Sleep Problems in Children With Attention-Deficit/Hyperactivity Disorder

Prevalence and the Effect on the Child and Family

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Objectives: To determine the prevalence of sleep problems in children with attention-deficit/hyperactivity disorder (ADHD) and their associations with child quality of life (QOL), daily functioning, and school attendance; caregiver mental health and work attendance; and family functioning.

Design: Cross-sectional survey.

Setting: Pediatric hospital outpatient clinic, private pediatricians' offices, and ADHD support groups in Victoria, Australia.

Participants: Schoolchildren with ADHD.

Main Exposure: Attention-deficit/hyperactivity disorder.

Outcome Measures: Primary measure was caregivers' reports of their children's sleep problems (none, mild, or moderate or severe). Secondary outcomes were (1) child QOL (Pediatric Quality of Life Inventory), daily functioning (Daily Parent Rating of Evening and Morning Behavior scale), and school attendance, (2) caregiver mental health (Depression Anxiety Stress Scale) and work attendance, and (3) family functioning

(Child Health Questionnaire subscales). Caregivers also reported on how their pediatrician treated their children's sleep problems.

Results: Two hundred thirty-nine of 330 (74%) eligible families completed the survey. Child sleep problems were common (mild, 28.5%; moderate or severe, 44.8%). Moderate or severe sleep problems were associated with poorer child psychosocial QOL, child daily functioning, caregiver mental health, and family functioning. After adjusting for confounders, all associations held except for family impacts. Compared with children without sleep problems, those with sleep problems were more likely to miss or be late for school, and their caregivers were more likely to be late to work. Forty-five percent of caregivers reported that their pediatricians had asked about their children's sleep and, of these, 60% reported receiving treatment advice.

Conclusions: Sleep problems in children with ADHD are common and associated with poorer child, caregiver, and family outcomes. Future research needs to determine whether management of sleep problems can reduce adverse outcomes.

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ALTHOUGH SLEEP PROBLEMS are common in children with attention-deficit/hyperactivity disorder (ADHD), their effect has received very little attention. This is a major omission. Attention-deficit/hyperactivity disorder is the most common mental health disorder in childhood, affecting up to 11% of Australians aged 6 to17 years.[1] Sleep problems are often readily treatable in the general pediatric population without medication, so—if shown to make a major contribution to morbidity—strategies for effective sleep management could potentially have important implications in reducing adverse outcomes of ADHD.

Up to 50% of parents of children with ADHD report difficulties with their chil-

dren's sleep, including difficulties initiating sleep (delayed onset sleep or bedtime resistance) and maintaining sleep (frequent nocturnal awakenings or restlessness).[2-7] Daytime sleepiness, tiredness on waking, and nightmares are also more common in children with ADHD than controls.[2-10] Objective studies using polysomnography, an actigraph, and video monitoring have shown that children with ADHD have increased sleep latency, decreased rapid eye movement sleep percentages, and increased nocturnal activity.[5,11] Other sleep problems identified in children with ADHD include sleep-disordered breathing ($\leq 25\%$)[12] and restless legs syndrome or periodic limb movement disorder ($\leq 36\%$).[3,13,14] Some studies suggest that parents of children with

ADHD overreport sleep problems, while other studies show underreporting when compared with objective studies.[4,6,14] Physiological differences in the sleep of children with and without ADHD are also unclear.[15]

Compared with children without ADHD, those with ADHD have greater difficulties in behavioral, social, and academic functioning[16,17] and poorer quality of life (QOL).[18,19] Their parents experience more parenting stress,[16,17] and their mothers are more likely to report symptoms of anxiety and depression.[16,20] Families of children with ADHD are more likely to report adversely on family activities and parental emotions than families of children without ADHD.[17,19] However, many of these same symptoms are also identical to those noted in children with sleep problems, with or without ADHD. Children with sleep problems have been shown to have more behavioral, emotional, and social problems and have more difficulties with school attendance.[21-23] Children with insufficient, fragmented, or poor-quality sleep have increased impulsivity, hyperactivity, and aggressiveness as well as problems with mood, academic performance, and neurocognitive functioning.[21-24] It has thus been postulated that children with ADHD and sleep problems could have poorer cognitive and behavioral outcomes than children with ADHD alone.[3,5,7,14]

However, no study has examined the associations between sleep problems and broader effects on the child with ADHD (eg, daily functioning and school attendance), the primary caregiver (eg, mental health and work attendance), and/or the family (eg, emotional and time impact and family activities). Clinically, each of these areas is commonly affected by ADHD and sleep problems in children, but the effect of sleep problems beyond ADHD alone is unknown. Similarly, it is unknown how effectively pediatricians identify and manage sleep problems in children with ADHD. Given that pediatric sleep problems, at least in children without ADHD, are often amenable to brief behavioral interventions,[25] quantifying their effect is an important first step toward developing a systematic approach to the identification and treatment of sleep problems in children with ADHD.

We therefore aimed to determine, in a clinical sample of schoolchildren with clinician-diagnosed ADHD, the prevalence of sleep problems and their associations with (1) child health-related QOL, daily functioning, and school attendance, (2) primary caregiver mental health and work attendance, and (3) family impacts. We hypothesized that sleep problems would be common in children with ADHD and would be associated with poorer outcomes in each of these areas. We also aimed to determine whether pediatricians routinely ask about children's sleep, and, if a sleep problem is identified, whether caregivers consider that effective treatment was offered.

METHODS

STUDY DESIGN AND SAMPLE

Primary caregivers of Victorian schoolchildren with ADHD (aged 5 to 18 years) completed a survey on their children's sleep and behavior between May and November 2006. The children's pediatricians or child psychiatrists diagnosed their ADHD. Families were systematically recruited through (1) behavioral outpatient clinics at the Royal Children's Hospital, Melbourne, Australia (the main tertiary pediatric center for the state of Victoria, population 4.6 million), (2) 8 pediatricians in private practice (selected because we knew they had an interest in children with ADHD), and (3) ADHD support groups. Families with insufficient English to complete the survey were excluded.

PROCEDURE

Eligible families, preidentified by an independent research assistant (at outpatient clinics and at ADHD support groups) or by the private pediatricians, received a written invitation to participate. Those who did not opt out were approached by telephone for informed consent. Surveys were then mailed to interested families. The Ethics in Human Research Committee at the Royal Children's Hospital approved the study.

MEASURES

The main outcome was the primary caregiver's report of the child's sleep problems during the previous 4 weeks. The primary caregiver was asked "During the past 4 weeks, has your child's sleep been a problem?" Primary caregivers selected from the following options: (1) no, it was not a problem, (2) yes, a mild problem, (3) yes, a moderate problem, or (4) yes, a severe problem. Responses were trichotomized into none vs mild vs moderate or severe sleep problems.[26] Caregivers who reported that their children had mild to severe sleep problems were asked "During the past 4 weeks, which of the following sleep pattern/s has/have been a problem for your child?" Problematic sleep patterns recorded included difficulty falling asleep, resisting going to bed, tossing or turning in bed, snoring or difficulty breathing, waking up frequently during the night, difficulty getting up in the morning, and tiredness on waking.[26]

Secondary outcomes included child, caregiver, and family measures. Child health-related QOL was measured by the Pediatric Quality of Life Inventory 4.0 (PedsQL),[27] a 23-item validated questionnaire that provides total, physical, and psychosocial health summary scores, with higher scores indicating better health-related QOL. Child daily functioning was measured by the Daily Parent Rating of Evening and Morning Behavior.[28] This is an 11-item scale in which caregivers rate the core ADHD symptoms and behavioral problems typically experienced by children with ADHD during the past 4 weeks, with higher scores indicating poorer daily functioning. The primary caregiver reported on the number of days his or her child missed or was late for school in the previous 6 months. Primary caregiver mental health was measured by the Depression Anxiety Stress Scale,[29] a 21-item measure in which adults rate symptoms experienced during the previous 4 weeks. Clinical cutoffs for each of the 3 subscales were calculated, with scores greater than 9 indicative of depression, scores greater than 7 indicative of anxiety, and scores greater than 14 indicative of stress. Also reported were the number of days the caregiver and/or his or her spouse missed or were late to work in the previous 6 months.

Family impacts were assessed using the Emotional Impact, Time Impact, and Family Activities subscales of the Child Health Questionnaire (CHQ) Parent Form 50, with higher scores indicating better functioning.[30,31] Finally, caregivers reported on pediatrician identification of sleep problems during the previous 6 months and, if applicable, advice offered and usefulness of this advice.

The child's age, sex, birth order, comorbid behavioral and psychiatric problems (learning difficulties, anxiety or depres-

Table 1. Characteristics of Children With ADHD and Their Families	
Characteristic	**No. (%)**
Child[a]	
Male sex	216 (90.4)
Age, mean (SD), range, y	11.7 (3.2), 5.4-18.6
Sleep problems	
None	64 (26.8)
Mild	68 (28.5)
Moderate or severe	107 (44.8)
Medication use	205 (85.8)
Methylphenidate	179 (74.9)
Dextroamphetamine sulfate	15 (6.3)
Atomoxetine	7 (2.9)
Clonidine	22 (9.2)
Other	13 (5.4)
Comorbidities	166 (69.5)
Learning difficulties	103 (43.1)
Oppositional defiant disorder	38 (15.9)
Depression and/or anxiety	38 (15.9)
Autism spectrum or Asperger disorder	33 (13.8)
Conduct disorder	12 (5.0)
Other	28 (11.7)
Primary Caregiver[a]	
Mother	208 (87.0)
Father	20 (8.4)
Other[b]	11 (4.6)
Age, mean (SD), range, y	43.3 (6.9), 25.6-72.7
Education status	
< High school	93 (39.1)
High school only	33 (13.9)
College/postgraduate degree	112 (47.0)
Employed	162 (68.1)
Primary Caregiver's Spouse[c]	
Age, mean (SD), range, y	45.5 (7.2), 27.1-73.4
Education status	
< High school	64 (35.0)
High school only	35 (19.1)
College/postgraduate degree	84 (55.9)
Employed	168 (70.3)
Family[a]	
Two-caregiver household	183 (76.6)
1 Child	28 (11.7)
Ordinal position of child	
First born	113 (47.3)
Second born or later	126 (52.7)

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.
[a] Sample size ranges from 238 to 239.
[b] Four were grandparents, 3 were adoptive parents, and 4 were foster parents.
[c] Spouse sample size is 183.

sion, oppositional defiant disorder, conduct disorder, and autism spectrum or Asperger disorder), and medication use were also sought. The child's ADHD symptom severity was identified as a potential confounder[18,32] and was measured by the ADHD Rating Scale,[33] an 18-item scale based on *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition)[34] criteria measuring frequency of core ADHD symptoms during the previous 4 weeks; higher scores indicate greater severity. Sociodemographic data included caregivers' age, educational and employment status, and the census-derived Socio-Economic Indexes for Areas Index of Relative Disadvantage[35] assigned to each family as a measure of social and economic welfare based on residential postal code. Higher scores indicate less disadvantage.

STATISTICAL ANALYSIS

Prevalence of no, mild, and moderate or severe sleep problems and of problem sleep patterns in the children were calculated. Differences between outcomes of interest were then calculated for children with no sleep problems vs those with mild sleep problems and those with moderate or severe sleep problems. Linear regression was used to estimate the mean differences between the referent group of no sleep problem and the mild sleep problems and moderate or severe sleep problems group for quantitative outcomes (ie, PedsQL total and physical/psychosocial summary scores, Daily Parent Rating of Evening and Morning Behavior scores, and CHQ subscale scores). Logistic regression was used to estimate the odds ratios for a mental health problem in the primary caregiver (measured by Depression Anxiety Stress Scale cutoffs) between the referent category of no sleep problem and the mild sleep problems and moderate or severe sleep problems category. Analyses were then adjusted for potential confounders[18,19] determined a priori, including children's age, sex, presence of comorbidities (yes or no), medication use (yes or no), severity of ADHD symptoms, and the primary caregiver's educational status (<high school, high school only, or >high school). Finally, a post hoc analysis was conducted to determine which comorbidity was contributing to confounding the relationship between sleep problems and the CHQ subscale scores, controlling for all other comorbidities. All analyses were conducted using Stata, version 9 (Stata Corp, College Station, Texas).

RESULTS

tj;3Of the 330 families eligible for recruitment, 251 were contactable by telephone (of whom, 197 [78%] returned their questionnaire, 45 did not, and 9 declined to participate), and 79 were not contactable but were sent a questionnaire by mail (of whom, 42 [53%] returned it). The overall response rate was 74% (239 of 321 mailed). The mean Socio-Economic Indexes for Areas Index of Disadvantage (for the general population in the state of Victoria, range, 706.95-1151.74; mean, 1020.27 [SD, 59.41]) was higher for responders than nonresponders (1043.26 [SD, 74.78] vs 1022.54 [SD, 61.23], respectively, *P*=.01). Sample characteristics are detailed in **Table 1**. In general, most children were male (90.4%) and lived in a 2-caregiver household (76.6%).

SLEEP PROBLEMS AND PATTERNS

Sleep problems were extremely common, affecting 73.3% (n=175) of all participants. The prevalence of mild sleep problems was 28.5% (n=68) and moderate or severe sleep problems was 44.8% (n=107). **Table 2** lists the prevalence of different sleep patterns in the mild vs the moderate or severe sleep problem groups. Difficulty falling asleep, resisting going to bed, and tiredness on waking were the most common sleep patterns encountered. Forty-five percent (n=108) of caregivers reported that their pediatricians had asked about their children's sleep and, of these, 65 (60%) reported receiving advice, which 44 caregivers (68% of 65, or 25% of those reporting sleep problems) rated as helpful.

ASSOCIATIONS WITH CHILD OUTCOMES

Children with mild and moderate or severe sleep problems had lower PedsQL total and psychosocial scores than those without sleep problems, and this relationship held true after adjusting for confounders ($P < .001$) (**Table 3**). Children with moderate or severe sleep problems were also more likely than those without to miss school and be late for school during the past 6 months, with the prevalence of each increasing as sleep problem severity increased (**Table 4**).

Severity of ADHD symptoms was strongly associated with both moderate or severe sleep problems and physical QOL (the physical PedsQL subscale score reduced by 0.8 points for every 1 unit increase in ADHD Rating Scale score; coefficient for ADHD Rating Scale, −0.8; 95% confidence interval [CI], −1.31 to −0.37). Because of the cross-sectional nature of the data and lack of a priori information, it was difficult to know whether severity of ADHD symptoms should be treated as a confounder for the relationship between sleep problems and their putative adverse outcomes in ADHD children or as a putative outcome in its own right; conservatively, we chose to treat it as a confounder in the main analyses. However, when we reran analyses without ADHD symptom severity as a confounder, we found that all relationships between mild and moderate or severe sleep problems and outcomes strengthened, with the relationships between moderate or severe sleep problems and family outcomes and physical PedsQL scores all achieving statistical significance ($P \leq .04$). We also found that moderate or severe sleep problems strongly predicted symptom severity (coefficient, 2.64; 95% CI, 1.08-4.21) after adjusting for all other confounders.

PRIMARY CAREGIVER MENTAL HEALTH AND WORK

Primary caregivers of children with ADHD who have moderate or severe sleep problems were more likely to have poorer mental health than those without sleep problems ($P \leq .01$) (Table 3). After adjusting for confounders, a primary caregiver of a child with moderate or severe sleep problems was 2.7 times more likely to be clinically depressed, stressed, or anxious than if the child had no sleep problem (odds ratio [OR], 2.72; 95% CI, 1.33-5.54). An education beyond high school was protective (OR, 0.38; 95% CI, 0.20-0.70). There was a higher percentage of primary caregivers of children with moderate or severe sleep problems who were late for work compared with those without sleep problems, and their spouses were more likely to be late to work (Table 4).

FAMILY FUNCTIONING

Families of children with moderate or severe sleep problems had poorer scores on all 3 measures, but this relationship was not significant after adjusting for confounders (Table 3). The presence of 1 or more comorbidities contributed to confounding for all 3 CHQ subscale scores. Of the comorbidities, conduct disorder had the greatest effect on CHQ Time Impact (coefficient, −21.87; 95% CI, −40.47 to −3.28) and CHQ Family Activities (coeffi-

Table 2. Sleep Patterns Reported in Children With ADHD and Sleep Problems During the Preceding 4 Weeks

Sleep Pattern	Sleep Problem Severity[a]		χ^2	P Value
	Mild, % (n=68)	Moderate or Severe, % (n=107)		
Difficulty falling asleep	70.6	84.1	4.56	.04
Resisting going to bed	44.1	68.2	9.95	< .001
Tiredness on waking	42.6	61.7	6.07	.01
Difficulty getting up in the morning	35.3	56.1	7.19	.01
Tossing/turning in bed	26.5	48.6	8.48	< .001
Waking up frequently during the night	25.0	36.4	2.50	.11
Snoring and/or breathing difficulty	8.8	11.2	0.26	.61

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.
[a] Caregivers who reported no sleep problems were not asked about their children's problem sleep patterns.

cient, −20.67; 95% CI, −35.65 to −5.69) subscale scores, while learning difficulties and autism spectrum or Asperger disorder had the greatest effects on CHQ Emotional Impact subscale scores (coefficient, −8.65; 95% CI, −15.27 to −2.03; and coefficient, −9.79; 95% CI, −17.49 to −1.91), respectively.

COMMENT

Sleep problems were extremely common in this sample of schoolchildren with ADHD, affecting nearly three-quarters. Moderate or severe sleep problems were strongly associated with poorer child psychosocial QOL and daily functioning, primary caregiver mental health, family functioning, and ability to participate in daily responsibilities outside the home (children being late for school and their caregivers being late to work). However, less than half of caregivers reported that their pediatricians had asked about their children's sleep problems.

Our study is the first to quantify the associations between sleep problems in children with ADHD and child, caregiver, and family functioning, taking into account potential confounders, such as ADHD severity and comorbidity. It is also the first to identify pediatrician management of sleep problems in children with ADHD. We had a good response rate and used validated measures for most outcomes.

Our study has some limitations. First, the data were cross-sectional and thus causality cannot be inferred. Second, the diagnosis of ADHD had been made by a clinician, not a standardized diagnostic interview and, as such, some children's disease may have been incorrectly diagnosed. It is possible that some children may have had a primary sleep disorder, which would result in an overestimation of the relationship between sleep problems and outcomes. Third, although validated outcome measures were used, the sleep measures were based on subjective caregiver reports. However, parental report has been shown to be a reliable indicator of problem sleep pat-

Table 3. Adjusted and Unadjusted Quality of Life Outcomes by Sleep Problem Severity[a]

Outcome	No Sleep Problem Value	Mild Sleep Problem			Moderate or Severe Sleep Problem		
		Value	Unadjusted Comparative Statistic[b] (95% CI)	Adjusted Comparative Statistic[b,c] (95% CI)	Value	Unadjusted Comparative Statistic[b] (95% CI)	Adjusted Comparative Statistic[b,c] (95% CI)
PedsQL score, mean (SD)							
Total	68.83 (13.78)	62.04 (11.59)	−6.79[d] (−11.18 to −2.39)	−4.78[d] (−8.77 to −0.78)	57.76 (10.55)	−11.06[d] (−14.76 to −7.36)	−6.26[d] (−9.57 to −2.96)
Physical summary	77.78 (19.84)	71.79 (19.59)	−6.00[d] (−12.79 to 0.79)	−3.99 (−10.91 to 2.93)	69.38 (15.67)	−8.40[d] (−13.81 to −2.99)	−4.75 (−10.42 to 0.93)
Psychosocial summary	65.84 (13.76)	58.73 (11.03)	−7.11[d] (−11.41 to −2.81)	−5.06[d] (−8.87 to −1.25)	53.89 (11.51)	−11.95[d] (−15.82 to −8.08)	−6.77[d] (−10.17 to −3.38)
Daily functioning							
DPREMB score, mean (SD)	14.98 (7.13)	18.62 (6.29)	3.63[d] (1.32 to 5.95)	2.33 (0.34 to 4.32)	22.70 (5.62)	7.72[d] (5.78 to 9.66)	4.97[d] (3.30 to 6.63)
Caregivers with mental health problems, %	34.4	52.9	2.14[d] (1.06 to 4.33)	2.01 (.94 to 4.30)	62.3	3.15[d] (1.65 to 6.02)	2.72[d] (1.33 to 5.54)
CHQ subscale score, mean (SD)							
Emotional Impact	42.97 (28.68)	37.68 (25.96)	−5.29 (−14.70 to 4.13)	−1.21[d] (−7.03 to −0.44)	32.01 (23.86)	−10.96[d] (−19.00 to −2.92)	−1.65 (−8.91 to 5.61)
Time Impact	62.70 (29.74)	51.47 (30.44)	−11.23[d] (−21.64 to −0.81)	−5.75 (−14.96 to 3.46)	47.33 (31.72)	−15.37[d] (−25.11 to −5.64)	−4.44 (−13.46 to 4.58)
Family Activities	57.10 (26.19)	51.35 (26.03)	−5.75 (−14.74 to 3.25)	−0.67 (−8.48 to 7.15)	41.98 (24.15)	−15.12[d] (−22.90 to −7.34)	−5.40 (−12.59 to 1.79)

Abbreviations: CHQ, Child Health Questionnaire; CI, confidence interval; DPREMB, Daily Parent Rating of Evening and Morning Behavior; PedsQL, Pediatric Quality of Life Inventory.
[a] Referent category for all analyses was no sleep problem.
[b] The comparative statistic is mean difference for continuous outcomes and odds ratio for dichotomous outcomes.
[c] Adjusted for child's age, sex, comorbidities (yes or no), ADHD Rating Scale total score, medication use (yes or no), and caregiver education level.
[d] Adjusted and unadjusted comparative statistic whose confidence interval does not include 1.

Table 4. School and Work Attendance in Children With ADHD and Their Caregivers by Sleep Problem Category

Participant	Sleep Problem Severity						
	None, No. (%)[a]	Mild, No. (%)[b]	χ^2	P Value	Moderate or Severe, No. (%)[c]	χ^2	P Value
Child							
Missed school	37 (57.8)	51 (75.0)	4.38	.04	84 (78.5)	7.47	.01
Late for school	22 (34.4)	24 (35.3)	0.00	.96	58 (54.2)	5.92	.02
Primary caregiver							
Missed work	12 (26.1)	10 (25.6)	0.00	.96	21 (27.6)	0.03	.85
Late for work	11 (23.9)	10 (25.6)	0.03	.85	28 (36.8)	1.80	.18
Caregiver's spouse							
Missed work	3 (6.8)	3 (6.0)	0.03	.87	10 (13.5)	1.71	.19
Late for work	2 (4.5)	9 (18.0)	4.10	.04	15 (20.3)	5.33	.02

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.
[a] Sample size ranged from 44 to 64.
[b] Sample size ranged from 39 to 68.
[c] Sample size ranged from 74 to 107.

terns in children compared with overnight infrared camera recording[36] and has shown robust associations with adverse outcomes in the general population.[26] Although there are validated measures of sleep in children, we considered these either too long[37] or not valid for our study's age range.[38] Studies have suggested that parents of children with ADHD overreport sleep problems compared with parents of children without ADHD,[4,6,14] but there are few studies directly comparing parental reports and objective measures of sleep in children with ADHD; 1 study that did (97 children with ADHD) found that parents underreported delayed sleep onset (43% of parents reported the problem; 94% was diagnosed on polysomnography) and overreported snoring and sleep-disordered breathing (63% of parents reported the problem; only 7% of cases were diagnosed on polysomnography).[4] The discrepancies between parental report and objective measures may reflect the discrepancy between parental perceptions as to what constitutes a problem for a family vs a predefined clinical definition. Fourth, responders were more likely to come from higher socioeconomic groups than nonresponders, and we excluded non–English-speaking families. Thus, our results are most likely to generalize to English-speaking

families of children with ADHD with less socioeconomic disadvantage. Finally, there was a preponderance of boys (90%) in our sample; however, this is in keeping with 1 of the largest studies of children with ADHD in which 80% of the sample were boys.[39]

The prevalence of mild and moderate or severe sleep problems was 73%, higher than the 50% reported in a recent review of sleep and ADHD.[3] It may be that inclusion of mild sleep problems raised the prevalence in our study. However, given their adverse associations, even mild sleep problems should not be ignored. The prevalence of difficulty falling asleep (71% in the mild group, and 84% in the moderate or severe group) was higher than the reported 48% in a US study[4] and also higher than the 56% reported in another review.[2] The reason for this is unclear.

Two other studies have described the relationship between ADHD and health-related QOL in children, with results similar to ours. A Canadian study of 131 children with ADHD aged 6 to 17 years found that both ADHD symptom severity and the presence of 2 or more comorbidities contributed significantly to poorer psychosocial QOL.[40] In a randomized controlled trial of atomoxetine in 297 children with ADHD, ADHD symptom severity was also found to be associated with poorer psychosocial QOL.[32] However, neither of these studies measured sleep. In our study, the presence of a sleep problem remained a predictor of poor psychosocial QOL even after accounting for ADHD symptom severity and comorbidities.

Consistent with our study, the Canadian study found that conduct disorder was associated with poorer family QOL as measured by the CHQ Time Impact subscale scores,[40] but, in contrast with our findings, learning difficulties were only weakly associated with the CHQ Emotional Impact subscale scores.

Primary caregivers of children with ADHD and sleep problems had poorer mental health than the caregivers of those without sleep problems. Although no other study has reported on the association between sleep problems and caregivers' mental health in children with ADHD, sleep problems in healthy children are a known risk factor for maternal depression and stress.[41]

In summary, sleep problems in schoolchildren with ADHD are extremely common and strongly associated with poorer QOL, daily functioning, and school attendance in the child and poorer caregiver mental health and work attendance. Implementation of a sleep intervention in children with ADHD could feasibly improve outcomes beyond treatment of ADHD alone. It is possible that such intervention could reduce the need for medication in some children. Additional research should include longitudinal analyses to determine the temporal direction of the relationship between ADHD and sleep problems and trials to determine the efficacy of routine sleep management. In the meantime, clinicians caring for children with ADHD should ask about their sleep, and if a problem is present, this should be addressed.

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