

Anxiety in Children With Attention-Deficit/Hyperactivity Disorder

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KEY WORDS

attention-deficit/hyperactivity disorder, child, comorbidity, anxiety disorders, internalizing disorders, quality of life, impairment

ABBREVIATIONS

ADHD—attention-deficit/hyperactivity disorder

ADHD-C—ADHD Combined presentation

ADHD-I—ADHD Inattentive presentation

ADIS-C—Anxiety Disorders Interview Schedule for Children/Parent Version IV

ASD—Autism Spectrum Disorder

DSM-IV—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*

ES—effect size

QoL—quality of life

SEIFA—Socioeconomic Indexes for Areas

Dr Sciberras coordinated the study and collected study data, conceptualized and designed the study, carried out the analyses, and drafted the initial manuscript; Ms Lycett coordinated the study and collected study data, contributed to the conception and design of the study, reviewed and revised the manuscript, and provided critical input; Drs Efron, Mensah, and Hiscock contributed to the conception and design of the study, reviewed and revised the manuscript, and provided critical input; Ms Gerner coordinated the study, collected study data, and contributed to the drafting of the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Up to 50% of children with attention-deficit/hyperactivity disorder (ADHD) meet criteria for a comorbid anxiety disorder. Despite the high prevalence of anxiety in these children, the impact of anxiety on the lives of children with ADHD has been largely overlooked.



WHAT THIS STUDY ADDS: Presence of ≥ 2 anxiety comorbidities in children with ADHD was associated with poorer child quality of life, daily functioning, and behavior. Multiple anxiety comorbidities were associated with poorer functioning for children with both ADHD-Inattentive and ADHD-Combined presentation.

abstract

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OBJECTIVES: Although anxiety is common in children with attention-deficit/hyperactivity disorder (ADHD), it is unclear how anxiety influences the lives of these children. This study examined the association between anxiety comorbidities and functioning by comparing children with ADHD and no, 1, or ≥ 2 anxiety comorbidities. Differential associations were examined by current ADHD presentation (subtype).

METHODS: Children with diagnostically confirmed ADHD ($N = 392$; 5–13 years) were recruited via 21 pediatrician practices across Victoria, Australia. Anxiety was assessed by using the Anxiety Disorders Interview Schedule for Children—IV. Functional measures included parent-reported: quality of life (QoL; Pediatric Quality of Life Inventory 4.0), behavior and peer problems (Strengths and Difficulties Questionnaire), daily functioning (Daily Parent Rating of Evening and Morning Behavior), and school attendance. Teacher-reported behavior and peer problems (Strengths and Difficulties Questionnaire) were also examined. Linear and logistic regression controlled for ADHD severity, medication use, comorbidities, and demographic factors.

RESULTS: Children with ≥ 2 anxiety comorbidities ($n = 143$; 39%) had poorer QoL (effect size: -0.8) and more difficulties with behavior (effect size: 0.4) and daily functioning (effect size: 0.3) than children without anxiety ($n = 132$; 36%). Poorer functioning was not observed for children with 1 anxiety comorbidity ($n = 95$; 26%). Two or more anxiety comorbidities were associated with poorer functioning for children with both ADHD-Inattentive and ADHD-Combined presentation.

CONCLUSIONS: Children with ADHD demonstrate poorer QoL, daily functioning and behavior when ≥ 2 anxiety comorbidities are present. Future research should examine whether treating anxiety in children with ADHD improves functional outcomes. *Pediatrics* 2014;133:801–808

At least 60% of children with attention-deficit/hyperactivity disorder (ADHD) meet criteria for ≥ 1 comorbid disorders (eg, externalizing, mood, autism spectrum [ASD], and learning disorders).¹ Although externalizing comorbidities have been widely studied in children with ADHD, anxiety has received less attention. Approximately 25% to 50% of children with ADHD suffer from at least 1 anxiety disorder, including separation, social, and generalized anxiety.^{2,3} Yet the impact of anxiety on the lives of children with ADHD remains poorly understood. If anxiety adversely affects functioning, then the management of anxiety should be prioritized in treatment.

Although previous research has suggested that children with ADHD and anxiety are less impulsive,^{4,5} studies have demonstrated that these children have more attentional^{4,6} and broader cognitive and executive functioning difficulties⁷ than those with ADHD alone. It is possible that exacerbation of executive functioning difficulties for children with ADHD and anxiety, in combination with the avoidance and negative thought patterns associated with anxiety, may have a negative impact on functioning for these children. Research examining the impact of anxiety in ADHD has largely focused on social function. Although anxiety has been shown to exacerbate social problems for children with ADHD,^{6,8–11} these findings are not always supported.^{12–14} Mixed findings may be due to methodologic limitations, including single clinical samples,⁸ broad participant age range,^{6,12} and small samples.^{6,10} Although it is suspected that anxiety in children with ADHD would be associated with poorer quality of life (QoL) and daily functioning, research has yet to examine this. Furthermore, despite children with ADHD-Combined (ADHD-C) and ADHD-Inattentive (ADHD-I) presentation having similar levels of anxiety,¹⁵ it is unknown whether the association between anxiety and function is similar for ADHD-C versus ADHD-I.

Previous research has not fully accounted for factors that may confound the relationship between anxiety and function including ADHD symptom severity, externalizing and mood disorders, and ASD, which is problematic given that these comorbidities influence functioning¹ and commonly co-occur with anxiety.^{16,17} Furthermore, studies have not accounted for the impact of having multiple anxiety disorders, a common occurrence for children with ADHD.^{18,19} It is unknown whether functioning is only comprised when more pervasive levels of anxiety are present. In the general population, the presence of multiple anxiety disorders, in particular, is associated with multiple adverse outcomes.²⁰ Although parents of children with ADHD and anxiety have increased psychiatric symptoms,^{21–23} this has not been taken into account when examining the impact of anxiety in these children.

Therefore, in a large sample of children with ADHD, we aimed to examine

1. differences in functioning (QoL, peer functioning, behavior, daily functioning, school attendance) between children without anxiety and those with 1 anxiety comorbidity and ≥ 2 anxiety comorbidities; and
2. whether anxiety is associated with poorer functioning in children with ADHD-C and ADHD-I.

It was hypothesized that children with ADHD and anxiety (both 1 or ≥ 2 anxiety comorbidities) would have poorer functioning across all domains compared with those without anxiety. No hypothesis was formed for the second aim given the paucity of previous research.

METHODS

Design and Setting

Participants were recruited via 21 public and private pediatric practices across Victoria, Australia, for 2 harmonized ADHD studies: (1) a randomized controlled trial of a behavioral sleep intervention²⁴ and

(2) a comparable cohort with no/mild sleep problems.²⁵ This study uses baseline data from these two studies. Ethics approval was obtained by the Royal Children's Hospital (31193; 30033) and the Victorian Department of Education and Early Childhood Development (2011_001307; 2010_000573).

Eligibility and Recruitment

Participating pediatricians ($N = 50$) mailed invitation letters to children with ADHD aged 5 to 12 years seen in the past year. An opt-out approach was used in which families contacted the research team if they did not want to hear about the study. Parents who did not opt out were telephoned to assess eligibility and interest in participating.

To be eligible, children needed to have been diagnosed with ADHD by their pediatrician and meet full *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) criteria for ADHD. DSM-IV symptom criteria was assessed by using the parent-reported 18-item ADHD Rating Scale—IV²⁶; items directly reflect DSM-IV symptom content, and the measure has excellent reliability and validity.²⁶ Parents reported on their child's unmedicated behavior. Items are rated on a 4-point scale from "never" (0) to "very often" (4). Symptoms rated "often" and "very often" are scored 1 (symptom present), and symptoms rated "never" and "sometimes" are scored 0 (symptom absent). Parents needed to endorse at least 6 of 9 symptoms as present in either symptom domain to be eligible. Study-designed questions assessed additional DSM-IV criteria including symptom duration of ≥ 6 months, age of onset before 7 years, and cross-situational impairment. Children were classified as ADHD-C if ≥ 6 symptoms were endorsed in both symptom domains and were classified as ADHD-I or ADHD hyperactive/impulsive type if ≥ 6 symptoms were only endorsed in 1 of the respective domains.

Children needed to be aged 5 to 13 years at the time of recruitment, and those in the randomized controlled trial needed to have a parent-reported moderate/severe sleep problem and meet criteria for ≥ 1 sleep disorder²⁷ to be eligible. Children in the cohort study needed to have no/mild sleep problems.

Exclusion criteria included (1) insufficient English to participate, (2) receiving specialized sleep assistance from a psychologist or sleep clinic, and (3) child having a serious medical condition (eg, cerebral palsy), intellectual disability, or suspected obstructive sleep apnea.

Eligible families were mailed an information sheet, consent form, and survey. Families were enrolled upon receipt of the completed consent form and survey. Enrolled parents were then telephoned to complete a diagnostic interview, and teachers were mailed a consent form and survey if parental consent was provided.

Measures

Anxiety was measured by using the Anxiety Disorders Interview Schedule for Children/Parent Version IV (ADIS-C), a semistructured diagnostic interview assessing DSM-IV disorders.²⁸ Separation anxiety disorder, social phobia, generalized anxiety disorder, panic disorder, posttraumatic stress disorder, and obsessive-compulsive disorder were assessed. To screen positive for an anxiety disorder, children needed to meet symptom criteria and be experiencing significant impairment (rating of ≥ 4 of 8). Interviewers held a minimum fourth-year degree in psychology, were extensively trained, and were blind to previous anxiety diagnosis. Cross-coding indicated good reliability for obsessive-compulsive disorder ($k = 0.69$; $P < .001$) and excellent reliability for other categories ($k = 0.83$ – 1.0 ; $P < .001$). In the parent survey, we also asked whether the child had been previously diagnosed with an anxiety disorder.

QoL was assessed by using the 23-item Pediatric Quality of Life Inventory 4.0—parent proxy report.²⁹ Items are rated on a 5-point scale from “never” (1) to “almost always” (5) based on the child’s problems over the past month. We report the 15-item psychosocial QoL score ($\alpha = 0.80$), with scores ranging from 0 to 100 (higher scores indicate better QoL).

Behavior and peer problems were measured by using the parent- and teacher-reported Strengths and Difficulties Questionnaire.³⁰ Items are rated on a 3-point scale from “not true” (0) to “certainly true” (2). Behavior and peer problems were assessed by using the 20-item total problems scale ($\alpha = 0.63$) and 5-item peer problems subscale ($\alpha = 0.71$), respectively.

Daily functioning was measured by using the Daily Parent Rating of Evening and Morning Behavior,³¹ an 11-item parent-reported measure of morning (eg, getting up and out of bed) and evening (eg, completing homework) behavior over the previous 4 weeks ($\alpha = 0.83$). Items are rated on a 4-point scale from “never” (0) to “a lot” (3), with higher scores indicating worse functioning.

Child school attendance was measured by parent-report of the number of days their child had missed or been late for school over the preceding 3 months.³²

Parent mental health was assessed by using the Depression, Anxiety and Stress Scales total score,³³ a 21-item measure of adult mental health, with higher scores indicating poorer mental health.

A priori confounders included child age and gender, ADHD medication use (yes/no), ADHD symptom severity (ADHD Rating Scale—IV, total score), mood disorder (yes/no: ADIS-C), externalizing disorder (yes/no: ADIS-C), ASD (yes/no: parent-report of a previous diagnosis), parent age, parent high school completion (yes/no), and neighborhood socioeconomic disadvantage score measured by the census-based Socioeconomic

Indexes for Areas Disadvantage Index (SEIFA) for the child’s postcode of residence (mean 1000, SD 100; higher scores reflect less disadvantage).³⁴

Analyses

Summary statistics were used to describe sample characteristics, outcome variables, and anxiety comorbidities. Children were classified into 1 of 3 groups: (1) no anxiety, (2) 1 anxiety comorbidity, or (3) ≥ 2 anxiety comorbidities. χ^2 tests and analysis of variance were used to compare sample characteristics across groups.

Linear regression was used to compare the mean difference on each continuous outcome for children with one anxiety comorbidity and children with ≥ 2 anxiety comorbidities, compared with those without anxiety (aim 1). Results are presented as effect sizes, which were calculated by standardizing outcome variables to have a mean of 0 and a SD of 1. Analyses were rerun adjusting for a priori confounding variables. Sensitivity analyses were conducted adjusting for parent mental health symptoms.

To examine whether the association between anxiety and functioning was similar for children with ADHD-C and ADHD-I, adjusted analyses were rerun stratifying by ADHD presentation (aim 2). We also conducted formal tests of interaction to determine differences in the association between anxiety and functioning by ADHD presentation. We adjusted for all variables described previously except for ADHD symptom severity given that this variable defines ADHD presentation groupings. Analyses were conducted by using Stata 13.0.

RESULTS

We distributed invitation letters to 1349 families, and of these, 522 were not assessed for eligibility: 233 were not interested, 192 could not be contacted, 9 had insufficient English to participate, and

89 were outside of the study age range. Of the 827 families assessed for eligibility, 561 were eligible. The main reasons for ineligibility included not meeting ADHD DSM-IV criteria ($n = 99$) and having an intellectual disability ($n = 53$).

70% ($n = 392$) of eligible families participated: 244 children with moderate/severe and 148 with no/mild sleep problems. There were no differences in child gender or age or SEIFA scores between participants and nonparticipants. Participants were analyzed if they had complete ADIS-C data ($n = 370$; 94%). Teacher data were available for 298 children (76%). Children with teacher data were slightly younger (mean 10.0 years vs 10.7 years); no other differences were detected.

Sample Characteristics

Thirty-six percent ($n = 132$) had no anxiety comorbidity; 26% ($n = 95$) had 1 anxiety comorbidity, and 39% ($n = 143$) had ≥ 2 anxiety comorbidities. Social phobia was the most common ($n = 177$; 48%), followed by generalized anxiety ($n = 125$; 34%), separation anxiety ($n = 119$; 32%), obsessive compulsive ($n = 31$; 8%), posttraumatic stress ($n = 22$; 6%), and panic ($n = 9$; 2%) disorders. All participants had seen their pediatrician in the past 12 months, and 85% were taking medication for ADHD. Children with multiple anxiety comorbidities were older; were more likely to have comorbidities and moderate/severe sleep problems; had more severe ADHD; were more likely to have ADHD-C; and had parents with elevated mental health symptoms (Table 1). Fifteen percent ($n = 14$) of children with 1 anxiety comorbidity and 32% ($n = 46$) with multiple anxiety comorbidities had been previously been diagnosed with an anxiety disorder.

Association Between Anxiety and Functioning

Table 2 presents the mean scores and standard deviations for outcome vari-

ables by anxiety group. In unadjusted analyses (Table 3), children with multiple anxiety comorbidities had poorer parent-reported QoL (effect size [ES]: -1.1) and more difficulties in behavior (ES: 0.9), peer functioning (ES: 0.5), and daily functioning (ES: 0.7). Differences in teacher-reported outcomes were not evident, although children with ADHD and multiple anxiety comorbidities were rated by their teachers as having more emotional problems (Strengths and Difficulties Questionnaire) in adjusted analyses (ES: 0.6). Poorer functioning was not observed for children with 1 anxiety comorbidity. On average, children with multiple anxiety comorbidities missed more school days (3.5 vs 2.1 days; $P = .02$), and tended to be late to school (3.9 vs 2.4 days; $P = .08$) more often than children without anxiety.

In adjusted analyses (Table 3), although the effect sizes attenuated, most findings

maintained statistical significance. Children with multiple anxiety comorbidities still had poorer parent-reported QoL, behavior, and daily functioning. Children with multiple anxiety comorbidities tended to have more days missed ($P = .07$) or late for school ($P = .06$).

All results maintained statistical significance when additionally adjusting for parent mental health symptoms except for daily functioning (standardized mean difference: 0.2; 95% confidence interval -0.01 to 0.4; $P = .06$).

Association Between Anxiety and Functional Status by ADHD Presentation

Multiple anxiety comorbidities were associated with poorer QoL (ES: -0.9) and behavior (ES: 0.4) for children with ADHD-C, and poorer QoL (ES: -0.8), behavior (ES: 0.9), and daily functioning (ES: 0.7) for children with ADHD-I, in

TABLE 1 Sample Characteristics by Anxiety Comorbidity Group

	Anxiety Comorbidity Group			P
	0 ($n = 132$)	1 ($n = 95$)	≥ 2 ($n = 143$)	
Child				
Male, %	83.3	89.5	85.3	.42
Age, y, mean (SD)	9.9 (1.8)	10.3 (2.0)	10.4 (1.8)	.03*
Medication for ADHD, %	85.4	87.2	84.4	.83
Ritalin/Ritalin LA	47.0	52.6	39.2	.11
Concerta	31.8	34.7	37.8	.59
Strattera	4.6	4.2	7.0	.56
Externalizing disorder, ^a %	50.4	56.4	73.4	<.001*
Mood disorder, ^b %	9.2	11.7	28.7	<.001*
ASD diagnosis, ^c %	15.2	24.2	32.2	.004*
Parent-reported ADHD symptoms, mean (SD)	32.5 (9.8)	33.9 (10.3)	38.6 (8.3)	<.001*
ADHD presentation, %				<.001*
Combined	53.0	64.9	73.9	
Inattentive	34.9	35.1	23.2	
Hyperactive/impulsive	12.1	0	2.8	
Moderate/ to severe sleep problem, ^d %	52.3	52.6	74.8	<.001*
Primary caregiver				
Mother, %	94.7	92.6	95.7	.69
Age, y, mean (SD)	40.4 (6.7)	40.9 (6.3)	40.3 (6.4)	.78
Completed high school, %	56.2	54.7	47.9	.35
Mental health symptoms (mean SD) ^e	27.5	29.3	40.5	<.001*
Family				
SEIFA, mean (SD)	1001.3 (68.4)	999.2 (71.5)	1004.2 (62.6)	.85

* Significant P value.

^a Externalizing disorder defined as meeting criteria for oppositional defiant disorder or conduct disorder on the ADIS-C.

^b Mood disorder defined as meeting criteria for major depressive disorder or dysthymia on the ADIS-C.

^c Parents reported whether their child had been previously diagnosed with ASD by a health professional.

^d Measured by parent report when determining eligibility for the study.

TABLE 2 Means and SDs for Child and Parent Outcomes by Anxiety Comorbidity Group

	Anxiety comorbidity group		
	0 (<i>n</i> = 132)	1 (<i>n</i> = 95)	≥2 (<i>n</i> = 143)
Parent-reported outcomes			
Psychosocial QoL ^a	58.9 (13.1)	56.8 (11.4)	43.6 (11.9)
Peer problems ^b	3.7 (2.2)	3.5 (2.1)	4.7 (2.2)
Behavior ^b	19.2 (5.7)	19.9 (5.4)	24.4 (5.1)
Daily functioning ^b	19.0 (6.3)	19.7 (6.1)	23.1 (5.6)
Teacher-reported outcomes			
Behavior ^b	16.2 (6.8)	14.9 (6.6)	17.6 (7.9)
Peer problems ^b	3.1 (2.2)	3.0 (2.3)	3.5 (2.5)

^a Lower scores indicate poorer functioning.

^b Higher scores indicate poorer functioning.

adjusted analyses (Table 4). The significance of the effects for child school attendance were not maintained in subgroup analyses. Although the association between anxiety and behavior and daily functioning appeared to be stronger for children with ADHD-I, there was not statistically significant evidence of a differential association for either outcome (behavior: $P = .10$; daily functioning: $P = .22$, tests of interaction).

DISCUSSION

This study examined the association between anxiety and functioning in children with ADHD. Anxiety was common, and multiple anxiety comorbidities were associated with poorer QoL and daily functioning, as well as more problematic behavior. There was lim-

ited evidence that anxiety exacerbated social difficulties. Multiple anxiety disorders were associated with poorer functioning for children with both ADHD-C and ADHD-I presentation.

The study strengths include the large sample, thorough assessment of ADHD and comorbidities, multi-informant data collection, and adjustment for variables that may have confounded the relationship between anxiety and function. To our knowledge, this is the first study to examine (1) how multiple anxiety comorbidities are associated with functioning in children with ADHD and (2) how anxiety affects the broader functioning (ie, QoL) of children with ADHD.

Anxiety was common in children with ADHD; 26% had 1 anxiety disorder, and 39% had ≥2 anxiety disorders. This

appears higher than previous studies⁵ but is likely due to the inclusion of children with ASD. We argue that the inclusion of children with ASD reflects real-life clinical practice, especially in light of the fifth edition of the DSM, published in 2013, which permits the simultaneous diagnosis of these disorders.³⁵ Multiple pathways may account for the overlap between ADHD and anxiety and have been outlined previously,^{3,22} including (1) anxiety developing secondary to ADHD in response to chronic failure, (2) ADHD symptoms being secondary to a primary anxiety disorder, (3) ADHD and anxiety arising due to separate etiologic pathways, and (4) comorbid anxiety and ADHD representing a separate, as yet unclassified disorder.

Previous research examining the association between anxiety and function in children with ADHD has used either a dimensional¹⁰ or a categorical approach¹⁴ in which children with ADHD and ≥1 anxiety disorders are compared with children with ADHD and no anxiety. Our study examined how screening positive for multiple anxiety disorders influences functioning. Children with multiple anxiety comorbidities were vulnerable to poorer functioning; however, children with 1 anxiety comorbidity

TABLE 3 Unadjusted and Adjusted^a Standardized^b Mean Differences (SMDs) for Children With Anxiety Comorbidities Compared With Those Without Comorbid Anxiety

Outcomes	Unadjusted					Adjusted					
	0 (ref) (<i>n</i> = 132)		1 Comorbidity (<i>n</i> = 95)		≥2 Comorbidities (<i>n</i> = 143)	0 (ref) (<i>n</i> = 132)		1 Comorbidity (<i>n</i> = 95)		≥2 Comorbidities (<i>n</i> = 143)	
	SMD (95% CI)		<i>P</i>		SMD (95% CI)	<i>P</i>	SMD (95% CI)		<i>P</i>	SMD (95% CI)	<i>P</i>
Parent-reported											
Psychosocial QoL ^c	—	-0.1 (-0.4 to 0.1)	.21	-1.1 (-1.3 to -0.9)	<.001*	—	-0.1 (-0.3 to 0.2)	.56	-0.8 (-1.0 to 0.6)	<.001*	
Peer problems ^d	—	-0.1 (-0.3 to 0.2)	.64	0.5 (0.2 to 0.7)	<.001*	—	-0.1 (-0.4 to 0.1)	.31	0.2 (-0.1 to 0.4)	.13	
Daily functioning ^d	—	-0.1 (-0.1 to 0.4)	.38	0.7 (0.4 to 0.9)	<.001*	—	-0.004 (-0.2 to 0.2)	.97	0.3 (0.1 to 0.9)	.01*	
Behavior ^d	—	-0.1 (-0.1 to 0.4)	.35	0.9 (0.7 to 1.1)	<.001*	—	-0.02 (-0.2 to 0.2)	.87	0.4 (0.2 to 0.6)	<.001*	
Teacher-reported											
Behavior ^d	—	-0.2 (-0.5 to 0.1)	.26	0.2 (-0.1 to 0.1)	.17	—	0.2 (-0.5 to 0.1)	.13	0.02 (-0.3 to 0.3)	.88	
Peer problems ^d	—	-0.03 (-0.3 to 0.3)	.84	0.2 (-0.1 to 0.4)	.23	—	-0.1 (-0.4 to 0.2)	.65	0.1 (-0.2 to 0.4)	.47	

*Significant *P* value.

^a Adjusted for child age and gender, ADHD medication, ADHD symptom severity, comorbidities (mood, externalizing, ASD), parent age, parent education, SEIFA.

^b Outcomes standardized to have a mean of 0 and an SD of 1.

^c Negative values indicate poorer functioning.

^d Positive values indicate poorer functioning.

TABLE 4 Adjusted^a Standardized^b Mean Differences (SMDs) for Children by Anxiety Comorbidity Group and ADHD Presentation^c

Outcomes	Combined (<i>n</i> = 236)					Inattentive (<i>n</i> = 112)				
	0 (ref) (<i>n</i> = 70)		1 Comorbidity (<i>n</i> = 61)		≥2 Comorbidities (<i>n</i> = 105)	0 (ref) (<i>n</i> = 46)		1 Comorbidity (<i>n</i> = 33)		≥2 Comorbidities (<i>n</i> = 33)
	SMD (95% CI)		SMD (95% CI)		SMD (95% CI)	SMD (95% CI)		SMD (95% CI)		SMD (95% CI)
Parent-reported										
Psychosocial QoL ^d	—	−0.01 (−0.3 to 0.3)	.92	−0.9 (−1.2 to −0.6)	<.001*	—	−0.1 (−0.5 to 0.3)	.69	−0.8 (1.3 to −0.4)	<.001*
Peer problems ^e	—	−0.2 (−0.5 to 0.1)	.24	0.2 (−0.1 to 0.5)	.19	—	−0.07 (−0.5 to 0.4)	.76	0.3 (−0.2 to 0.8)	.19
Behavior ^e	—	−0.03 (−0.3 to 0.3)	.85	0.4 (0.2 to 0.7)	.002*	—	0.02 (−0.4 to 0.4)	.91	0.9 (0.5 to 1.3)	<.001*
Daily functioning ^e	—	−0.2 (−0.5 to 0.1)	.23	0.3 (−0.01 to 0.6)	.06	—	0.2 (−0.2 to 0.6)	.33	0.7 (0.3 to 1.1)	.001*
Teacher-reported										
Behavior (teacher report) ^e	—	−0.2 (−0.6 to 0.2)	.35	−0.04 (−0.4 to 0.4)	.83	—	−0.2 (−0.7 to 0.3)	.48	0.2 (−0.4 to 0.7)	.61
Peer problems (teacher report) ^f	—	−0.1 (−0.5 to 0.3)	.53	−0.02 (−0.4 to 0.4)	.91	—	−0.2 (−0.7 to 0.4)	.60	0.04 (−0.6 to 0.7)	.90

*Significant *P* value.^a Adjusted for child age and gender, ADHD medication, ADHD symptom severity, comorbidities (mood, externalizing, ASD), parent age, parent education, SEIFA.^b Outcomes standardized to have a mean of 0 and a SD of 1.^c Children with ADHD hyperactive/impulsive type not examined due to small sample size (*n* = 20).^d Negative values indicate poorer functioning.^e Positive values indicate poorer functioning.

were not. Thus the broader functioning of children with ADHD may only be compromised when a particularly high or pervasive level of anxiety is present. For example, greater levels of anxiety are likely associated with greater cognitive or executive functioning deficits and higher levels of avoidance and negative thought patterns, which in turn negatively influence daily functioning. It is also possible that a clinically significant anxiety phenotype is identified when children with ADHD are required to meet criteria for ≥2 anxiety disorders and that this approach avoids false positives.¹⁸ Multiple anxiety disorders were associated with poorer QoL and behavior for children with ADHD-C and poorer QoL, behavior, and daily functioning for children with ADHD-I. Although the effect sizes for the association between anxiety and behavior and daily functioning appeared stronger for children with ADHD-I compared with ADHD-C, this difference was not statistically significant. We did not find evidence of an association between peer problems and anxiety. Although our findings are consistent with multiple studies,^{13,14,36} they are also in contrast to others.^{6,9,10} It is possible that our brief measure may not have been sensitive in detecting more subtle

associations between social functioning and anxiety and that the use of observational methods or peer reports may have yielded different findings. Alternatively, our finding could be due to adjustment for externalizing, mood, and ASD comorbidities.

Consistent with previous research, children with anxiety and ADHD had parents with elevated mental health symptoms.^{22,23} The relationship between child anxiety and parental mental health is complex. Parental mental health difficulties may indicate that children with ADHD are vulnerable to environmental and familial stressors that could be manifested through anxiety.²² Parents may also experience heightened mental health symptoms due to challenges associated with their child's behavior. This relationship could also reflect shared genetic vulnerabilities²² or the child modeling parental anxious behaviors. Even when taking into account parent mental health symptoms, we found that children with multiple anxiety disorders still had poorer QoL and behavior.

This study has some limitations. It was cross-sectional, and therefore longitudinal research is needed to examine how

anxiety influences outcomes for children with ADHD overtime. Newcorn and colleagues did not find that anxiety predicted poorer outcomes for boys with ADHD (*n* = 32)³⁷; however, research is needed using larger samples. Our sample consisted largely of males and families who were participating in studies examining sleep patterns; therefore, participants may have more comorbidities than the general ADHD population. Children with multiple anxiety disorders were more likely to have moderate/severe sleep problems. Anxiety is known to be a contributing factor to sleep problems in children³⁸ and in turn, sleep problems may exacerbate daily functioning difficulties.³² We were unable to assess for ASD using a standardized measure; therefore, we relied on parent-reported diagnosis. Our findings should be replicated using child self-reports of anxiety given that anxiety was associated with poorer functioning by parent but not teacher report. However, teachers did observe children with parent-reported anxiety to have more emotional difficulties. Our teacher-report measures were brief, and the inclusion of more comprehensive measures (eg, academic functioning, self-esteem) may be more informative.

Although anxiety is common in children with ADHD, the influence of anxiety on the broader functioning of children with ADHD has been overlooked. Children with multiple anxiety comorbidities have sub-

stantially reduced QoL and poorer overall behavior and daily functioning. Systematically assessing and treating anxiety in children with ADHD has the potential to improve functioning for these children.

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REFERENCES

- Gillberg C, Gillberg IC, Rasmussen P, et al. Co-existing disorders in ADHD — implications for diagnosis and intervention. *Eur Child Adolesc Psychiatry*. 2004;13(suppl 1):180–192
- Jensen PS, Martin D, Cantwell DP. Comorbidity in ADHD: implications for research, practice, and DSM-V. *J Am Acad Child Adolesc Psychiatry*. 1997;36(8):1065–1079
- Jarrett MA, Ollendick TH. A conceptual review of the comorbidity of attention-deficit/hyperactivity disorder and anxiety: implications for future research and practice. *Clin Psychol Rev*. 2008;28(7):1266–1280
- Newcorn JH, Halperin JM, Jensen PS, et al. Symptom profiles in children with ADHD: effects of comorbidity and gender. *J Am Acad Child Adolesc Psychiatry*. 2001;40(2):137–146
- Pliszka SR. Comorbidity of attention-deficit hyperactivity disorder and overanxious disorder. *J Am Acad Child Adolesc Psychiatry*. 1992;31(2):197–203
- Bowen R, Chavira DA, Bailey K, Stein MT, Stein MB. Nature of anxiety comorbid with attention deficit hyperactivity disorder in children from a pediatric primary care setting. *Psychiatry Res*. 2008;157(1-3):201–209
- Tannock R, Ickowicz A, Schachar R. Differential effects of methylphenidate on working memory in ADHD children with and without comorbid anxiety. *J Am Acad Child Adolesc Psychiatry*. 1995;34(7):886–896
- Greene RW, Biederman J, Faraone SV, et al. Social impairment in girls with ADHD: patterns, gender comparisons, and correlates. *J Am Acad Child Adolesc Psychiatry*. 2001;40(6):704–710
- Karustis JL, Power TJ, Rescorla LA, Eiraldi RB, Gallagher PR. Anxiety and depression in children with ADHD: unique associations with academic and social functioning. *J Atten Disord*. 2000;4(3):133–149
- Mikami AY, Ransone ML, Calhoun CD. Influence of anxiety on the social functioning of children with and without ADHD. *J Atten Disord*. 2011;15(6):473–484
- Sukhodolsky DG, do Rosario-Campos MC, Scahill L, et al. Adaptive, emotional, and family functioning of children with obsessive-compulsive disorder and comorbid attention deficit hyperactivity disorder. *Am J Psychiatry*. 2005;162(6):1125–1132
- Graziano PA, Geffken GR, McNamara JP. Atypical behaviors and comorbid externalizing symptoms equally predict children with attention-deficit/hyperactivity disorder's social functioning. *Child Psychiatry Hum Dev*. 2011;42(4):377–389
- Hoza B, Mrug S, Gerdes AC, et al. What aspects of peer relationships are impaired in children with attention-deficit/hyperactivity disorder? *J Consult Clin Psychol*. 2005;73(3):411–423
- Lee SS, Falk AE, Aguirre VP. Association of comorbid anxiety with social functioning in school-age children with and without attention-deficit/hyperactivity disorder (ADHD). *Psychiatry Res*. 2012;197(1-2):90–96
- Power TJ, Costigan TE, Eiraldi RB, Leff SS. Variations in anxiety and depression as a function of ADHD subtypes defined by DSM-IV: do subtype differences exist or not? *J Abnorm Child Psychol*. 2004;32(1):27–37
- Kendall PC, Brady EU, Verduin TL. Comorbidity in childhood anxiety disorders and treatment outcome. *J Am Acad Child Adolesc Psychiatry*. 2001;40(7):787–794
- White SW, Oswald D, Ollendick TH, Scahill L. Anxiety in children and adolescents with autism spectrum disorders. *Clin Psychol Rev*. 2009;29(3):216–229
- Mennin D, Biederman J, Mick E, Faraone SV. Towards defining a meaningful anxiety phenotype for research in ADHD children. *J Atten Disord*. 2000;3(4):192–199
- Spencer T, Biederman J, Wilens T. Attention-deficit/hyperactivity disorder and comorbidity. *Pediatr Clin North Am*. 1999;46(5):915–927, vii
- Woodward LJ, Fergusson DM. Life course outcomes of young people with anxiety disorders in adolescence. *J Am Acad Child Adolesc Psychiatry*. 2001;40(9):1086–1093
- Humphreys KL, Mehta N, Lee SS. Association of parental ADHD and depression with externalizing and internalizing dimensions of child psychopathology. *J Atten Disord*. 2012;16(4):267–275
- Jensen PS, Shervette RE III, Xenakis SN, Richters J. Anxiety and depressive disorders in attention deficit disorder with hyperactivity: new findings. *Am J Psychiatry*. 1993;150(8):1203–1209
- Pfiffner LJ, McBurnett K. Family correlates of comorbid anxiety disorders in children with attention deficit/hyperactivity disorder. *J Abnorm Child Psychol*. 2006;34(5):725–735
- Sciberras E, Efron D, Gerner B, et al. Study protocol: the sleeping sound with attention-deficit/hyperactivity disorder project. *BMC Pediatr*. 2010;10:101
- Lycett K, Sciberras E, Mensah FK, Gulenc A, Hiscock H. Behavioural sleep problems in children with attention-deficit/hyperactivity disorder (ADHD): protocol for a prospective cohort study. *BMJ Open*. 2014;4(2):e004070
- DuPaul GJ, Power TJ, Anastopoulos AD, Reid R. *ADHD Rating Scale—IV (for Children and Adolescents)*. Checklists, Norms, and Clinical Interpretation; 1998
- American Academy of Sleep Medicine. *The International Classification of Sleep Disorders, Revised: Diagnostic and Coding Manual*. Westchester, NY: American Academy of Sleep Medicine; 2001
- Lyneham HJ, Rapee RM. Agreement between telephone and in-person delivery of a structured interview for anxiety disorders in children. *J Am Acad Child Adolesc Psychiatry*. 2005;44(3):274–282
- Varni JW, Limbers CA, Burwinkle TM. Parent proxy-report of their children's health-related quality of life: an analysis of 13,878 parents' reliability and validity across age subgroups using the PedsQL 4.0 Generic Core Scales. *Health Qual Life Outcomes*. 2007;5:2
- Goodman R. Psychometric properties of the strengths and difficulties questionnaire. *J Am Acad Child Adolesc Psychiatry*. 2001;40(11):1337–1345
- Kelsey DK, Sumner CR, Casat CD, et al. Once-daily atomoxetine treatment for children with attention-deficit/hyperactivity disorder, including an assessment of evening and morning behavior: a double-blind, placebo-controlled trial. *Pediatrics*. 2004;

- 114(1). Available at: www.pediatrics.org/cgi/content/full/114/1/e1
32. Sung V, Hiscock H, Sciberras E, Efron D. Sleep problems in children with attention-deficit/hyperactivity disorder: prevalence and the effect on the child and family. *Arch Pediatr Adolesc Med.* 2008;162(4):336–342
33. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther.* 1995;33(3):335–343
34. Australian Bureau of Statistics. Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia—data only. Canberra: Author; 2013. Available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2033.0.55.0012011?OpenDocument>. Accessed May 1, 2013
35. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Arlington, VA: American Psychiatric Publishing; 2013
36. Booster GD, Dupaul GJ, Eiraldi RB, Power TJ. Functional impairments in children with ADHD: unique effects of age and comorbid status. *J Atten Disord.* 2012;16(3):179–189
37. Newcorn JH, Miller SR, Ivanova I, et al. Adolescent outcome of ADHD: impact of childhood conduct and anxiety disorders. *CNS Spectr.* 2004;9(9):668–678
38. Mayes SD, Calhoun SL, Bixler EO, et al. ADHD subtypes and comorbid anxiety, depression, and oppositional-defiant disorder: differences in sleep problems. *J Pediatr Psychol.* 2009;34(3):328–337

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