Objective: To determine the prevalence of parent-reported and self-reported sleep disturbances in a sample of school-aged children with attention-deficit/hyperactivity disorder (ADHD).

Design: Cross-sectional survey questionnaire.

Setting: A multidisciplinary ADHD evaluation clinic in a children's teaching hospital (ADHD sample) and 3 elementary schools in southern New England (control sample).

Participants: Forty-six unmedicated, school-aged children (mean age, 89.4±18.7 months; 74% male) diagnosed as having ADHD by Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, criteria who had been screened for marked symptoms of sleep-disordered breathing, and 46 normal control children (mean age, 86.5±16.9 months; 70% male).

Intervention: None.

Main Outcome Measure: Sleep habits and sleep disturbances reported by parents and children.

Results: Children with ADHD had significantly higher (more sleep-disturbed) scores on all sleep subscales of the Children's Sleep Habits Questionnaire (parent measure) than did controls; average sleep duration as reported by parents was also significantly shorter in the ADHD group. Children with ADHD also reported their own sleep to be more disturbed than controls did on the Sleep Self-report, particularly on items relating to bedtime struggles (P range, .05-.001). There was a much higher correlation between parent and child sleep report items for the children with ADHD (mean correlation, 0.55) than for the control children.

Conclusions: Sleep disturbances, particularly at bedtime, are frequently reported by both parents and children with ADHD. Children undergoing evaluation for ADHD should be routinely screened for sleep disturbances, especially symptoms of sleep-disordered breathing. The causes of sleep-onset delay in children with ADHD should be considered in designing intervention strategies for children with difficulty falling and staying asleep.


Considerable clinical and anecdotal evidence, as well as empirical data, support an association between sleep problems and the diagnosis of attention-deficit/hyperactivity disorder (ADHD) in children. However, the magnitude, exact nature, and impact on treatment outcome of sleep disorders in children with ADHD are not well understood. More objective methods of examining sleep and sleep architecture, such as polysomnographic techniques and actigraphy, have overall disclosed minimal or inconsistent differences between children with ADHD and healthy controls on such variables as sleep duration, sleep efficiency (total time asleep/total time in bed), sleep-onset latency, and percentage of rapid eye movement sleep. In contrast, previous studies that have focused on parental ratings of sleep behavior have more consistently supported an increased prevalence of sleep problems, including delayed sleep onset, poor sleep quality, and more frequent night wakings in children diagnosed as having ADHD compared with healthy control subjects, siblings, or children with other behavioral and learning problems.

This inconsistency in findings both between objective and subjective measures of sleep in children with ADHD and across studies, however, is not necessarily surprising. Sleep problems in children with ADHD are likely to be multifactorial in origin, ranging from psychostimulant-mediated sleep-onset delay in some children to bedtime resistance related to a comorbid anxiety disorder in others.
ADHD, is information about sleep obtained from the child's subjective experience becomes increasingly important to ascertain. A recent study examining the sleep habits of almost 500 school-aged children suggests that there are considerable discrepancies between parent and child reports for a variety of sleep behaviors, including sleep-onset delay and night wakings.

There are a num-

some cases, symptoms of ADHD may be exacerbated by or even solely attributable to a primary sleep disorder such as obstructive sleep apnea syndrome (OSAS). Children may also exhibit ADHD symptoms as the manifestation of chronic sleep deprivation resulting from behaviorally based sleep disorders. In addition, a fundamental ADHD-linked dysregulation in arousal functioning resulting in settling difficulties has also been proposed. Furthermore, many of the sleep variables measured by more objective methods, such as polysomnographic studies, may be viewed as reflecting fundamentally different sleep domains than do more subjective parental rating scales (sleep “architecture” vs sleep “behavior”) and, as such, might not be expected to have a high level of correspondence.

An additional factor, which has not been systematically examined in evaluating the sleep of children with ADHD, is information about sleep obtained from the children themselves. Previous reports have suggested that school-aged children may have very different perceptions than their parents about a variety of their own experiences and behaviors, including stressful events and somatic complaints. In addition, parents of older children often receive less information about or may even be unaware of some of their child’s emotional and behavioral responses to a variety of events. Thus, consideration of only the parent’s perspective on an issue may give the outside observer an incomplete picture of the child’s experience.

Sleep is clearly such an area about which the older child’s subjective experience becomes increasingly important to ascertain. A recent study examining the sleep habits of almost 500 school-aged children suggests that there are considerable discrepancies between parent and child reports for a variety of sleep behaviors, including sleep-onset delay and night wakings.

There are a num-

EXCLUSION CRITERIA

Children with a documented history in the medical record of neuromuscular or neurodegenerative disease, seizure disorder or notable head injury, chronic tic disorder or Tourette syndrome, mental retardation (IQ <70 on the Wechsler Preschool and Primary Scales of Intelligence-Revised), pervasive developmental disorder, or previously diagnosed depression, anxiety disorder, or bipolar disorders were excluded from this study. Additional exclusion criteria were intercurrent (defined as within the past month) use of medications with known or possible effects on sleep (such as sedatives, hypnotics, or antihistamines) as reported by parents, or current use of any medication for ADHD (by parent history and record review). Children who were thought to have a symptom complex highly suggestive of obstructive sleep apnea on the basis of their total scores on a brief screening questionnaire for sleep-disordered breathing were also excluded from the study. This questionnaire, which we devised and adapted from the standard clinical assessment screen for OSAS used in our pediatric sleep disorders clinic, consisted of 3 items relating to loud snoring, breathing pauses, and choking or gasping respirations during sleep. Parents were asked to rate the frequency of these behaviors as 1 (never), 2 (occasionally), or 3 (frequently), and a total score of 3 or more was considered to be suggestive of marked sleep-disordered breathing.

CONTROL POPULATION

The control population consisted of a sample of elementary school students, aged 5 through 10 years. These students represented a subset matched for sex and, as closely as possible, for age, from a sample of 493 children who had participated in a larger community survey of sleep in healthy school-aged children enrolled in kindergarten to fourth grade in 3 public elementary schools in southern New England.

Children were excluded from the control sample if their parents reported on an accompanying demographics questionnaire that the children had a diagnosed psychiatric condition, including ADHD, mental retardation, or significant learning disabilities, or used medications affecting sleep on a long-term basis. Children receiving special education services in the context of a regular classroom setting were not excluded from the study.

SLEEP INSTRUMENTS

The questionnaires used consisted of the following measures of sleep-related behavior.

1. The Children’s Sleep Habits Questionnaire (CSHQ) (available from the authors) is a retrospective, 45-item parent questionnaire that has been used in a number of studies to examine sleep behavior in young children. It appears to have adequate validity and reliability. Thirty-two items on the CSHQ are grouped into 8 subscales relating to a
number of key sleep domains: (1) bedtime resistance (6 items); (2) sleep-onset delay (1 item); (3) sleep duration (3 items); (4) sleep anxiety (4 items); (5) night wakings (3 items); (6) parasomnias (7 items); (7) sleep-disordered breathing (2 items); and (8) daytime sleepiness (8 items) (Table 1). The total score consists of only 30 items rather than 32 because 2 of the items on the bedtime resistance and sleep anxiety subscales are the same. Parents are asked to recall sleep behaviors occurring during a typical recent week. Items are rated on a 3-point scale: usually if the sleep behavior occurred 5 to 7 times per week, sometimes for 2 to 4 times per week, and rarely for 0 to 1 time per week. Scores were adjusted so that a higher score was indicative of more disturbed sleep. Parents were also asked to give a numerical value for typical bedtime, morning wake time, and sleep duration.

2. The Sleep Self-report (SSR) is an 18-item, 1-week retrospective survey designed to be administered to or self-administered by school-aged children, in the age range of 7 to 12 years (second through sixth grade). The SSR was designed to assess sleep domains similar to those of the CSHQ. Items were selected to approximate corresponding items on the CSHQ. Items are rated on a 3-point scale, ranging from usually (5-7 times per week) to sometimes (2-4 times per week) to rarely (0-1 time per week). The total SSR score consisted of 13 items pertaining directly to the same sleep domains as are incorporated in the CSHQ: difficulty going to bed and falling asleep, sleep duration, night wakings, and daytime sleepiness. Some items were reversed so that a higher score on any given item consistently indicated more disturbed sleep or more problematic sleep behavior.

PROCEDURE

ADHD Group

When the ADHD evaluation appointment was scheduled, a sleep assessment battery was mailed to the patient’s home, along with a standard ADHD assessment questionnaire packet, demographics questionnaire, and a consent form. Parents were asked to complete both sets of the questionnaires and mail them or bring them back on the evaluation day. The sleep assessment battery was designed to provide comprehensive baseline data on sleep-related behavior in children with ADHD and included the CSHQ and a sleep-disordered breathing screening questionnaire. The SSR was completed by all children who were at least 7 years old. Parents were instructed to read the SSR to their child only if necessary and were asked to record the child’s answers verbatim, even if they did not agree with the answers.

As part of the standard ADHD assessment packet, parents were asked to complete both the Child Behavior Checklist20 and a Parent Child Depression Inventory31 to screen for comorbidity, and the Conners Parent Questionnaire32 to assess for ADHD-related daytime behavior. Teachers were asked to complete a Conners Teacher Questionnaire. The team evaluators were blind to the results of the sleep assessment battery at the time of the evaluation.

Control Group

For the control group, a packet containing informed consent forms, a brief survey regarding parents’ education and occupation and any substantial medical problems and/or medication for the child, and the CSHQ were sent home with the student to be completed by the parent or guardian. A second mailing and reminder were sent to all parents within 2 weeks of the initial mailing. We were unable to obtain detailed information on nonresponders because of the school board’s request of anonymity. All students in grades 2 through 4 whose parents had signed a consent form were given the SSR as a group in their classroom. A research assistant was present during each classroom administration and assisted children with any difficulties in reading or interpreting the questionnaire.

STATISTICAL ANALYSIS

All data analyses were conducted with the SPSS program (SPSS Inc, Chicago, Ill). Demographic data were compared with t tests and χ2 tests. The α coefficients were calculated for the subscale and total sleep survey scores for both the ADHD and control groups to assess internal reliability of the scales. The t tests were used to assess between-group differences on the various sleep measures. Spearman correlations were calculated to examine correspondence between sleep CSHQ and SSR scores. Significance levels were set at P ≤ .05 for all statistical tests.

Thus, the purpose of the following study was to examine sleep behavior and sleep disturbances in a group of children diagnosed as having ADHD by means of a comprehensive sleep screening battery that included both parent and child reports. The Children’s Sleep Habits Questionnaire (CSHQ), a previously validated parent-report sleep measure, surveys parents about a wide variety of children’s sleep behaviors and problems.29 A corresponding self-report sleep measure, the Sleep Self-report (SSR), was developed to assess many of the same sleep issues from the child’s perspective. The sleep of children meeting the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition,23 diagnostic criteria for ADHD was compared with that of a healthy control group matched for age, sex, and socioeconomic status.
A secondary aim of the study was to eliminate several possible confounding variables that have been shown in previous studies to potentially affect the sleep of children with ADHD. On the basis of a number of studies that have reported a significant impact of psychostimulants on sleep onset in ADHD,2,13 only children undergoing initial evaluation for ADHD and thus who were not being treated with psychostimulants or other medication were included in the study. Second, because of the well-documented association between sleep-disordered breathing and hyperactivity, inattention, and impulsivity,14,20,27 we screened the ADHD sample for symptoms of sleep-disordered breathing and subsequently excluded all children with a symptom complex suggestive of obstructive sleep apnea.

<table>
<thead>
<tr>
<th>Item</th>
<th>ADHD Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night wakings</td>
<td>.75</td>
<td>.54</td>
</tr>
<tr>
<td>Parasomnias</td>
<td>.61</td>
<td>.36</td>
</tr>
<tr>
<td>Sleep-disordered breathing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child snores loudly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child seems to stop breathing during sleep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>.47</td>
<td>.65</td>
</tr>
<tr>
<td>Child wakes up by himself/herself</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child wakes up in regular mood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult or siblings wake up child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child has difficulty getting out of bed in morning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child takes a long time to become alert in morning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child seems tired</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child has appeared sleepy or fallen asleep watching television</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child has appeared sleepy or fallen asleep riding in car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>.75</td>
<td>.68</td>
</tr>
</tbody>
</table>

* ADHD indicates attention-deficit/hyperactivity disorder.
† These subscale items appear in both bedtime resistance and sleep anxiety subscales. To avoid assigning additional weight to these items, they were included only once in the total score, which thus consists of 30 rather than 32 items.

RESULTS

SAMPLE

A total of 57 subjects in the age range of 5 through 10 years met the diagnostic criteria for the hyperactive/impulsive, inattentive, or combined subtypes of ADHD as well as the exclusion criteria for the study. Eleven (19%) of these children received a total score above a predetermined cutoff score on the sleep-disordered breathing screen and were subsequently excluded because of the confound of possible OSAS, leaving a final study group of 46. Three (7%) of the 46 patients with ADHD received a comorbid diagnosis of oppositional defiant disorder, 1 (2%) received a comorbid diagnosis of conduct disorder, and 5 subjects (11%) were given a comorbid diagnosis of learning disability. None of the patients with ADHD were thought to have symptoms on the screening questionnaires or elicited during the clinical interview that were suggestive of comorbid diagnosis of depression or anxiety disorders. The mean age of the ADHD group was 89.4±18.7 months; 34 (74%) were male. The group's mean score for Hollingshead socioeconomic status was 36.2±13.8 (class III).

CONTROL GROUP

The mean age of the 46 control group children was 86.5±16.9 months; 32 (70%) were male. The mean socioeconomic status score of the controls was 35.3±6.3 (class III). The χ² and t tests showed no significant differences between the ADHD and control groups for age, sex, and socioeconomic status.

PARENTAL RATINGS OF SLEEP

Comparisons of the 8 CSHQ subscale scores for the ADHD and control groups, and total score for both groups are shown in Table 2. The ADHD group had a significantly higher score on every subscale except for sleep-disordered breathing than did the control group. The t tests were also performed to examine significant differences between the ADHD and control groups for several additional sleep variables on the CSHQ: average bedtime, morning wake time, and sleep duration (numerical value of “usual amount of sleep that child gets”) (Table 2). Average sleep duration, reported by parents, was significantly shorter in the ADHD group than in the control group.

CHILD RATINGS OF SLEEP

Thirty-eight of the 46 children with ADHD were 7 years old or older and completed the SSR; 24 of the control chil-
children had parental consent and also completed the SSR. There was no significant age difference between the children in the ADHD and control groups who completed the self-reports. Comparisons of items on the SSR between the groups and α coefficients for the total SSR score for both groups are shown in Table 3. Because the SSR has significantly fewer items than the CSHQ, subscales were not developed. We instead compared the scores on the 14 individual items across the 2 groups. The SSR items on which the ADHD group had a significantly higher score than controls (ie, more problematic or more disturbed sleep) largely involved difficulty and/or struggle at bedtime.

To assess the agreement between parents’ and children’s ratings of sleep disturbance, we also calculated Spearman correlations between the 10 corresponding items on the SSR and the CSHQ for both the ADHD group and the control group. Statistically significant correlations (P ≤ .05) for the ADHD group ranged from a low of 0.33 and 0.38 (afraid of the dark and fights or struggles at bedtime, respectively) to 0.63 (falls asleep in 20-30 minutes) and 1.00 (pain awakens at night). The mean Spearman correlation for the significant items was 0.55, and 80% (8/10) of the items had a correlation coefficient of 0.30 or more. In contrast, none of the Spearman correlations for the 10 corresponding SSR and CSHQ items for the control group were significant at P ≤ .05.

The results of this study, which controls for a number of important possible confounders found in previous examinations of ADHD and sleep, support the results of a number of other studies that have found an increased overall prevalence of parent-reported sleep disturbances in children with ADHD compared with healthy control subjects. On a standardized parent sleep questionnaire, children with ADHD both had significantly more problems with sleep onset and were more likely to be perceived as receiving an inadequate amount of nighttime sleep than control children, indicated by the highly significant differences in corresponding subscale scores on the CSHQ. The average number of hours of sleep reported by parents on the CSHQ was also significantly lower in the ADHD group than in the control group. Because the average bedtime and morning wake times did not significantly differ between groups, this difference in sleep duration is presumably at least partially accounted for by a prolonged sleep-onset latency.

Although parents of children with ADHD also reported overall increased bedtime resistance on the CSHQ compared with controls, our results suggest that, although parents of children with ADHD seemed to be aware of their child’s difficulties in falling asleep, this did not automatically lead them to perceive increased behavioral refusal or resistance to bedtime in their children. Although previous authors have emphasized the frequent association between bedtime struggles and delayed sleep onset in the context of sleep disorders in young children, such as delayed sleep phase syndrome, it appears that parents can and do differentiate between school-aged children’s “unwillingness” (bedtime refusal) vs “inability” (sleep-onset delay) to fall asleep.
This distinction may be particularly important in evaluating possible causative factors related to parental descriptions of “difficulty going to sleep” in their children with ADHD. Bedtime resistance associated with a limit-setting sleep disorder, for example, may be more likely to occur in a child with ADHD who has a comorbid oppositional defiant disorder. Alternatively, delayed sleep onset without bedtime refusal could be related to psychostimulant medication effects. Because only a small number of subjects with ADHD in our study met the criteria for any given comorbid diagnosis, we were unable to independently assess the effect of a comorbid condition, such as oppositional defiant disorder, on the sleep of the children in our sample. In any event, it is likely that the cause of bedtime resistance and sleep-onset latency in children with ADHD is multifactorial, and that all contextual variables should be considered in evaluating an individual child's sleep-onset disturbance.

In terms of self-report items relating to difficulties at bedtime and/or sleep onset (items 1-5), children with ADHD perceived themselves overall as having significantly more problems than controls on 3 of the 5 items. The SSR item relating to delayed sleep onset (item 4), however, was not different between the groups. It may be that children in the age range surveyed, although clearly aware of having problems at bedtime that may require parental intervention or lead to conflict with parents, are not developmentally capable of recognizing the underlying reasons for the struggle and distinguishing between inability and unwillingness to fall asleep. The other domain in which children with ADHD seemed more likely to endorse problems potentially related to anxiety around sleep (items 5 and 7). Most of the previous studies of sleep in children with ADHD have not specifically examined sleep-related anxiety, although at least 1 study reported an increased use of nightlights in children with ADHD. Given the high level of comorbid anxiety disorders reported in children with ADHD, our finding of increased symptoms of anxiety at bedtime may have reflected the fact that some of the children in the clinical group had an undiagnosed anxiety disorder. Alternatively, the increased fear of the dark reported by children with ADHD possibly represents their attempt to explain or rationalize their perception of sleep onset as problematic. At least, our results indicate that children with ADHD clearly view the period around sleep onset as one that frequently engenders anxiety and that is often difficult and unpleasant.

Parent-reported problematic night wakings also appeared to be more common in children with ADHD than in control children. Because the argument could be made that parents of children in the age range of the sample might underreport night wakings, as supported by the very low correlation between parent-reported and self-reported night waking problems in the control children, it becomes particularly important to examine the items related to night wakings as reported by the children themselves (SSR items 9-11). Children with ADHD were not significantly more likely than children without ADHD to endorse SSR items relating to sleep disturbances during the night and, in fact, on some items (nightmares and night pain) were much less likely than controls to report problems, suggesting that these children do not perceive their sleep, once it occurs, to be significantly disturbed.

The contrast between the overall very low level of correlation between parent and child reports for the controls and the higher correlations for the ADHD parent-child dyads on the CSHQ and SSR deserves some additional comment. Although parents of children with ADHD were specifically instructed to either allow the child to complete the form themselves (if developmentally appropriate) or record all responses verbatim if it was necessary to read the survey to the child, there was more opportunity for the parents in the ADHD group to bias the sleep self-report results. Alternatively, it is possible that parents of children with ADHD are more attuned to their children’s behavior, including sleep, than parents of healthy children and, thus, may be relatively more accurate reporters of their children's sleep disturbances.

Previous studies have established a link between symptoms of sleep-disordered breathing and behaviors consistent with ADHD, such as motoric hyperactivity, inattention, and difficulty focusing, and have documented improvement in ADHD symptoms after treatment (adenotonsillectomy) for OSAS. One recent study has suggested that as many as 25% of cases of ADHD may be linked to symptoms of sleep-disordered breathing. The percentage of children with ADHD who “always” and “loudly” snored in that same study was also remarkably similar to the percentage of children with ADHD in our study (19%) who were excluded because of marked symptoms of sleep-disordered breathing. To our knowledge, ours is the only study of sleep in ADHD to screen for and exclude children with marked symptoms of sleep-disordered breathing from the sample to reduce the possibility that referral symptoms such as poor focusing, distractibility, and impulsivity were actually symptoms of obstructive sleep apnea. Although no constellation of clinical symptoms of OSAS has consistently been found to reliably predict polysomnographic confirmatory results, the lack of polysomnographic confirmation of OSAS is a limitation of our study, our threshold for defining marked sleep-disordered breathing was very conservative, making it unlikely that we failed to exclude children with such sleep-disordered breathing. The finding that the ADHD and control groups had similar sleep-disordered breathing subscale scores on the CSHQ also suggests that we were successful in excluding children with notable OSAS symptoms from the ADHD group.

An additional limitation of our study was that we did not formally screen in this study for symptoms of restless legs and periodic leg movement disorder, another primary sleep disorder that has been reported to result in an ADHD-like symptom complex caused by delayed sleep onset and/or sleep fragmentation. Our results did indicate that at least 1 possible symptom of periodic leg movement disorder, the SSR item (item 10) relating to nighttime pain, was actually less frequently reported by the ADHD group than by controls. This finding may make it somewhat less likely that restless legs and periodic leg movement disorder played a significant role in the genesis of ADHD symptoms in our sample.

Our study was also limited by the relatively small sample size, which makes the findings less generaliz-
able to other groups of children with ADHD. As noted above, the small sample size also did not allow us to examine either comorbid diagnostic or ADHD subtype diagnostic groups with respect to sleep. The time frame of the CSHQ (a typical week) may have led to the inclusion of transient sleep problems and inflated the prevalence of some sleep behaviors, although this should have been true for the control group as well.

In conclusion, these results underscore the importance of screening all children who have a symptom constellation suggestive of ADHD for sleep problems that may either play a causative role or exacerbate the clinical appearance of ADHD in a given child. The presence of sleep-disordered breathing symptoms should be rigorously assessed and, if warranted, further diagnostic evaluation conducted. Management strategies for ADHD should consider the presence of comorbid sleep problems and address these issues behaviorally and/or pharmacologically. Finally, further research needs to explore the impact of comorbid sleep disorders on the treatment and prognosis of ADHD in children.

Accepted for publication December 1, 1999.


Corresponding author: Judith A. Owens, MD, MPH, Division of Pediatric Ambulatory Medicine, Rhode Island Hospital, 593 Eddy St, Providence, RI 02903 (e-mail: jowens@lifespan.org).

REFERENCES