (b) a non-clinic study examining parent and adolescent relationships (community control adolescents). For both groups we used several inclusion criteria: (a) adolescents were required to be aged 14-to-15 years and currently living with the participating parent, (b) adolescents and parents needed to be proficient in speaking and reading English, (c) parents needed to report that the adolescent had not received cognitive behavioral therapy for at least 3 months prior to participation in the study, and (d) parents and adolescents needed to understand the consent and assent process. We chose to recruit adolescents in the 14-to-15-year age range because, when we designed the study, the most accurate estimate for the median age of onset of social anxiety disorder was 13 years (Kessler et al., 2005). Being both a narrow age range and inclusive of ages immediately following the median age of onset increased the likelihood that we could recruit an adequate number of adolescents from the geographic region of recruitment.

Both the clinic-referred and community control groups completed the same tasks and measures described below. What differentiated the groups is that, following their participation, parents of the clinic-referred group received feedback about their adolescent's

social anxiety behaviors and referrals to local providers for diagnostic testing and treatment, whereas the community control group did not receive feedback or referrals. This recruitment method results in clinic-referred and community control groups that significantly differ on levels of social anxiety and/or anxiety-related processes (e.g., fears of evaluation, safety behaviors, social skills) across adolescent and parent-reported surveys, as well as independent observers' ratings of adolescent behavior on controlled laboratory tasks (e.g., Deros et al. 2018; Glenn et al. 2019; Karp et al., 2018).

The total sample included 45 clinic-referred adolescents and 89 community control adolescents. Adolescents were 14 or 15 years old (M = 14.5, SD = 0.5), 89 (66.4%) adolescents were female, and 45 (33.6%) were male. Parents reported adolescents' racial/ethnic backgrounds as African American or Black (53%); European, White or Caucasian (34%); Hispanic, Spanish or Latino/ Latina (10%); Asian American or Asian (5%); American Indian (0.7%); and "other" (7%). These rates totaled above 100% because parents could select multiple backgrounds. Parents also reported their relationship to the adolescent, which included biological mother/father (95.5%) or other parent (e.g., adopted mother/father; stepmother/father; 4.5%). Parental marital status varied, with 50% reporting that they were married, 21% never married, 16% divorced, 8% separated, 4% living with a significant other, and 0.7% widowed. Parents reported weekly household income as the following: 26% less than $500, 22% $501 and $900, and 51% $901 and above.

To test our aims, we examined the clinic-referred and community control groups as one pooled sample. In support of this approach, prior work suggests that both groups display comparable (i.e., non-significantly different) demographic characteristics (see Deros et al. 2018; Karp et al. 2018; Keeley et al. 2018; Rausch et al. 2017). Demographic data for the

two groups are available upon request from the corresponding author.

All procedures were reviewed and approved by the Institutional Review Board of the large Mid-Atlantic university where the study took place. Parents and adolescents completed a series of measures via Qualtrics on computers located in the laboratory. Parents reported demographic information for themselves and their adolescent. The adolescents participated in the Unfamiliar Peer Paradigm described below following completion of the survey measures. Upon completion, parent-adolescent dyads received $100 ($50 to parents, $50 to adolescents), and staff members debriefed the participants regarding study procedures. Lastly, independent observers (i.e., research assistants who we masked to adolescents' clinical information and study hypotheses) completed ratings of the adolescents' social skills based on video archives of the Unfamiliar Peer Paradigm.

Survey Measures

To address our study aims, we administered a survey battery to parents and adolescents that consisted of measures of social anxiety, ADHD, and psychosocial impairments. Each of these measures were parallel such that both informants completed a slightly modified version of the same measure. By "slightly modified," we mean that we kept all item content consistent across measure versions, with minor modifications to fit the informant's perspective (e.g., "I" for self-report; "my child" for parent report). A common feature of all of the survey measures used in this study—and for that matter, measures taken from the Unfamiliar Peer Paradigm—is that their psychometric properties have been thoroughly evaluated in diverse samples of adolescents and their parents (e.g., Beale et al., 2018; De Los Reyes et al., 2019; Deros et al., 2018; Glenn et al., 2019; Keeley et al., 2018; Okuno et al., 2021; Rausch et al., 2017; Szollos et al., 2019).

Social Phobia and Anxiety Inventory for Children (SPAIC; Beidel et al., 1995)

Adolescents and parents completed the SPAIC: A 26-item measure where each item describes a social situation and the respondent reports how often the adolescent feels nervous or scared when encountering such a scenario. The measure used a 3-point Likert-scale ranging from "0" (Never) to "2" (Always). Several items have "sub-items" that prompt the respondent to rate adolescents' social anxiety with different interaction partners (i.e., "adults" vs. "boys and girls I know" vs. "boys and girls I don't know"). The scores on these sub-items were averaged to create the composite score for each item. Final total scores may range from 0–52, with higher scores indicating greater levels of social anxiety symptoms. The self-report and parent report versions of the SPAIC display convergent validity, distinguish children and adolescents on referral status, and relate to independent observers' ratings of social functioning (Beidel et al., 1995; De Los Reyes et al., 2010, 2011; Deros et al., 2018; Glenn et al., 2019). In the current study, we used the cut score of "18" established by Beidel and colleagues (1995) to detect adolescents who displayed elevated social anxiety symptoms.

Six-Item Version of the Adult ADHD Self-Report Scale (ASRS-6, Kessler et al., 2007)

Both parents and adolescents completed the ASRS-6. The ASRS is an 18-item self-report questionnaire designed to measure levels of ADHD symptomatology in the participant. Originally created to measure ADHD symptomatology among adults, recent studies find that the ASRS also displays sound psychometric properties when administered to adolescents (Adler et al., 2011; Green et al., 2019; Keeley et al., 2018; Somma et al., 2021; Sonnby et al., 2015). Responses are recorded on a 5-point scale ranging from "0" (Never) to "4" (Very Often). For the current study, we administered the first six items of

the ASRS (i.e., ASRS-6). Prior work indicates that, relative to the other items on the scale, the items on the ASRS-6 are most predictive of clinically relevant ADHD concerns (Kessler et al., 2007). In this study, we identified clinically elevated ADHD symptoms using an established cut score on the ASRS-6 (i.e., rating 4 or more symptoms in the clinical range; Kessler et al., 2007).

Work and Social Adjustment Scale for Youth (WSASY, De Los Reyes et al., 2019).

Adolescents and parents completed the WSASY to assess adolescents' psychosocial impairments. The WSASY consists of five items assessing the adolescent's behavior without mention of mental health concerns or status (e.g., "Because of the ways I think, feel or behave, my ability to do well in school is impaired."). The severity of the impairment is indicated using a 8-point scale from 0 (Not at all) to 8 (Very severely). The sum of the scores range from 0 to 40, with higher scores indicating greater impairments. Scores on the WSASY relate to multiple domains of youth, parent, and family functioning (De Los Reyes et al., 2019, 2022; Okuno et al., 2021; Szollos et al., 2019).

Unfamiliar Peer Paradigm

All adolescents participated in the Unfamiliar Peer Paradigm (Cannon et al., 2020), a series of standardized tasks designed to simulate social interactions with same-age, unfamiliar peers that often provoke anxiety among adolescents. Within these tasks, we trained undergraduate and post-baccalaureate research assistants to present as same-age, unfamiliar peer confederates, who we masked to adolescents' clinical information and study hypotheses. Participants completed these tasks in a counterbalanced order. We made available extensive details regarding peer confederate training and examples of task procedures (e.g., manuals and videotaped renditions of our tasks) on the Open Science

Framework platform (De Los Reyes, 2020). Specifically, the Unfamiliar Peer Paradigm consists of three tasks. First, the Simulated Social Interaction Test (SSIT) consists of a series of five role-playing scenes between the adolescent and a gender-matched peer confederate. The scenes portray situations that individuals might perceive as stressful. The peer confederate initiated the conversation with two standardized lines. Each scene lasted approximately one to three minutes. The SSIT is designed so that each role-play includes a different social interaction including offering/accepting assistance, giving/receiving a compliment, and reacting to inappropriate behavior. As part of the task procedures, we included one practice role-play to ensure that participants understood the task.

Second, adolescents completed the Unstructured Conversation Task (UCT). The UCT simulates an extended interaction between peers. Participants interacted with the same peer confederate from the SSIT. The interaction lasted three minutes and started with the instruction "Pretend it is your first day of class and you do not know anyone." We trained peer confederates to react neutrally to all participant comments (i.e., the UCT did not include standardized responses) and allow the participant to lead the conversation.

Third, adolescents participated in the Impromptu Speech Task (IST). The IST simulates situations in which adolescents are required to speak publicly to an audience. Participants gave a speech about their opinions on one-to-three predetermined topics including politics, public health, and legal issues. Adolescents had three minutes to prepare their speech, and research personnel instructed them to speak for 10 minutes. However, research assistants were instructed to give the adolescents the option to stop their speech after 3 minutes if they felt too anxious to continue. Adolescents delivered their speech in front of the task administrator, peer confederate from the SSIT and UCT, and a third peer confederate. The

confederates and administrator maintained neutral facial expressions and eye contact with the participant, and refrained from engaging in verbal or nonverbal interactions.

Independent Observers' Ratings of Adolescents' Social Skills

We derived our key criterion variable by measuring adolescents' behavior during the Unfamiliar Peer Paradigm. Specifically, we trained independent observers to make ratings of adolescents' social skills within the SSIT, UCT, and IST. This allowed us to avoid shared method bias across informants used to assess other key constructs (i.e., social anxiety and ADHD symptoms). The independent observers, also consisting of undergraduate and post-baccalaureate research assistants, did not participate in any of the social interaction tasks as a peer confederate. As mentioned previously, we masked independent observers to all of the adolescent participants' clinical information. For each adolescent, two independent observers viewed archived videotapes of their participation in the Unfamiliar Peer Paradigm. Independent observers made ratings of adolescents' social skills, based on observations of the SSIT (five ratings; $M = 3.74$; $SD = 0.84$), UCT (one rating; $M = 3.14$; $SD = 1.31$), and IST (one rating; $M = 3.67$; $SD = 1.00$), using an extensively validated behavioral coding scheme (e.g., Botkin et al., 2021; De Los Reyes et al., 2019; Glenn et al. 2019; Rezeppa et al., 2021). Ratings were made on a 5-point scale ranging from 1 (*Not effective at all*) to 5 (*Very effective*), where higher scores indicated greater social skills. The *ICC*'s (for average measures) testing inter-rater reliability for independent observers' ratings displayed an average *ICC*(1,2) of .81. This average *ICC* is considered within the "excellent" range, based on thresholds recommended by Cicchetti (1994). In supplementary material, we further describe coder characteristics and training.

Data Analytic Plan

Preliminary Analyses

We followed a three-step plan for addressing our aims. First, for all of our continuous measures, we calculated estimates of either internal consistency (Cronbach's α for survey measures) or inter-rater reliability (*ICC*s for independent observers' ratings). We interpreted these calculations relative to conventions for α (e.g., Nunnally & Bernstein, 1994) and *ICC*s (e.g., Cicchetti, 1994). We also computed means and standard deviations for all continuous measures, and skewness and kurtosis statistics to test the degree to which our data met assumptions for the parametric analyses we leveraged to address our study aims (i.e., skewness/kurtosis in range of ±2.0; Tabachnick & Fidell, 2001).

Classifying Groups of Adolescents on Elevations of Social Anxiety and ADHD Symptoms

To classify adolescents on levels of social anxiety and ADHD symptoms, we followed an approach used in recent work on individual differences in anxiety-related processes (e.g., Lipton et al., 2016; Szollos et al., 2019). We first classified groups of adolescents who were high versus low in social anxiety and ADHD symptoms using the cut scores described previously for adolescents' and parents' SPAIC and ASRS reports (i.e., 1 = above cut score, 0 = below cut score). Using these cut scores, we created an "OR rule" by identifying an adolescent who displayed elevated social anxiety and/or ADHD symptoms based on whether the parent or adolescent report was above the cut score. This approach allowed us to focus on adolescents for whom prior work indicates display clinically elevated levels of social anxiety and ADHD symptoms. As such, our approach produced an optimal index for individual differences in levels of social anxiety and ADHD symptoms. That is, we leveraged these data to create a single variable representing four different groups; namely, individuals who were: (a) low in both social anxiety and ADHD symptoms (i.e., Low social

anxiety/Low ADHD), (b) high in social anxiety and low in ADHD symptoms (i.e., High social anxiety/Low ADHD), (c) low in social anxiety and high in ADHD symptoms (i.e., Low social anxiety/High ADHD), and (d) high in both social anxiety and ADHD symptoms (i.e., social anxiety + ADHD). This grouping variable served as the key predictor in tests of our main hypotheses, and we report the frequencies of these groups in Table 2.

In light of the relevance of this grouping approach to addressing our study aims, we also calculated a series of one-way analyses of variance (ANOVAs) to compare the groups on mean levels of the continuous SPAIC and ASRS scores used to create the groups. These tests essentially provided a means to validate the approach we took to creating these groups. In particular, these ANOVAs addressed the question of whether the groups accurately reflected the underlying continuous data from which we created the groups. In supplementary material, we provide additional justification for our approach.

Links between Social Anxiety + ADHD and Observed Social Skills

To test links between individual differences in levels of social anxiety and ADHD symptoms and independent observers' ratings of adolescent social skills, we used generalized estimating equations (GEE). The GEE framework allowed us to treat observers' ratings across the multiple social situations as a repeated-measures variable (Hanley et al., 2003). In capitalizing on the dependent data structure underlying our criterion variable, using GEE allowed us to boost our effective sample size and thus statistical power to detect effects. For GEE modeling, we used an identity link function with an unstructured correlation matrix, given the small number of dependent variables. In this GEE model, independent observers' ratings served as a nested, repeated-measures (within social context) dependent variable, and we modeled the dependent variable as a

function of two factors. We entered a within-subjects Social Context factor (coded SSIT, UCT, and IST), and a between-subjects Social Anxiety/ADHD Group factor reflecting the four groups described previously (coded Low social anxiety/Low ADHD, High social anxiety/Low ADHD, Low social anxiety/High ADHD, and social anxiety + ADHD). As in prior work (e.g., Alfano et al., 2015; De Los Reyes et al., 2013; Lipton et al., 2014), we estimated magnitudes of effects for these factors by calculating pseudo-R^2 figures. Specifically, we divided each Wald χ^2 estimate by the summation of all estimates in the GEE model. Further, we sought to examine differences in adolescents' social skills between the social anxiety + ADHD group and other groups. Thus, in the presence of significant between-subjects effects, we conducted follow-up univariate contrasts for differences in adolescent social skills for social anxiety + ADHD vs.: (a) Low social anxiety/Low ADHD, (b) High social anxiety/Low ADHD, and (c) Low social anxiety/High ADHD.

Links between Social Anxiety + ADHD and Survey Reports of Psychosocial Impairments

As a sensitivity analysis, we tested links between individual differences in levels of social anxiety and ADHD symptoms and survey measures of psychosocial impairments, by constructing another GEE model. For this model, we used an identity link function with an unstructured correlation matrix, again given the small number of dependent variables. We modeled informants' WSASY reports as a nested, repeated-measures (i.e., within adolescent-parent dyad) dependent variable. We modeled the dependent variable as a function of two factors. We entered a within-subjects Informant factor (coded parent, then adolescent), and the between-subjects Social Anxiety/ADHD Group factor described previously. We estimated magnitudes of effects using the pseudo-R^2 procedure described previously, and in the presence of significant between-subjects effects, we conducted the

follow-up univariate contrasts described previously for our tests of adolescents' social skills, except this time our focus was on differences in levels of psychosocial impairments.

Addressing Possible Gender Effects in our GEE Models

In recent work (Becker at al., 2019), researchers observed decreased peer functioning for social anxiety + ADHD, but specifically for girls. Thus, we considered accounting for possible gender effects in the two GEE models described previously. As an initial step, we first tested whether we observed gender differences in our criterion variables. These analyses would allow us to determine whether it would be necessary to demonstrate that our key predictors' relations to our criterion variables were robust to accounting for gender. However, independent samples *t* tests revealed non-significant gender effects for all independent observers' social skills ratings (*p*s ranging from .09-.60), as well as for adolescent ($p = .99$) and parent ($p = .28$) WSASY reports. Because gender did not explain significant variance in our criterion variables, we did not control for it in our GEE models.

Results

Preliminary Analyses

We report in Table 1 means, standard deviations, and internal consistency estimates for all survey measures. All survey measures displayed acceptable levels of internal consistency. Further, all survey and behavioral measures displayed acceptable levels of skewness and kurtosis (i.e., scores $< \pm 2.0$).

Classifying Individual Differences in Levels of Social Anxiety and ADHD

In Table 2, we report the groups reflecting our measure of individual differences in levels of social anxiety and ADHD. As expected, we observed four groups reflecting these individual differences: (a) Low social anxiety/Low ADHD, (b) High social anxiety/Low

ADHD, (c) Low social anxiety/High ADHD, and (d) social anxiety + ADHD. Importantly, these groups validly reflected the underlying continuous data from which we created them, namely the SPAIC and ASRS-6 reports provided by adolescents and parents. Specifically, ANOVAs revealed significant omnibus effects of these groups for adolescents' SPAIC reports (F[3, 130] = 22.85; $p < .001$) and ASRS-6 reports (F[3, 130] = 19.05; $p < .001$), as well as for parents' SPAIC reports (F[3, 130] = 20.52; $p < .001$) and ASRS-6 reports (F[3, 130] = 25.09; $p < .001$). Follow-up univariate contrasts using Dunnett's $T3$ tests (i.e., to account for inequality of variances) revealed group differences in the expected directions. For instance, the social anxiety +ADHD group evidenced significantly higher adolescent and parent SPAIC scores relative to the Low social anxiety/Low ADHD and Low social anxiety/High ADHD groups, all ps < .001. Similarly, the social anxiety +ADHD group evidenced significantly higher adolescent and parent ASRS-6 scores relative to the Low social anxiety/Low ADHD and High social anxiety/Low ADHD groups, all ps < .001. Crucially, for both adolescent and parent reports, we also observed non-significant differences between the social anxiety + ADHD group and both the High social anxiety/Low ADHD group on the SPAIC scores (both $ps \geq .90$) and the Low social anxiety/High ADHD group on the ASRS-6 scores (both ps > .90). These last set of analyses indicate that the social anxiety + ADHD group did not merely reflect a group that had higher overall symptom severity relative to the two other clinically elevated groups (i.e., the social anxiety- or ADHD-specific groups). Rather, the social anxiety + ADHD group appeared to display a distinct clinical presentation regarding the presence of relatively high levels of both social anxiety and ADHD symptoms, relative to all other groups. Taken together, these analyses indicate that our grouping approach accurately reflected the

underlying continuous data used to create the groups (i.e., the SPAIC and ASRS-6 scores). Thus, these analyses support our use of this approach to address our study aims.

Links between Social Anxiety + ADHD and Observed Social Skills

GEE analysis revealed significant effects for both context (Wald $\chi^2 = 45.59$; pseudo-$R^2 = 75.43\%$; $p < .001$) and group (Wald $\chi^2 = 14.84$; pseudo-$R^2 = 24.56\%$; $p < .01$). Consistent with prior work (Glenn et al., 2019), the context effect reflected adolescents displaying significantly lower observed social skills during the UCT, relative to both the SSIT (estimated marginal means [*EMM*s] = 3.23 vs. 3.83; $p < .001$) and IST (*EMM*s = 3.23 vs. 3.76; $p < .001$). Consistent with our hypotheses, the significant group effect reflected adolescents in the social anxiety + ADHD group displaying significantly lower observed social skills, relative to adolescents in the Low social anxiety/Low ADHD (*EMM*s = 3.20 vs. 3.66; $p < .05$), High social anxiety/Low ADHD (*EMM*s = 3.20 vs. 3.57; $p < .05$), and Low social anxiety/High ADHD (*EMM*s = 3.20 vs. 3.99; $p < .001$), groups.

Links between Social Anxiety + ADHD and Reports of Psychosocial Impairments

GEE analysis revealed a non-significant informant effect (Wald $\chi^2 = 2.28$; pseudo-$R^2 = 5\%$; $p = .13$) and a significant group effect (Wald $\chi^2 = 43.41$; pseudo-$R^2 = 95\%$; $p < .001$). Consistent with our hypotheses, the significant group effect reflected adolescents in the social anxiety + ADHD group displaying significantly greater WSASY scores, relative to adolescents in the Low social anxiety/Low ADHD (*EMM*s = 12.97 vs. 5.80; $p < .001$), High social anxiety/Low ADHD (*EMM*s = 12.97 vs. 9.54; $p < .01$), and Low social anxiety/High ADHD (*EMM*s = 12.97 vs. 6.00; $p < .001$) groups.

Discussion

Main Findings

This study expands upon the literature regarding psychosocial impairments among those who experience social anxiety + ADHD. We made three findings in a mixed-clinical/community control sample of adolescents. First, we identified a group of social anxiety + ADHD adolescents who comprised roughly one-third of the sample. Second, this social anxiety + ADHD group displayed the lowest social skills when interacting with peer confederates on a controlled set of social interaction tasks (i.e., Unfamiliar Peer Paradigm), relative to all other adolescent groups (i.e., elevated on social anxiety or ADHD but not both; elevated on neither). Third, we also observed the social anxiety + ADHD group displaying significantly greater levels of impairment on direct survey reports of adolescents' psychosocial impairments, relative to all other adolescent groups. In sum, social anxiety + ADHD adolescents experienced greater peer-related impairments and psychosocial impairments generally, relative to adolescents who experienced relatively low symptoms or elevated symptoms of either social anxiety or ADHD, but not both.

Theoretical, Research, and Clinical Implications

Research is inconsistent on the links between social anxiety + ADHD and impairments. Although aspects of avoidance typified by anxiety may inhibit impulsive and aggressive behaviors associated with ADHD, anxiety presenting with ADHD might, instead, intensify these behaviors, thereby creating compounding effects on impairment (see Jarrett & Ollendick, 2008, 2012). Our study supports the latter contention. That is, the social anxiety + ADHD group demonstrated significantly greater adolescent- and parent-reported psychosocial impairments, and displayed greater peer-related impairments on a set of controlled laboratory interactions with peer confederates. Although our results support the theory that social anxiety + ADHD has a compound effect on peer-related impairments, we

did not collect data that speaks to the mechanisms that explain these compounding effects. That said, one set of mechanisms to consider involves an idea noted previously, that peers tend to find hyperactive and impulsive behaviors indicative of ADHD quite aversive (e.g., APA, 2013; Whalen & Henker, 1992). Adolescents who display these behaviors may learn through peer interactions that how they behave leads to poor social outcomes, the exact kinds of outcomes that socially anxious adolescents already find anxiety provoking (see Alfano & Beidel, 2011). When coupled with the avoidance behaviors that typify increased social anxiety, adolescents who experience social anxiety + ADHD may not only display maladaptive externalizing behaviors within those peer interactions they choose to approach, but also maladaptively avoid future interactions like those where they previously encountered negative outcomes. Needless to say, these speculations merit further study.

As noted by Becker et al. (2012) and Jarrett and Ollendick (2008), one potential reason for the mixed findings in the literature regarding social anxiety + ADHD and impairment is the lack of consistency in multi-method, multi-informant methodology across studies. This study supports the notion that research investigating social impairment in adolescents with social anxiety + ADHD should pay careful attention to assessing developmentally appropriate domains of impairment using multiple measures and modalities. Impairments such as those displayed within peer interactions might manifest differently across development. Thus, when addressing aims relevant to social anxiety + ADHD in a sample of youth, it is important to leverage developmentally appropriate measures that sensitively capture impairment domains relevant to all youth in the sample (Alfano & Beidel, 2011).

Relatedly, our use of the Unfamiliar Peer Paradigm to index developmentally sensitive areas of impairment speaks to the need to not only use such approaches to *characterize*

impairments within clinical assessments, but perhaps also to track response to intervention. Indeed, a key rationale for development of the Unfamiliar Peer Paradigm stemmed from the need to understand how adolescents react to clinically relevant social scenarios that are often difficult to simulate in traditional administrations of exposure-based therapy (see Cannon et al., 2020). In fact, the constituent tasks within the paradigm were designed to have the "look and feel" of exposures delivered in therapy, except with the added element of simulating interactions with unfamiliar, same age peers. In this respect, this study speaks to the need for professionals working with adolescents to use developmentally sensitive approaches to assessment but also to construct therapeutic activities like exposures using personnel who represent the closest possible simulation to social interaction partners that the adolescent client will naturally encounter in their social environment.

This study also supports the use of short, well-established survey reports of social anxiety and ADHD for case conceptualization as it relates to peer-related impairments. Specifically, we leveraged parent and adolescent reports on the ASRS-6 and SPAIC to not only identify adolescents who displayed social anxiety + ADHD, but also in a way that predicted actual social behaviors when interacting with peer confederates. Importantly, the tasks that comprise the Unfamiliar Peer Paradigm essentially mimic the characteristics of not only social interactions germane to adolescent functioning, but also the nature of the very exposures used in well-established social anxiety treatments (Alfano & Beidel, 2011; Cannon et al., 2020). Consequently, our findings support use of survey measures like the ASRS-6 and SPAIC to screen for peer-related impairments. Future research should test the degree to which these survey measures display utility when used to inform clinical decision-making tasks such as case conceptualization and treatment planning.

Limitations

Our findings should be interpreted in light of our study's limitations. First, the peer confederates who participated in the Unfamiliar Peer Paradigm were undergraduate and post-baccalaureate personnel trained to simulate unfamiliar, same-age peers. As in prior work using the same or similar paradigms (Anderson & Hope, 2009; Deros et al., 2018), only personnel who appeared youthful and could reasonably "stand in" as same-age, unfamiliar peers (e.g., wearing age-appropriate casual clothing, absence of facial hair for male confederates) posed as peer confederates in these studies. Nevertheless, peer confederates were a different age relative to our study participants. Second, we did not assess the participants' level of belief in the authenticity of peer confederates. However, we have indirectly addressed this issue. That is, in prior work we found that adolescents' reactions to peer confederates within this paradigm predict their reactions to an independent and well-established task where they are told explicitly that they will be interacting with same-age, unfamiliar peers; and provided with photographic stimuli to support this element of the task (i.e., Cyberball; see Karp et al., 2018). Nevertheless, we cannot be certain that adolescents' reactions to the Unfamiliar Peer Paradigm would have been identical to their reactions to interactions with same-age, unfamiliar peers in general. Third, we did not diagnose participants with social anxiety disorder or ADHD. Rather, we leveraged well-established cut scores on the SPAIC and ASRS-6 to identify clinically elevated symptoms, with these scores based on prior work indicating that they distinguish participants on the outcomes of diagnostic interviews (see Beidel et al., 1995; Kessler et al., 2007). Thus, future studies should replicate and extend our findings using diagnostic instruments.

Concluding Comments

Adolescents with elevated social anxiety often experience profound peer-related impairments, often typified by low social skills when interacting with same-age, unfamiliar peers. Peer-related impairments are not unique to social anxiety, as adolescents who experience social anxiety may also experience ADHD, and elevated ADHD symptoms increase risk for peer-related impairments. Prior studies investigating links between social anxiety +ADHD and impairments generally have yielded mixed findings. We found inspiration for our study based on the notion that these inconsistent findings might be attributable, in part, to the need to examine these links using developmentally appropriate measures that assess domains relevant to all youth in the sample. In this study, we leveraged a developmentally adapted set of social interaction tasks designed to simulate adolescents' interactions with same-age, unfamiliar peers (i.e., Unfamiliar Peer Paradigm; Cannon et al., 2020). Using these tasks, we learned that adolescents who experience social anxiety + ADHD display greater peer-related impairments relative to those who experience neither of these symptom domains or only one domain. Our findings support the notion that the combination of social anxiety and ADHD symptoms results in compounding effects on peer-related impairments. As such, these findings have important implications for research, theory, and clinical practice germane to social anxiety- and ADHD-related services. In particular, therapists working with social anxiety + ADHD adolescents should probe for peer-related impairments and factors implicated in their development and maintenance. Further, our study supports the idea that cut scores on well-established social anxiety and ADHD surveys may inform case conceptualization and treatment planning, insofar as they can serve as useful screening devices for detecting peer-related impairments.

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Table 1

Means (M), Standard Deviations (SD), and Internal Consistency Estimates (α) of Survey Measures

Variable	*M*	*SD*	*α*
Social Phobia and Anxiety Inventory for Children			
Adolescent Self-Report	17.38	10.57	.95
Parent Report about Adolescent	17.44	10.90	.95
Adult ADHD Self-Report Scale [a]			
Adolescent Self-Report, Raw	11.37	3.93	.66 [b]
Adolescent Self-Report, Clinically Elevated	2.76	1.60	—
Parent Report about Adolescent, Raw	9.88	4.80	.81
Parent Report about Adolescent, Clinically Elevated	2.31	1.80	—
Work and Social Adjustment Scale for Youth			
Adolescent Self-Report	10.07	8.07	.84
Parent Report about Adolescent	8.83	7.71	.84

Note. [a] For the Adult ADHD Self-Report Scale, we reported the raw, numerical scores used to estimate sample internal consistency (e.g., "Adolescent Self-Report, Raw"), alongside the descriptive statistics of scores used to identify adolescents who displayed clinically elevated levels of ADHD (e.g., "Adolescent Self-Report, Clinically Elevated"). With these clinically elevated scores, we followed the scoring procedure from Kessler and colleagues (2017), which involves identifying clinical elevations at the item level, and operationally defining clinically elevated ADHD symptoms using the established cut score of rating 4 or more symptoms in the clinical range (Kessler et al., 2007). [b] Historically, internal consistency estimates below .70 have raised cause for concern (e.g., Nunnally & Bernstein, 1994). However, recent work has called these interpretations into question, and instead has highlighted the need to contextualize interpretations of internal consistency, particularly with regard to scale characteristics (see Youngstrom et al., 2019). In these respects, an estimate at this level can be seen as acceptable, in that it was derived from scores taken from a brief, six-item scale, and scale length heavily impacts estimates of internal consistency. Further, several recent studies have used this same scale to classify adolescents who display clinically elevated ADHD symptoms, using the same cut score approach as used in this study (e.g., Beale et al., 2018; De Los Reyes et al., 2019; Keeley et al., 2018). Each of these prior studies support the score validity of the approach we took in this study to identify adolescents who display clinically elevated ADHD symptoms.

Table 2

Means (M) and Standard Deviations (SD) of Continuous Scores for the Social Anxiety and ADHD Groups (N = 134)

Group	**SPAIC** ***M* (*SD*)** **(Adolescent)**	**SPAIC** ***M* (*SD*)** **(Parent)**	**ASRS-6** ***M* (*SD*)** **(Adolescent)**	**ASRS-6** ***M* (*SD*)** **(Parent)**
Low Social Anxiety/Low ADHD (*n* = 30)	9.79 (5.09)	10.09 (4.40)	8.70 (2.83)	6.95 (3.01)
High Social Anxiety/Low ADHD (*n* = 34)	20.79 (9.45)	21.40 (10.85)	9.53 (2.62)	6.79 (3.22)
Low Social Anxiety/High ADHD (*n* = 20)	8.92 (4.50)	8.63 (5.41)	12.90 (3.35)	11.95 (4.64)
Social Anxiety + ADHD (*n* = 50)	23.01 (10.74)	22.69 (10.81)	13.62 (3.93)	12.90 (4.34)

Note. **SPAIC** = Social Phobia and Anxiety Inventory for Children; **ASRS-6** = Adult ADHD Self-Report Scale.

When Adolescents Experience Co-Occurring Social Anxiety and ADHD Symptoms: Links with Social Skills When Interacting with Unfamiliar Peer Confederates

ONLINE SUPPLEMENTARY MATERIAL

Supplementary Analyses and Justification of our Approach to Measuring Individual Differences in Levels of Social Anxiety and ADHD Symptoms

As with multi-informant assessments of youth mental health generally (De Los Reyes et al., 2015, 2022), parents and adolescents commonly disagree in their reports of adolescent mental health domains, notably with the same survey instruments used in the present study to identify adolescents who display clinically elevated levels of social anxiety and ADHD symptoms (Keeley et al., 2018; Rausch et al., 2017). Consistent with this larger body of work, in our sample, cross-tabulations of clinically elevated levels of symptoms for both parent and adolescent reports on the SPAIC (phi = .22, $p < .01$) and ASRS-6 (phi = .18, $p < .05$) both revealed relatively low levels of correspondence. Notably, recent work indicates that this low correspondence speaks to the strength of our approach to measuring individual differences in levels of social anxiety and ADHD symptoms. Specifically, both parents' and adolescents' survey reports each individually relate to independent observers' ratings of behaviors that adolescents display within the Unfamiliar Peer Paradigm (Cannon et al., 2020; De Los Reyes et al., 2019; Glenn et al., 2019). These findings point to each of these informants' reports reflecting valid, unique aspects of adolescent functioning (see also Deros et al., 2018). As further evidence of this, consider that in recent work, approaches that *integrate* these informants' reports predict observed behavior, over-and-above the individual reports, indicating that there is much to gain from these reports collectively as opposed to treating them individually (Makol et al., 2020). Thus, recent work supports the grouping approach we took in this study.

Additional Information about Unfamiliar Peer Confederates

Research personnel from our laboratory who served as unfamiliar peer confederates largely came from the undergraduate student population at the university at which we conducted

the study. Importantly, we addressed the aims of our study using an archival database of a study for which participant recruitment began in April 2014 and ended in February 2020. As research assistants typically serve in our laboratory for two consecutive semesters, we quickly lose contact with them once their service in the laboratory ends, and unfortunately, at the time of their work with us we failed to collect demographic information on our unfamiliar peer confederates.

That said, in recent work we collected demographic information on research personnel who served other roles in our studies, namely as untrained raters (see online supplementary material for Rezeppa et al., 2021). Our recruitment of these raters followed the same procedures as those for our unfamiliar peer confederates, namely that all of these personnel were recruited from the population of personnel from our laboratory. Importantly, characteristics of these personnel—namely their diverse racial and ethnic backgrounds—were consistent with the underlying student demographics of the university where we conducted this study.

Characteristics and Training of Independent Observers

Trained independent observers consisted of post-baccalaureate and undergraduate research assistants. We masked trained independent observers to adolescents' referral status and they did not have access to adolescents' clinical information. Further, none of the trained independent observers participated as a peer confederate in the Unfamiliar Peer Paradigm. For each adolescent, two trained independent observers viewed archived videotapes of their participation in the Unfamiliar Peer Paradigm. Over the course of the study, we trained three dyads of independent observers, and each dyad made ratings for an independent set of adolescents. The first dyad observed and rated 89 adolescents, the second observed and rated 16 adolescents, and the third observed and rated 29 adolescents. Each dyad consisted of one observer who identified as female and another who identified as male. As with our study

participants, independent observers varied considerably as to identified racial/ethnic background, with three (50%) identifying as Asian American or Asian; two (33%) identifying as Hispanic, Spanish or Latino/Latina; and two (33%) identifying as European, White or Caucasian. These rates totaled above 100% because observers could select multiple backgrounds. Each of the three sets of dyads consisted of at least one observer who identified with a racial/ethnic background other than European, White or Caucasian.

All independent observers received training on how to use the behavioral ratings of adolescent social skills. To train independent observers on the coding scheme described below, a team of eight to ten researchers (i.e., undergraduate students, post-baccalaureate research assistants, graduate students, and faculty) participated in consensus coding meetings in which team members simultaneously viewed videos of all the social interaction tasks (i.e., SSIT, UCT, IST) performed by five adolescent participants in the sample. Following each task viewing, team members independently rated the adolescent in the video on the levels of social skills they displayed during the task, using the coding scheme below (i.e., a rating for each of the five SSIT role-plays, a rating for UCT, a rating for IST). After each team member made their ratings for a task, the entire team discussed the ratings. During this discussion, the team resolved discrepancies among ratings, and came to a final consensus rating for social skills displayed by the adolescent participant performing the task. We repeated this process for each of the five participants across all seven tasks (i.e., seven social skills consensus ratings per participant).

After creating the consensus ratings for five training cases, we trained the independent observers described previously. Each trained independent observer independently viewed videos for the five training cases and made seven social skills ratings per case. After making their training ratings, we calculated intraclass correlation (ICC) statistics to assess inter-rater

reliability between each trained independent observer and the consensus ratings. We set a threshold of a mean ICC of .80 to determine whether a trained independent observer successfully passed the training stage. All trained independent observers passed our criterion ICC, and following training, these observers coded the cases in the sample to which they were assigned.

Trained Independent Observers' Ratings about Adolescent Social Skills

We used the behavioral coding scheme described in Glenn et al. (2019). For each adolescent and across each of the seven tasks, trained independent observers made macro-level ratings on a five-point scale of social skills. Social skills ratings ranged from 1 (*Not effective at all*) to 5 (*Very effective*), with greater scores indicating greater social skills. Supplementary Table 1 includes a description of the rating scheme used by trained independent observers to make social skills ratings.

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Supplementary Table 1.

Behavioral ratings used by trained independent observers to rate adolescent social skills

Rating	Definition	Behavioral Examples
5	**Very Effective**: Displays *strong* interpersonal skills throughout interaction.	Carries on conversation when expected, displays appropriate self-disclosure (e.g., interests and hobbies), uses appropriate transitioning between topics (i.e., during a conversation or speech), appears comfortable in interactions with confederate(s) (e.g., appropriate hand gestures and eye contact)
4	**Moderately Effective**: Displays *good* interpersonal skills throughout interaction.	Able to communicate with some brief periods of uncertainty or hesitancy (e.g., awkward pauses during interaction); makes an appropriate effort at social engagement but at times appears stilted, wooden, or superficial
3	**Mildly Effective**: Displays *adequate* interpersonal skills throughout interaction.	Mild awkwardness (e.g., unnatural pauses); inconsistent eye contact; irrelevant responses to questions during conversation; provides surface-level responses during interactions (e.g., short responses that could be expanded upon); inconsistent effort at social engagement and frequently appears stilted, wooden, or superficial
2	**Minimally Effective**: Displays *poor* interpersonal skills throughout interaction.	Moderate awkwardness, very little eye contact; provides infrequent responses with few words; asks very few questions during conversation; makes little effort to keep the interaction going; mumbled speech
1	**Not Effective At All**: Displays *insufficient* interpersonal skills throughout interaction.	Extremely awkward, 1-2 word responses, if at all; no eye contact; asks no questions during conversation; makes no effort to keep the interaction going; inaudible (e.g., you know they are talking but cannot hear their voice)