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Comparisons Among Parent Reports and Self-Reports of Sleep in ADHD and Normal School-Aged Children

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COMPARISONS AMONG PARENT REPORTS AND SELF-REPORTS OF SLEEP IN ADHD AND NORMAL SCHOOL-AGED CHILDREN

by

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ABSTRACT

COMPARISONS AMONG PARENT REPORTS AND SELF-REPORTS OF SLEEP IN ADHD AND NORMAL SCHOOL-AGED CHILDREN

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The objective of the study was to investigate whether school-aged children diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD) experience greater sleep disturbance than do normally-developing children. Participants included 33 parents and their children with ADHD (mean age = 10.7 ± 1.7 years) and 33 parents and their children without ADHD (mean age = 10.7 ± 1.6 years). Both parents and their children completed sleep questionnaires developed to assess a number of sleep variables. Based on parental report, the Total Sleep Disturbance score was significantly greater for the ADHD group than for the comparison group. Parents indicated that children with ADHD had significantly more disturbed sleep than did children without ADHD on 8 of the 10 sleep subscales of the Sleep Questionnaire for Parents. These were: Bedtime Resistance, Morning Difficulty, Parasomnias/Other Sleep Disturbance, Restless Legs Syndrome, Sleep Anxiety/Transitioning, Sleep Duration/Quality, Sleep Hygiene, and Sleep Onset. Although bedtimes and morning wake times were similar for children with ADHD and children in the comparison group, parents reported that children with ADHD experienced significantly less total time asleep. The children with ADHD reported their own sleep to be significantly more problematic than did the children in the comparison group. Similar to the parents' reports, children's reports of Total Sleep Disturbance was greater for the ADHD group than for the comparison group. Six of the 8 subscales on the Sleep Questionnaire for Children indicated more disturbed sleep for the children with ADHD:

Bedtime Resistance, Daytime Sleepiness, Morning Difficulty, Sleep Anxiety/Transitioning, Sleep Duration/Quality, and Sleep Onset. These findings suggest that sleep disturbance should be routinely assessed as part of the clinical evaluation for and treatment of ADHD.

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INTRODUCTION

Attention-Deficit Hyperactivity Disorder (ADHD) is the most common psychological problem in childhood and is one of the most common reasons why children are referred to mental health providers. The childhood incidence of ADHD is estimated to be 5% to 7% for boys and 2% to 4% for girls (Barkley, 1990). Although the diagnosis and definitions of ADHD have evolved over time to include Defective Moral Control (1902), Restlessness Syndrome (1920's), Post-Encephalitic Behavior Disorder (1920's and 1930's), Brain Injured Child (1940's), Minimal Brain Damage (1950's), Minimal Brain Dysfunction (1960's and 1970's), Hyperactive Child Syndrome or Hyperkinetic Reaction of Childhood (1960's), Attention Deficit Disorder With or Without Hyperactivity (1980), Attention Deficit Hyperactivity Disorder and Undifferentiated Attention Deficit Disorder (1987), and since 1994, Attention Deficit Hyperactivity Disorder—Three Subtypes: Predominantly Inattentive, Predominantly Hyperactive-Impulsive, and Combined Types (Barkley, 1998), throughout versions of the *Diagnostic and Statistical Manual of Mental Disorders* ([*DSM*]; American Psychiatric Association [APA], 1968, 1980, 1987, 1994, 2000), the three consistent cardinal symptoms have been inattention, impulsivity, and hyperactivity. In addition to these, parents have often described their ADHD children as having problems with sleep (Brown, Maistros, & Guilleminault, 1995).

The definitions of ADHD have varied throughout the history of this disorder as has the criteria for obtaining a diagnosis. ADHD is not a unitary construct and it is likely that the group of people diagnosed with ADHD is heterogeneous. Furthermore, there are

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three different subtypes of ADHD—Predominantly Inattentive, Predominantly Hyperactive-Impulsive, and Combined. It has not yet been in the research whether the Predominantly Inattentive type is a true subtype of ADHD and sharing a common attention deficit with the other types or whether it is a qualitatively different disorder entirely. There are several research studies that have suggested that it is unlikely that these subtypes have the same impairment in inattention. The Predominantly Inattentive Type may be more closely related to problems in focused/selective attention and slowed information processing whereas the Combined Type of ADHD may reflect problems of persistence of effort and distractibility. The research may indicate that the Predominantly Inattentive Type of ADHD should be a separate, distinct, and independent disorder from ADHD. Likewise, it is also undetermined whether the Predominantly Hyperactive-Impulsive Type is really a separate type from the Combined Type (Barkley, 1989). Variance in people diagnosed with ADHD may also stem from possibly different etiologies of ADHD. A number of etiologies have been proposed for ADHD and include neurological factors, genetic factors, environmental factors including pre-, peri-, and postnatal complications and malnutrition, diseases, trauma, or other neurologically compromising events, side effects of some medications, and psychosocial factors. (Barkley, 1998). Furthermore, variability occurs through the diagnosing of ADHD as a person must meet only six of nine syptoms to meet one of the criterion for a diagnosis of Inattentive subtype or six of nine different symptoms to meet one of the criterion for Hyperactive-Impulsive subtype of ADHD (APA, 2000).

Sleep problems are common in childhood and represent an area of concern for many parents (Day & Abmayr, 1998). Researchers agree that approximately one quarter

of all children have some type of sleep disturbance (Dahl, 1992; Mindell, 1993). Empirical research examining the prevalence of sleep disorders in children was sparse prior to 1980, although many anecdotal and clinical reports have suggested that children with ADHD have disturbed sleep (Ball & Koloian, 1995). Despite a lack of empirical validation, problematic sleep has been commonly associated with ADHD. In fact, the relationship between problematic sleep and ADHD was so widely presumed, until the revised third edition of the *DSM*, sleep restlessness was an operational criterion for the diagnosis of ADHD (APA, 1987). Prior to this edition of the *DSM*, "moves about excessively during sleep" was one of five possible behavioral markers of hyperactivity for the diagnosis of ADD With Hyperactivity (APA, 1980). The association between sleep problems and childhood ADHD, however, has been so controversial that the most recent versions of the *DSM* (*DSM-III-R*, *DSM-IV*, and *DSM-IV-TR*) have not listed sleep disturbance as a marker for, nor an associated feature of, ADHD (APA, 1987, 1994, 2000). Although there has not been any definitive resolution to this issue, previous rationale for including sleep disturbance as a criterion for the diagnosis of ADHD appears to have been based primarily on clinical observations and theoretical speculations.

Sleep and circadian rhythm disorders are observed commonly in children with severe neurological disorders, such as prematurity, chromosomal disorders, pervasive developmental disorders, neuromuscular diseases, blindness, and mental retardation (Brown et al., 1995). Although the clinical significance of such problems is unclear, problematic sleep also is frequently reported by parents of children with less severe neurobehavioral/neurodevelopmental disorders, such as ADHD and Tourette's Syndrome (Brown et al., 1995; Marcotte, Thacher, Butters, Bortz, & Carskadon, 1998). The

relationship between sleep and neurodevelopmental disorders, however, appears to have been most commonly researched in children diagnosed with ADHD (Marcotte et al., 1998).

In addition to children with ADHD, problematic sleep is common in children and adolescents who are under stress or have psychiatric disorders. Such disorders include depressive disorders, bipolar disorder, conduct disorder, and Tourette's Syndrome (Brown et al., 1995). Difficulties with sleep often resolve with behavioral techniques designed to reduce stress, develop a consistent sleep routine, improve daytime activity level, and reduce nighttime conflicts and activities. Despite these modifications, some children with psychiatric disorders continue to suffer from sleep impairment (Wilens, 1994). For instance, sleep disturbances are common in children and adolescents with ADHD (Wilens, Biederman, & Spencer, 1994). There seems little doubt that insufficient or disturbed sleep impacts daily functioning and may mimic ADHD, contribute to disruptive behaviors, or further exacerbate the severity of a pre-existing attention disorder (Brown et al., 1995; Weinberg & Emslie, 1991).

Although ADHD has become a heavily investigated topic, empirical research specifically examining sleep patterns among children with ADHD is uncommon. As a result, the prevalence and significance of problematic sleep in children with ADHD has not been determined. Moreover, existing studies have yielded contradictory findings (Ball & Koloian, 1995; Corkum, Tannock, & Moldofsky, 1998). Because sleep is influenced by environmental, genetic, medical, and biological influences, examination of sleep in children with ADHD provides a unique opportunity to explore the relative importance of biological and psychosocial factors as well as the possible underlying

etiologies and related theories proposed to explain the various subtypes and comorbid conditions (Corkum et al., 1998).

This study was intended to further investigate sleep patterns and disturbances in school-aged children diagnosed with ADHD through surveying parents of children with ADHD and parents of normally developing children. In addition, this study was among the first to elicit self-reports of children with and without ADHD. The following sections review the prevalence of sleep disorders in children, methodological issues relevant to research on sleep and ADHD, and the results of objective and subjective research. In addition, the relationship between sleep and daytime behaviors, severity of ADHD and sleep disturbance, the sleep disturbance of children with different subtypes of ADHD, the relationship among ADHD, comorbid diagnoses, and sleep disorders, the effects of stimulant medications on sleep, and the results of a meta-analysis of research on this topic are highlighted. As already noted, since one of the first references to a hyperactive child (referred to as "Fidgety Phil") by the German physician Heinrich Hoffman in 1865 (Barkley, 1998), the nature and description of ADHD has evolved. Given this, the current review periodically includes references to other historically-noted behavioral conditions in children that have closely approximated what is currently known as ADHD.

Prevalence of Sleep Disorders in Children

Little research has examined sleep habits, sleep disturbances, and consequences of disturbed sleep in normally developing school-aged children (Owens, Spirito, McGuinn, & Nobile, 2000). It is not known what the true prevalence of sleep disturbances and sleep disorders in children is because relatively few epidemiological studies have been conducted (Owens, Spirito, et al., 2000; Richman, 1987). Although there is increasing

evidence of the impact of sleep on children's health and functioning, sleep disorders in middle childhood are not adequately recognized by health care providers (Mindell, Moline, Zendell, Brown, & Fry, 1994). In fact, in a national survey conducted by Mindell and colleagues reported that pediatricians received a mean of 4.8 hours of instruction on sleep problems in children (the mode and median hours of instruction was 0 hours). Despite the limited information that pediatricians receive on sleep and sleep disorders in children, approximately 25% of their patients had some type of sleep disturbance. Moreover, respondents ranked sleep problems as the fifth leading concern of parents (Mindell et al., 1994).

Another problem in this literature is that often these studies survey children across a wide age range. One study that examined sleep disturbance in children was conducted by Salzarulo and Chevalier (1983). They interviewed families of children aged 2 to 15 who were referred for either pediatric or psychiatric consultation. They found that some sleep problems were rather common, with 32% experiencing sleep talking, 31% nightmares, 28% waking at night, 23% trouble falling asleep, 17% nocturnal enuresis, 10% bruxism, 7% sleep rocking, and 7% night terrors. In another survey of mothers seeking consultation at a university clinic for their 3- to 15-year-olds, Dollinger (1982) found that sleep talking was the most common problem (53%), followed by refusal at bedtime and restless sleep (42%), requiring a nightlight (40%), bad dreams (35%), difficulty going to sleep (26%), crying out during sleep (16%), and nightmares (11%). A third study in which children in Grades 1 to 12 were studied was conducted by Fisher and Wilson (1987). Results indicated that 24% of children had walked in their sleep at least once in their lifetime, 14% were currently sleepwalking, and 21% had done so in the past

year. Additionally, the prevalence of other sleep disturbances were: 25% for nightmares, 74% for talking in their sleep (60% occasionally, 14% often), and 18% for problematic bedwetting.

Blader, Koplewicz, Abikoff, and Foley (1997) were among the first to comprehensively examine the prevalence, co-occurrence, and correlates of sleep problems specifically among school-aged children. Following their study, Owens, Spirito, et al. (2000) surveyed a large, general community-based sample consisting of 494 elementary school-aged children and examined the prevalence of common medical and behavior sleep disturbances utilizing parent, teacher, and child self-report measures. Overall, results indicated that "problem sleepers" identified on Owens and colleagues' questionnaire subscales ranged from 3.7% to 15.1%. Thirty-seven percent of the overall sample demonstrated sleep problems in at least one domain (Owens, Spirito, et al., 2000). Bedtime resistance was the most common sleep-related complaint of parents of elementary-aged school children (Blader et al., 1997). Results of Owens, Spirito, et al. which were based on grouping related items together to form a subscale, the prevalence of "problem" bedtime resistance was 15.1%, although when examining the specific item "child resists going to bed", almost 38% of the sample indicated it occurred at least twice a week. These results were comparable to those found by Blader et al. (1997) who found a prevalence of bedtime resistance of 27% (in which "problematic sleep behaviors" were defined as those occurring three to four times a week).

Difficulties initiating and maintaining sleep are one of the most common types of sleep problems in children and adults (Richman, 1987). Based on a comprehensive review of published epidemiological research, Richman (1987) concluded that factors

that may be associated with disorders of initiating and maintaining sleep in children may include maturation, neurophysiological status, temperament, cultural, social, and family factors, and styles of parental responding. Recurrent sleep onset delays have been found to be relatively common. In fact, based on parent report, 11.3% of elementary-aged children experience sleep onset delays, with 22.6% taking up to 30 minutes to fall asleep, 54.3% taking 30 minutes to 1 hour, and 20.9% taking longer than 1 hour (Blader et al., 1997). In addition, there was a significant discrepancy between parent and child reports on individual items relating to sleep onset delays, with 4.9% of parents but 26.2% of children endorsing that they "rarely" fall asleep within 20 minutes (Owens, Spirito, et al., 2000). Problems with sleep onset correlated with increased nighttime fears, night waking, psychiatric and medical conditions, requirement of reassurance and caregiver proximity, and a history of sleep problems (Blader et al., 1997).

Blader et al. (1997) found a strong association between bedtime resistance and sleep onset difficulties. Specifically, parents reported that 34% of children who resisted going to bed have difficulty falling asleep, whereas for children with sleep onset problems, 81% displayed bedtime resistance. Bedtime resistance was associated with inconsistency in bedtime and falling asleep away from their bed. Children who both resisted going to bed and who had sleep onset delays were more likely to have fears, night waking, psychiatric and medical morbidity, nightmares, need for reassurances and caregiver proximity, complaints of fatigue, and a sleep history that included early difficulty with sleep maintenance and sleeping away from home. They were also somewhat younger which may have reflected difficulty coping with the separation (Blader et al., 1997).

Some authors contend that regular waking is uncommon in later childhood (Richman, 1987). However, Owens, Spirito, et al. (2000) reported that night wakings occurred in 6.7% of their school-aged sample based on a subscale included in their questionnaire. This is similar to results of Blader et al. (1997) who found that 6.5% of children experienced nocturnal wakings at least three nights per week. However, in response to a single questionnaire item, 27.1% of parents reported that their children had at least one night waking minimally twice a week (Owens, Spirito, et al., 2000). In another study, the authors found that by age 8, the rate of sleep disruptions had fallen to 3% (Richman, 1987). However, when children aged 10 through 13 were asked directly, 35% reported waking once a night, and 5% indicated waking several times each night (Anders, Carskadon, Dement, & Harvey, 1978). Similar to the discrepancies between parent and child report of difficulties with sleep onset, 14.6% of children endorsed problematic night wakings. This percentage was significantly greater than the 4.6% of parents who reported that their children experienced problematic night wakings. Although parental reports of getting into bed with their children is related to children's sleep problems, almost one third of parents whose children frequently wake at night get into bed with their children. Difficulty for school-aged children to fall back asleep was also found to be problematic. In fact, among the school-aged children surveyed, only 16.5% of children who woke more than twice a night fell back to sleep within 30 minutes and approximately 50% required 30 to 60 minutes to return to sleep, 27% required 1 to 2 hours, and 3.7% needed 2 to 3 hours to return to sleep (Blader et al., 1997).

There is no clear developmental trend for difficulties settling down to sleep (Richman, 1987). At different ages, different mechanisms may be operating that prevent

a child from settling to sleep. These include control issues, fearfulness in younger children, and anxiety about daily events in older children (Richman, 1987). Fears were found to be more prevalent for children with any sleep-related difficulty except for children with enuresis and sleep-walking (Blader et al., 1997). Results of an investigation conducted by Bauer (1976) found that more than one-half of 4- to 6-year-olds, two-thirds of 6- to 8- year-olds, and one-third of 10- to 12-year-olds indicated fearfulness at bedtime (Bauer, 1976). Based on a longitudinal study, 90% of New Zealand 1 1/2-year-olds were attached to comforting objects (45% with a strong attachment, 45% with a weaker attachment), although by 7 years of age, this decreased to 43% (13% with a strong attachment, 30% with a weaker attachment). Interestingly, children demonstrated a continued preference for the same sorts of objects over the years (Mahalski, 1983).

Some investigators have concluded that daytime sleepiness does not seem to occur in the prepubertal child (Anders et al., 1978). However, the prevalence of daytime fatigue was 18% in Blader and colleagues' sample of school-aged children. Similarly, Owens, Spirito, and colleagues (2000) reported the prevalence of daytime sleepiness was approximately 10% as reported by parents, teachers, and children. Seventeen percent of parents indicated that they have at least moderate difficulty waking their children on a weekday, which may represent morning fatigue, whereas only 2% reported this problem on weekends (Blader et al., 1997). More than one-third of parents did not feel that their children receive enough sleep (Blader et al., 1997). Average sleep duration decreased significantly in older school-aged children compared to younger school-aged children, although the mean difference between kindergarteners and third or fourth graders was

only 26 minutes (Owens, Spirito, et al., 2000). More specifically, children aged 5 and 6 years had a bedtime that averaged at 8 hours and 34 minutes. The mean bedtime for older children increased steadily at 15 minutes each year until age 11, when the mean bedtime was 9 hours and 30 minutes. (Blader et al., 1997).

Age has been another factor found to be related to the co-occurrence of bedtime resistance and sleep onset difficulties. Children who displayed sleep onset problems only tended to be older than children who displayed combined bedtime resistance and onset problems. There was an increased prevalence of overall sleep disturbance in the younger (kindergarten through second grade) as compared with the older (third and fourth grade) children. Reports of greater sleep disturbance among younger children were consistent among teacher, parent, and children's self-reports (Owens, Spirito, et al., 2000).

Most of the 4- to 8-year-old (53-67%) and one-third (35%) of the 10- to 12-year-old children in Bauer's (1976) sample endorsed occasional frightening dreams. The prevalence of night terrors in children has been reported to be 1 to 3% (Kales et al., 1980) to 6% (Beltramini & Hertzig, 1983). Sleepwalking is more common than night terrors. Specifically, 15% of latency-aged children had sleepwalked at least once (Kales et al., 1980). Results of a longitudinal study conducted in Sweden found that the peak age for sleepwalking was 11- to 12-years-old, when nearly 17% indicated sleepwalking at least occasionally. Overall, approximately 5% of the whole age group studied (3- to 16-year-olds) sleepwalked "regularly", defined as 3 or more times a year (Klackenberg, 1982). Boys and girls have been shown to experience similar rates of sleep problems, with the exception of nocturnal enuresis that has been well-established as more common for boys (8.2%) than for girls (2.6%) (Blader et al., 1997). Nearly one-third of school-aged

children reported body pain during the night. It is important to note that parents were largely unaware of their children's body pain (Owens, Spirito, et al., 2000). In this same age group, the prevalence of occasional snoring was around 20%, whereas the prevalence of more significant breathing or apneic pauses was 1.7% (Owens, Spirito, et al., 2000). Parents endorsed symptoms suggestive of obstructive sleep apnea in 3.7% of their children (Owens, Spirito, et al., 2000). Bruxism, or grinding or clenching of the teeth during sleep, has been reported to occur in 7 to 88% of children (Attanasio, 1991). Although Periodic Limb Movement Disorder does occasionally occur during middle childhood, its prevalence is currently unknown (Brown et al., 1995).

Methodological Issues in Sleep Research

In general, sleep research can be divided into two general categories based on the assessment methodology employed, which are detailed below (Corkum et al., 1998). Subjective measures are commonly in the form of sleep diaries (daily log of sleep recorded by the participant or parent), questionnaires, and interviews. These measures focus on the more observable aspects of sleep (i.e., sleep latency, duration, number of wakings, and so forth), and, with the exception of sleep diaries, tend to be retrospective in nature. Objective measures, including polysomnographs, actigraphy, and videos, are recorded in real time, and, in addition to the above, can capture information not overtly observable. Polysomnographs, which yield information on stages of sleep and sleep architecture, have historically been considered the "gold standard" within sleep research, and involve the recording of multiple physiological measures during sleep within a laboratory-based environment. In the assessment of children, the parameters used most in polysomnographic studies include behavior, respiration, eye movements (EOG), brain

electrical activity (EEG), muscle tone (EMG) or motor activity, and heart rate (ECG) (Thoman & Acebo, 1995). Actigraphy is a relatively newer instrument and utilizes a computerized wristband that quantifies body movement during sleep. Actigraphy assists in distinguishing between sleep and wakefulness, and provides numerical information on sleep duration, number of arousals, and length of sleep onset. Although wrist-actigraphy is a less sophisticated sleep measurement tool and yields less objective sleep information (i.e., it does not provide information on sleep stages or architecture) than do results of full polysomnograms, this instrumentation can be used easily in the home rather than in the artificial setting of a sleep laboratory (Ball & Koloian, 1995).

Discrepancies between objective and subjective measures of sleep. It has generally been assumed that sleep disorders occur in children with ADHD, however, laboratory documentation of its occurrence has remained controversial. The relationship between sleep disturbance and ADHD is largely unresolved due to inconsistent findings both in the areas of subjective assessment of children's sleep (including parent's perceptions of sleep problems), and more objective, polysomnogram (PSG), home activity monitor, and/or actigraphy evidence of sleep for medication-free children with ADHD. Furthermore, clinically-reported sleep abnormalities in children with ADHD often do not support available laboratory-based sleep research findings.

The current findings concerning sleep disturbances in children with ADHD are inconsistent. Specifically, data collected from parental reports often have indicated greater sleep disturbance in children with ADHD than has more objective data (Busby, Firestone, & Pivik, 1981; Corkum, Tannock, Moldofsky, Hogg-Johnson, & Humphries, 2001; Greenhill, Puig-Antich, Goetz, Hanlon, & Davies, 1983; O'Brien et al., 2003; Stein

et al., 1996). Questions remain as to why the two assessment strategies tend to yield different results. One reason why objective physiological studies have not produced clear, specific evidence of sleep disruption in children and adolescents may be due to technical limitations of measuring sleep, therefore making it difficult to detect subtle sleep problems (Dahl & Puig-Antich, 1990; Greenhill et al., 1983). Others have suggested that it may be due to maturational differences which protect the sleep of children and mask findings (Dahl & Puig-Antich, 1990). In addition, it has been postulated that discrepancies may be a result of the different variables measured by the two methods. Subjective assessment generally focuses on areas related to sleep continuity (sleep onset, duration, interruptions), whereas objective measures produce data that includes information on sleep architecture (i.e., REM latency, percentages of non-REM sleep). It has also been proposed that fundamentally, observational parental report and physiological sleep measures may reflect different domains (sleep "architecture" vs. sleep "behavior" respectively). As such, one might not expect them to have a high rate of correspondence (Owens, Maxim, Nobile, McGuinn, & Msall, 2000). Despite these measurement differences, even when polysomnogram/actigraph data have also included information about sleep continuity, results have still been found to differ from data acquired through parent perceptions. In attempts to account for the discrepancy between parent reports of sleep difficulty and findings from PSG research that do not demonstrate sleep difficulties among children with ADHD, some authors have suggested that it may be the result of a behavioral disturbance rather than a specific sleep problem. (Ball, Tiernan, Janusz, & Furr, 1997).

In a comprehensive study conducted by Corkum et al. (2001), sleep parameters in latency-aged unmedicated children with ADHD and their normally developing peers were assessed through the use of multiple sleep measures including a parent-completed retrospective questionnaire spanning the previous 6 months, children wearing an actigraph for 7 nights, and the child's parents completing a sleep diary during the same time period. Although parents of children with ADHD reported significantly more sleep disturbance than did parents of the normally-developing children, the majority of the differences were not verified through actigraphy or sleep diary data.

In perhaps the largest study to date that compared subjective and objective reports of sleep disturbance in sleep clinic referred children with ADHD, community children with ADHD, and controls, children in both ADHD groups were reported by their parents to have more sleep problems than were children in the control group with respect to difficulty initiating sleep, having restless sleep, having nightmares, and experiencing daytime sleepiness. Reports of sleep walking, nocturnal enuresis, and sleep breathing problems were endorsed more frequently by parents of children with ADHD in the referred group, but not the community group, when compared to children in the control group. However, despite the high frequency of subjective sleep complaints, most of the sleep variables measured by polysomnography were insignificant (O'Brien et al., 2003).

A similar trend was reported by Greenhill et al. (1983) who investigated parental perceptions of sleep difficulties in children with Attention Deficit Disorder with Hyperactivity (ADDH) and compared their reports to polysomnographic data. On a baseline parental questionnaire of ADDH boys, 57% of the sample were noted as having moderate to severe restless sleep, 42% were identified as very early risers, 29% had

difficulty falling asleep, and 14% indicated occasional nightmares, night awakenings, and enuresis. Despite these relatively high percentages, other than differences in REM activity between the two groups, there were no sleep architecture abnormalities on PSG data between the non-medicated ADDH children and the normals. Greenhill et al. tried to resolve the discrepancy in parent reports and PSG data by raising the possibility that the novelty of the laboratory experience may temporarily normalize the sleep of ADHD children. In addition, they suggested a "negative halo effect" may occur for parents responding to sleep problems that were embedded among a number of other items they endorsed relating to other problematic daytime behaviors. That is, they argued that parents may generally over-report behavioral problems (Ball et al., 1997; Greenhill et al., 1983). Greenhill and colleagues further postulated that sleep disturbances may be observed by parents, although polysomnogram evidence or the standard sleep scoring methods may not be sensitive enough to detect these clinically reported sleep problems when they are more subtle. It is still unclear as to whether parents are misperceiving the quality of their children's sleep or perhaps detecting some aspect of sleep that is not measurable through more objective means (Greenhill et al., 1983). Greenhill and colleagues concluded that there was a lack of association between parental reports of disturbed home sleep and the near absence of sleep architectural abnormalities in children with ADDH in the sleep laboratory as compared to the control sample.

However, in a study conducted with normally-developing infants, Minde, Popiel, Leos, Falkner, and Handley-Derry (1993) demonstrated that parental reports of "poor sleepers" were more accurate than were reports of "good sleepers." Based on objective measures, few differences were demonstrated between children described by their parents

as poor sleepers versus good sleepers; however, poor sleepers were more likely to cry or call out for someone when they woke and were unable or unwilling to go back to sleep on their own. As a result, reports by parents of good sleepers significantly underestimated how long their children took to fall asleep, how many times they awoke, and how much they were awake during the night because parents assumed them to be asleep even when they were not. The investigators concluded that it may be safe to rely on parental reports when studying sleep-disordered children.

Although there is somewhat fair to poor correlation among parental report, child report, and more automated measurements of children's sleep, because parents typically report sleep problems in their children and parents are usually those who implement the interventions, clearly parent reports are important to investigate (Blader et al., 1997). Even if there is only a difference in psychological perception of ADHD children's sleep relative to normal children, this is important clinically in determining appropriate treatment interventions (Ball & Koloian, 1995).

Methodological limitations of current research. Both sleep and ADHD research has been hampered by limitations in our knowledge of childhood sleep problems as well as methodological issues in the extant research. Due to the limited number of studies conducted to date, it is unclear how prevalent sleep problems are for school-aged children. The dearth of normative information makes comparisons difficult and thus, understanding sleep disorders in children with ADHD difficult. Methodological concerns such as widely different experimental conditions, number of participants, case selection methods, drug dosages, and number of sleep nights have weakened the reliability of the

findings on the sleep of children with ADHD and have made it difficult to pool data to generate a conclusive review of findings (Busby et al., 1981).

As past literature utilized early diagnostic criteria and the criteria to identify ADHD has evolved with subsequent versions of the *DSM*, the majority of studies have not employed a homogeneous definition of ADHD or have used hyperactivity as the major diagnostic criterion (Ramos Platon, Vela Bueno, Espinar Sierra, & Kales, 1990). Therefore, comparisons across samples is difficult. Studies that were conducted prior to 1987 concerning the incidence of sleep problems in ADHD children may have been confounded through the use of sleep disturbances as a diagnostic criterion (Ball et al., 1997). In order to reduce these methodological limitations, the present study utilized children who were currently diagnosed with ADHD. Thus, presumably *DSM-IV* criteria will have been employed to diagnose all children with ADHD.

Corkum et al. (1998) reviewed all studies on sleep disturbance in children with ADHD conducted prior to 1998 and noted several methodological limitations in the research. These investigators pointed out that diagnostic criteria and procedures varied widely across studies and may have accounted for some of the inconsistencies in findings. Experienced clinicians recommend that a variety of data sources and measurement tools should be utilized within an optimal assessment for ADHD. These include a thorough psychosocial and medical history, physical/neurological examinations, reports from parents and teachers, measures of cognitive attention skills, and direct behavioral observations (Barkley, 1990). However, studies differ widely in their criteria for including children in their studies ranging from including "previously diagnosed" children to relying solely on parent and teacher reports on behavior.

More than one-half of studies reviewed by Corkum et al. (1998) did not indicate exclusionary criteria and the majority did not screen for or exclude children with comorbid disorders. Moreover, some of the studies reviewed by Corkum and colleagues distinguished between children who exhibited hyperactivity and non-hyperactivity; however, others did not. Such sleep problems in referred children may not be specific to an ADHD diagnoses as there are reports of sleep problems in children with numerous other child psychiatric disorders. It is not clear if any association between ADHD and sleep is specific to ADHD and not the result of a psychiatric disorder in general. For instance, sleep difficulties may be due to factors related to ADHD such as comorbid anxiety, depression, Tourette's Syndrome, disruptive behavior (resistance to going to bed), and mental retardation (Stein, 1999). Likewise, sleep problems, including sleep-related breathing disorders or Restless Legs Syndrome, may also contribute to poor arousal or alertness which could be mistaken for symptoms of ADHD (Chervin, Dillon, Bassetti, Ganoczy, & Pituch, 1997). In light of this consideration, as is detailed more in the following sections, children who had a history of a diagnosed sleep disorder were excluded from participation in the study. In addition, separate subscales assessed for symptoms related to sleep apnea/sleep-disordered breathing and for symptoms of Restless Legs Syndrome.

In the majority of studies reviewed, children were not medication-naïve (Corkum et al., 1998); however, some of the studies reviewed ensured medication-free periods prior to children's participation. Also, much variability existed between the type of medication, dose, and schedule of the administration. As many previous studies of medicated children have only used global ratings of sleep problems, additional research

that examines the specific sleep-related behaviors of children with ADHD receiving stimulant therapy is needed (Day & Abmayr, 1998). Some authors have also questioned how much the knowledge that their children are on stimulant medications may impact or contribute to parental perceptions of sleep difficulties (Corkum et al., 1998).

Parents may not perceive their children's disturbed sleep as problematic, but rather an expected component of normal development (Richman, 1987). As such, it has been suggested that studies that examine the prevalence of children's sleep problems should also differentiate between the actual sleep events and the events that are considered problematic to the caregiver (Richman, 1987).

The definition of what constitutes a cut-off for "sleep disturbance" has varied widely across studies (Kaplan, McNicol, Conte, & Moghadam, 1987). Additionally, the frequencies of behaviors that define a "problem" are also often not described in the literature, further resulting in difficulties comparing results across multiple studies (Richman, 1987). Sleep disturbance may be defined statistically or by a somewhat arbitrary threshold set by the researchers (Kaplan et al., 1987). As sleep needs have been defined in some literature by the amount of sleep needed for optimal daytime functioning, this is problematic in dealing with children with ADD, who inherently have suboptimal daytime functioning (Dahl & Puig-Antich, 1990). Those who identify sleep disturbance should consider what the parent defines as a problematic sleep behavior. Clearly, parental perception strongly influences whether a parent brings the behavior to the attention of a primary care provider or eventually complies with treatment recommendations (Owens, Maxim, et al., 2000). Due to these considerations, in addition to requesting information about the actual sleep events of ADHD and normal children,

the current study assessed whether the parents or guardians considered these disturbances to be problematic for themselves or their children.

Corkum et al. (1998) also noted that inadequate control procedures were characteristic of the majority of their reviewed studies. Often, the comparison group was not equally matched for gender, so that in many studies a majority of the ADHD sample were boys, whereas the comparison groups were comprised predominantly of girls. The lack of normative sleep data in school-age children also makes comparisons difficult (Owens, Spirito, et al., 2000; Richman, 1987). This study matched the comparison group for sex and as closely as possible for child age. Some studies have used normative data collected in different laboratories, collected at different times, and that utilized varying procedures (Nahas & Krynicki, 1977; Ramos Platon et al., 1990).

To date, many studies have utilized small samples and reported only significant findings (Ramos Platon et al., 1990). Other methodological criticisms have included studies not determining how long the child was awake during the night when he or she got up, which may have resulted in more total sleep deficiencies (Kaplan et al., 1987). Some studies have requested that parents not change the child's sleep routines (Palm, Persson, Bjerre, Elmqvist, & Biennow, 1992), whereas some requested that children not be allowed to nap (Busby et al., 1981; Ramos Platon et al., 1990). Changing sleep structures (such as napping, earlier bedtimes) may have an impact on a child's sleep (Corkum et al., 1998). Due to the retrospective nature of the present study combined with the instructions for parents or guardians to consider a "typical" week for their children, reports should closely represent "usual" sleep practices. In addition, the structured sleep questionnaires utilized previously were created initially for and intended

to assess adult's sleep (Ring et al., 1998). Both the parent and the child sleep measures in the current study were designed to be utilized specifically with a pediatric population.

In spite of the fact that development and maturation influence many components of sleep and the prevalence of various sleep disturbances and changes in EEG sleep have been found over the life span, many studies only present overall frequencies for a wide age range and the data are not presented separately by age group (Richman, 1987). In addition, the range in children's ages that has occurred both within studies and within the sleep disorders literature is considerable (Corkum et al., 1998). Although the child's stage of sexual development is related to sleep variables, information regarding the stage of sexual development has not been provided in most studies (i.e., only two studies reviewed by Corkum et al. ascertained this information). In fact, as of 1998, no research studies had examined psychosocial variables that may account for differences in sleep (e.g., bedtime routines) nor were the potential influences of culture and family sleep patterns assessed (Corkum et al., 1998; Richman, 1987).

Because parental reports of poor sleep are not always corroborated by more objective, laboratory-based evidence, some investigators have questioned the validity of parents' subjective reports of their children's sleep patterns. Adults' own self-reports of poor sleep are not always corroborated by laboratory evidence. This casts further doubt on the validity of parents' reports of their children's sleep (Richman, 1987). Results of many studies have indicated that parents have a tendency to report more problematic sleep than actually occurs (Busby et al., 1981; Greenhill et al., 1983; Stein et al., 1996). In contrast to studies in which parents have been found to over-report sleep difficulties in their children, one study has suggested that parents underreport night wakings in their

children based on comparisons of parent reports to an all-night video recording of children's sleep (Anders, 1978).

Most studies that have attempted to determine the overall prevalence of sleep problems in school-aged children are based solely on parental report, which may provide an inaccurate or incomplete picture of sleep behavior (Owens, Spirito, et al., 2000). In fact, many studies have depended on parents to hear when their children get up, both during the night as well as in the morning (Kaplan et al., 1987). Parents can only report sleep disturbance of which they are aware, which may result in episodes in which the children do not make noise or do not wake the parents not being endorsed in parent reports (Richman, 1987). Therefore, rates may be underestimated if they are generated based exclusively on parental reports, as children do not necessarily tell parents that they woke but fall back asleep on their own (Richman, 1987). The problem may be that not only are these children not able to maintain sleep, but once they are awakened, they may not be able to fall asleep without parental contact (Richman, 1987) as successfully as other children, thereby increasing parental awareness of sleep disruptions. Also, as children get older, parents may be increasingly unaware of sleep onset problems or frequency and duration of night wakings that their children may experience (Minde et al., 1993). Certainly, as children mature, they are increasingly likely to cope with sleep problems on their own, which again may contribute to potential underreporting by parents (Richman, 1987). An older child may also be able to supply more information about sleep of which parents are not aware such as fearfulness, difficulty falling asleep, nightmares, and nocturnal wakings. This has lead some to question if some sleep behaviors, such as sleep onset and nocturnal wakings, may be perceived more accurately

by children because parents may be uninformed of the problem or not identify that the behavior poses a problem for their children (Owens, Maxim, et al., 2000; Owens, Spirito, et al., 2000). One step toward clarifying this issue should include soliciting children's perceptions of their own sleep and determining the relationships of the children's perceptions to parents' perceptions (Ball & Koloian, 1995). The only investigation that the author is aware of that included both parental and self-report of sleep in children with ADHD identified the importance of asking both the parents as well as the school-aged child about sleep behaviors, especially those that relate to sleep onset and wakings (Owens, Maxim, et al., 2000). Due to the increasing recognition that children's perceptions of their own sleep may shed some additional light into whether sleep disturbance is more prevalent in those with ADHD than in the general population, this study gathered information on sleep from parents as well as children themselves.

Published sleep investigations have shown few consistent PSG or electroencephalographic abnormalities in children with ADHD (Dahl, Pelham, & Wierson, 1991; Greenhill et al., 1983). Due to the time intensive and expensive nature of more sophisticated technological data collection methods, a primary criticism of this research has been that polysomnogram data is not available on many children. Busby et al. (1981) argued additional methodological limitations of ADHD-related polysomnographic research studies include widely different experimental methods, number and selection of participants, varying medication doses, and number of study sleep nights. Many objective studies have not included the days of the week in which the recordings were collected. Other studies, for instance Porrino et al. (1983), have found children have more sleep movements on weekdays than they do on weekends. Others

have noted reservations about applying the standard PSG scoring system to children (Corkum et al., 1998).

Objective studies also bring forth questions as to procedural issues confounding the data. The sleep laboratory is an unfamiliar environment for children and various aspects of the experience, such as sleeping away from home and being connected with wires, may feel threatening to many children. The sleep laboratory is also not usually set up in a manner that is comforting to a child nor child-friendly (i.e., decorated for children, positioned next to a parent's bedroom) (Corkum et al., 1998). Additionally, children with ADHD have been shown to demonstrate less tolerance for procedures included in sleep studies both in the sleep laboratory (Busby et al., 1981) and when compared to normal controls even when utilizing home recordings (Palm et al., 1992). This phenomenon has been indicated through a greater "first-night effect," when participants show a reduced amount of REM sleep and an increase in waking time or time awake on the first recording night as compared to subsequent nights (Busby et al., 1981; Palm et al., 1992). Varying degrees in which objective studies recognize or account for this phenomenon are also likely to account for divergent results. This has lead some investigators to utilize home PSGs (Palm et al., 1992) or actigraphy (Porrino et al., 1983; Tirosh, Sadeh, Munvez, & Lavie, 1993) in hopes of yielding more ecologically valid results.

In summary, relatively few studies have been conducted, and the existing studies are fraught with poorly defined diagnostic groups, small sample sizes, samples not representative of epidemiological data (i.e., reflecting age, gender), poor control comparisons, and other methodological and procedural limitations. As a result of these

limitations, it is difficult for the scientific community to determine the relationship between sleep problems and ADHD. Hence, the association of sleep disturbances with ADHD and its treatment remains unclear.

Objective Sleep Measures

Sleep onset. Several studies have compared sleep onset of ADHD children to that of normal controls. Some studies have found children with ADHD have longer latencies to sleep onset. Busby and Pivik (1985) examined three groups of children--medicated Hyperkinetic, non-medicated Hyperkinetic, and normal control prepubertal boys; both the medicated and non-medicated Hyperkinetic children had significantly greater durations to sleep onset compared to controls. However, these findings were demonstrated for only one of the nights studied. Haig, Schroeder, and Schroeder (1974) studied hyperactive boys from 8 to14 years of age. Compared to the controls, significant effects were found for increased sleep latency for the hyperactive children, both when medicated and non-medicated. Even when the PSG sleep recordings were collected at the homes of recruited unmedicated 6- to 12-year-olds with significant deficits in attention, motor control, and perception, findings of Palm et al. (1992) yielded increased sleep onset latency on the first night recorded for the children with combined deficits in attention, motor control, and perception as compared with controls.

Other studies have found shorter sleep onset latencies for ADHD or ADHD-related diagnostic concepts. Small, Hibi, and Feinberg (1971) found a significantly reduced sleep latency time for hyperactive children with minimal brain dysfunction when compared to normal children. Analysis of sleep pattern variables of prepubertal ADD children also revealed a significant reduction in sleep onset latency as compared to

controls. The results were especially marked in younger ADD/H children, for whom the average barely reached two minutes (Ramos Platon et al., 1990).

Many other studies have found no differences between ADHD children and normally-developing children. Results of a study conducted by Busby et al. (1981) showed no difference in sleep onset latencies between non-medicated hyperkinetic 8- to 12-year-old boys and boys in the normal control condition. Feinberg et al. (1974) studied sleep patterns in two groups of boys diagnosed with minimal brain dysfunction syndrome or hyperkinesis. One group received short-term stimulant therapy and were recorded under placebo, drug (stimulant, short-term) and withdrawal conditions. The other experimental group consisted of children who had been receiving long-term stimulant/amphetamine treatment. Participants were maintained on their treatment for three nights and then received a placebo (to examine withdrawal effects) for two or three consecutive nights. Participants were compared to each other and to normal controls. There was no difference in sleep onset between children with minimal brain dysfunction syndrome and age-matched controls either before or during stimulant treatment. Khan (1982) also found similar sleep latencies between 6- to 12-year-old hyperkinetic boys and normals. Greenhill et al. (1983) continued this line of research with non-medicated boys with ADDH and a mixed-gendered group of controls. Similarly, there was no difference between sleep onset latencies between the groups. Tirosh et al. (1993) recruited 6- to 12-year-old children who were diagnosed with ADHD and had them undergo activity monitoring at home during six days of no treatment (baseline) followed both by a placebo and methylphenidate treatment. These three trial stages, as well as those of an age- and

sex-matched control group, were compared. There were no differences between any of the groups with respect to time to sleep onset.

Total sleep time. Total sleep time has been measured in many objective studies. A limited number of studies have demonstrated a trend for children with ADHD to have a longer sleep time. For instance, Ramos Platon et al. (1990) found that children with ADHD had an increased total sleep time, but that sleep time was interrupted by several awakenings.

However, most research conducted to date has not found differences between ADHD and normal control groups with respect to total sleep time. Small et al. (1971) found no difference between 7- to 8-year-old hyperactive children with minimal brain dysfunction and normal controls in total sleep time. Feinberg et al. (1974) also failed to find any difference in sleep time for boys with minimal brain dysfunction syndrome as compared to age-matched controls before and during stimulant treatment. Haig et al. (1974) verified this finding with hyperactive boys, finding no difference between normal control and hyperactive children who were on medication. Khan and Rechtschaffen (1978) also compared 6- to 8-year-old boys with hyperkinetic syndrome to normals and found no significant or substantial group differences in percentage of time asleep; this finding was replicated in a later study by Khan (1982) for a larger sample of 6- to 12-year-old hyperkinetic children. Results of a study conducted by Stahl, Orr, and Griffiths (1979) indicated no difference in total amount of sleep between hyperactive 6- to 12-year-olds when compared to age-matched controls. Similarly, results of a study by Busby et al. (1981) indicated that total sleep time was the same for non-medicated boys with hyperkinetic syndrome compared to controls. Follow-up studies conducted by these

same investigators also indicated no differences in total sleep time among pre-pubertal, medicated hyperkinetic, non-medicated hyperkinetic, and control boys. Results of a study conducted by Greenhill et al. (1983) indicated no difference between non-medicated preadolescent children with ADDH and controls. Utilizing actigraph monitoring instead of PSG monitoring, Tirosh et al. (1993) completed a double-blind, controlled drug-placebo crossover design; results further substantiated no difference between 6- to 12-year-old ADHD and age and sex-matched normal children.

Nocturnal awakenings and sleep efficiency. Sleep efficiency is indicated by the ratio of sleep time and total time in bed. To the best of the author's knowledge, no studies have determined that children with ADHD have better sleep efficiency than do normal children. In contrast, considerable research suggests that children with ADHD have worse sleep efficiency. Results obtained by Stahl et al. (1979) indicated that hyperactive 9- to 11-year-olds demonstrated significantly more nocturnal wakings than did aged-matched controls. Non-medicated, pre-pubertal ADD children have also been shown to experience a greater number of nocturnal awakenings than normally-developing children of the same age group over two consecutive nights of PSG recording (Ramos Platon et al., 1990). Children with deficits in attention, motor control, and perception (aged 6 to12) demonstrated significantly longer wakings (although not significantly more wakings) and lower sleep efficiency in the first of two consecutive nights compared to controls, even when allowed to sleep in their own homes (Palm et al., 1992).

Other studies have failed to document differences between children with ADHD and that of normally-developing children. Small et al. (1971) found that the overall sleep efficiency, number of awakenings, and length of time awake after falling asleep were

similar for hyperactive children with minimal brain dysfunction and normally-developing aged-matched controls. Feinberg et al. (1974) did not find any difference on sleep efficiency/night awakenings between minimal brain dysfunction boys and age- and sex-matched controls. The Feinberg et al. findings were later substantiated by Busby et al. (1981) with hyperkinetic and normally-developing boys. Results of a study conducted by Greenhill et al. (1983) found no difference in the percentage of time awake between pre-pubescent boys with ADDH as compared to control children. Based on results attained by an activity monitoring at home, there were no differences in sleep efficiency between either latency-aged children with ADHD and sex and age-matched controls, or between on and off stages of methylphenidate treatment for the children with ADHD (Tirosh et al., 1993).

Movements. The literature has shown increased body movement time during sleep in unmedicated children diagnosed with ADHD. Based on PSG data, Small et al. (1971) demonstrated that when compared to normal children, children with minimal brain dysfunction demonstrated significantly increased muscle activity during sleep. Small and colleagues considered this behavior an indicator of restlessness. Results of a study conducted ten years later further supported this finding. Specifically, Busby et al. (1981) found a marginally significant greater absolute and relative amounts (minutes and percentage) of movement time for hyperkinetic boys relative to children in the control group. A few studies have utilized actigraphy to examine movements during sleep for children with ADHD. In a naturalistic environment, hyperactive, unmedicated latency-aged boys were more restless in their sleep, as determined by a significantly higher level of motor activity than were control children (Porrino et al., 1983). Tirosh et al. (1993)

also reported a trend for the amount of quiet sleep to be lower among the unmedicated ADHD group compared to controls; however, no significant differences were reported when the group with ADHD received psychostimulant medication. Konofal, Lecendreaux, Bouvard, and Mouren-Simeoni (2001) examined the sleep patterns of 30 medication-free, latency-aged children with ADHD as compared to age- and sex-matched controls. Although polysomnography data showed no difference between the groups, results of a video recording indicated that children with ADHD moved more often than did controls and their duration of movements was also significantly longer. The higher levels of nocturnal activity were predominantly in the upper and lower limbs.

However, this alteration has not been confirmed by other investigators. Nahas and Krynicki (1977) examined PSG data for unmedicated, 8-year-old boys diagnosed with Hyperactive Impulse Disorder of Childhood as compared to normative data. Children slept in their own bedrooms. There were no differences in movements during sleep between the groups. Additionally, a 21-day, twice-daily, 20 mg dose trial of methylphenidate HCl and then discontinuation of the medication for two days did not have effects on the hyperactive boys' movements during sleep. Results of a study conducted by Greenhill et al. (1983) evidenced no difference in the number of movements between non-medicated ADDH children as compared to children in the control group. In part, the lack of significant differences between the groups may reflect the fact that not all hyperkinetic symptoms are evident within a laboratory setting (Ramos Platon et al., 1990). In addition, studies that examine the sleep of children with ADDH at home show a significant increase in body movements (Porrino et al., 1983).

Arousability. Based on results of Busby and Pivik (1985), there has been a noted trend toward enhanced sensitivity of non-medicated hyperkinetic participants to auditory stimuli during sleep relative to normal and medicated hyperkinetic children; the lower threshold response, however, was only evidenced during stage 2 sleep. Arousal thresholds in hyperkinetic children who received stimulant medication approximated that of normal control children (Busby & Pivik, 1985).

Sleepiness. Palm et al. (1992) conducted a multiple sleep latency test (MSLT) to determine sleepiness in children with deficits in attention, motor control, and perception. Using a MSLT, Palm et al. found no significant differences between children with deficits in attention, motor control, and perception and children without deficits in attention, motor control, and perception in the time to fall asleep in the sequence of daytime naps. Although, more children with deficits in attention, motor control, and perception were "sleepy." However, while three patients with deficits in attention, motor control, and perception had short sleep latencies on the MSLT, no control children experienced short sleep latency (short sleep latency on the MSLT is an indication of daytime hypersomnolence). However, most patients did not suffer from increased daytime sleepiness.

Using the MSLT, Lecendreaux et al. (2000) evaluated 30 unmedicated boys with ADHD between the ages of 5 and 10 as compared to age and sex-matched controls. Results indicated that while there were no differences in sleep variables based on polysomnography, the boys with ADHD were determined to be more sleepy during the day. This finding was based on data from the MSLT, which indicated more daytime

sleep onsets and increased rapidity of sleep onsets for the boys in the clinical group, as compared to the control group.

REM sleep. Sleep architecture parameters related to the REM cycle that have been investigated in the ADHD population include the percentage of total sleep time in REM, the amount and density of REM sleep, and the latency to the onset of REM sleep. Some studies have reported a reduced amount of REM sleep in children with ADHD. Nahas and Krynicki (1977) found that hyperactive boys had a decrease in REM sleep when compared with normative data. Results of Greenhill et al. (1983) supported this finding within a non-medicated ADDH group; the non-medicated group had reduced REM activity and REM density compared to controls. Ramos Platon et al. (1990) further supported disturbance in REM activity in children diagnosed with ADD with results indicating that pre-pubertal non-medicated children with ADD had less total REM, less percentage of total sleep time in REM, and shorter third REM period than did normals. Although Khan (1982) found that the percentage of REM sleep was similar for the 6- to 12-year-olds hyperkinetic children and controls, results indicated that REM latencies were significantly shorter in the children with hyperkinesis. More recently, in a study conducted by O'Brien et al. (2003), REM sleep latency was longer in a sleep clinic referral sample and a community sample of children with ADHD as compared to controls. There were also differences evidenced between the groups for the percentage of REM sleep; the control group exhibited the highest percentage and the clinic referred ADHD group exhibited the lowest.

Other objective studies have not verified REM sleep differences between ADHD and non-ADHD children. In a pioneering study by Small et al. (1971), there were no

significant differences between hyperactive 7- to 8-year-old boys with minimal brain dysfunction syndrome as compared to children in the normal sample on any of the REM sleep measures assessed. Feinberg et al. (1974) also supported this finding with non-medicated boys with minimal brain dysfunction syndrome as compared to age and sex-matched controls. In addition, results of a study conducted by Stahl et al. (1979) and Busby et al. (1981) found that hyperactive and hyperkinetic children had similar REM percentages and REM average cycle durations as did normal children. Palm et al. (1992) replicated these findings in a PSG study conducted at the children's home. Data indicated that the organization of the sleep cycles and REM within the individual cycles did not significantly differ between the study group (6- to12-years-olds with deficits in attention, motor control, and perception) and the controls.

While some research has indicated that for children with ADHD, the duration of REM latency is similar to children without ADHD, (Greenhill et al., 1983; Small et al., 1971), other research has found the time to REM to be increased (Busby et al., 1981; Haig et al., 1974) or decreased (Khan, 1982). Specifically, 8- to 14-year-old boys with hyperactivity evidenced a longer latency to first REM over several consecutive nights in a sleep laboratory. The difference between the clinical and non-clinical sample was significant both when the subjects took methylphenidate and when they did not. Latency was found to increase by an average of 43 minutes and 36 minutes, respectively (Haig et al., 1974). A significantly longer latency to REM (the first NREM cycle was exaggerated) also was exhibited in non-medicated 8- to 12-year-old hyperkinetic boys relative to controls (Busby et al., 1981). However, Khan (1982) found REM latency to be decreased compared to normally developing children. A significant interaction in

REM style also has been found with REM sleep (Ramos Platon et al., 1990). In the sample of normally-developing children, the amount of REM sleep decreased for children aged 10- to 11-years-old when compared to the younger age groups (age 6 to 7, age 8 to 9); conversely, for children with ADD in this age subgroup, the amount of REM sleep increased with age. Moreover, the number of REM periods for children in the control group decreased during the night, whereas for children with ADD, the number of REM periods increased.

NREM sleep. A similar pattern of inconsistencies has been found when NREM sleep has been examined. Some studies have specifically measured sleep spindle activity. Data has associated cortical EEG spindle activity with motor inhibition. Due to the inherent difficulty that children with ADHD have with motor control, there has been interest in investigating the relationships between spindle activity and ADHD. In one study, hyperkinetic boys were found to demonstrate less spindle activity than normal children (Khan & Rechtschaffen, 1978). However, a subsequent study found an increase in the number of sleep spindles (Poitras, Bylsma, Simeon, & Pivik, 1981). Poitras et al. (1981) examined the sleep patterns of unmedicated hyperkinetic as compared to normally-developing 8- to 12-year-old boys. Spindle activity decreased each night for hyperkinetic boys whereas it increased for control children for nights three through five; hyperkinetic children had consistently more spindle activity than did controls each night. This is contrary to the report by Khan and Rechtschaffen (1978), who found that boys with hyperkinesis had fewer sleep spindles in Stage 2 in every scoring category. Children in the sample also had lower "weighted spindle scores." Other studies, however, have not documented these differences. For instance, Kiesow and Surwillo

(1987) found no difference for the number of sleep spindles per second in Stage 2 sleep in boys aged 3- to 11-years-old diagnosed as ADD With Hyperactivity compared to age- and sex-matched controls. Unlike the other investigations reviewed, the participants received medication to induce sleep.

Other aspects of NREM have been examined in a number of other objective sleep studies. Small et al. (1971) found no significant differences in the NREM sleep of children with minimal brain dysfunction syndrome compared to controls. This was further supported by Khan and Rechtschaffen (1978), who found a similar percentage of time in all of the conventional sleep stages for boys with hyperkinesis as compared to the control group. These findings were replicated by Khan (1982) who found that hyperkinetic boys' sleep approximated that of normal controls with respect to total NREM sleep time, number of stage changes, and percent of time in sleep Stages 1 through 4. Additionally, Stahl et al. (1979) reported that the slow-wave sleep of hyperactive 6- to 12-year-olds was similar to age-matched controls. Results of a study conducted by Haig et al. (1974) yielded no significant difference between medicated, medication-withdrawn, and control boys in NREM sleep. Similarly, when comparing children diagnosed with deficits in attention, motor control, and perception to controls, results of Palm et al. (1992) did not indicate any differences in time spent in Stage 1, 2, and overall slow wave sleep (SWS) or the time from sleep onset to the first appearance of any NREM stage. Greenhill et al. (1983) also did not find evidence of any NREM sleep disturbance in unmedicated ADDH boys compared to controls. Kiesow and Surwillo (1987) also found as compared to a control sample, boys diagnosed with ADD With Hyperactivity did not differ in the amount of time spent in Stage 2 sleep. Further results

of Greenhill et al. (1983) supported the finding of Haig et al. (1974), that even when children were treated with methylphenidate, there were no differences between medicated ADDH children and the comparison group or between the ADDH children when medicated as compared to when the children did not receive psychostimulant medication.

In contrast to the studies reported above, some researchers have demonstrated differences between NREM sleep patterns of normal and ADHD children. Specifically, PSG data has indicated that boys with hyperactivity demonstrated more Stage 2, less Stage 4, and increased sleep state changes when compared to normative data (Nahas & Krynicki, 1977). Analysis of sleep pattern variables in another study revealed that the boys in the hyperkinesis group had more Stage 2, less Stage 4, and less overall short-wave-sleep in the first cycle of sleep (Busby et al., 1981). Ramos Platon et al. (1990) found evidence in ADD children for an altered sleep stage pattern in NREM in which the Delta sleep predominates. There was a high increase of Delta sleep percentage for prepubertal, unmedicated children with ADHD compared to the comparison group. Changes in the pattern of NREM sleep included children with ADD having an increased percentage of Stage 3 sleep (over double that of controls for ADD Without Hyperactivity children), greater proportion of total slow-wave sleep, and decreased Stage 1 sleep (Ramos Platon et al., 1990). Differences in the percentage of Stage 2 sleep were also noted. For normally-developing children, the percentage of Stage 2 sleep increased with age, while with the ADD group, the percentage of Stage 2 sleep decreased. This finding was especially pronounced in the 10- to 11-year-old group.

Conclusion. Results obtained from objective sleep studies on the relationship between ADHD and sleep remain inconclusive. Although differences between ADHD

children and normal controls have been noted with regard to sleep onset (Busby & Pivik, 1985; Haig et al., 1974; Palm et al., 1992; Ramos Platon et al., 1990; Small et al., 1971), total sleep time (Ramos Platon et al., 1990), nocturnal awakenings and sleep efficiency (Palm et al., 1992; Ramos Platon et al., 1999; Stahl et al., 1979), movements (Busby et al., 1981; Porrino et al., 1983; Small et al., 1971; Tirosh et al., 1993), arousability (Busby & Pivik, 1985), sleepiness (Palm et al., 1992), REM sleep (Busby et al., 1981; Greenhill et al., 1983; Haig et al., 1974; Khan, 1982; Nahas & Krynicki, 1977; Ramos Platon et al., 1990), and NREM sleep (Busby et al., 1981; Khan & Rechtschaffen, 1978; Nahas & Krynicki, 1977; Poitras et al., 1981; Ramos Platon et al., 1990), other researchers have not replicated these findings (i.e., Busby et al., 1981; Feinberg et al., 1974; Greenhill et al., 1983; Haig et al., 1974; Khan, 1982; Nahas & Krynicki, 1977; Kiesow & Surwillo, 1987; Palm et al., 1992; Small et al., 1971; Stahl et al., 1979; Tirosh et al., 1993). The current investigation examined all of these aspects of sleep using a subjective assessment. Analyses on items that relate to sleep onset, total sleep time, daytime sleepiness, nocturnal arousals, nocturnal movements, and disturbances related to REM and NREM cycles were conducted and are discussed in the following sections with respect to the aforementioned objective studies.

Subjective Sleep Measures

Researchers have repeatedly documented parental reports of sleep difficulty in their children with ADHD and results of many subjective reports of children's sleep have confirmed that the presence of parent-reported sleep problems is greater in children with ADHD than in normally-developing children. Furthermore, sleep problems may be apparent at a young age and may reflect a continuation of early developmental difficulties

with sleep. Trommer, Hoeppner, Rosenberg, and Armstrong (1988) found that, as compared to normally-developing children, parents of unmedicated 5- to 13-year-old children with ADD reported that their children had more difficulty falling asleep (56% versus 23%) and were more tired upon waking (55% versus 27%). Specifically, children with ADD required more than 30 minutes on average to fall asleep at least three nights a week. Developmentally, the children with ADD demonstrated more frequent arousals both in the first year of life (52% versus 21% of controls) and from 1 to 4 years of age (48% versus 23%) based on retrospective data.

Results of a series of three studies conducted by Kaplan et al. (1987) showed that parents of unmedicated hyperactive preschoolers reported more difficulties with their children's sleep than did parents of normally-developing children. Specifically, the first study surveyed 80 parents of children with ADDH between the ages of 3 1/2 to 6 as compared to surveys of children whose parents "found them to be normal and manageable." Sixty percent of the parents of children with ADDH reported that their children get an inadequate amount of sleep each night compared with 25% of the parents of control children. Parents of the children with ADDH also endorsed night awakenings significantly more often than parents of control children (60% versus 25%). The present study utilized similar descriptors of "generally healthy and normal" to identify children for the control group.

In the second study by Kaplan et al. (1987), the authors attempted to control for the possibility that parents of children who were requesting or receiving clinical consultations to assist with their children's behavior problems were more sensitive to all their children's problems and thus may represent a unique subgroup of parents of

children with ADDH. They sought comparable information from a less biased sample, consisting of an unselected sample of parents of unmedicated children with ADDH. Parents in this study were recruited via letters that were sent home to parents from more than 100 daycare centers in a large urban area. Significant group differences between children suspected of ADDH (based on *DSM-III* criteria and a symptom questionnaire) and those who failed to meet the diagnostic criteria were found with respect to difficulty falling asleep, nighttime wakings, wakes early in the morning, and cries out during the night. Likewise, to control for the potential confound of parents tendency to endorse problematic behaviors for their children due to the more urgent or troublesome nature of their children's current difficulties that resulted in a psychological evaluation, the present study surveyed parents and children who were not currently presenting for an evaluation but who had been previously diagnosed with ADHD. As the children included in the present study were already assessed and diagnosed by a pediatrician or mental health practitioner, presumably the anxiety related to a psychological evaluation or not having a diagnosis for their children's behavioral difficulties were reduced. Clearly, the aforementioned concerns could affect parents' response styles to surveys that include a number of behavioral items.

In an effort to reduce reporting bias, the third study by Kaplan et al. (1987) requested parents to document specific daily log information as opposed to global scores. Review of sleep diaries (spanning 21 days) indicated significant differences in five of seven characteristics: nap length (normal children napped longer), sleep length at night (children with ADDH slept longer), awake after going to sleep (children with ADDH awoke more often), bedwetting at night (children with ADDH wet the bed more often),

and night sweats (children with ADDH children experienced more night sweats). The only variables that did not differ between these groups were sleep onset latency and the number of times the child got up from bed before falling asleep. In addition, both groups were similar in the total amount of sleep during a 24-hour period. Thus, during the course of a day, children with ADDH appeared to sleep the same amount of time as children in the control group; however, sleep was more disrupted, with the children in the ADDH group getting up more during the night, wetting the bed more often, and experiencing more night sweats. Twenty–five percent of the ADDH sample averaged at least one awakening per night for the 14 nights examined versus only 7% of children without ADDH. Seventy-six percent of the ADDH children got up more than once during the course of the study (the study duration was 14 nights); the average number the child got up was 7.4. In contrast, 55% of the children without ADDH got up more than once during the nights that the study took place; these children averaged 5.4 awakenings. ADDH children got up during the night approximately twice as often as did the control children. Further analysis indicated that the group difference for bedwetting and night sweats were primarily the result of subgroups of children with ADDH.

Following the finding that ADDH children got up twice as often as control children during the night and that ADDH children napped significantly less than the control children, Kaplan et al. (1987) suggested that these differences may account for increased parental perception of sleep disturbances. Parent perceptions may be influenced by greater parental fatigue (i.e., their children's night awakenings disrupted their own sleep on average every other night), as well as their children's high activity level during the day and their refusal to nap. The investigators concluded that their data

also may suggest that children with ADHD may be less inhibited about wakening their parents and thus, parents may be more likely to over-report sleep disturbance. With respect to this finding, a question was specifically included in the children's sleep self-report measure developed for this study in order to examine if children with ADHD are more likely to inform or wake up their parents during the night than are non-ADHD children.

Stein (1999) added a psychiatric contrast group to determine if sleep problems may be due to related factors or comorbid conditions and to examine parental perceptions of sleep problems in children with other disorders that require treatment. In this study, researchers investigated parental perceptions of sleep problems in unmedicated and medicated children with ADHD, pediatric outpatients, and psychiatric controls. Parents of children with ADHD identified significantly more moderate to severe "sleep problems" at least once a week (19.3%) compared to parents of children with other psychiatric diagnoses (13.3%) and the pediatric controls (6.2%). Bedwetting followed a similar pattern, with 14.1% of children with ADHD, 8.8% of psychiatric controls, and 3.7% of pediatric controls reported to have at least one incident of bedwetting per week. Sleep onset insomnia was also common for the ADHD group (42.7% had latencies of 30 minutes or longer at least once a week) and for the psychiatric controls (40%); in both the ADHD and psychiatric groups, children experienced significantly more sleep onset insomnia than did pediatric controls (24.3%). Overall, children with ADHD displayed almost double the rate of insomnia reported for the pediatric controls. ADHD was associated with increased sleep problems in general compared to psychiatric and pediatric controls and specifically with sleep problems such as insomnia and enuresis. These sleep

problems occurred at least once a week in 20% to 50% of children with ADHD and nightly in 5% to 30% of children with ADHD. However, the ADHD sample did not differ from the psychiatric and pediatric controls in several areas: waking frequently during the night, not seeming to need to sleep, appearing tired during the day, falling asleep during the day, sleeptalking, sleepwalking, grinding teeth during sleep, banging head or rocking during sleep, snoring, gagging or choking during sleep, experiencing night terrors, and having nightmares.

Ball et al. (1997) also sought to control for a possible "halo effect" by using children who had been referred for psychological evaluations due to concerns about learning or behavioral problems as a control group. Based on parents' perceptions, children with ADHD had greater sleep difficulty and were rated as having a higher intensity of sleep difficulty than were the non-ADHD comparison group. Among parents of unmedicated ADHD children, nearly 53% indicated some degree of sleep difficulty as compared with approximately 33% of parents whose children did not have ADHD. These parents of children with ADHD were also more likely to endorse that their children "get up at night" as well as their children "insisting on keeping the light on at night." Based on parental reports, there were no differences between either medicated or unmedicated children with ADHD and other children referred for psychological evaluations in sleep behaviors pertaining to complaints about going to sleep, frequent nightmares, and daytime fatigue (i.e., tired/exhausted/sleeping on holidays).

Rose et al. (1995) added children with other medical problems as another comparison group. Results of a parent-completed pediatric sleep questionnaire indicated that parents of children with ADHD tended to report sleep disturbances that may be more

related to psychological factors rather than daytime sleepiness, depth of sleep, sleep-related breathing problems, or sleep hygiene concerns than did parents of children with other medical problems and parents of normally-developing children.

In an effort to gain better experimental control and examine maturational, genetic, familial, and constitutional factors, and learning, conditioning, and parental sleep habits, Ring et al. (1998) published the first study that examined sleep profiles of children diagnosed as having ADHD as compared to those of their normally-developing siblings. The study consisted of 13 children whose only diagnosis was ADHD and their siblings. All children with ADHD were treated with a single morning dose of methylphenidate for at least 4 weeks prior to entry into the study. The questionnaire consisted of items related to duration of sleep, initial, middle, and late insomnia, parasomnias, nocturnal enuresis, dream anxiety disorder, hours of daytime sleep, and satisfaction with sleep; however, the instrument utilized was created initially to assess adults' sleep. The authors also had mothers and fathers independently complete the form and items; items were considered positive only if both parents rated the item positively. The most frequent disturbances endorsed by parents for their children with ADHD were: initial and middle insomnia (46%), nocturnal enuresis (38.5%), and parasomnias (31%). Children diagnosed with ADHD demonstrated a significantly greater prevalence of single (61.5% vs. 37.5%) or multiple sleep disturbances (46% vs. 18.8% for more than one disturbance; 38.5% vs. 6.3% for more than two disturbances) when compared with their non-ADHD siblings, respectfully. Additionally, parents reported their children with ADHD as experiencing significantly higher rates of middle insomnia and disturbances with initiating and maintaining sleep (or combined initial and middle insomnia) compared with their other

children. Significant differences were not found for children with ADHD compared to their non-ADHD siblings for sleep duration, satisfaction with sleep, parasomnias (sleep walking and talking disorder, night terror disorder, bruxism), nocturnal enuresis, dream anxiety disorder, or hours of sleep during the daytime. The investigators noted that both groups demonstrated higher rates of sleep problems as compared to reports in previous research that utilized community-based controls. The authors concluded these findings may have been the result of a familial pattern of sleep disturbance.

A study conducted by Day and Abmayr (1998) expanded on current research by including a quasi-prospective component. That is, parents were instructed to be vigilant regarding their children's sleep behaviors over two week periods of time. Similar to Stein (1999), they also included a psychiatric control group; however, the psychiatric control group was unmedicated, whereas participants in the ADHD group were all medicated. Data were collected by means of parental responses to a series of structured telephone interviews regarding the frequency of their children's sleep disturbances. Parents of medicated children with ADHD (aged 5 to 12) reported significantly more disturbance than did parents in either the "other psychiatric diagnosis" group or the non-clinical control group for all three groups of behaviors measured (i.e., settling and going to sleep, disruptions during sleep, and morning activities). Between 25% to 50% of parents indicated very frequent occurrences of problems associated with settling and going to sleep. More specifically, problems included a reluctance to settle down for sleep and conflicts about preparations for bedtime. A majority of parents reported tossing and movements during the night to be a very frequent occurrence in their children with ADHD. In the category of behaviors associated with morning activities, the most

frequent and consistent problems reported by parents of ADHD children included awakening in a bad mood and verbal arguing, which at least 20% of parents reported to occur at least twice a week. Parents of the ADHD children perceived that they slept significantly less than did children in the control group. However, it is important to note that at least one-third of parents of children with ADHD reported no or infrequent problems with their children's sleep behaviors. Although parent-child interactions associated with going to sleep and awakening were a problem for a substantial portion of parents of medicated ADHD children, an equally large proportion of families indicated that these sleep-related events were not sources of major difficulty.

Owens, Maxim, et al. (2000) improved and expanded on the previous research by screening and then excluding children who displayed marked symptoms of sleep-disordered breathing. They also had children complete a self-report measure of sleep. The investigators had 46 unmedicated ADHD school-aged children and 46 normal control children; parents and children in both groups completed a questionnaire on children's sleep habits. Results of parental ratings indicated that children with ADHD had significantly more sleep-disturbance based on all sleep subscales than did controls. These sleep subscales included bedtime resistance, sleep onset delay, perception of adequate amount of sleep, sleep anxiety, night wakings, parasomnias, and daytime sleepiness. Parental reports indicated that the average sleep duration was shorter for the ADHD group, although average bedtime and morning wake-up times were similar for both groups. The children with ADHD also reported their own sleep to be more disturbed than did controls, particularly on items relating to difficulty and/or struggles at bedtime. However, they did not report greater difficulty with sleep onset. Overall,

children with ADHD were not significantly more likely to endorse items relating to sleep disturbances than were children without ADHD. In fact, children with ADHD endorsed less problems relating to nightmares and night pain than did controls. Interestingly, there was a higher correlation between parent and child reports of items for the children with ADHD than for the control children. In conclusion, there was an increased overall prevalence of parent-reported sleep disturbances in children with ADHD compared to healthy controls.

In order to replicate or refute the findings reported by Owens, Maxim, et al. (2000), the present study included parents' perceptions of their children's sleep and children's perceptions of their own sleep. Although many of the actual items/questions are different, the questionnaires included in the present study had many subscales that are similar to those used in the Owens, Maxim, et al. study. Specifically, the present study measured bedtime resistance, daytime sleepiness, parasomnias/other disturbance (i.e., sleepwalking, sleep talking, nocturnal enuresis), sleep anxiety, sleep-disordered breathing, sleep duration/quality, and sleep onset delay. However, the questionnaires created for the present investigation included three additional areas that reflect morning difficulty, sleep hygiene, and symptoms of Restless Legs Syndrome. In addition to these subscales, this investigation incorporated difficulties transitioning with the sleep anxiety subscale and grouped together items relating to sleep duration, nocturnal wakings, and sleep quality under one subscale. The present study specifically asked about and excluded children who had any history of a diagnosed or treated sleep disorder. Although children with a symptom complex of sleep-disordered breathing were not excluded from this study (in contrast to the methodology of Owens, Maxim, et al.), the

percentage of children with ADHD who have sleep-disordered breathing was examined. To build upon the work by Owens, Maxim, et al., the present study gathered information regarding whether the parents or guardians considered any of the endorsed sleep difficulties as problematic for the family or the child.

Relationship Between Sleep and Daytime Behaviors

Sleep likely has a role in regulation of arousal, mood, and learning. These areas are key to thinking about ADHD symptomology. The control of arousal and attention are a likely source of overlap between regulation of sleep and the underlying biology of ADHD. Although there is unclear experimental evidence for performance and behavioral deficits following sleep deprivation, clinical experience supports the notion that children who are not receiving sufficient sleep are more irritable, restless, and oppositional than are children who receive adequate sleep (Dahl et al., 1991). Furthermore, symptoms of ADHD are associated with symptoms that children with inadequate sleep often demonstrate. These include irritability, distractibility, restlessness, impulsivity, and oppositionality (Dahl & Puig-Antich, 1990). It is also possible that sleep disturbances may aggravate certain disturbances of temperament already inherent in ADHD populations (Miller & Kraft, 1992).

Although parents often complain about their hyperactive children's insomnia, frequent nocturnal wakening, and restless legs, some investigators have questioned whether these features are the result of the behavioral disorder or treatment rather than an etiological factor (Chervin et al., 1997). There is increasing recognition that sleep problems may contribute to or exacerbate daytime behavioral difficulties of children with developmental disabilities (Dahl & Puig-Antich, 1990; Miller & Kraft, 1992; Wilens et

al., 1994). Furthermore, there have been other reports in which the behavioral treatment of sleep disturbances has improved children's daytime behavioral problems (Bergman, 1976; Dahl et al., 1991). One example of this is a case study that was performed by Dahl et al. (1991) of a 10 year-old girl diagnosed with ADD and delayed sleep phase insomnia. Treatment included behavior modification procedures in combination with chronotherapy (successive delays in bedtimes around the clock until sleep onset realigns with an earlier, more appropriate clock time) for her sleep disorder. Treatment resulted in clinically significant improvements in sleep patterns (i.e., reduced sleep onset latency and increased total sleep time) as well as improvements in daytime functioning (i.e., increased productivity and persistence with schoolwork, improved social interactions). Improvements were maintained over the 18-month follow-up period. Despite persistence of core ADD symptoms, improvements in sleep contributed to significant reductions in symptoms of ADD (irritability, alertness, and oppositional behaviors). The authors speculated that this girl's sleep problems exacerbated her ADD symptomology. In another case history, Bergman (1976) eliminated insomnia symptomology in a 7-year-old boy through behavioral interventions. Within two weeks of the recommendations being implemented, the child was sleeping soundly through the night in his own bed. In a 6-month follow-up, there continued to be no evidence of further insomnia problems; a marked decrease in hyperactivity was also demonstrated (Bergman, 1976). Hence, sleep disturbances may contribute to the behavioral problems of some children diagnosed with ADHD. Thus, as sleep problems can be responsive to behavioral therapies, it is important to determine how frequently such disturbances occur in children diagnosed with ADHD (Day & Abmayr, 1998).

Severity of ADHD and Sleep Disturbance

Children with ADHD may be inherently at risk for disturbances in their sleep due to dysregulation of the autonomic nervous system. Variability of the degree of autonomic dysfunction may account for the heterogeneity of this population. Some have speculated that unless sleep disturbance is extreme, there may not be a detectable effect on daytime behavior. Thus, this effect may not be as readily detectable in earlier and more subtle variations of ADHD (Miller & Kraft, 1992). One study examined whether the severity of ADHD symptomology was associated with the degree of derangement of sleep architecture. No significant association was found in either the ADHD or the control group between the total score on the sleep questionnaire and the severity of ADHD symptomology as measured by the Conners' Rating Scales (Ring et al., 1998).

Sleep Differences Within Subtypes of ADHD

The *DSM-IV* distinguishes between ADHD children with Primary Hyperactive/Impulsive and Primary Inattentive subtypes. Children diagnosed with the Inattentive subtype may present with less overt behavioral symptoms. Consequently, some investigators have speculated that children with predominantly Inattentive Subtype may have fewer sleep problems (Ball et al., 1997). Investigators have examined whether there are sleep differences between two subtypes of ADHD children (those with and those without hyperactivity). Using polysomnography, Ramos Platon et al. (1990) found that overall, the ADD/H subgroup had a greater instability/sleep fragmentation and a lesser grade of sleep efficiency than did the ADD/WO subgroup. Also, the ADD/H children had greater time of wakefulness (greater sleep onset latency and intrasleep wakefulness), greater number of sleep changes during sleep, and a greater absolute and

percentage time spent in Stage 1 than did children with ADD/WO. The ADD/H children had longer latencies to REM than did controls, but this was especially pronounced in children with ADD/WO. However, in both conditions, the sleep disturbances endorsed exceeded that of the normally-developing children. Trommer et al. (1988) further examined this question by utilizing parents' reports and found that ADD/H and ADDnoH children were similar on current measures of sleep onset problems (58% versus 50%) and morning fatigue (53% versus 59%). Similar to the results noted in the Ramos Platon et al. study, ADD/H children were reported to have more frequent nocturnal arousals than were ADDnoH children (32% versus 16%; controls=13%). In addition, parents of ADDnoH children were more likely to report that their children had nightmares as least once a month as compared to parents of ADD/H children (25% versus 14%; controls = 3%). The overall conclusion was similar to Ramos Platon et al. and confirmed that the incidence of parent-reported sleep problems was greater in both subtypes of ADD children than in normally-developing children.

Relationships Among ADHD, Comorbid Diagnoses, and Sleep Disorders

There is little doubt that insufficient or disturbed sleep impacts daily functioning and may mimic ADHD or further exacerbate the severity of a pre-existing attention disorder (Weinberg & Emslie, 1991). Certainly fatigue in children may lead paradoxically to over-activity and irritability and that parents often recognize that disturbance in a child's sleep schedule may led to difficulty concentrating, behavioral dyscontrol, and noncompliance the following day (Brown et al., 1995).

Sleep disturbances related to ADHD or its treatment may further contribute to impairment and the successful treatment of sleep problems may reduce ADHD-

symptomology and improve overall functioning (Prince, Wilens, Biederman, Spencer, & Wozniak, 1996). For instance, some have suggested that insomnia may reciprocally contribute to daytime over-activity and poor academic performance (Trommer et al., 1988). Management of sleep disturbances associated with ADHD has not received sufficient attention (Prince et al., 1996). Some research has documented that ADHD symptoms in children with sleep disorders improve or resolve when the sleep disorders are appropriately identified and treated (Guilleminault, Korobkin, & Winkle, 1981; Picchietti & Walters, 1996). Also, daytime features of obstructive sleep apnea in children include hyperactivity, impulsivity, and behavioral difficulties, which often resolve when apnea is corrected by an appropriate intervention (Brown et al., 1995). Additionally, sleep disorders such as narcolepsy can produce poor attention and hyperactivity. Periodic leg movements, schedule disorders, and insufficient sleep can also reduce alertness and result in hyperactivity (Brown et al., 1995). Some sleep problems such as Periodic Limb Movement Disorder/Restless Legs Syndrome and sleep-related breathing disorders (such as Sleep Apnea) may contribute to poor arousal or alertness which in turn, could be mistaken for ADHD symptoms and/or result in ADHD-like symptomology (Chervin et al., 1997). However, it is unclear how often this may be the case. Moreover, treatment of the sleep disturbances can lead to improvements in behavior and a discontinuation of stimulant medication (Ali, Pitson, & Stradling, 1993; Guilleminault, Korobkin, & Winkle, 1981; Picchietti & Walters, 1996). Others have speculated that Restless Legs Syndrome and Periodic Limb Movement Disorder may be more common in children with ADHD (Picchietti & Walters, 1996). Investigators have also suggested comparing the sleep of children with ADHD to that of children with other sleep disorders such as

Narcolepsy. Because Narcolepsy also affects cognition and is responsive to stimulant medication, study of Narcolepsy in comparison to ADHD may contribute to a greater understanding of the pathogenesis associated with ADHD (Trommer et al., 1988).

Due to the overlap between the diagnosis of ADHD and sleep disorders, recently a number of investigators have expressed concern that children with sleep disorders are being misdiagnosed as ADHD. Picchietti, England, Walters, Willis, and Verrico (1998) conducted the first large-scale study that determined a potential comorbidity between ADHD and Periodic Limb Movement Disorder. They asked parents of ADHD children about symptoms of Periodic Limb Movement Disorder and/or Restless Legs Syndrome. Twenty-seven of 69 children were found to have sufficient symptoms of sleep disorder. After this "at-risk group" underwent a polysomnography, 18 (26% of the original sample of children with ADHD) fulfilled the criteria for Periodic Limb Movement Disorder. The investigators concluded that sleep disruption and motor restlessness secondary to Periodic Limb Movement Disorder and Restless Legs Syndrome can result in inattention and hyperactivity in a subgroup of children diagnosed with ADHD.

Pediatric patients referred for sleep evaluations are also frequently described as exhibiting significant behavioral disturbance, including symptoms that are associated with ADHD, oppositional-defiant disorder, and conduct disorder (Brown et al., 1995). Chervin et al. (1997) surveyed parents of children between the ages of 2 and 18 recruited from either a child psychiatry or a general pediatric clinic in an effort to assess the children's behavior, snoring, complaints of restless legs at night, and daytime sleepiness. Results indicated that habitual snoring was more frequent among children with ADHD (33%) than among the non-ADHD children recruited from either the psychiatric (11%) or

pediatric (9%) clinics. Snoring was associated with a greater degree of inattention and hyperactivity, particularly when it was reported that snoring occurred more than one-half of the time while asleep. The complaints of restless legs and daytime sleepiness showed some association with inattention and hyperactivity. The authors concluded that sleep-related breathing disorders and perhaps other sleep disorders could be the cause of inattention and hyperactivity in some children. Moreover, their data indicated that 81% of habitually snoring children with ADHD (25% of all children with ADHD) may experience significant reductions in their attention problems if habitual snoring and any related sleep-related breathing disorder were effectively treated.

A primary clinical significance of children experiencing sleep-disordered breathing may have to do with the initiation or exacerbation of behavioral symptoms such as excessive sleepiness, hyperactivity, learning difficulties, and other problematic behaviors (Carskadon, Pueschel, & Millman, 1993). Increased prevalence of daytime sleepiness, hyperactivity, and restless sleep has been found to be significantly more common among habitual snorers than among never snorers (Ali et al., 1993). In a study that included children and adolescents with obstructive sleep apnea syndrome and related breathing disorders during sleep, hyperactivity was noted in 42% of the children. Frequent complaints by teachers included asocial behavior, poor attention span, and fluctuations between periods of hyperactivity to periods of excessive somnolence and withdrawn conduct (Guilleminault et al., 1981). O'Brien, Holbrook, and colleagues (2003) also found an unusually high prevalence obstructive sleep apnea and related snoring in a group of community-based children designated as showing mild symptoms of ADHD. In another study, 7% of children with ADHD who were referred to a sleep

medical center were found to have sleep-disordered breathing (Crabtree, Ivanenko, & Gozal, 2003). Hence, appropriate diagnosis of sleep-disordered breathing in children with ADHD is essential as treatment of sleep-disordered breathing in some children may ameliorate the behavioral symptoms and learning difficulties frequently associated with ADHD (Carskadon et al., 1993; Gozal, 1998).

Other investigators have examined the potential impact of impaired sleep on the academic performance of children in a public-school setting. To examine for obstructive sleep apnea, Gozal (1998) screened nearly 300 first-graders who were performing in the lowest 10th percentile scholastically as compared with their classmates. Of the 54 children identified, 24 underwent a surgical tonsillectomy and adenoidectomy to treat these symptoms. Overall grade point average significantly improved (from 2.43 on average to a mean of 2.87) during the second grade for children who had this medical intervention. In contrast, children identified with sleep breathing problems whose parents elected not to seek a therapeutic intervention did not show significant improvement. The investigator concluded that some aspect of the learning difficulties exhibited by these children may have been caused by sleep-disordered breathing. The finding further underscored the importance that sleep-related symptoms should be assessed in all children with developmental or learning problems.

To determine whether symptoms of poor frustration tolerance, impulsivity, and distractibility were secondary to obstructive sleep apnea rather than ADHD, Owens, Maxim, et al. (2000) conducted the first study to screen for and exclude children with symptoms of sleep-disordered breathing. A limitation of their study, however, included not screening for Restless Legs Syndrome and Periodic Limb Movement Disorder which

may also result in an ADHD symptom profile that results from delayed sleep onset or increased sleep fragmentation (Picchietti & Walters, 1996; Picchietti & Walters, 1999).

Marcotte et al. (1998) conducted a study to examine if parents of children (aged 6 to 12) referred for a neurodevelopmental evaluation that resulted in a diagnosis of ADHD are more likely to report sleep-disordered breathing or other sleep problems than would be endorsed by parents of normal children in a community setting. The authors divided the groups based on children's diagnosis (i.e., ADHD, learning disability (LD), or a dual-diagnosis of ADHD/LD). No difference was found between boys and girls on any scale assessed including sleep and breathing problems, sleepiness, behavioral problems, and length of sleep on weeknights. Parents reported that the three females with LD slept longer than any of the other gender by diagnostic subgroups. Sleep-related difficulties were reported at the same frequency across all three clinical subgroups (ADHD, LD, Combined ADHD/LD). There were no significant differences based on parental reports among the ADHD, LD, and ADHD/LD groups with respect to the three scales assessed (i.e., sleep and breathing problems, sleepiness, and behavioral problems). Overall analysis revealed that parents of children who were diagnosed with ADHD and/or LD were more likely to report greater problems among the measured dimensions of sleep-related problems (including sleep/breathing-related problems and sleepiness) and behavioral problems in their offspring than were the parents of community-based control children. However, no significant difference was found between the clinical and control groups on the length of sleep on weeknights. Even when the researchers compared the control group with children who scored at the 90th percentile or higher on each of the three scales, there were no significant differences found between total time asleep.

Effects of Psychopharmacological Agents Used to Treat ADHD on Sleep

Stimulant medications. Beginning in 1937, when Bradley first identified the therapeutic effects of central nervous system stimulants to improve maladaptive behaviors of hyperactive children, psychostimulants have been a preferred treatment for children with ADHD. Approximately 75% of children receiving psychostimulants improve (Barkley, 1977). Currently, recommendations for the most effective interventions and treatment strategies include a combination of approaches including parent and teacher education and training, individual and family psychotherapy, and psychostimulant medications (Barkley, 1990). Despite the fact that stimulant medication has been an increasingly common component in the treatment and management of many children with ADHD (Barkley, McMurray, Edelbrock, & Robbins, 1990), there are only a few controlled pharmacological studies that have examined sleep problems in children with ADHD (Corkum et al., 1998). In addition, empirical formulation on the side effects of psychostimulants is inconclusive as to whether ADHD children's sleep is compromised by their use during treatment (Ball & Koloian, 1995).

Parent perceptions and poloysomnogram data are somewhat more congruent for medicated children with ADHD than for children not medicated (Ball & Koloian, 1995). However, consideration should also be given to the results of surveys involving medication-free children with ADHD, which also have indicated that parents often perceive sleep disturbance in the children (Ball & Koloian, 1995). Barkley et al. (1990) noted that many of the behavioral side effects that have been attributed to the side effects of stimulant medication already occur in a sizeable percentage of children with ADHD before they begin pharmacotherapy; some of the research that has cited "side effects"

during stimulant medication treatment may have been confounded by high base-rate occurrence. For example, parent ratings indicated that 40% of children with ADHD had problems with insomnia during the placebo condition (Barkley et al., 1990).

Survey research on medicated ADHD children. Anecdotal reports may have led many clinicians to suspect insomnia as a common side effect of stimulants used in this population (Ball & Koloian, 1995). In 1977, Barkley reviewed articles pertaining to behavioral side effects of stimulant medication use with hyperactive children. His review was based primarily on clinical impressions from interviews with parents. Nearly all of the studies reviewed (26 of 29) indicated insomnia to be a specific side-effect. Barkley and colleagues (1990) employed a rigorous, triple-blind, placebo-controlled, crossover evaluation of methylphenidate at a low and high dose (0.3 and 0.5 mg/kg twice a day, respectively) in 83 children with ADHD to assess the frequency and severity of side effects that have been presumed to be associated with stimulant pharmacotherapy. Of the 17 side effects studied, four of them were determined to be significant drug effects. One of these was insomnia. Although 40% of parents with children in the placebo condition reported insomnia as troublesome for their children with ADHD, the percentage of children with insomnia in the drug condition was 62% for children in the low-dose group and 68% for children in the high-dose condition. Additionally, as reported by their parents, 7% of children with ADHD receiving the placebo dose displayed the side effect of insomnia within the serious range. This is comparable to18% of children with ADHD in both drug conditions whose parents reported insomnia to be in the serious range.

Similarly, employing children recruited from a clinical setting, Ahmann et al. (1993) used a double-blind, placebo-controlled, crossover design to address the frequency

of side effects of methylphenidate. The frequency of insomnia significantly increased in both of the medication conditions compared with either baseline or placebo conditions. As reported by parents, rates of insomnia increased to 59% for the .3mg/kg per dose condition and 53% for the .5 mg/kg per dose condition (when administered three times a day) as opposed to 38% at baseline and 37% for children in the placebo condition after intervention.

Stein (1999) also investigated parental perception of sleep problems in both medicated and unmedicated children with ADHD. In contrast to the previous research, Stein compared parent ratings for children with ADHD as compared to ratings by parents of psychiatric clinic referred children and pediatric outpatients. According to a sleep questionnaire completed by parents, ADHD children who were treated with stimulants were reported to display a higher prevalence of nightly "severe" sleep problems than were unmedicated children with ADHD. Nearly one-third (29%) of medicated children were reported to have an increased sleep onset latency or insomnia every night versus 10% of non-medicated children with ADHD. However, ADHD children who were not treated still displayed a two-fold increase in nightly insomnia compared to the psychiatric (3.6%) and pediatric controls (4.1%). The investigator concluded that use of stimulant medications appears to dramatically increase parents' reports of insomnia with almost one-third of medicated children with ADHD experiencing latencies of 30 minutes or longer to fall asleep every night.

Other research has utilized nurses as blind raters for inpatient children diagnosed with comorbid ADHD and depressive disorders (Pataki, Carlson, Kelly, Rapport, & Biancaniello, 1993). Results of their randomized, double-blind, placebo controlled,

crossover design found no differences among baseline, placebo, and methylphenidate (20 mgs twice a day) conditions on any sleep variables.

Concerta (methylphenidate HCl), a more recently developed, once-daily extended release tablet (OROS methylphenidate) of methylphenidate, has been shown to have effects similar to immediate-release methylphenidate. Two hundred and eighty-two children aged 6- to 12-years-old were randomized to placebo, immediate release methylphenidate three times a day, or Concerta for a 28-day trial. Results of this double-blind study indicated that at baseline, 70.5%, 72.8%, and 76.6% of patients in the immediate release, extended release, and placebo conditions, respectively, were assessed to have good or excellent sleep. At least 65% of the children in each group continued to have good or excellent sleep quality throughout the study; no differences were observed for the three groups (Wolraich et al., 2001). Similarly, results of a within-subjects double-blind comparison of adverse effects secondary to placebo, immediate release methylphenidate three times a day and a comparable dosage of Concerta provided to 68 latency-aged children yielded no difference between placebo and either drug or between the two active drugs with regard to sleep (Pelham et al., 2001).

Non-stimulant medication. Atomoxetine HCl (Strattera) is a recently-developed, non-stimulant, selective norepinephrine reuptake inhibitor used to treat symptoms of ADHD. There are still relatively few studies that have examined the sleep side-effects of atomoxetine on children. Results of a double-blind study in which 171 children and adolescents were randomized to 6 weeks of low-dose atomoxetine (.5 mg), higher-dose atomoxetine (1.2 mg), or placebo, indicated there were no differences in either dose groups compared to placebo with respect to somnolence and insomnia. Six percent or

less of the children in each condition reported either of these adverse effects. Results did indicate that somnolence tended to increase with increasing doses (Michelson et al., 2001). Other investigations have not demonstrated differences for asthenia (tiredness and fatigue) or insomnia in 228 children and adolescents randomized to open-label treatment with atomoxetine or to methylphenidate for a 10-week period. However, somnolence was more frequently reported among children randomized to atomoxetine than to methylphenidate (Kratochvil et al., 2002). In a third study utilizing 171 children with ADHD who were randomly assigned to amoxetine or placebo for a 6-week period, asthenia was reported more frequently in children medicated than for children receiving the placebo (Michelson et al., 2002).

Objective research on medicated ADHD children. Laboratory research on the sleep side effects of amphetamines in patients of all ages has produced inconsistent findings. Because many studies have failed to produce impressive evidence for the presence of sleep disturbance as a result of psychostimulant medication, it is possible that the effects of psychostimulants on sleep have been overstated and overly assumed within the clinical literature (see Ball & Koloian, 1995 for a discussion). For instance, Golinko (1982) found that regardless of dosage, when children were placed on a twice-daily regimen of Dexedrine for a period of 6 weeks, the frequency and intensity of insomnia did not exceed minimal levels. Other researchers have not found differences in sleep in medicated versus non-medicated children (Haig et al., 1974; Nahas & Krynicki, 1977). Nahas and Krynicki (1977) examined the potential effects of 20 mgs of methylphenidate (morning and afternoon doses) on sleep patterns in four hyperactive boys. Polysomnograph data were collected two nights before drug administration, again on the

1st and 21st nights of drug administration, and on the 1st and 2nd nights after drug withdrawal. Psychostimulant medication did not affect standard sleep variables including sleep stages, movements, and sleep time. Analyzing data from six medicated and medication-withdrawn hyperactive boys, Haig et al. (1974) found no difference in any sleep parameters, including percent of time spent in each NREM and REM sleep stage, overall sleep length, number of awakenings, sleep latency, time to first REM period, and number of REM periods. The authors concluded that the use of methylphenidate has little effect on the sleep of hyperactive children, even with large doses and with administration close to bedtime.

The studies cited above found psychostimulant medication did not cause sleep problems. However, the majority of research has found small, but not clinically significant problems in sleep due to psychostimulant medication (Busby & Pivik, 1985; Feinberg et al., 1974; Greenhill et al., 1983; Khan & Rechtschaffen, 1978; Small et al., 1971; Tirosh et al., 1993). Feinberg et al. (1974) examined the EEG sleep patterns of boys with minimal brain dysfunction syndrome before, during, and during withdrawal from stimulant medication as well as while on a placebo drug. The four children diagnosed with minimal brain dysfunction syndrome showed baseline sleep patterns that resembled those of age and sex-matched controls. Sleep patterns of four children with minimal brain dysfunction syndrome who received short-term stimulant medication therapy and four children who received long-term medication were similar to those of the drug-free controls. The few changes induced by drug treatment were later REM onset and a trend toward more intense eye movement activity. Greenhill et al. (1983) studied nine pre-pubescent boys both before and after 6 months of methylphenidate therapy.

Boys medicated on methylphenidate twice daily (morning and noon dose) for six months were compared to normally-developing children for two nights. The medicated children with ADDH demonstrated significantly longer mean recording period, a longer mean sleep period time when left to awaken at will, longer sleep latency, and increased mean number of sleep stage shifts. Although different than those found by Feinberg et al., Greenhill et al. also found REM changes. Medication resulted in an increased number of REM periods and increased REM activity and fragmentation. Khan and Rechtschaffen (1978) found that the number of sleep spindles during Stage 2 sleep more than doubled for hyperkinetics after being treated with methylphenidate. Using EEG sleep parameters, Small et al. (1971) compared baseline sleep patterns in age-matched normal controls with three children treated with dextroamphetamine sulfate before and during treatment. Results indicated that the baseline sleep patterns of the hyperactive children with minimal brain dysfunction varied little from normally-developing children. During a 5 mg trial, no changes were reported at baseline for the children with minimal brain dysfunction. During the optimal clinical dose phase, sleep latency increased significantly from baseline. Similar to results by Feinberg et al., there was a longer onset to the first REM period, which resulted in a significant reduction in the number of sleep cycles. However, dextroamphetamine sulfate did not affect total sleep time, the constituent EEG sleep stages, or the amount of eye movement activity. To assess the effects of a morning dose of methylphenidate on sleep patterns of 6- to 9-year-old children diagnosed with ADHD, Tirosh et al. (1993) conducted a double-blind, controlled drug-placebo crossover design utilizing activity monitoring at home. Results indicated shorter total sleep duration during stimulant treatment as compared with baseline and placebo treatments.

No other differences, including measures of activity level, sleep onset, sleep efficiency, or activity level, were evidenced between children with ADHD and controls or between periods when the children were on and off of methylphenidate treatment.

Nature of side-effects of sleep difficulty secondary to stimulants. One primary criticism of the Barkley et al. (1990) study is that the children were only medicated for a 7 to 10 day trial. Physicians highly experienced in using stimulant medications to treat children with ADHD have argued that effects of stimulant medications on sleep disturbance are transient. For instance, Conner's (1972) observed that although at least 60% of hyperactive children experienced insomnia as an initial side effect of stimulant medication (which peaked at 28 days), by the end of the 8-week treatment period, fewer than 5% of children reported moderate or severe insomnia. Similarly, Silver (1992) reported that some children and adolescents seem to have difficulty falling to sleep when they take; however, this problem often decreases or subsides after 2 to 3 weeks. In addition, Golinko (1982) found the intensity of reported insomnia stabilized when the dosage was held constant over a 6-week period.

Use of clonidine to ameliorate possible side-effects of stimulants. Because insomnia is regarded as a common problem, a number of studies have examined the clinical use of other drugs to counteract or manage the sleep problems that have been associated with the treatment of ADHD. One such drug is clonidine, which has been noted as appearing helpful in ameliorating sleep disturbances in children with ADHD (Prince et al., 1996; Wilens et al., 1994). Anecdotally, Wilens et al. (1994) noted that common parental observations of their children following stimulant treatment with clonidine at night included less oppositional behavior toward sleep, reduced sleep

latency, reduced sleep restlessness, increased overall hours slept, and improved morning awakenings. Additionally, they noted that many of the children surveyed demonstrated fewer ADHD-like symptoms the following day; they suggested this may be due to improved quality of sleep. They also noted that at the time the study took place, no controlled research had examined clonidine's efficacy, impact on sleep architecture, adverse effects, development of tolerance, and parameters for proper dosage. Additionally, they reported that nighttime administration of clonidine has not produced any unusual adverse effects and may be helpful for treatment of sleep disturbances inherently associated with ADHD or its treatment.

Prince et al. (1996) reviewed charts of 62 children and adolescents who had received clonidine for ADHD-associated sleep disturbance. The most commonly reported sleep complaints prior to the use of clonidine were difficulty falling asleep (77%), restless sleep (40%), and difficulty awakening in the morning (10%). Results indicated that 24 of 62 children and adolescents reported sleep disturbance prior to medication use and eleven reported greater sleep problems after taking ADHD medication; 38 patients reported developing sleep disturbances after receiving medication for ADHD. Following treatment with clonidine, most patients reported a significant improvement in their sleep. The authors concluded that clonidine may be an effective medication in reducing sleep disturbances associated with ADHD or its treatment. Eighty-five percent of patients receiving clonidine for ADHD-associated sleep disturbances appeared to respond positively to this treatment and were considered to be much to very much improved in their sleep.

Withdrawal effects. Some have speculated that insomnia may be a "rebound effect" that is associated with the stimulant tapering off late in the day (Barkley, 1990). Other studies have reported that withdrawal from stimulant medication is less serious. For instance, based on polysomnograph data, when hyperactive children stopped taking their medication during summer recess from school, methylphenidate withdrawal did not cause significant rebound effects (Haig et al., 1974). Nahas and Krynicki (1977) found no negative effects on sleep upon withdrawal of methylphenidate in any of the sleep variables assessed including Stages 1 through 4, REM, REM latency, movement time, duration of REM cycle, number of stage changes and overall sleep time (with the exception of a trend toward lengthening of the delta cycle). Other studies have found that compared to the drug phase, withdrawal of the stimulant led to a reduction in sleep latency and increased sleep time (Feinberg et al., 1974). The children with minimal brain dysfunction syndrome did not demonstrate withdrawal elevations of REM sleep after receiving psychostimulant medication administered in a constant dosage. In a previous study, these same researchers noted that REM rebounds in medicated young adults with minimal brain dysfunction syndrome only occurred when the dosage was increased prior to withdrawal.

AM versus PM dosage and potential normalization of sleep. Many investigators have reported small or no effects of stimulant medication on sleep-related behaviors. Some researchers have documented that psychostimulants improve or normalize ADHD children's sleep (Tirosh et al., 1993). Some clinicians have reported that late doses of stimulant medication are beneficial for children's sleep (Chatoor et al., 1983); other clinicians recommend using additional medications at bedtime to reduce presumed

stimulant-related sleep problems (Wilens et al., 1994). It remains unclear whether a late-afternoon stimulant administration may improve children's behaviors without causing adverse effects on sleep (Kent, Blader, Koplewicz, Abikoff, & Foley, 1995). Overall, there seems to be considerable individual variation in the degree to which stimulants affect sleep (Dahl & Puig-Antich, 1990). Some clinicians have argued that they have encountered children with severe insomnia due to late afternoon/evening doses of methylphenidate. Resolution of sleep problems occurs with a change to either earlier dosing or shorter-acting stimulants. However, others have observed patients in which the difficulties in going to sleep are improved significantly when they are on later doses or longer-acting agents (Dahl & Puig-Antich, 1990). Even other clinicians have suggested that this paradoxical improvement in sleep for some children on stimulants may be due to more organized behavior prior to bedtime (Dahl & Puig-Antich, 1990). Silver (1992) also noted that clinical reports indicate that for some children, the medication reduces their ability to go to sleep, whereas for others, the lack of medication may keep them awake. Difficulty in sleep onset may be due to the medication wearing off and the negative behaviors returning, sometimes with greater intensity. This may result in novelty for the child. As a result, this may create difficulty for the child in lying still, blocking out stimuli, and successfully falling asleep. In fact, for some children, a late (i.e., 8 p.m.) dose may allow them to fall asleep more easily. Silver (1992) further noted that it is difficult to distinguish clinically which may cause the sleep problem. Thus, parents are advised to try both conditions at home to determine whether a late evening dose is beneficial for the child's sleep.

Utilizing a double-blind crossover method, Chatoor et al. (1983) examined the effects of nocturnally administered dextroamphetamine upon EEG sleep in seven children with ADD. Children recruited for participation had nighttime and early morning behavior problems including sleep disturbance. Each child was being treated for at least 6 months prior to study entry with a morning dose of dextroamphetamine in a sustained-release capsule, with a clinical effect of 6 to 12 hours compared with 3 to 6 hours for the regular tablet. In addition, all children received an evening dose throughout the study. Nocturnally medicated children showed a significant increase in the percentage of Stage 1 and 2 sleep and a significant decrease in the percentage of REM sleep, number of REM periods, sleep efficiency, and total amount of sleep during the recording period. Additionally, they found an increase in REM latency. The investigators concluded that there seemed to be a shift in sleep architecture with an overall decrease in REM sleep and an increase in Stage 1 and 2 sleep. Due to the increase in these early stages of sleep, there was a delay in the onset of REM sleep and a decrease in overall REM sleep throughout the night. There was no change in deep sleep or in Stage 3 and 4 sleep for children in the nocturnally-administered medication condition. The investigators, however, noted that the overall sleep efficiency of the children was reduced only by 5% under drug versus placebo conditions. Thus, the reduction in the overall sleep efficiencies may be inconsequential compared to the potential clinical advantages to nocturnal administrations of stimulants.

Chatoor et al. (1983) also discussed informal observations made by parents. Parents of children who received an evening dose of dextroamphetamine reported that their children seemed to settle down more readily to sleep versus when only a morning

dose of amphetamine was administered. In addition, parents of children who received medications during the day only reported a frequent occurrence of negative and oppositional behaviors during the afternoon that intensified at bedtime. When given a morning, long-acting dose of medication and an additional regular afternoon dose, behavior improved considerably, however, behavior deteriorated before bedtime. This may have been due to the medication wearing off in the late evening hours leading to a rebound effect with severe behavioral problems that resulted in a delay of bedtime. When children received the additional bedtime dosage, the children seemed to be more agreeable and there was a decrease in oppositional behavior, which was likely interpreted by the parents as going to sleep better. It was unclear whether the parents' reports that children slept better with a nighttime dosage of stimulants were skewed by the child's generally more manageable behavior at bedtime and wake-up or whether reduced restlessness secondary to fewer and shorter REM periods significantly impacted parents' judgment of their children's soundness of sleep.

Results of some studies have supported that stimulant treatment may normalize sleep patterns in children with ADHD. Busby and Pivik (1985) found that non-medicated children with ADHD were more easily aroused than were normal controls but when medicated, arousability reached that of the normal controls. Tirosh et al. (1993) found a trend for a lower amount of quiet sleep among the unmedicated ADHD group when compared to controls, however, this difference was eliminated during the medication phase. The authors concluded that methylphenidate does not significantly impact sleep patterns adversely and may help normalize sleep patterns in children with ADHD. This was postulated to be due either to a metabolic carryover effect or due to a decreased

energy expenditure and fatigability during the day while receiving the medication may then result in a shorter sleep duration and a decreased need for movement to maintain the arousal level. Kent et al. (1995) reached a similar conclusion as Tirosh et al. Using a double-blind crossover study, they evaluated the effects of an early evening dose of methylphenidate on behavior and sleep in 12 children with ADHD admitted to a psychiatric inpatient hospital. Participants received a 4 p.m. dose of 15 mg methylphenidate, 10 mg methylphenidate, or a placebo. Children with ADHD experienced substantial symptom reduction and significantly improved behavioral control from methylphenidate administration in the late afternoon with no adverse effects on sleep. In fact, children were rated as being less tired upon awakening after nights in which they received 10 mg of methylphenidate as compared with the placebo dose. Contrary to previously held notions, this finding suggests that a medium-dose, late-day stimulant may actually assist children in settling down more easily, and consequently result in better sleep. They concluded that three doses of medication a day should be considered for children with ADHD.

Relationship between sleep and amount/dosage of stimulant. Studies have found similar effects of stimulants on the sleep of children with ADHD regardless of dosage amount. Kent et al. (1995) found that neither a 10 mg nor a 15 mg early-evening dose of methylphenidate was found to alter sleep latencies. Based on the study conducted by Barkley et al. (1990), both the low dose and the high dose of methylphenidate resulted in a significant increase in insomnia relative to the placebo; however, no significant differences were found between the two dose conditions. While 15% of their sample reported insomnia as troublesome during the placebo condition, during the drug

condition, this increased to 52% (low-dose) and 56% (high-dose). Additionally, parents of children with ADHD indicated an increase in insomnia rated in the serious range from 7% during the placebo condition to 18% in both dose conditions. Ahmann et al. (1993) reported similar findings. Specifically, results indicated increased insomnia for children receiving methylphenidate three times a day as compared to the baseline and the placebo conditions. Reports of insomnia were congruent for both the .3mg/kg and the .5mg/kg doses.

Conclusion. Although Barkley's (1977) review of 29 articles supported insomnia as a sleep side-effect of stimulant use and in subsequent, rigorous studies, parents have rated insomnia to increase for their medicated children with ADHD (Ahmann et al., 1993; Barkley et al., 1990; Stein, 1999), other studies have not found any sleep differences pre- and post-medication conditions (Haig et al., 1974; Nahas & Krynicki, 1977; Pataki et al., 1993). Other researchers have detected some differences but they did not exceed minimal levels and were not clinically significant (Busby & Pivik, 1985; Feinberg et al., 1974; Golinko, 1982; Greenhill et al., 1983; Khan & Rechtschaffen, 1978; Small et al., 1971; Tirosh et al., 1993). Furthermore, some clinicians have suggested that the specific sleep side effects of stimulant use may be transitory or stabilize with continued use (Conners, 1972; Golinko, 1982; Silver, 1992). To control for this, medicated subjects included in the present research had been prescribed their stimulant and/or antidepressant at least 1month previously. Others have recommended that clonidine be prescribed to combat presumed ADHD-associated sleep disturbance (Prince et al., 1996; Wilens et al., 1994). Because clonidine has been shown to

significantly affect sleep, children who are prescribed this or any other sleep agent were excluded from the current investigation.

In addition, some clinicians have speculated that sleep disturbance may result from a rebound effect secondary to the stimulant tapering off late in the day or when withdrawn completely (Barkley, 1990; Feinberg et al., 1974); other research, however, has not supported this hypothesis (Haig et al., 1974; Nahas & Krynicki, 1977). Some studies have reported the potential benefits of late doses of stimulants (Chatoor et al., 1983; Dahl & Puig-Antich, 1990), whereas other research has suggested that late evening doses may normalize sleep patterns for children with ADHD (Busby & Pivik, 1985; Kent et al., 1995; Tirosh et al., 1993). Many studies have demonstrated that the effects of stimulants on sleep are similar even when different dosages are administered (Ahmann et al., 1993; Barkley et al., 1990; Kent et al., 1995). Therefore, dosage amount was not examined as a potential function in the present investigation.

Overall, research on whether children with ADHD can take daytime or evening doses of stimulant medications without significant sleep disturbance remains sparse and inconclusive (Ball & Koloian, 1995). At the level of an individual patient, amphetamines do not appear to have consistent side effects on sleep for either children who are hyperactive or normally-developing (Feinberg et al., 1974). Existing data does not support that stimulant treatment is always associated with significant sleep disturbance (Ball & Koloian, 1995). As such, the primary analysis conducted in the present study combined medicated and non-medicated children with ADHD.

Results of a Meta-Analysis

Corkum et al. (1998) reviewed all research published since 1970 (16 articles) on sleep disturbances in children with ADHD. Using a box-score approach to explore the consistency of findings across studies, results of their review of subjective measures indicated that parents of children with ADHD did report a greater variety of sleep problems than did parents of normal controls. Their results estimated the prevalence of sleep problems in children with ADHD to be between 25% and 50% as compared with 7% of normal controls. This represents a five-fold increase in the rate of sleep disturbance in children with ADHD over that of controls. However, it is still undetermined whether the increased parental report of sleep disturbance is a factor unique with ADHD or whether it reflects a more general psychological disturbance.

In contrast to the prevalent, subjective accounts of sleep disturbance in children with ADHD, results of a meta-analysis determined that objective verification of this was less robust and results were inconsistent (Corkum et al., 1998). The results of their review indicated that sleep onset was found to be longer (33%), shorter (22%), and the same (45%); however, 90% of the studies found no difference in total sleep time for ADHD children. Their only consistent objective finding was that children with ADHD demonstrated increased nocturnal movements. More specifically, 38% of the studies found significantly less sleep efficiency for the ADHD group whereas 67% found that children with ADHD exhibited more restlessness during sleep. One-half of the studies that examined sleep phase disturbances for children with ADHD found evidence for differences in NREM and REM sleep (55% and 50% respectively), although the other remaining studies did not detect such differences. Changes in sleep with the introduction

of stimulants were found in 75% of the studies reviewed. Most typically, stimulant medication produced changes in children's sleep with respect to prolonged sleep latency and increased onset to the first REM cycle. However, these findings were not considered to be clinically significant, pathological, or reflective of a serious sleep disorder.

Purpose and Hypotheses

The purpose of the present study was to examine sleep disturbances and behaviors in a group of children diagnosed with ADHD. A major goal of this investigation was to validate or dispute parental perceptions as reported in the clinical literature. In addition, one factor that has not received much attention in the empirical research on sleep of children is information gleaned from the children themselves (Ball & Koloian, 1995; Owens, Maxim, et al., 2000; Owens, Spirito, et al., 2000). Given this, the current investigation also included a children's self-report measure. The Sleep Questionnaire for Children (SQ-C) was developed to assess many of the same sleep issues that were included in the parent report form but from the child's perspective.

There are some additional features of the parent-report and self-report measures that were created for this study. In order to quantify the Likert scale descriptor and reduce subjectivity, each response item included both the descriptors (i.e., "sometimes") and a range that indicated specific number of days during the typical week (i.e., "1 or 2 times a week"). A second feature of the parent questionnaire was a separate scale in which parents or guardians indicated whether or not they consider each sleep disturbance problematic for the parent, the caregiver, or the child. Responses of the children with ADHD and their parents were compared with that of a healthy control group that was matched for age and sex.

Another goal of this study was to control for several factors that have been shown to affect the sleep of children with ADHD. Since results as to whether psychopharmacological agents have a significant impact on the sleep of children with ADHD have often been contradictory (i.e., Ball & Koloian, 1995; Barkley et al., 1990; Busby & Pivik, 1981; Greenhill et al., 1983; Haig et al., 1974; Nahas & Krynicki, 1977; Pataki et al., 1993; Stein, 1999) and because children included in this study were previously assessed and many were presumably receiving pharmacotherapy, both children who were and who were not presently being treated with medications for ADHD were included and grouped together in this study.

In addition, due to a documented association between sleep-disordered breathing and symptoms of hyperactivity, inattention, and impulsivity (Ali et al., 1993; Guilleminault et al., 1981), this study included a sleep-disordered breathing subscale that was created to indicate a symptom complex that may be suggestive of obstructive sleep apnea. Additionally, this study utilized a subscale that screened for symptoms reflective of Restless Legs Syndrome/Periodic Limb Movement Disorder, which are other sleep disorders that have been documented and may result in an ADHD symptom complex as the result of delayed sleep onset and/or sleep fragmentation (Picchietti & Walters, 1996; Picchietti & Walters, 1999).

Hypotheses developed a priori for this study were as follows:

- Based on both parental and child reports, children with ADHD have a greater severity of overall sleep disturbance than do children without ADHD. In addition, children with ADHD demonstrate more sleep disturbance as indicated in both parental and child reports in all areas assessed including bedtime resistance, daytime sleepiness,

morning difficulty, parasomnias/other sleep disturbance, sleep anxiety/transitioning, sleep duration/quality, sleep hygiene, sleep onset, and symptom complexes suggestive of Restless Legs Syndrome/Periodic Limb Movement Disorder and sleep-disordered breathing.

- Parents of children with ADHD express more concern with the sleep difficulties (by indicating that the behaviors are problematic for themselves, their families, and/or their children) than do parents of normally-developing children.
- Morning wake times and bedtimes on both weekdays and weekends are similar for children with and without ADHD. However, children with ADHD have substantially less total time asleep during the night as compared to controls.
- There is greater congruence between the reports of children with ADHD and their parents than between children in the control group and their parents.

METHODS

Participants

Inclusion criteria. Participants were children between the ages of 8- and 14-years-old, inclusive, and their parents. Parents indicated that their children had been previously diagnosed with ADHD with Predominantly Inattentive, Predominantly Hyperactive-Impulsive, or Combined subtypes by either a pediatrician or a licensed mental health care provider. All children with ADHD and their parents who were members of selected Children and Adults with ADHD (CHADD) chapters were eligible for inclusion. CHADD is a national, non-profit organization that provides individuals with ADHD education, support, and advocacy. In addition, ADHD participants were also gathered from initially approached comparison children whose parents indicated that their children have been diagnosed with ADHD. Although ADHD was a primary diagnosis for all children as indicated by their parents, children in the ADHD group could be diagnosed with comorbid learning disorders. The comparison group consisted of a sample of school-aged children, also aged 8 through 14 years, and were recruited in one of three ways: children waiting to receive services at the Pediatric Dentistry Clinic at Connecticut Children's Medical Center, through friends and family members of staff at Connecticut Children's Medical Center School, or through the Religious Education Program at Saint Bridget's Parish in Cheshire, Connecticut. Children represented a subset matched for gender and age as the children with ADHD.

Exclusion criteria. Exclusion criteria for both groups of children included a history of significant medical, psychiatric, or neurological condition, specifically including a neuromuscular or neurodegenerative disorder, seizure disorder, head injury

with loss of consciousness, chronic pain, tic disorder or Tourette's Syndrome, pervasive developmental disorder, mental retardation, or serious mental illness including bipolar disorder, conduct disorder, major depressive disorder, obsessive-compulsive disorder, post-traumatic stress disorder, psychosis, or significant anxiety. Even if parents did not indicate one of the above diagnoses, but the child was being prescribed a medication used to treat any psychological condition other than ADHD, the child was excluded from participation. In addition, children with ADHD and children in the comparison group were excluded from the study if they regularly used any medication (other than those prescribed to treat ADHD symptomology for the study children) that has been known to significantly impact sleep or had been diagnosed previously with a sleep disorder. In order to reduce the likelihood that sleep side effects may be the result of physiological adaptation to a psychopharmacological agent prescribed for ADHD, children were excluded if they had been begun medication within the previous month. In addition to all of the above, further exclusion criteria for the comparison sample included the parent's or guardian's report on a demographics questionnaire that the child had any of the above criteria, had been previously diagnosed with or treated for ADHD or learning disability, or received any type of special education services.

Instrumentation

Sleep Questionnaire for Parents (SQ-P). The SQ-P is a 57-item, retrospective survey created for use in the present study. It was designed for parents or guardians to complete to assess the sleep of their school-aged child during a typical week. The SQ-P includes items relating to the following sleep domains: Bedtime Resistance (i.e., argues with parents about bedtime"), Daytime Sleepiness (i.e., "sleepy during the day"),

Morning Difficulty (i.e., "difficulty waking up in morning", "drowsy in the morning"), Parasomnias/Other Sleep Disturbances (i.e., "talks in sleep", "sleepwalks"), Restless Legs Syndrome/Periodic Limb Movement Disorder (i.e., "bothersome leg sensations while relaxing or just before falls asleep"), Sleep Anxiety/Transitioning (i.e., "fearful of sleeping alone", Sleep-Disordered Breathing (i.e., "loud or heavy breathing while asleep"), Sleep Duration/Quality ("complains of poor or inadequate sleep", "wakes up easily to any sound", "seems to sleep too little"), Sleep Hygiene (i.e., "does not have bedtime routine", "falls asleep in place other than own bed"), and Sleep Onset (i.e. "takes longer than 20 minutes to fall asleep"). Parents or guardians were asked to rate each statement using a 5-point Likert scale (i.e., "never" = 0 times a week, "rarely" = less than once a week, "sometimes" = 1 or 2 times a week, "often" = 3 or 4 times a week, "usually" = 5, 6, or 7 times a week). In addition, for those items endorsed from "rarely" to "usually," parents or guardians indicated whether they believed that the behavior represented a problem or concern to either the parent or guardian or the child by checking "yes," "somewhat," or "no" following each rating.

Items intended to represent subcategories of sleep problems were grouped together into subscales. Appendix F provides a breakdown of individual items into the initial respective subscales. However, internal consistency was low for several subscales; this was especially pronounced for the control group. As a result, items that were not highly correlated with the other scale items were dropped from the subscales. Moreover, one sleep item (snores) was moved from one subscale (parasomnias/other) to another (sleep-disordered breathing). As a result of the changes made, the Restless Legs Syndrome/Periodic Limb Movement Disorder and the Sleep Onset subscales then

consisted of only one sleep item. The Restless Legs Syndrome/Periodic Limb Movement Disorder subscale was changed to the Restless Legs Syndrome subscale to accurately reflect the change. Final Cronbach alpha coefficients indicating internal consistency among items for all other subscales and the total score scale, as well as the number of items included for the final subscales and final scale are reported in Table 1. A breakdown of the sleep items into their final respective subscales is presented in Appendix H.

Table 1

Standardized Cronbach Alpha Coefficients for the Subscales on the Sleep Questionnaire for Parents (SQ-P)

Subscale	No. Items	ADHD	Control	Total
Bedtime Resistance	5	.82	.67	.83
Daytime Sleepiness	3	.85	.59	.80
Morning Difficulty	5	.84	.81	.85
Parasomnias/Other	5	.59	.70	.68
Sleep Anxiety/Transitioning	8	.82	.75	.81
Sleep-Disordered Breathing	4	.73	.62	.65
Sleep Duration/Quality	9	.89	.66	.90
Sleep Hygiene	7	.70	.66	.69
Total Sleep Disturbance	57	.87	.80	.90

Sleep Questionnaire for Children (SQ-C). The SQ-C is a 26-item, retrospective survey for school-aged children created for use in the present study. It was designed to be completed independently. The SQ-C assesses the same aspects of sleep as the SQ-P.

Items were developed to approximate the items and subscales on the SQ-P. Similar to the SQ-P, items are rated on a 5-point Likert scale, using the same rating scale as the SQ-P. One item was reversed scored; higher scores consistently indicate more sleep disturbance or problematic sleep behavior. A breakdown of the items into their respective subscales is presented in Appendix G.

Similar to the SQ-P, items intended to represent subcategories of sleep problems were grouped together into subscales. Appendix H provides a breakdown of individual items into the initial, respective subscales. However, internal consistency was not sufficient for several subscales. As a result, items that were not highly correlated with the others were dropped from the subscales or if none of the items correlated adequately, one item that was believed to represent the subscale sufficiently was selected for use in the subsequent analyses. An effort was made to exclude items that were related to the items dropped from the SQ-P and to keep items on the SQ-C that remained components of the SQ-P. For 6 subscales, items were dropped so that each subscale retained only 1 sleep item: Bedtime Resistance, Daytime Sleepiness, Morning Difficulty, Restless Legs, and Sleep Hygiene. The Parasomnias/Other Sleep Disturbance subscale was dropped altogether as a subscale. Final Cronbach alpha coefficients indicating internal consistency among items for all other subscales and the total score, as well as the number of items included in the subscales are presented in Table 2. Appendix I provides a breakdown of individual sleep items into their final respective subscales.

Demographics Questionnaire. The Demographics Questionnaire is a brief form in which parents or guardians supplied information about their children (i.e., age, sex, race/ethnicity) as well as information that assessed any significant medical, educational,

Table 2

Standardized Cronbach Alpha Coefficients for the Subscales on the Sleep Questionnaire for Children (SQ-C)

Subscale	No. Items	ADHD	Control	Total
Sleep Anxiety/Transitioning	6	.76	.57	.74
Sleep Duration/Quality	6	.64	.52	.62
Total Sleep Disturbance	26	.86	.70	.86

or psychiatric conditions. This form also requested the parents or guardians to report on the typical time on weekdays and weekends when their children fall asleep at night, when their children awaken, and the average length of the children's total sleep time.

Procedure

The current protocol was approved by the Institutional Review Boards at Connecticut Children's Medical Center in Hartford, Connecticut, and Old Dominion University in Norfolk, Virginia. A brief letter explaining the nature and purpose of the study and the instructions, the Demographics Questionnaire, and both sleep surveys (SQ-P and SQ-C) were mailed, along with a pre-stamped and addressed return envelope, by the CHADD Chapter's leader to each CHADD member's household. In addition, this investigator traveled to two CHADD Chapter meetings (in Connecticut and New York-White Plains), informed the members of the research, and distributed the survey packets to interested parents. Comparison children and their parents were recruited from patients at the CCMC Dentistry Clinic, from family and friends of CCMC School employees, and from 5th and 6th grade Religious Education classes at Saint Bridget's Roman Catholic Church in Cheshire, Connecticut. Parents or guardians and their children waiting for

their appointments at the Dentistry Clinic were approached by the primary investigator, explained the purpose of the study, asked if they generally fit inclusion criteria, and asked if they would be willing to participate. If they chose to participate, a letter describing the nature and purpose of the study, the instructions, and the questionnaires were provided. Prior to completing the questionnaires, any questions the parents or guardians or children had were answered. The parents or guardians and the children then completed the respective questionnaires and directly returned them to the investigator. Other comparison participants were identified through family or friends of employees at CCMC School. A flier was placed in all CCMC School employees' workplace mailboxes explaining the study and asking for participation or for them to provide information regarding the study to family or friends. A stack of the letters explaining the study, the questionnaires, and a pre-addressed and stamped return envelope was placed in the mailroom for employees to get if they chose to participate or to assist in finding participants. In addition, Saint Bridget's Parish staff allowed this investigator to distribute the same survey packets (as noted above) to their 5th and 6th grade religious education classes. The investigator requested the children to take the packets home and give them to their parents so their parents could decide whether or not to participate. For all of the participants, the parents or guardians were instructed to allow their children to complete the SQ-C independently, unless this was not possible given the children's age and/or reading ability. In this case, the parents or guardians were instructed to assist their children by reading, explaining, and marking their answers as appropriate. If the children required the SQ-C to be read aloud to them, the parents or guardians were instructed to place the enclosed separate sheet of paper with an enlarged Likert scale in

front of the children and to mark the appropriate box on the SQ-C indicating assistance. In all cases, consent and assent was implied through return of the questionnaires; participation was anonymous.

Overview of Questionnaires Distributed, Returned, and Utilized

Approximate return rates were as follows for the following chapters: 0 (0%) of the 125 surveys sent were returned from the Connecticut CHADD Chapter, 0 (0%) of the 2 surveys distributed in person were returned for the Connecticut CHADD Chapter, 13 (8.7%) of the 150 surveys sent were returned for the Massachusetts CHADD Chapter, 0 (0%) of the surveys distributed in person were returned for the New York-White Plains CHADD Chapter, 8 of 80 (10%) surveys sent were returned for the Rhode Island CHADD Chapter, 10 of 80 (12.5%) surveys sent were returned for the Virginia-Tidewater CHADD Chapter, 47 of 150 (31.3%) surveys picked up were returned for family and friends of CCMC School employees, 18 of 80 (22.5%) surveys distributed to 5th and 6th grade Roman Catholic Religious Education students were returned, and all 17 (100%) surveys distributed to parents and children in the waiting area of the CCMC Dentistry Clinic were returned. In all, approximately 700 surveys were sent or distributed, 113 (16.1%) were returned, and 66 were selected for inclusion in the final study or control groups. The numbers of surveys distributed, returned, and utilized from each population source are detailed in Table 3.

ADHD Group

A total of 33 children out of 45 (73.3%) children with ADHD in the age range of 8 through 14 years met the inclusion and exclusion criteria. Twelve children with ADHD were excluded from participation most often due to comorbid psychopathology,

Table 3

Numbers of Questionnaires Distributed, Returned, and Utilized from Each Population

	Distributed	Returned		Utilized	
		ADHD	Control	ADHD	Control
Source	N	N	N	N (%)	N (%)
CHADD Chapters					
CT	127	0	0	0	0
MA	150	12	1	9 (27.3)	0
NY (White Plains)	14	0	0	0	0
RI	80	8	0	6 (18.2)	0
VA (Tidewater)	80	10	0	5 (15.2)	0
CCMC					
Dental Clinic	17	2	15	2 (6.1)	5 (15.2)
School	150	12	35	10 (30.3)	17 (51.5)
Religious Class	80	1	17	1 (3.0)	11 (33.3)
Total	700	45	68	33	33

psychotropic medications for difficulties other than ADHD or to assist children in falling and staying asleep, or a combination of these factors. More specifically, 7 children were either diagnosed with a sleep disorder or taking medications specifically to aid sleep. Four children were diagnosed with a Tic Disorder, Tourette's Syndrome, Obsessive Compulsive Disorder, or Asperger's Disorder, suggesting potentially greater neurological impairment. Seven children had a comorbid mood or anxiety disorders and two children had additional major medical problems.

The mean age of the 33 children selected was 10.7 ± 1.7 years and 25 (75.8%) were male. Seven (21.2%) of the selected children with ADHD were reported by their parents to have a comorbid diagnosis of Learning Disability, 1 (3%) had a comorbid diagnosis of Oppositional Defiant Disorder, and 4 (12.1%) also had a diagnosis of other psychiatric disturbance with 3 of these representing minor speech articulation difficulties and 1 involving sensory integration deficits. Approximately three-quarters of the children were medicated for ADHD (75.8% versus 24.2%). Three children were medicated with Strattera, 6 with Ritalin (either long-acting or immediate-release), 1 with Dexedrine, 1 with Symmetrel, 2 with Metadate CD, 4 with Adderall, and 8 with Concerta with two of these children also receiving a late-afternoon dose of immediate-release Ritalin. Biological mothers most frequently completed the surveys (90.9%). One biological father (3%), 1 step-mother (3%) and 1 foster mother (3%) also completed the surveys for their children with ADHD. Nearly one-half of the children with ADHD received some form of special education services (48.5% special education versus 51.5% regular education). Twelve (36.4%) parents assisted their children in the completion of the SQ-C. The mean education achieved for parents of these children was 4.13 ± 1.8, which corresponds to between a 4-year college degree and some graduate study. Twenty-seven (81.8%) of the 33 children were identified as Caucasian, 3 (9.1%) as African-American, and 3 (9.1%) as Hispanic. Table 4 indicates general information about all of the children selected for inclusion in the study and Table 6 includes information about the parents of the sample children. Parents reported that 16 (48.5%) of their children with ADHD were diagnosed as Combined Subtype, 7 (21.2%) as Primary

Hyperactive/Impulsive Subtype, and 10 (30.3%) as Primary Inattentive Subtype. Table 5 contains information specific to the children with ADHD.

To explore whether certain demographic characteristics were related to overall degree of parent-reported sleep disturbance, children in the ADHD group were separated into thirds based on severity of overall sleep disturbance. Then, the highest one-third and lowest one-third were compared for sex, age, parental education, medication condition, subtype of ADHD, co-existing learning disability, and tonsillectomy/adenoidectomy. Utilizing *t*-tests and chi-square (Fisher Exact Test) analyses, there were no significant differences found between these two groups for any of the noted demographics.

Control Group

A total of 55 (80.9%) children out of 68 normally-developing children in the age range of 8 though 14 years met the inclusion and exclusion criteria. Children were then matched for sex and as closely as possible for age with the children in the ADHD group. If there were more than the needed children in the age group, children with minor medical conditions (i.e., asthma) or children whose parents did not complete all the questions were excluded. In the few study cases where there were remaining participants, data were randomly selected for inclusion. These 55 children were down-selected to 33 children who served in the final control group. The mean age of the 33 children selected for the control group was 10.7 ± 1.6 and 25 (75.8%) were male. The mean years of education for parents of these children was 4.82 ± 2.0, with corresponds to an educational level between a 4-year college degree and some graduate study. Nine (27.3%) parents assisted their children in the completion of the SQ-C. Twenty-eight (84.8%) of the children were identified as Caucasian, 2 (6.1%) as African-American, 1

(3%) as Hispanic, 1 (3%) as "Other," and race/ethnicity was not reported for 1 (3%) participant. Twenty-seven (81.8%) biological mothers and 6 (18.2%) biological fathers completed the surveys.

Nearly all children were matched exactly for age; exceptions included one 11-year-old male in the control group who was matched with a 10-year-old male in the ADHD group and one 11-year-old female in the control group who was matched with a 12-year-old female in the ADHD group. Two-thirds of age and sex-matched children also were matched for race/ethnicity. Although one-third of children were not matched for race/ethnicity, overall, there was a discrepancy of only one or two children between groups for the racial/ethnic categories of African-American, Caucasian, Hispanic, and "Other." The matching procedure was effective. There were no significant differences between the ADHD and control groups for age, sex, and parental education. Table 4 contains general information about all of the children selected for inclusion in the study. Table 6 reports information about the parents and guardians of the sample children.

Children in the control group were separated into thirds, based on severity of overall parent-reported sleep disturbance, in order to explore whether certain demographic characteristics were related to overall degree of sleep disturbance. Then, the most sleep-disturbed one-third and the least sleep-disturbed one-third were compared for sex, age, parental education, and tonsillectomy/adenoidectomy. Utilizing *t*-tests and chi-square (Fisher Exact Test) analyses, there were no significant differences found between these two groups for any of the noted demographics.

Table 4

Characteristics of Children in the Study Sample

	ADHD		Control		Total	
Characteristic	N	%	N	%	N	%
Sex						
Male	25	75.8	25	75.8	50	75.8
Female	8	24.2	8	24.2	16	24.2
Age						
8	5	15.2	5	15.2	10	15.2
9	4	12.1	4	12.1	8	12.1
10	4	12.1	3	9.1	7	10.6
11	7	21.2	9	27.3	16	24.2
12	10	30.3	9	27.3	19	28.8
13	2	6.1	2	6.1	4	6.1
14	1	3.0	1	3.0	2	3.0
Race/Ethnicity						
African-Am.	3	9.1	2	6.1	5	7.6
Caucasian	27	81.8	28	84.8	55	83.3
Hispanic	3	9.1	1	3.0	4	6.1
Other	0	0	2	6.1	2	3.0

Statistical Analyses

Based on Cohen (1992), a minimum sample size of 26 to 28 (*t*-test and correlational analysis, respectively) respondents per group was determined to be required in order to detect a large effect size. With multiple comparisons, however, caution

Table 5

Specific Characteristics of the Children with ADHD

Characteristic	N	%
Medicated for ADHD	25	75.8
Special Education	16	48.5
Subtype of ADHD		
Hyperactive/Impulsive	7	21.2
Inattentive	10	30.3
Combined	16	48.5

should be exercised in interpreting specific subscale findings. ADHD respondents and controls were matched for gender and as closely as possible for age prior to data entry. Most but not all children were able to be matched for race/ethnicity. All data analysis were conducted with the SPSS program (SPSS Inc., Chicago, IL). Significant levels were set at $p < .05$ for all statistical analyses. Cronbach alpha coefficients were calculated for each subscale and the total scores for the ADHD, control, and total groups to assess internal reliability of the scales and scales were modified. Demographic data, subscale totals for both the SQ-P and SQ-C, and the total survey scores of both the instruments were compared using Independent Samples *t*-tests. Additionally, actual bedtime, wake-up time, and total sleep time (as reported by the parent or guardian) were compared. Spearman correlations, a distribution-free correlational statistic, were calculated to examine the correspondence between sleep items that parents endorsed and those that their children endorsed on the respective questionnaires. Then, differences among the correlations were computed.

Table 6

Characteristics of Parents or Guardians of Children in the Study Sample

Characteristics	ADHD		Control		Total	
	N	%	N	%	N	%
Relationship to Child						
Mother	30	90.9	27	81.8	57	86.4
Step-Mother	1	3.0	0	0	1	1.5
Father	1	3.0	6	18.2	7	10.6
Other	1	3.0	0	0	1	1.5
Education						
Below High School	0	0	1	3.0	1	1.5
High School Degree	9	27.3	6	18.2	15	22.7
Some College Study	5	15.2	2	6.1	7	10.6
Associate's Degree	3	9.1	4	12.1	7	10.6
4-Year College Degree	9	27.3	7	21.2	16	24.2
Some Graduate Study	0	0	2	6.1	2	3.0
Graduate Degree	6	18.2	11	33.3	17	25.8

RESULTS

Parental Ratings of Sleep Disturbance

Comparisons of the 10 SQ-P subscale scores for the ADHD and control groups and the total score for both groups are detailed in Table 7. When grouping all of the items, the Total Sleep Disturbance score was significantly greater for the ADHD group than for the control group, $t = -6.45$, $p < .001$. Comparisons between the means of the ADHD and control groups' scale scores using *t*-tests indicated that, with the exception of Daytime Sleepiness ($t = -1.71$, $p = .09$) and Sleep-Disordered Breathing ($t = -1.23$, $p = .22$), all other subscales were indicated to occur significantly more frequently in the ADHD group than in the control group. The following 3 subscales were significant at $p < .05$: Restless Legs/Periodic Limb Movement Disorder ($t = -2.55$), Sleep Anxiety/Transitioning ($t = -2.40$), and Sleep Hygiene ($t = -2.18$). Morning Difficulty ($t = -3.61$) was the only subscale significant at $p < .01$. Four subscales were significant at $p < .001$ including Bedtime Resistance ($t = -4.33$), Parasomnias/Other Sleep Disturbance ($t = -4.54$), Sleep Duration/Quality ($t = -4.70$), and Sleep Onset ($t = -4.09$).

For the ADHD group, these means ranged from a low of 1.36 for the Sleep-Disordered Breathing subscale to 3.42 for the Sleep Onset subscale. Of the 10 subscales, 6 subscales (Daytime Sleepiness, Parasomnias/Other Sleep Disturbance, Restless Legs Syndrome, Sleep Anxiety/Transitioning, Sleep-Disordered Breathing, and Sleep Hygiene) had overall item means ranging between "never" (0 times a week) to "rarely" (Less than 1 time a week). Three subscales (Bedtime Resistance, Morning Difficulty, and Sleep Duration/Quality) had overall item means in the "rarely" (Less than 1 time a week) to "sometimes" (1 or 2 times a week) range. The Sleep Onset subscale item mean

was the highest of all the subscales and indicated overall rating between "sometimes" (1 or 2 times a week) to "often" (3 or 4 times a week). The Total Sleep Disturbance scale's overall item mean was 1.96, which approximately corresponds to an overall item endorsement of "rarely" (Less than 1 time a week).

For the control group, 9 of the 10 subscale item means (Bedtime Resistance, Daytime Sleepiness, Morning Difficulty, Parasomnias/Other Sleep Disturbance, Restless Legs Syndrome, Sleep Anxiety/Transitioning, Sleep Disordered Breathing, Sleep Duration/Quality, Sleep Hygiene) fell between "never" (0 times a week) and "rarely" (Less than 1 time a week). Only the Sleep Onset subscale was in the lower portion between "rarely" (Less than 1 time a week) and "sometimes" (1 or 2 times a week). The Total Sleep Disturbance score was 1.43 and ranged midway between "never" (0 times a week) and "rarely" (Less than 1 time a week).

Several additional sleep variables were also examined and are presented in Table 8. There were no significant differences evidenced between the ADHD and control groups with regard to average bedtime on weekdays, average bedtime on weekends, average morning wake time on the weekdays, and average morning wake time on the weekends. However, average time asleep was significantly shorter for the ADHD group ($M = 8.05$, $SD = 1.80$) than for the control group ($M = 9.20$, $SD = .71$), $t = 3.27$, $p < .01$. Children in the ADHD and control groups generally went to sleep at 9:00 p.m. on the weekdays and 10:00 p.m. on the weekends. Average morning wake up time was approximately 7:00 a.m. on the weekdays and 8:00 a.m. on the weekends.

Table 7

Sleep Questionnaire for Parents (SQ-P): Comparison of Subscale and Total Means and Standard Deviations for ADHD and Control Groups

Scale	M ± SD	
	ADHD	Control
Bedtime Resistance	2.49 ± 1.07	1.59 ± 0.52***
Daytime Sleepiness	1.52 ± 0.80	1.25 ± 0.38
Morning Difficulty	2.71 ± 0.99	1.95 ± 0.70**
Parasomnias/Other	1.92 ± 0.72	1.29 ± 0.35***
Restless Legs Syndrome	1.55 ± 1.06	1.06 ± 0.24*
Sleep Anxiety/Transitioning	1.83 ± 0.87	1.40 ± 0.56*
Sleep-Disordered Breathing	1.36 ± 0.60	1.20 ± 0.44
Sleep Duration/Quality	2.31 ± 1.01	1.43 ± 0.35***
Sleep Hygiene	1.77 ± 0.55	1.52 ± 0.41*
Sleep Onset	3.42 ± 1.50	2.15 ± 0.97***
Total Sleep Disturbance	1.96 ± 0.43	1.43 ± 0.19***

Note. Higher scores indicate more frequently disturbed sleep. Individual items were ranked on a 5-point Likert scale. For means, 1 = "never" (0 times per week), 2 = "rarely" (less than 1 time per week), 3 = "sometimes" (1 or 2 times per week), 4 = "often" (3 or 4 times per week), and 5 = "usually" (5, 6, or 7 times per week). *P*-values are based on *t*-test comparisons of ADHD and control groups.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 8

Mean Bedtimes, Morning Wake Times, and Total Sleep Times for ADHD and Control Groups

	M (Hours) ± SD	
Sleep Variable	ADHD	Control
Bedtime (Weekday)	8.95 ± 0.79	9.04 ± 0.57
Bedtime (Weekend)	10.00 ± 0.84	9.95 ± 0.78
Morning Wake Time (Weekday)	6.81 ± 0.91	6.98 ± 0.73
Morning Wake Time (Weekend)	8.08 ± 1.36	8.23 ± 1.17
Total Sleep Time	8.05 ± 1.80	9.20 ± 0.71**

** $p < .01$.

Children's Ratings of Sleep Disturbance

Means, standard deviations and comparisons of the 8 SQ-C subscale scores and the total score for the ADHD and control groups are detailed in Table 9. When grouping all of the items, the Total Sleep Disturbance score was significantly greater for the ADHD group than for the control group, $t = -3.76$, $p < .001$. Compared with the control group, the ADHD group had a significantly greater mean score on 6 of the 8 subscales. The following 4 subscales were significant at $p < .05$: Daytime Sleepiness ($t = -2.55$), Sleep Anxiety/Transitioning ($t = -2.44$), Sleep Duration/Quality ($t = -2.09$), and Sleep Onset ($t = -2.28$). Two subscales were significant at $p < .01$. These were Bedtime Resistance ($t = -2.95$) and Morning Difficulty ($t = -2.94$). There were no significant differences evidenced between the ADHD and control groups for the Sleep Hygiene or the Restless Legs Syndrome subscales.

For the ADHD group, the Total Sleep Disturbance scale's overall item mean was 2.25, which approximately corresponds to an overall item endorsement of "rarely" (Less than 1 time a week) to "sometimes" (1 to 2 times a week). Subscale means ranged from a low of 1.76 for the Restless Legs Syndrome subscale to 3.36 for the Morning Difficulty subscale. Of the 8 subscales, 3 subscales (Restless Legs Syndrome, Sleep Anxiety/Transitioning, and Sleep Hygiene) had overall item means in the upper portions of the "never" (0 times a week) to "rarely" (Less than 1 time a week) range. Two subscales (Bedtime Resistance and Sleep Duration/Quality) had overall item means ranging midway between "rarely" (Less than 1 time a week) and "sometimes" (1 or 2 times a week). The Daytime Sleepiness, Morning Difficulty, and Sleep Onset subscale item means were the highest of all the subscales and indicated overall ratings between "sometimes" (1 or 2 times a week) and "often" (3 or 4 times a week). For the control group, 4 of the 8 subscale item means (Bedtime Resistance, Restless Legs Syndrome, Sleep Anxiety/Transitioning, and Sleep Hygiene) fell between "never" (0 times a week) and "rarely" (Less than 1 time a week). Only items in the Daytime Sleepiness, Morning Difficulty, Sleep Duration/Quality, and Sleep Onset subscales were in the lower to middle portion between "rarely" (Less than 1 time a week) and "sometimes" (1 or 2 times a week). The Total Sleep Disturbance score was 1.76 and ranged between "never" (0 times a week) and "rarely" (Less than 1 time a week).

Correspondence Between Parents' and Children's Ratings of Sleep

Agreement between the parents' and children's ratings of sleep disturbance on the 8 corresponding subscales and the total scale on the SQ-P and SQ-C was determined from Spearman correlations between the mean scores for parents and children. Spearman

Table 9

Sleep Questionnaire for Children (SQ-C): Comparison of Subscale and Total Means and Standard Deviations for ADHD and Control Groups

	M ± SD	
Scale	ADHD	Control
Bedtime Resistance	2.52 ± 1.48	1.64 ± .86**
Daytime Sleepiness	3.00 ± 1.50	2.18 ± 1.07*
Morning Difficulty	3.36 ± 1.34	2.52 ± 0.97**
Restless Legs Syndrome	1.76 ± 1.30	1.36 ± 0.70
Sleep Anxiety/Transitioning	1.91 ± 0.93	1.45 ± 0.56*
Sleep Duration/Quality	2.40 ± 0.87	2.00 ± 0.68*
Sleep Hygiene	1.88 ± 1.22	1.76 ± 1.17
Sleep Onset	3.03 ± 1.69	2.21 ± 1.19*
Total Sleep Disturbance	2.25 ± 0.67	1.76 ± 0.34***

Note. Higher scores indicate more frequently disturbed sleep. Individual items were ranked on a 5-point Likert scale. For means, 1 = "never" (0 times per week), 2 = "rarely" (less than 1 time per week), 3 = "sometimes" (1 or 2 times per week), 4 = "often" (3 or 4 times per week), and 5 = "usually" (5, 6, or 7 times per week). *P*-values are based on *t*-test comparisons of ADHD and control groups.

*$p < .05$. **$p < .01$. ***$p < .001$.

rank correlation coefficients for the ADHD group ranged from -.12 and .17 (Restless Legs Syndrome and Daytime Sleepiness, respectively) to a high of .67 (Sleep Duration/Quality). In the ADHD group, 6 of the 8 subscales (75%) were statistically significantly correlated: Bedtime Resistance ($p < .05$), Morning Difficulty ($p < .01$),

Sleep Anxiety/Transitioning ($p < .01$), Sleep Duration/Quality ($p < .001$), Sleep Hygiene ($p < .01$), and Sleep Onset ($p < .01$). The scores for Total Sleep Disturbance were also significantly correlated ($p < .01$). For the control group, 3 of the 8 subscales (37.5%) were statistically significantly correlated: Morning Difficulty ($p < .05$), Sleep Anxiety/Transitioning ($p < .001$), and Sleep Hygiene ($p < .01$). Spearman rank correlation coefficients ranged from .11 (Restless Legs Syndrome) and -.18 (Bedtime Resistance) to a high of .80 (Sleep Anxiety/Transitioning). Similar to the ADHD group, in the control group, there was a significant correlation between parents' and children's ratings for Total Sleep Disturbance ($p < .05$).

However, when differences between the correlation coefficients were calculated, only two subscales emerged as having significant differences. There was greater agreement between parents' and children's reports of sleep duration and quality for the ADHD group than the control group. Conversely, there was more congruence between the reports of the children and their parents in the control group than the reports of children and their parents in the ADHD group for sleep anxiety and difficulty transitioning. Spearman rank correlation coefficients and differences between the correlation coefficients for the total and subscales are presented in Table 10.

Degree to Which Sleep Items are Endorsed as Problematic by Parents

Parents of children with ADHD were asked whether they considered each sleep item endorsed as problematic for them or their children. Table 11 shows the numbers and average percentages of individual sleep items that were endorsed as problematic. Appendix J breaks down parental ratings by each sleep item. The average endorsement of "yes" for all sleep items was 9%, "somewhat" was 6%, "no" was 75%, and 10%

Table 10

Correspondence Between Total and Subscale Scores on the Sleep Questionnaire for Parents (SQ-P) and the Sleep Questionnaire for Children (SQ-C)

	r_s	
Scale	ADHD	Control
Bedtime Resistance	.36*	-.18
Daytime Sleepiness	.17	.32
Morning Difficulty	.46**	.42*
Restless Legs Syndrome	-.12	.11
Sleep Anxiety/Transitioning	.53**	.80*** †
Sleep Duration/Quality	.67***	.26 †
Sleep Hygiene	.45**	.44*
Sleep Onset	.49**	.32
Total Sleep Disturbance	.55**	.43*

Note. Higher scores indicate greater agreement between parents' reports and children's reports based on Spearman rank correlation coefficients.

*$p < .05$. **$p < .01$. ***$p < .001$.

Differences between the correlation coefficients for the ADHD and Control groups are indicated.

†$p < .05$.

occurred to some degree but were not rated as to the degree of problem that they presented. With regard to Morning Difficulty, there was a mean of 10% responding "yes" (with individual items ranging from 21% to 3%), 17% for "somewhat" (15% to 21%), 61% for either "no" it was not problematic or "no" it does not occur, and 12% (9%

to 15%) occurred at least "rarely" for their children, but the parents did not indicate whether or not they consider it problematic. For Sleep Onset, 27% of parents indicated that the problems their children experienced in this realm were problematic, 18% indicated that they were "somewhat" problematic, 39% identified that their children did not have difficulties in this area or if it did occur, these problems were not considered problematic, and 15% endorsed some degree of occurrence but did not report how problematic the items were. In the Sleep Duration/Quality subscale, an average of 17% of items (items' averages ranged from 6% to 27%) were identified as problematic, 7% (3% to 12%) as "somewhat" problematic, 63% (45% to 73%) as not problematic or not occurring, and 13% (9% to 18%) of sleep difficulties occurred but the degree of problem was not rated. On average, 21% (average individual items ranged from 12% to 30%) of items in the Bedtime Resistance subscale were indicated as problematic, 9% (6% to 12%) as "somewhat" problematic, 59% (48%to 73%) as not occurring or not problematic, and 12% (6% to 18%) rate the items as occurring but were not rated. No parents endorsed any Daytime Sleepiness items as problematic, 6% of items (3% to 12% for individual items) endorsed were considered "somewhat" problematic, 80% of items (73% to 85%) were endorsed as not problematic or not occurring, and how problematic the items were was not rated for an average of 14% (range for individual items was 12% to 15%).

Table 11 highlights the numbers and average percentages of individual sleep items within each subscale that were endorsed as problematic by parents of children in the control group. Appendix K breaks down parental ratings by each sleep item. For the Total Sleep Disturbance scale, an average of 0% of items were endorsed as problematic, 3% as "somewhat" problematic, 96% as not occurring or not problematic, and 1% were

rated as occurring at least minimally but were not rated as to the degree to which they caused problems for parents or children. Parents of normally-developing children did not endorse any individual sleep items on the Daytime Sleepiness, Parasomnias/Other Sleep Disturbance, Restless Legs Syndrome, Sleep Anxiety/Transitioning, Sleep Disordered Breathing, Sleep Duration/Quality, Sleep Hygiene, and Sleep Onset subscales as problematic for them or their children. Items on the Bedtime Resistance subscale appeared to be the most problematic with 9% of these items were rated as "somewhat" problematic (the range for individual items on this scale was 3% to 15%). In fact, only 3 sleep items--"difficulty waking up in the morning", "engages in prolonged or elaborate bedtime routine", and "stalls or protests bedtime" were rated by only one parent as being problematic. Further statistical analysis was intended but not possible due to the substantial number of parents that did not complete this section of the SQ-P.

Sleep Items Experienced Weekly

Sleep problems reported by parents as occurring at least once a week may be of concern to clinicians. When breaking down the SQ-P into separate, specific sleep items that parents reported occurred once a week or more, it is notable that nearly 67% of children with ADHD had weekly problems with sleep initiation. Sixty-one percent of children with ADHD experienced difficulty waking up in the morning at least once a week, and 42% to 55% of the sample argued with parents about bedtime, slept too little, and tossed and turned in their sleep. While parents in both groups reported similar frequencies of snoring, parents of children with ADHD reported significantly more disturbance with snoring loudly for their children than for parents of children without

Table 11

Numbers and Average Percentages of Individual Sleep Items Within Each Subscale That Were Endorsed as Problematic

	ADHD Group			Control Group		
Scale	"Yes"	"Somewhat"	Missing	"Yes"	"Somewhat"	Missing
Bedtime Resistance	34 (21%)	15 (9%)	19 (12%)	3 (2%)	15 (9%)	4 (2%)
Daytime Sleepiness	0 (0%)	6 (6%)	14 (14%)	0 (0%)	2 (2%)	0 (0%)
Morning Difficulty	17 (10%)	28 (17%)	20 (12%)	1 (1%)	9 (5%)	5 (3%)
Parasomnias/Other	8 (5%)	10 (6%)	17 (10%)	0 (0%)	1 (1%)	3 (2%)
Restless Legs Syndrome	3 (9%)	2 (6%)	2 (6%)	0 (0%)	0 (0%)	0 (0%)
Sleep Anxiety/Transitioning	21 (8%)	12 (5%)	26 (10%)	0 (0%)	4 (2%)	1 (0%)
Sleep-Disordered Breathing	2 (2%)	4 (3%)	8 (6%)	0 (0%)	2 (2%)	1 (1%)
Sleep Duration/Quality	51 (17%)	20 (7%)	38 (13%)	0 (0%)	15 (5%)	5 (2%)
Sleep Hygiene	4 (2%)	10 (4%)	22 (10%)	0 (0%)	4 (2%)	3 (1%)
Sleep Onset	9 (27%)	6 (18%)	5 (15%)	0 (0%)	2 (6%)	0 (0%)
Total Sleep Disturbance	166 (9%)	6 (4%)	10 (6%)	4 (0%)	54 (3%)	24 (1%)

ADHD. Also notable was the relatively high percentage of children with ADHD who have body pain and leg cramps during their sleep; parents reported 30% of the children with ADHD experienced this type of problem at least once a week as compared to none of the parents of normally-developing children. In comparison to children in the control group, over twice the children with ADHD demonstrated weekly problems falling asleep, sleeping too little, nocturnal wakenings, tossing and turning, arguing with parents about bedtime, having nightmares, grinding teeth, talking in sleep, sleepwalking, experiencing nocturnal enuresis, and snoring loudly. Percentages of parents who endorsed sleep items as occurring regularly once a week or more are presented in Table 12.

While a majority of children with ADHD were reported to never have any of the symptoms of sleep-disordered breathing, 5 (15%) children were reported to have, on average, at least occasional symptoms as compared to 3 (9%) children who do not have ADHD. General snoring was found to occur at least once a week in 15 (45.5%) and "often" or "usually" in nearly one-quarter (24.3%) of children with ADHD. This is comparable to 7 (21.2%) children without ADHD to experience snoring at least once a week and 4 (12.1%) children who experience snoring "often" or "usually." Six (18.2%) children with ADHD were reported to snore loudly at least occasionally and 4 (12.1%) of these children experienced snoring "sometimes" to "usually" during each week. In the control group, only 1 (3%) child snored loudly at any frequency during the week. One child with ADHD was reported to experience snorting sounds that wake him up at least once or twice a week. Two children with ADHD, at least occasionally, gagged or choked during their sleep. No children in the control group experienced snorting sounds or

Table 12

Numbers and Percentages of Parents Who Endorsed Sleep Items to Occur Once a Week or More for Their Children

	ADHD		Control	
Sleep Item	N	%	N	%
Difficulty waking up in morning	20	60.6	11	33.3
Wakes up in irritable mood	20	60.6	6	18.2
Long time to get alert in the morning	20	60.6	6	18.2
Heavy sleeper—difficult to rouse	14	42.4	7	21.3
Drowsy in the morning	16	48.5	10	30.2
Falls asleep easily during the day	3	9.1	1	3.0
Sleepy during the day	6	18.1	3	9.1
Takes unscheduled/unintentional nap	3	9.1	0	0
Takes more than 20 minutes to fall asleep	22	66.7	7	21.2
Seems to sleep too little	14	42.5	2	6.1
Complains of poor/inadequate sleep	12	36.4	2	6.1
Wakes early (before desired time)	10	30.4	6	18.2
Wakes up to urinate	10	30.3	6	18.2
Wakes up during the night (except to urinate)	12	36.4	4	12.1
Gets out of bed during the night	11	33.4	2	6.1
Wakes and goes into parent's bed	11	33.4	2	6.0
Difficulty falling back to sleep when wakens	12	36.4	3	9.1
Wakes up easily to any sound	8	24.3	1	3.0
Tosses and turns excessively in sleep	14	42.5	4	12.2

Table 12 (continued)

Numbers and Percentages of Parents Who Endorsed Sleep Items to Occur Once a Week or More for Their Children

	ADHD		Control	
Sleep Item	N	%	N	%
Does not have a bedtime routine	10	30.4	5	15.1
Does not fall asleep in own bed	5	15.2	1	3.0
Falls asleep in place other than own bed	7	21.3	1	3.0
Naps in afternoon (scheduled)	1	3.0	1	3.0
Naps in evening (scheduled)	1	3.0	1	3.0
Irregular bedtime (varies more than 1 hour)	9	27.2	5	15.1
Sleep schedule varies more than 1 hour on weekends compared to weeknights	19	57.6	15	45.4
Does not comply with bedtime routine	10	30.3	3	9.1
Engages in prolonged bedtime routing	15	45.5	3	9.1
Argues with parents about bedtime	18	54.5	5	15.2
Requests parent to repeatedly enter room	10	30.3	1	3.0
Stalls or protests bedtime	19	57.6	5	15.2
Calls out to parents after "lights out"	16	48.5	2	6.0
Insists on taking a particular object to bed	12	36.3	6	18.2
Fearful of sleeping alone	8	24.3	1	3.0
Sucks fingers or thumb in bed	2	6.1	2	6.1
Needs parent in room to fall asleep	4	12.1	0	0
Requests/requires nightlight	10	30.3	9	27.3
Fearful of dark	9	27.3	6	18.2

Table 12 (continued)

Numbers and Percentages of Parents Who Endorsed Sleep Items to Occur Once a Week or More for Their Children

	ADHD		Control	
Sleep Item	N	%	N	%
Expresses fearfulness at bedtime	6	18.2	1	3.0
Reports nightmares	10	30.3	1	3.0
Talks in sleep	10	30.3	4	12.1
Bangs head or rocks during sleep	0	0	0	0
Grinds teeth during sleep	8	24.3	3	9.1
Sleepwalks	2	6.0	0	0
Complains of body pain/leg cramps	10	30.3	0	0
Restless/moves a lot during sleep	15	45.5	5	15.2
Sits up, cries, screams suddenly during sleep	2	6.1	0	0
Snores	8	24.3	7	21.2
Wets the bed	3	9.1	0	0
Bothersome leg sensations while relaxing or just before falls asleep	7	21.2	0	0
Repetitive limb movements during sleep	4	12.1	1	3.0
Leg sensations can only be helped by walking or moving body rigorously	1	3.0	0	0
Snorting sounds that wake child up	1	3.0	0	0
Gags or chokes during sleep	1	3.0	0	0
Loud or heavy breathing while asleep	3	9.1	3	9.1
Morning headaches	7	21.2	0	0
Snores loudly (it disturbs others)	4	12.1	1	3.0

gagging or choking during their sleep. Taken together, results support that there may be a subset of children with ADHD who experience sleep-disordered breathing.

In sum, 9 of the 11 parent-report measure scales supported the initial hypotheses of greater sleep disturbance for children with ADHD as compared to children without ADHD. Based on children's self-reports, 7 of the 9 scales supported the initial hypotheses of greater sleep disturbance for children with ADHD as compared to children without ADHD. The hypotheses related to similar bedtimes and morning wake times for both groups of children were supported and the hypothesis of less total sleep time for children with ADHD as compared to normally-developing peers was supported. Congruence among parents' and children's reports were found for 7 of the 9 scales in the ADHD group and 4 of the 9 scales in the control group. However, significant differences between the correlations were found for only two scales and only one of the scales showed more congruence for the ADHD group. Thus, the hypothesis that there would be more correspondence between the reports in the ADHD group than in the control group was not strongly supported. Due to poor completion rates, hypotheses related to the degree of problem that each of the sleep behaviors posed for the children or their families were not able to be tested. Table 13 depicts the initial hypotheses and whether or not they were supported.

Table 13

Empirical Support for A Priori Hypotheses

	Hypothesis	Parent	Child
Scale			
Total Sleep Disturbance	ADHD > Control	X	X
Bedtime Resistance	ADHD > Control	X	X
Daytime Sleepiness	ADHD > Control		X
Morning Difficulty	ADHD > Control	X	X
Parasomnias/Other	ADHD > Control	X	N/A
Restless Legs Syndrome	ADHD > Control	X	
Sleep Anxiety/Transitioning	ADHD > Control	X	X
Sleep-Disordered Breathing	ADHD > Control		N/A
Sleep Duration/Quality	ADHD > Control	X	X
Sleep Hygiene	ADHD > Control	X	
Sleep Onset	ADHD > Control	X	X
Sleep Variable			
Bedtime (Weekday)	ADHD = Control	X	N/A
Bedtime (Weekend)	ADHD = Control	X	N/A
Morning Wake Time (Weekday)	ADHD = Control	X	N/A
Morning Wake Time (Weekend)	ADHD = Control	X	N/A
Total Sleep Time	ADHD < Control	X	N/A

Note. An "X" indicates empirical support for an a priori hypothesis.

DISCUSSION

This study sought to control for possible confounding factors that have been noted in the previous literature through excluding children with clinical co-morbidity, a history of medical conditions, and taking medications that may affect sleep, as well as utilizing age and sex-matched controls. The results of this study support the results of other studies that have found significantly increased overall prevalence of sleep disturbances in children with ADHD compared with community-based healthy control children. Based on the parents' reports of their children, 8 of the 10 subscales (Bedtime Resistance, Morning Difficulty, Parasomnias/Other, Restless Legs Syndrome, Sleep Anxiety/Transitioning, Sleep Duration/Quality, Sleep Hygiene, and Sleep Onset) were rated significantly more prevalent for children with ADHD as compared to normally-developing children. Based on children's self-reports, 6 of the 8 subscales (Bedtime Resistance, Daytime Sleepiness, Morning Difficulty, Sleep Anxiety/Transitioning, Sleep Duration/Quality, and Sleep Onset) were rated significantly more prevalent for children with ADHD than for normally-developing children. The subsequent sections discuss the findings separately and in greater detail.

Parents' and Children's Reports of Sleep Disturbance

The Total Sleep Disturbance scale and the Bedtime Resistance, Morning Difficulty, Sleep Anxiety/Transitioning, Sleep Duration/Quality, and Sleep Onset subscales were significantly greater for children with ADHD than for normally-developing children based on both parental reports and child self-report measures.

Total Sleep Disturbance. When all of the sleep variables were examined together, total sleep disturbance was significantly greater for children with ADHD than for

children without ADHD. This was evidenced with both parents' reports and children's own self-reports. The overall average for individual sleep items for the group with ADHD indicated that children experienced sleep disturbances from zero to two times per week as rated by both parents and children. When asked if parents felt that the sleep disturbance posed a problem or concern for them or their children, 9% of the items included in this measure were marked "yes" and 6% were marked as "somewhat". These numbers may be even greater because 10% of the items that parents indicated their children experienced were not rated for the degree of problem.

Bedtime Resistance. Based on both parent report and children's self-reports, children with ADHD exhibited more bedtime resistance than did children without ADHD. Bedtime resistance related to a limit-setting sleep problem may be more common in children with a comborbid behavioral disorder such as oppositional defiant disorder or conduct disorder. Only one child in this study was diagnosed with oppositional defiant disorder. Therefore, it was not possible to assess independently the effect that this diagnosis may have on the sleep of children with ADHD. Parents of normally-developing children recruited from a community setting have been shown to be capable of differentiating between their children's unwillingness (bedtime refusal) and inability (sleep onset delay) to fall asleep (Blader et al., 1997). It may be that parents of children with ADHD have more difficulty delineating between these or that these behaviors may overlap more. Difficulties evidenced in bedtime resistance and sleep onset may be reflected by ADHD children's general difficulties with settling down in the evenings. In one study, it was found that between 25% and 50% of parents reported very frequent difficulties for their children with ADHD in settling down for sleep and conflicts

about bedtime preparation (Day & Abmayr, 1998). Another study found that children with ADHD exhibit increased bedtime resistance and that parent-child interactions during their bedtime routines were more challenging (Corkum et al., 2001). This led the investigators to speculate that many of the sleep problems in children with ADHD may be the result of challenging behaviors during bedtime routines. In all, it is probable that many factors contribute to bedtime resistance and sleep onset latency in children with ADHD; when evaluating a child's sleep onset disturbance, consideration should be given for all contextual variables.

Morning Difficulty. Parents and children with ADHD reported significantly more difficulties in the morning than did parents and children without ADHD. Based on ADHD children's self-reports, Morning Difficulty was one of the highest areas of concern, occurring approximately once to twice a week on average. More problems in morning activities for children with ADHD than for either children with other psychiatric diagnoses or children in a nonclinical sample were further supported by Day and Abmayr (1998). Other studies have found children with ADHD to feel less refreshed in the morning as compared to children with other psychiatric diagnoses and to children without psychiatric disturbances (Chervin et al., 1997). In addition, children with ADHD also feel more tired upon waking as compared to control children (Trommer et al., 1988).

Sleep Anxiety/Transitioning. Based on both parents' reports and children's self-reports, children with ADHD had significantly more sleep anxiety and difficulties transitioning to sleep than did the control group. In school-aged children, anxiety, stress, or fears can contribute to difficulties falling asleep and staying asleep. Difficulty can begin in response to specific events related to sleep (i.e., a bad nightmare) or a stressful

incident during the day. Conditioned factors often then sustain the problem. Once children develop the habit of lying awake in a tense or anxious mood before falling asleep, the pattern can be difficult to change. Children with anxiety and depressive disorders also frequently have difficulties falling asleep. The present finding of increased symptoms of anxiety and difficulty transitioning at bedtime may suggest undiagnosed comorbid anxiety in the clinical children. In fact, one study found that internalizing symptoms were predictive of 8 to 14% of the variance in global ratings of sleep problem severity and insomnia (Stein, 1999). Identification of specific sources of anxiety is important. If an anxiety or mood disorder is indicated, appropriate treatment for these should be conducted. Behavioral treatments, relaxation therapy, and positive imagery have all be helpful in reducing the conditioned component to the problem. In addition, it is often helpful to work with the parents in setting consistent limits and reward schedules for compliance (Dahl, 1992). Increased nighttime fearfulness scores may also represent children's attempts to explain or rationalize their reported difficulties with sleep onset. Either way, results support those of Owens, Maxim, et al. (2000) and indicate that children with ADHD perceive the period of time around sleep onset as one that can produce anxiety and create difficulties or unpleasantness.

Sleep Duration/Quality of Sleep. With regards to sleep duration, nocturnal wakenings, and overall sleep quality, children with ADHD were more impaired than were children without ADHD as reported both by parents and the children themselves. This may be even more significant given that 10 children with ADHD (40.2%) reported that at least one night a week, they were awake when their parents thought that they were asleep. These results are supported by other studies that have documented more disruptions

during sleep in children with ADHD compared to nonclinical controls (Day & Abmayr, 1998; Kaplan et al., 1987; Owens, Maxim, et al., 2000). These current results are also supported by objective studies that indicate increased muscle activity during sleep for children with ADHD than for children without ADHD (Konofal et al., 2001; Porrino et al., 1983; Small et al., 1971) and subjective studies that have indicated greater restless sleep in children with ADHD (Corkum, Moldofsky, Hogg-Johnson, Humphries, & Tannock, 1999; O'Brien et al., 2003). Some investigators have speculated that greater restlessness during sleep could reflect the continuation of ADHD children's waking overactivity into sleep in a degree proportional to that present during wakefulness or may reflect a centrally hyperaroused state influencing motor systems throughout sleep (Busby et al., 1981).

Sleep Onset. Parent-reported problematic sleep onset was more prevalent in children with ADHD than for comparison children. Children with ADHD also endorsed more difficulty in falling asleep than did children without ADHD. Based on parents' reports of their children with ADHD, the highest average for the subscale individual items was for difficulty falling asleep. This mean fell in between the "sometimes" to "often" categories, and suggested children experienced this problem from one to four times a week. Children also self-reported sleep onset to be one of the highest two areas of concern based on the individual items in each subscale. Children with ADHD reported that this problem occurred approximately once to twice a week on average. Forty-five percent of parents of children with ADHD indicated that their children's sleep onset was at least somewhat problematic for their children. This number could be as high as 60%

when the 15% of parents who endorsed some degree of sleep onset problems for their children but did not complete the degree of problem that it posed is factored in.

The difficulty with initiation of sleep has been well-documented in previous investigations employing subjective measures (Corkum et al., 2001; Kaplan et al., 1987; O'Brien et al., 2003; Owens, Maxim, et al., 2000; Ring et al., 1998; Stein, 1999; Trommer et al., 1988) as well as objective measures (Busby & Pivik, 1985; Haig et al., 1974; Palm et al., 1992). One question that has remained largely unresolved in the literature is whether delayed sleep onset is related to medication effects (Ball & Koloian, 1995).

Based on parents' reports, two sleep subscales (Restless Legs Syndrome and Sleep Hygiene) were rated as a greater concern for children with ADHD than for children without ADHD. However, a difference was not evidenced in these subscales based on children's own reports. Also, based on parents' reports, the Parasomnias/Other Sleep Disturbance subscale score was significantly greater for the ADHD group than for the control group. Comparison with the children's reports was not available for this subscale because it was not included in the final version of the SQ-C.

Restless Legs Syndrome. Restless Legs Syndrome is a disorder of uncomfortable leg sensations with irresistible urges to move the legs. Most people with Restless Legs Syndrome show periodic limb movements during sleep. Periodic limb movements involve brief jerks of the toes, feet, legs, or thighs predominantly in sleep stages 1 and 2 (Picchietti & Walters, 1996). In this study, parents of children with ADHD reported significantly more symptoms associated with Restless Legs Syndrome than did parents of children without ADHD. Based on the children's self-reports, there were no differences

between the groups. Some investigators have suggested that Restless Legs Syndrome and Periodic Limb Movement Disorder may be more common in children with ADHD (Chervin et al., 1997; Picchietti & Walters, 1996) and that inattention and hyperactivity among general pediatric patients are associated with symptoms of Periodic Limb Movement Disorder and Restless Legs Syndrome (Chervin et al., 2002). Periodic limb movements with arousals has been shown to be higher in children with ADHD referred to a sleep clinic than in children with ADHD recruited from a community or in a control setting (O'Brien et al., 2003). One study indicated that 36% of children with ADHD who have sleep problems and have been referred to a sleep medical center revealed Periodic Limb Movement Disorder (Crabtree, Ivanenko, & Gozal, 2003). Furthermore, 26% of children with ADHD were found to fulfill criteria for a diagnosis of Periodic Limb Movement Disorder as compared with a 5% prevalence in a comparison group of children referred to a sleep laboratory for sleep complaints but without ADHD (Picchietti & Walters, 1996). Sleep disruption that is associated with Periodic Limb Movement Disorder and Restless Legs Syndrome and the motoric restlessness during the awake hours of Restless Legs Syndrome could cause or aggravate inattention and hyperactivity observed in a subgroup of children with ADHD (Picchietti et al., 1998; Picchietti & Walters, 1996). Taken altogether, there may be a subgroup of children with ADHD who are at risk for Periodic Limb Movement Disorder and Restless Legs Syndrome.

Sleep Hygiene. Based on parents' reports, the sleep hygiene subscale, which measured sleep routines and practices that can impact the quality of sleep such as having a bedtime routine, falling asleep in the child's own bed, limited daytime sleeping, and regular bedtimes, was found to be significantly poorer in the ADHD group than in the

control group. However, results of the children's self-reports did not yield any differences between the two groups. This finding suggests that poor sleep behaviors in children with ADHD may adversely affect the overall quality of sleep and contribute to reports of more sleep disturbance for other sleep variables. Conversely, having parents and children employ some basic changes in behaviors during bedtime may have a positive influence on the quality of sleep in children with ADHD.

Parasomnias/Other Sleep Disturbance. Parasomnias is a general term for a group of unusual behaviors emerging from sleep and include sleepwalking, sleep talking, night terrors, confused partial arousals, enuresis, and headbanging (Dahl, 1992). Parents of children in the ADHD group endorsed significantly more frequent experiences a week of parasomnias or other sleep disturbance not characterized in the other subscales as compared to parents in the control group. Because there was little correlation among items on this measure nor would one expect there to be from a clinical perspective, many of the items on this subscale were selected to be analyzed separately. Experiencing body pain during the night and having nightmares was more prevalent in children with ADHD than in those without ADHD, whereas there were no differences evidenced between the groups with respect to grinding teeth, sleepwalking, snoring, and having nocturnal enuretic events. However, due to the exploratory nature of the analyses, these results should be cautiously interpreted. Results are similar to those of Owens, Maxim, et al. (2000), which also supported more frequent parasomnias for children with ADHD as compared to normally-developing children. However, Corkum et al. (1999) did not find any differences in the frequency of parasomnias among unmedicated children with ADHD, medicated children with ADHD, children in a clinical comparison group, and

children in a nonclinical comparison group. Other studies have not shown group differences in parasomnias and other less frequently occurring sleep problems in medicated and unmedicated children with ADHD, psychiatric controls, and pediatric controls for children aged 4 to 18 (Stein, 1999). It seems that these contradictory results may reflect the individual sleep items that are included in the grouping of parasomnias.

Daytime Sleepiness. Parents did not endorse daytime sleepiness as more problematic for their children with ADHD as compared to the ratings of parents of normally-developing children. However, this was the only subscale in which the parents did not report any sleep differences but the children with ADHD significantly endorsed more daytime sleepiness than did their normally-developing peers.

One reason for the discrepancy between the reports of daytime sleepiness among children as compared to parents is that parents may not be knowledgeable of their children's sleepiness while the children are in school. Moreover, children with ADHD may manifest their sleepiness differently than other children. Specifically, these children may have a greater inclination to manifest their sleepiness with increased motoric restlessness and inattention rather than with the more classic signs of sleepiness such as yawning, running out of energy, and easily falling asleep during the day. For example, although children with ADHD showed no clinical signs of sleep problems, they were shown to be sleepier during the day than children without ADHD based on a MSLT. Evidence of excessive sleepiness may be obscured from parents confronted with other behavioral changes that accompany ADHD (Chervin et al., 1997). Based on parental report, Chervin and colleagues found that daytime sleepiness scores were not significantly different among children with ADHD in comparison with either children

without ADHD recruited from a psychiatry clinic or a general pediatric clinic. Other researchers have suggested that there may be a subset of children with ADHD who are excessively sleepy have sleep apnea, narcolepsy, insufficient sleep, and circadian rhythm disturbances that may cause these problems (Anders et al., 1978; Carskadon et al., 1993). Thus, there may be a subgroup of children for whom daytime sleepiness should be taken seriously. Questions remain as to how treatment providers can efficiently identify these children and how they should best screen children for daytime sleepiness.

Sleep-Disordered Breathing. As compared to parents of normally-developing children, parents of children with ADHD did not indicate that their children experience significantly more or had more frequent symptoms of sleep-disordered breathing. However, results suggest that there may be a subset of children with ADHD who experience sleep-disordered breathing. Overall, caution should be utilized when interpreting these results because polysomnograph information was not collected. Thus, sleep-disordered breathing could not be confirmed or ruled out. So far, no constellation of clinical symptoms has been shown to reliably predict PSG findings. The lack of significant findings in the present study may support the difficulty identifying sleep-disordered breathing. Furthermore, the threshold for defining Obstructive Sleep Apnea Snydrome based exclusively on parental report is arbitrary. Some studies have indicated that validated questionnaires that assess for symptoms of obstructive sleep apnea and sleep-related breathing disturbance are limited in their utility as clinical screening devices due to the difficulty in predicting apnea from questionnaire research (Kump et al., 1994).

Bedtime, Wake Time, and Total Time Asleep

There were no significant difference evidenced between the ADHD and control groups with regard to average bedtime on weekdays, average bedtime on weekends, average morning wake time on the weekdays, and average morning wake time on the weekends. Although the average number of hours that the children were lying in bed at night were similar, the average number of hours asleep as reported by parents was significantly lower for children with ADHD than for children in the control group. These findings supported the results of Owens, Maxim, et al. (2000) and also those of Corkum et al. (1999) who found no differences for average bedtime and awakening time among unmedicated ADHD, medicated ADHD, clinical comparison, and healthy nonclinical comparison groups. Based on both the children's self-reports and parent's reports, the children with ADHD had substantially more problems falling asleep and staying asleep throughout the night. Hence, this difference in sleep duration is presumably at least partially accounted for by prolonged sleep onset latency and nocturnal wakings.

Correlations Between Parents' and Children's Reports

For both the ADHD and the non-ADHD groups, children's reports of overall sleep disturbance were significantly correlated with their parents' reports of overall sleep disturbance. There were more subscales that demonstrated congruency between parents' and children's self-reports in the ADHD group than in the control group (6 subscales versus 3 subscales, respectively). While this finding generally supported the results of Owens, Maxim, and colleagues (2000), results of the present study were not as pronounced as those of Owens and colleagues. Specifically, Owens and colleagues found more correlations among the respondents with ADHD and their parents and fewer among

the children in the comparison group and their parents than was determined in this study. However, Owens and colleagues compared individual items between the two report forms, whereas the present study examined correlations between parent and child commensurate subscales.

There was significant agreement between parents' and children's reports for 3 subscales in both the ADHD and the control group. For both children with ADHD and normally-developing children, children's own report of sleep anxiety and difficulty transitioning was significantly correlated to their parents' reports. Although less significant, children and parental reports of morning difficulty and sleep hygiene corresponded with one another in both groups of children.

It is important to note that all of the subscales that significantly correlated for children without ADHD were significantly correlated for children with ADHD. However, the converse was found in 3 subscales. That is, children with ADHD demonstrated a correspondence with their parents' reports of bedtime resistance. This was not the case for children without ADHD. Likewise, for the ADHD group only, there was a significant correlation between parent-reported and self-reported difficulty falling asleep and inadequate sleep duration and impaired quality of sleep. Based on these results, parents of children with ADHD appear to be more aware of their children's difficulty falling asleep and wakings during the night than parents of normally-developing children. This may reflect less ability for children with ADHD to self-soothe or greater communication with or greater dependency for children with ADHD to rely on their parents in falling and staying asleep.

A lack of significant correspondence between parents' and children's reports in 2 subscales was evidenced in both groups of children. These 2 subscales were Restless Legs Syndrome/Periodic Limb Movement Disorder and Daytime Sleepiness. Incongruence in reports of daytime sleepiness may be due to differences in the perception of daytime sleepiness with regard to how the children appear sleepy, act sleepy, or feel sleepy.

However, when differences between the correlation coefficients were calculated, only two subscales emerged as having significant differences. There was greater agreement between parents' and children's reports of sleep duration and quality for the ADHD group than the control group. Conversely, there was more congruence between the reports of the children and their parents in the control group than the reports of children and their parents in the ADHD group for sleep anxiety and difficulty transitioning.

In sum, there is a possibility that parents of children with ADHD are more sensitive and aware of some aspects of their children's sleep behaviors than are parents of other children. Results of this study highlight the importance of obtaining children's own self-reports as they provide supplementary and sometimes discrepant information from the information that their parents have provided. Also of clinical importance is the finding that children with ADHD were fairly good reporters of their own sleep. Or, at least, the children's self-reports of sleep disturbance were generally commensurate with their parents' reports.

Study Limitations

Limitations related to the overall methodology. Several methodological issues in the current investigation deserve further comment. The selection of both children with ADHD and normally-developing control children was based strictly on parental reports. None of the children included into the study was rigorously assessed in the present study as part of the selection process in order to establish a diagnosis of ADHD or to determine whether additional psychiatric disorders were present. The present study did not screen extensively for other potential confounding factors such as family history of sleep problems, current stressors, or puberty. In addition, the present study did not include a control group of children with psychiatric disorders other than ADHD. Thus, it was not possible to evaluate the effects of psychiatric disorders or children's sleep problems more generally. Lastly, although all parents were instructed to allow their children to complete the children's questionnaire independently if within their ability, three more parents in the ADHD group than the control group assisted their children in the reading of or marking responses for the children's questionnaire. This could potentially bias the results by providing the parents of children with ADHD more input into the self-report results. Certainly, this could result in greater agreement in responses between parents and children.

Limitations related to the sample. There are limitations related to the sample included in this study. Participating parents and their respective children were relatively highly educated and there was a fairly homogeneous ethnic composition. Direct comparison of these results with children from other racial, cultural, or socioeconomic backgrounds must be done cautiously. The response rates were rather low and ranged

from 0% to 31% for surveys that required parents or guardians to return by mail. The low response rate in part reflects the fact that CHADD members and those sent the questionnaires consisted of adults with ADHD and parents of children spanning a greater age range than were included in the study. Also, professionals who work with this population or have a special interest in this population may also be registered members and appear on the mailing list. Other potential biases include the fact that parents whose children have sleep-related problems may have been more motivated to complete the study. The results may have also been skewed in that parents of normally-developing children with good sleep habits may have been more likely to participate. Due to the anonymous nature of this study, it was not possible to obtain information from the non-responders. A greater return rate in future studies could enhance the generalizibility of the results.

Some clinicians have speculated that those who are higher-functioning may demonstrate less extreme sleep problems than do those who are lower-functioning (Ball & Koloian, 1995). Due to the manner in which children were recruited and the relatively high proportion of children with ADHD who receive special education services, the sample may have been over-represented by lower functioning children with ADHD. If this were the case, then results of this study may reflect a more substantial or inflated discrepancy between the ADHD group and control group.

The majority of children in the ADHD group were receiving psychopharmacological medication for ADHD and studies have yielded inconsistent findings with respect to whether stimulant medication negatively affects sleep (Ball & Koloian, 1995). In addition, compared to parents in the control group, parents of children

who receive medications may have been more sensitized to look for sleep problems because sleep disturbance is a possible side effect commonly listed for stimulant medications. In addition, there may be factors that also contribute to the effects of medication on sleep. For instance, children medicated versus not medicated may be older, more aggressive, or have more disturbance and increased externalizing behaviors. This may contribute to sleep problems or parental perception of sleep problems. All of these factors could result in an overestimation of sleep problems in the treated ADHD group (Stein, 1999).

The generalizibility of the findings of this study is further limited by a relatively small sample size. Because of the small sample size, it was not possible to examine the sleep of children in comorbid diagnostic groups, ADHD subtype diagnostic groups, medication conditions, medication dosage amounts, racial or ethnic subgroups, or similar age or sex groupings. The ADHD group was highly heterogeneous with reference to sex, age, comorbidity with learning disabilities, medication condition, and the medication type, dosage, and schedule of administration for medicated children with ADHD. The nature of the diagnostic criteria for ADHD and the multiple possible etiologies of ADHD further contributed to a highly heterogeneous group of children.

It is important to note that the ADHD group included in the current study was a highly selected sample of children who were selected in an effort to more thoroughly control for possible confounding factors that have been limitations noted in previously conducted studies. However, as a result of stringent exclusion criteria (i.e., children with clinical co-morbidity, a history of medical conditions, and children prescribed a number of other medications), the sample of children with ADHD used in the present study may

not reflect a typical sample of children with ADHD commonly be seen in a clinical practice. On the other hand, this highly selected sample allowed for specifically examining the role of ADHD on sleep. A less selected group of children with ADHD may have greater sleep problems. This is highly likely given that 7 of the excluded children were diagnosed with a sleep disorder or were prescribed medications to aid sleep. Furthermore, 4 children were excluded due to specific psychopathology that suggested additional neurological impairment. More severe neurological impairment would likely contribute to greater sleep difficulties.

Limitations related to the instruments. There are several limitations regarding the instruments utilized in the current study. It is important to emphasize that data on the psychometric properties of the SQ-P and the SQ-C are preliminary. Thus, the validity and reliability of these instruments have not been confirmed. There is currently no standardized questionnaire that successfully assesses sleep, sleep-disordered breathing, and excessive daytime sleepiness in children with ADHD. As such, it is not possible to present data regarding the validity of the utilized sleep questionnaires (Marcotte et al., 1998). This questionnaire provided a systematic method to gather important data about sleep in children that would otherwise not be possible through nonstandardized clinical interviews. While the questionnaires developed for this study (SQ-P and SQ-C) were of descriptive use, they could be strengthened by validity studies assessing the ability of these instruments to accurately discriminate children with diagnosed sleep disorders from those without sleep problems and examining test-retest reliability. Although the internal consistency found for the SQ-P and SQ-C was comparable to or higher than that of the instruments in the similar measure developed by Owens, Maxim, et al. (2000), future

research should examine how to continue to make improvements on the psychometric properties of the questionnaires. It should be noted that the questionnaires were designed to be a screening tool and should not be construed as a diagnostic instrument; no sleep-disorder diagnosis can be made on the basis of an individual's item responses. However, the subscales on the instruments were created to approximate many of the major sleep diagnostic categories and symptoms are indicative of these types of sleep diagnoses.

The definition of what constitutes the threshold for a sleep disturbance as compared to a sleep behavior is problematic and varies across studies. Sleep disturbance can be defined statistically or by a somewhat arbitrary threshold set by the researcher. It can be argued that what a parent defines as problematic sleep may be the most relevant with reference to further clinical evaluation and treatment. This study sought to examine problematic sleep both statistically as well as by parental indication that not only does the sleep disturbance occur for their child, but that it is considered problematic. However, because several parents did not complete the second portion of the questionnaire (i.e., that requested parents to assess the degree to which each behavior endorsed was a problem), analyses between children with and without ADHD were not able to be conducted.

Other concerns involve the one-week time frame utilized in this survey. Although one point on the Likert scale involved "rarely" that was defined as "Less than 1 time a week", the time period was vague. It is possible that the "typical week" time frame may have been inadequate to screen for some sleep disorders and may have led to poor estimations of some of the more transient sleep problems. Conversely, a week as a time frame may have contributed to an increased inclusion of more transient sleep problems

and inflated prevalence of some of the behaviors, although this should have affected the clinical and control groups equally.

Although children completed a self-report of their own sleep, another limitation includes the reliability of parents as informants of their children's sleep and daytime behaviors, particularly as parents typically do not observe their children's total night of sleep or are always able to report on their children's behaviors during the week as the children are commonly away from home attending school (Marcotte et al., 1998). A combination of parent, child, and teacher reports may supply more accurate information about childhood sleep. The accuracy of parent's reports have been questioned in previous studies, particularly when results have suggested that they are not congruent with more objective data (Busby et al., 1981; Corkum et al., 2001; Greenhill et al., 1983; O'Brien et al., 2003; Stein et al., 1996). Due to the time-intensive and the costly nature of objective measures, they were not able to be utilized in this study. However, it is believed that obtaining subjective reports was a preliminary and positive step in addressing relationships between sleep in children with ADHD.

This study was also limited by the retrospective nature of the surveys. Some studies have detailed a tendency for parents of children with ADHD to report more frequent sleep problems when retrospective methodology rather than quasi-prospective means were utilized (Abmayr & Day, 1998). This discrepancy was more pronounced in the parents of children with ADHD than for parents of children with other psychiatric diagnoses or parents of normally-developing children. In conclusion, there may be negative response bias in the retrospective data, true for all parents, but especially

pronounced for the ADHD parents (Abmayr & Day, 1998). However, this could not be assessed by the instruments utilized in the current study.

Research Implications of Results

Results of the present investigation indicate the need for continuing research studies on the sleep in children diagnosed with ADHD. Future studies should characterize type, frequency, severity, and significance of sleep difficulty in children with a confirmed diagnosis of ADHD and compare sleep in children with ADHD to those of nondisabled children and children with other learning disabilities, behavior problems, and sleep problems. There is also a need for further investigations to examine, clarify, and elucidate relationships among sleep disturbance, a confirmed diagnosis of ADHD, comorbid diagnoses associated with ADHD, and pharmacological treatment for ADHD. As the DSM-IV distinguishes between children with Primary Inattentive, Primary Hyperactive/Impulsive, and Combined subtypes of ADHD, future research should compare the sleep of children in each of these subtypes. Specifically, some studies have found that examination of subytpes of ADHD have contributed to an understanding of the relationship between ADHD and sleep whereas other investigators have suggested that less overt behavioral difficulties (i.e., the Inattentive subtype relative to the other subtypes) may help delineate between whether behavioral disturbances rather than specific sleep disturbance contributes to the noted discrepancies between parent perceptions of sleep disturbance and the lack of validation by objective means (Ball et al., 1997). The field may also benefit from examining higher and lower functioning children with ADHD to examine how severity may contribute to relationships between sleep disturbance and behavioral problems (Ball et al., 1997). It is also important for future

research to more fully explore the short-term and long-term consequences of sleep disturbance for latency-aged children with ADHD.

Future research should examine specific parent factors that may contribute to an exacerbation or reduction of sleep problems in children with ADHD. As there is a familial pattern for ADHD, it is likely that some of the parents of children with ADHD also are diagnosed with ADHD. This can potentially result in a parent who has had similar sleep difficulties and/or poor sleep practices. Characteristics of parents (i.e., diagnosis of ADHD, parenting style, beliefs about children's sleep, the degree of structure imposed in the home) may have important effects on children's sleep. In addition, future studies could determine the effects of parent-child dynamics, such as attachment and interactional patterns, on the sleep of children with ADHD.

In order to gain a more comprehensive understanding of sleep disturbance in the ADHD population, it will also be important for future studies to gather information regarding sleep and possibly resulting behavioral symptoms that result from a combination of multiple sources including the parent, the child, and the child's teacher or daytime care provider. To further explore sleep disturbance in children with ADHD and to attempt to resolve discrepancies between the results obtained through subjective reports of sleep and the results obtained through sleep diary data, actigraphy, and polysomnography, more studies are needed that utilize combinations of multiple sleep measures such as polysomnography, actigraphy, home monitoring, sleep diaries and parental reports (Busby et al., 1981; Corkum et al., 2001; Greenhill et al., 1983; Stein et al., 1996). More comprehensive, reliable, and valid subjective measures that address all areas of sleep problems from both parents' and children's perspectives need to be

developed. As this study attempted to do, examination of the degree to which a parent acknowledges a sleep disturbance as problematic may be an important area of further investigation since parental perception is likely to strongly influence the decision of whether or not a sleep concern is brought to the attention of a pediatric care provider and will also likely affect compliance with recommended treatment.

Clinical Implications of Results

The results of the current study highlight the need for clinicians to routinely and comprehensively assess sleep problems in latency-aged children referred for an assessment of ADHD or diagnosed with ADHD. This need is underscored by the high percentage of sleep problems identified in this study, as well as in previous studies, and the high reports of parents indicating that several of the sleep variables assessed were posing a substantial problem for them, their children, or their families. While several sleep problems may not be unique to ADHD, these sleep problems may contribute to or exacerbate behavioral and learning difficulties and therefore need to be addressed (Marcotte et al., 1998; Corkum et al., 1999). Proper diagnosis is essential because it will drive appropriate treatment interventions and many behavioral approaches have been demonstrated to be effective in reducing bedtime problems, night wakings, insufficient sleep, and insomnia in children with ADHD (Meltzer & Mindell, 2004). The etiology of sleep disturbance in children with ADHD is likely heterogeneous in nature (Stein, 1999). When working with an individual child, it is essential to assess whether sleep problems result from or are exacerbated by comorbid anxiety or mood disturbance, oppositional behavior or sleep resistance, rater bias, poor sleep habits and hygiene, response to stimulant treatment, or other factors (Stein, 1999).

There is a need for more education in sleep and sleep disorders in children within the pediatric community in order for children to have appropriate screening, diagnosis, and treatment for sleep difficulties. Identification and treatment of sleep problems in latency-aged children is essential because sleep disturbance has been shown to have a negative impact on the child and family functioning (Saxby & Morgan, 1993). Also, when there are delays or inaccuracies in the diagnosis of sleep problems or when effective treatments for these problems are not provided, family tensions may be intensified (Stores, 1996).

CONCLUSION

This study investigated whether school-aged children diagnosed with ADHD experience greater sleep disturbance than do normally-developing children. Based on both parents' reports and children's self-reports, there was significantly greater overall sleep disturbance for children with ADHD than for normally-developing children. Specifically, parents indicated that children with ADHD had significantly more disturbed sleep than did children without ADHD in the areas of bedtime resistance, morning difficulty, parasomnias/other sleep disturbance, Restless Legs Syndrome, sleep anxiety/transitioning, sleep duration/quality, sleep hygiene, and sleep onset. As reported by the children, specific aspects of sleep that were more disturbed for the children with ADHD included bedtime resistance, daytime sleepiness, morning difficulty, sleep anxiety/transitioning, sleep duration/quality, and sleep onset. Although bedtimes and morning wake times were similar for children with ADHD and children in the comparison group, parents reported that children with ADHD experienced significantly less total time asleep. These findings indicate that sleep disturbance should be routinely assessed as part of the clinical evaluation for and treatment of ADHD.

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APPENDIX A

LETTER OF CONSENT

July 16, 2003

Dear Parent or Guardian,

We are conducting a study that involves the comparison of sleep patterns of children with and without Attention-Deficit Hyperactivity Disorder (ADHD). Both children's and parents'/guardians' perspectives of children's sleep are being included in this study. To conduct this study, we need the participation of children aged 8 through 14 (inclusive) who have either been diagnosed with ADHD/ADD or who are considered by their parents/guardians to generally be "normal and healthy", and one of their parents or guardians. This study is being conducted through the support of organizations including Connecticut Children's Medical Center, Connecticut Children's Medical Center School, local chapters of Children and Adults with Attention-Deficit Hyperactivity Disorder (CHADD), and Old Dominion University.

You and your child are being asked to participate in a research project involving the collection of information in the form of questionnaires. Completion of the questionnaire will require less than 20 minutes of your/your child's time.

Although the results of this research may not directly benefit you or your child, they may benefit children with ADHD or children with sleep disturbance through better knowledge and identification in the future. Results will be made available to you upon request.

This is a completely anonymous research study. In no manner will your or your child's name or any specific identifying information be requested nor included in this study.

There are no specific risks related to your or your child's participation, but there may be other risks not yet identified. Agreeing to participate does not waive any of your legal rights.

There will be no costs associated with participation in this study nor will there be any reimbursement for participation. Your and your child's participation in this study is completely voluntary.

If you have a child that is between 8 and 14 years old and has been diagnosed with ADHD/ADD, we are requesting for you to specifically consider this child's participation over other children in the family that may also fit the above criteria.

Connecticut Children's Medical Center School
170 Ridge Road Wethersfield, CT 06109 (860) 947-4100 fax (860) 947-4110

APPENDIX A (continued)

LETTER OF CONSENT

Should you choose for you and your child to participate in this study, please read the directions and answer all questions carefully. The Demographics Questionnaire and the Sleep Questionnaire for Parents are for you, a parent/guardian, to complete. The Sleep Questionnaire for Children is for your child to complete. We ask that you allow your child to complete the Sleep Questionnaire for Children independently unless, given your child's age or reading ability, he/she needs help in reading, understanding, and/or marking his/her responses on the questionnaire. If you read the questionnaire to your child, please place a copy of the scale (included on a separate sheet of paper) in front of him/her. Please do not tell your child any answers or direct his/her responses in any manner. If you do assist your child, please mark this at the appropriate place at the end of the questionnaire. Please return all three of the questionnaires via the enclosed addressed and stamped envelope as soon as possible.

If you have any questions pertaining to this research study, please feel free to contact Diana M. Turner-Eadie at (860) 947-4100. You may receive information about the results of this study when it is completed by contacting the aforementioned. If you have any questions about your or your child's rights as a research subject, you may call the Research Office at Connecticut Children's Medical Center at (860) 545-9980 or the Research Office at Old Dominion University at (757) 683-3460.

By returning the completed questionnaires, you are agreeing to participate in this study.

Thank you so very much for taking the time to consider your and your child's participation in this study.

Sincerely,

Diana M. Turner-Eadie

Diana M. Turner-Eadie
Primary Therapist
Connecticut Children's Medical Center School

Doctoral Student
Virginia Consortium Program in Clinical Psychology

(860) 947-4100

APPENDIX B

DEMOGRAPHICS QUESTIONNAIRE

DEMOGRAPHICS QUESTIONNAIRE

Please complete each of the following:

1) What is your **relationship** to the child? ___Mother ___Father ___Step-Mother ___Step-Father ___Grandparent ___Other
2) Child's **sex**? ___Male ___Female
3) Child's **age**? _____Years
4) Child's **race/ethnicity**? ___Am. Ind. or Alask. Nat. ___Asian ___Blk. or Af. Am. ___Hispanic ___Nat. Hawai. or Pac. Isl. ___Caucasian ___Other
5) What is your (parent's) highest **educational achievement**?
   ___Below high school degree ___High school degree ___Some college study ___Associate's degree
   ___4-year college degree ___Some graduate study ___Graduate degree
6) Please **circle all** that your child has been diagnosed with by a **licensed clinical provider** (i.e., psychologist, pediatrician, social worker):

Attention Deficit Hyperactivity Disorder(ADHD)	Panic Disorder	Psychotic Disorder
Mental Retardation(MR)	Generalized Anxiety Disorder	Schizophrenia
Head Injury with Loss of Consciousness	Specific Phobia	Posttraumatic Stress Disorder(PTSD)
Oppositional Defiant Disorder(ODD)	Other Tic Disorder	Obsessive-Compulsive Disorder(OCD)
Conduct Disorder(CD)	Tourette's Disorder	Pervasive Developmental Disorder NOS
Major Depressive Disorder	Bipolar Disorder	Autistic Disorder
Learning Disorder/Disability (please specify type, i.e., math)__________		Asperger's Disorder

Others (please write in)______________________________

7) If your child has been diagnosed with Attention Deficit-Hyperactivity Disorder (ADHD), is your child primarily Inattentive, Hyperactive, Both, or you Do Not Know? **In Hyp Both D/K**
8) Has your child been declared formally eligible for **Special Education** (not including 504 Plans)? **Y N**
9) Does your child have any **chronic medical illnesses or disabilities**? **Y N**
   If yes, please list problems______________________________
10) Has your child had his/her **tonsils/adenoids** removed? **Y N**
11) Has your child ever been diagnosed with a **sleep disorder**? **Y N**
   If yes, what?______________________________
12) Please list all the **medications** that your child is **currently taking** (medical and/or psychiatric):

	Medication	Dosage	Time(s) of day taken	What it is prescribed for	Date 1st prescribed
Example:	*Ritalin*	*10 mgs*	*8AM, 12noon, 4PM*	*ADHD*	*approx. 10/02*

13) Please complete the following regarding your child:

*Average bedtime (week days): _________ *Average bedtime (weekends): _________
*Average morning wake time (week days): _________ *Average morning wake time (weekends): _________
*Average total time asleep each night (subtract time it takes to fall asleep and time when child is awake during night. Round to nearest 15 minute interval): ____________ *(i.e., 8 hrs, 45 min)*

APPENDIX C

SLEEP QUESTIONNAIRE-PARENT FORM

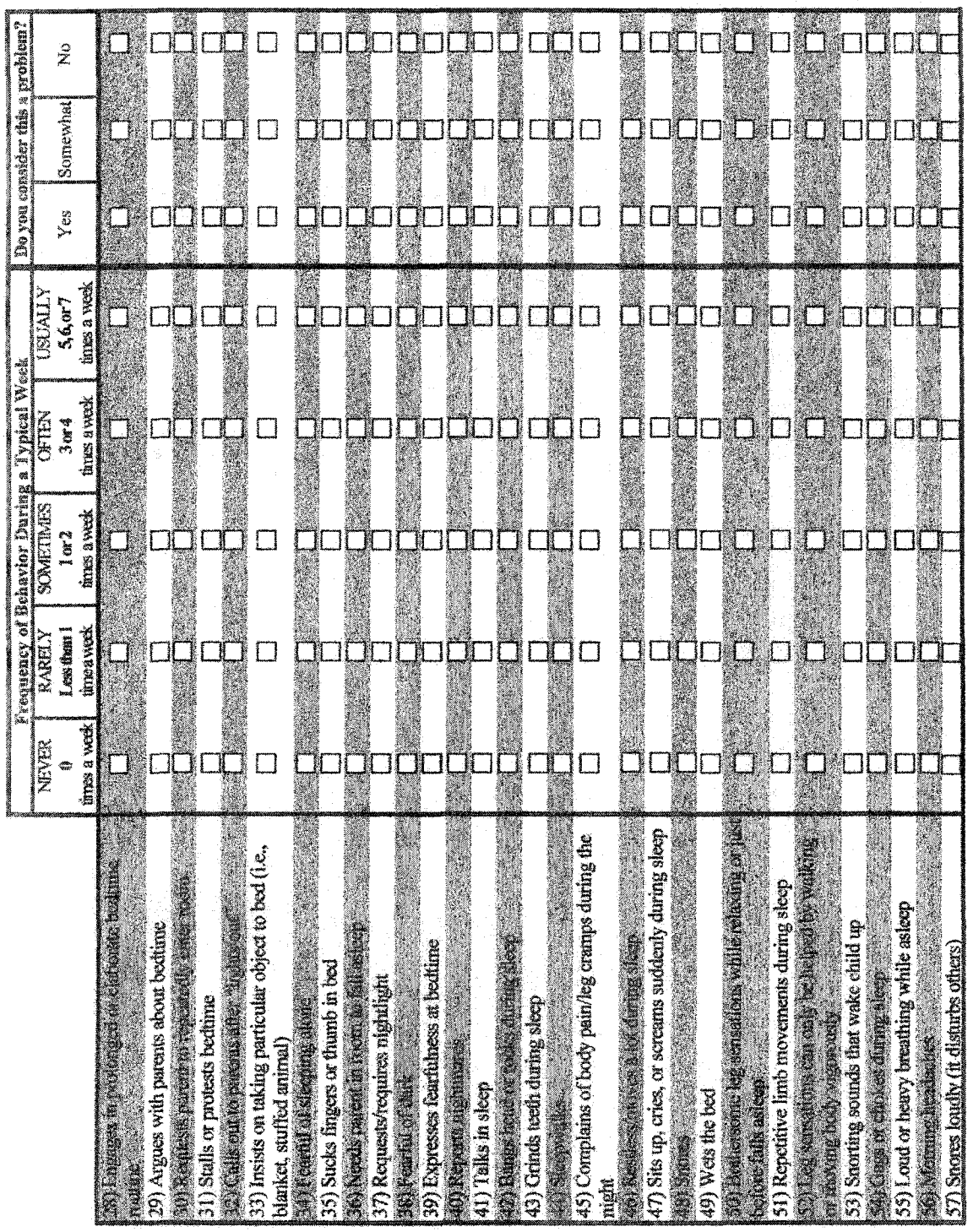
SLEEP QUESTIONNAIRE-PARENT FORM

Below are a number of items about sleep. Thinking of a typical week for your child, please mark in the corresponding box approximately how often each of the items occur. For each of the items that you report (other than those that "never" occur), please also mark whether you consider each item to be problematic for you and/or your child.

	Frequency of Behavior During a Typical Week					Do you consider this a problem?		
	NEVER 0 times a week	RARELY Less than 1 time a week	SOMETIMES 1 or 2 times a week	OFTEN 3 or 4 times a week	USUALLY 5, 6, or 7 times a week	Yes	Somewhat	No
1) Difficulty waking up in morning	☐	☐	☐	☐	☐	☐	☐	☐
2) Wakes up in irritable mood	☐	☐	☐	☐	☐	☐	☐	☐
3) Long time to get alert in morning	☐	☐	☐	☐	☐	☐	☐	☐
4) Heavy sleeper-difficult to rouse	☐	☐	☐	☐	☐	☐	☐	☐
5) Drowsy in the morning	☐	☐	☐	☐	☐	☐	☐	☐
6) Falls asleep easily during the day (i.e., at school, watching T.V, reading)	☐	☐	☐	☐	☐	☐	☐	☐
7) Sleepy during the day	☐	☐	☐	☐	☐	☐	☐	☐
8) Takes unscheduled/unintentional nap	☐	☐	☐	☐	☐	☐	☐	☐
9) Takes more than 20 minutes to fall asleep	☐	☐	☐	☐	☐	☐	☐	☐
10) Seems to sleep too little	☐	☐	☐	☐	☐	☐	☐	☐
11) Complains of poor/inadequate sleep	☐	☐	☐	☐	☐	☐	☐	☐
12) Wakes early (before desired time)	☐	☐	☐	☐	☐	☐	☐	☐
13) Wakes up to urinate	☐	☐	☐	☐	☐	☐	☐	☐
14) Wakes up during the night (except to urinate)	☐	☐	☐	☐	☐	☐	☐	☐
15) Gets out of bed during the night (except to urinate)	☐	☐	☐	☐	☐	☐	☐	☐
16) Wakes and goes into parent's bed	☐	☐	☐	☐	☐	☐	☐	☐
17) Difficulty falling back to sleep when wakens	☐	☐	☐	☐	☐	☐	☐	☐
18) Wakes up easily to any sound	☐	☐	☐	☐	☐	☐	☐	☐
19) Tosses and turns excessively in sleep	☐	☐	☐	☐	☐	☐	☐	☐
20) Does not have a bedtime routine	☐	☐	☐	☐	☐	☐	☐	☐
21) Does not fall asleep in own bed	☐	☐	☐	☐	☐	☐	☐	☐
22) Falls asleep in place other than own bed	☐	☐	☐	☐	☐	☐	☐	☐
23) Naps in afternoon (scheduled)	☐	☐	☐	☐	☐	☐	☐	☐
24) Naps in evening (scheduled)	☐	☐	☐	☐	☐	☐	☐	☐
25) Irregular bedtime (varies more than 1 hr.)	☐	☐	☐	☐	☐	☐	☐	☐
26) Sleep schedule varies more than 1 hour on weekends compared with weeknights	☐	☐	☐	☐	☐	☐	☐	☐
27) Does not comply with bedtime routine	☐	☐	☐	☐	☐	☐	☐	☐

APPENDIX C (continued)

SLEEP QUESTIONNAIRE-PARENT FORM



	Frequency of Behavior During a Typical Week					Do you consider this a problem?		
	NEVER 0 times a week	RARELY Less than 1 time a week	SOMETIMES 1 or 2 times a week	OFTEN 3 or 4 times a week	USUALLY 5,6, or 7 times a week	Yes	Somewhat	No
28) Engages in prolonged or elaborate bedtime routine	☐	☐	☐	☐	☐	☐	☐	☐
29) Argues with parents about bedtime	☐	☐	☐	☐	☐	☐	☐	☐
30) Requires parent to repeatedly enter room	☐	☐	☐	☐	☐	☐	☐	☐
31) Stalls or protests bedtime	☐	☐	☐	☐	☐	☐	☐	☐
32) Calls out to parents after "lights out"	☐	☐	☐	☐	☐	☐	☐	☐
33) Insists on taking particular object to bed (i.e., blanket, stuffed animal)	☐	☐	☐	☐	☐	☐	☐	☐
34) Fearful of sleeping alone	☐	☐	☐	☐	☐	☐	☐	☐
35) Sucks fingers or thumb in bed	☐	☐	☐	☐	☐	☐	☐	☐
36) Needs parent in room to fall asleep	☐	☐	☐	☐	☐	☐	☐	☐
37) Requests/requires nightlight	☐	☐	☐	☐	☐	☐	☐	☐
38) Fearful of dark	☐	☐	☐	☐	☐	☐	☐	☐
39) Expresses fearfulness at bedtime	☐	☐	☐	☐	☐	☐	☐	☐
40) Reports nightmares	☐	☐	☐	☐	☐	☐	☐	☐
41) Talks in sleep	☐	☐	☐	☐	☐	☐	☐	☐
42) Bangs head or rocks during sleep	☐	☐	☐	☐	☐	☐	☐	☐
43) Grinds teeth during sleep	☐	☐	☐	☐	☐	☐	☐	☐
44) Sleep talks	☐	☐	☐	☐	☐	☐	☐	☐
45) Complains of body pain/leg cramps during the night	☐	☐	☐	☐	☐	☐	☐	☐
46) Restless moves a lot during sleep	☐	☐	☐	☐	☐	☐	☐	☐
47) Sits up, cries, or screams suddenly during sleep	☐	☐	☐	☐	☐	☐	☐	☐
48) Snores	☐	☐	☐	☐	☐	☐	☐	☐
49) Wets the bed	☐	☐	☐	☐	☐	☐	☐	☐
50) Evidences leg sensations while relaxing or just before falls asleep	☐	☐	☐	☐	☐	☐	☐	☐
51) Repetitive limb movements during sleep	☐	☐	☐	☐	☐	☐	☐	☐
52) Leg sensations can only be helped by walking or moving body vigorously	☐	☐	☐	☐	☐	☐	☐	☐
53) Snorting sounds that wake child up	☐	☐	☐	☐	☐	☐	☐	☐
54) Gags or chokes during sleep	☐	☐	☐	☐	☐	☐	☐	☐
55) Loud or heavy breathing while asleep	☐	☐	☐	☐	☐	☐	☐	☐
56) Morning headaches	☐	☐	☐	☐	☐	☐	☐	☐
57) Snores loudly (it disturbs others)	☐	☐	☐	☐	☐	☐	☐	☐

APPENDIX D

SLEEP QUESTIONNAIRE-CHILD FORM

SLEEP QUESTIONNAIRE-CHILD FORM

These are all statements about your sleep. Think of a usual week (7 days). How many times during that week is each one true? Please check your answer to each statement in the box. Only check one box for each. Remember, there are no right or wrong answers. Please ask an adult if you do not understand one.

	NEVER **0** times a week	RARELY **Less than 1** time a week	SOMETIMES **1 or 2** times a week	OFTEN **3 or 4** times a week	USUALLY **5, 6, or 7** times a week
Example: I eat pizza	☐	☐	☒	☐	☐
Example: I brush my teeth	☐	☐	☐	☐	☒
1) I have a hard time waking up in the morning	☐	☐	☐	☐	☐
2) I feel grouchy in the morning when I wake up	☐	☐	☐	☐	☐
3) I feel sleepy during the day	☐	☐	☐	☐	☐
4) I fall asleep during the day when I do not mean to (like at school or when watching TV)	☐	☐	☐	☐	☐
5) I have about the same bedtime every night	☐	☐	☐	☐	☐
6) I fall asleep in my parents' or brother/sister's bed	☐	☐	☐	☐	☐
7) It is hard for me to fall asleep/I lie in bed wide awake	☐	☐	☐	☐	☐
8) I do not feel rested after a night's sleep	☐	☐	☐	☐	☐
9) I think that I do not sleep enough	☐	☐	☐	☐	☐
10) I wake up earlier in the morning than I need to	☐	☐	☐	☐	☐
11) I wake up during the night to go to the bathroom	☐	☐	☐	☐	☐
12) I wake up during the night even when I do not have to go to the bathroom	☐	☐	☐	☐	☐

APPENDIX D (continued)

SLEEP QUESTIONNAIRE-CHILD FORM

	NEVER **0** times a week	RARELY **Less than 1** time a week	SOMETIMES **1 or 2** times a week	OFTEN **3 or 4** times a week	USUALLY **5, 6, or 7** times a week
13) I wake up and go into my parent's bed	☐	☐	☐	☐	☐
14) I have trouble falling back to sleep when I wake up during the night	☐	☐	☐	☐	☐
15) I am awake when my parents think I am asleep	☐	☐	☐	☐	☐
16) I fight with my parents about having to go to bed	☐	☐	☐	☐	☐
17) I want to have a night light on in my bedroom	☐	☐	☐	☐	☐
18) I am scared of the dark	☐	☐	☐	☐	☐
19) I take a special thing to bed with me (like a blanket, doll, or stuffed animal)	☐	☐	☐	☐	☐
20) I am scared of sleeping by myself	☐	☐	☐	☐	☐
21) I suck my fingers or thumb in bed	☐	☐	☐	☐	☐
22) I ask my parents to stay with me in my room until I fall asleep	☐	☐	☐	☐	☐
23) I feel like I toss and turn a lot while sleeping	☐	☐	☐	☐	☐
24) I wet my bed	☐	☐	☐	☐	☐
25) I have nightmares or bad dreams	☐	☐	☐	☐	☐
26) I have pain in my legs just before I sleep	☐	☐	☐	☐	☐

_______ Parent: Please check here if you read this to or marked this for your child

APPENDIX E

SUPPLEMENTARY LIKERT SCALE

NEVER	RARELY	SOMETIMES	OFTEN	USUALLY
0	Less than 1	1 or 2	3 or 4	5, 6, or 7
Times a week	Times a week	Times a week	Times a week	Times a week

APPENDIX F

SLEEP QUESTIONNAIRE FOR PARENTS: INITIAL SUBSCALE ITEMS

Number	Sleep Item	Subscale
1	Difficulty waking up in morning	Morning Difficulty
2	Wakes up in irritable mood	Morning Difficulty
3	Long time to get alert in morning	Morning Difficulty
4	Heavy sleeper-difficult to rouse	Morning Difficulty
5	Drowsy in the morning	Morning Difficulty
6	Falls asleep easily during the day (i.e., at school, watching T.V, reading)	Daytime Sleepiness
7	Sleepy during the day	Daytime Sleepiness
8	Takes unscheduled/unintentional nap	Daytime Sleepiness
9	Takes more than 20 minutes to fall asleep	Sleep Onset
10	Seems to sleep too little	Sleep Duration/Quality
11	Complains of poor/inadequate sleep	Sleep Duration/Quality
12	Wakes early (before desired time)	Sleep Duration/Quality
13	Wakes up to urinate	Sleep Duration/Quality
14	Wakes up during the night (except to urinate)	Sleep Duration/Quality
15	Gets out of bed during the night (except to urinate)	Sleep Duration/Quality
16	Wakes and goes into parent's bed	Sleep Duration/Quality
17	Difficulty falling back to sleep when wakens	Sleep Duration/Quality
18	Wakes up easily to any sound	Sleep Duration/Quality
19	Tosses and turns excessively in sleep	Sleep Duration/Quality
20	Does not have a bedtime routine	Sleep Hygiene
21	Does not fall asleep in own bed	Sleep Hygiene
22	Falls asleep in place other than own bed	Sleep Hygiene
23	Naps in afternoon (scheduled)	Sleep Hygiene
24	Naps in evening (scheduled)	Sleep Hygiene
25	Irregular bedtime (varies more than 1 hr.)	Sleep Hygiene
26	Sleep schedule varies more than 1 hour on weekends compared with	Sleep Hygiene
27	Does not comply with bedtime routine	Bedtime Resistance
28	Engages in prolonged or elaborate bedtime routine	Bedtime Resistance
29	Argues with parents about bedtime	Bedtime Resistance
30	Requests parent to repeatedly enter room	Bedtime Resistance
31	Stalls or protests bedtime	Bedtime Resistance
32	Calls out to parents after "lights out"	Sleep Anxiety/Transitioning
33	Insists on taking particular object to bed (i.e., blanket, stuffed animal)	Sleep Anxiety/Transitioning
34	Fearful of sleeping alone	Sleep Anxiety/Transitioning
35	Sucks fingers or thumb in bed	Sleep Anxiety/Transitioning
36	Needs parent in room to fall asleep	Sleep Anxiety/Transitioning
37	Requests/requires nightlight	Sleep Anxiety/Transitioning
38	Fearful of dark	Sleep Anxiety/Transitioning
39	Expresses fearfulness at bedtime	Sleep Anxiety/Transitioning
40	Reports nightmares	Parasomnias/Other Sleep Disturbance
41	Talks in sleep	Parasomnias/Other Sleep Disturbance
42	Bangs head or rocks during sleep	Parasomnias/Other Sleep Disturbance
43	Grinds teeth during sleep	Parasomnias/Other Sleep Disturbance
44	Sleepwalks	Parasomnias/Other Sleep Disturbance
45	Complains of body pain/leg cramps during the night	Parasomnias/Other Sleep Disturbance
46	Suddenly wakes up frightened	Parasomnias/Other Sleep Disturbance
47	Sits up, cries, or screams out suddenly during sleep	Parasomnias/Other Sleep Disturbance
48	Snores	Parasomnias/Other Sleep Disturbance
49	Wets the bed	Parasomnias/Other Sleep Disturbance
50	Bothersome leg sensations while relaxing or just before falls asleep	RLS/PLMD
51	Repetitive limb movements during sleep	RLS/PLMD
52	Leg sensations can only be helped by walking or moving body vigorously	RLS/PLMD
53	Snorting sounds that wake child up	Sleep-Disordered Breathing
54	Gags or chokes during sleep	Sleep-Disordered Breathing
55	Loud or heavy breathing while asleep	Sleep-Disordered Breathing
56	Morning headaches	Sleep-Disordered Breathing
57	Snores loudly (it disturbs others)	Sleep-Disordered Breathing

APPENDIX G

SLEEP QUESTIONNAIRE FOR CHILDREN: INITIAL SUBSCALE ITEMS

Number	Sleep Item	Subscale
1	I have a hard time waking up in the morning	Morning Difficulty
2	I feel grouchy in the morning when I wake up	Morning Difficulty
3	I feel sleepy during the day	Daytime Sleepiness
4	I accidentally fall asleep during the day (like at school or when watching TV)	Daytime Sleepiness
5	I have about the same bedtime every school night and weekend night	Sleep Hygiene
6	I fall asleep in my parents' or brother/sister's bed	Sleep Hygiene
7	It is hard for me to fall asleep/I lie in bed wide awake	Sleep Onset
8	I do not feel rested after a night's sleep	Sleep Duration/Quality
9	I think that I don't sleep enough	Sleep Duration/Quality
10	I wake up earlier in the morning than I need to	Sleep Duration/Quality
11	I wake up during the night to go to the bathroom	Sleep Duration/Quality
12	I wake up during the night even when I don't have to go to the bathroom	Sleep Duration/Quality
13	I wake up and go into my parent's bed	Sleep Duration/Quality
14	I have trouble falling back to sleep when I wake up during the night	Sleep Duration/Quality
15	I am awake when my parents think I am asleep	Sleep Duration/Quality
16	I fight with my parents about having to go to bed	Bedtime Resistance
17	I want to have a night light on in my bedroom	Sleep Anxiety/Transitioning
18	I am scared of the dark	Sleep Anxiety/Transitioning
19	I take a special thing to bed with me (like a blanket, doll, or stuffed animal)	Sleep Anxiety/Transitioning
20	I am scared of sleeping by myself	Sleep Anxiety/Transitioning
21	I suck my fingers or thumb in bed	Sleep Anxiety/Transitioning
22	I ask my parents to stay with me in my room until I fall asleep	Sleep Anxiety/Transitioning
23	I feel like I toss and turn a lot while sleeping	Parasomnias/Other Sleep Disturbance
24	I wet my bed	Parasomnias/Other Sleep Disturbance
25	I have nightmares or bad dreams	Parasomnias/Other Sleep Disturbance
26	I have pain in my legs just before I sleep	RLS/PLMD

APPENDIX H

SLEEP QUESTIONNAIRE FOR PARENTS: FINAL SUBSCALE ITEMS

Number	Sleep Item	Subscale
1	Difficulty waking up in morning	Morning Difficulty
2	Wakes up in irritable mood	Morning Difficulty
3	Long time to get alert in morning	Morning Difficulty
4	Heavy sleeper-difficult to rouse	Morning Difficulty
5	Drowsy in the morning	Morning Difficulty
6	Falls asleep easily during the day (i.e., at school, watching T.V, reading)	Daytime Sleepiness
7	Sleepy during the day	Daytime Sleepiness
8	Takes unscheduled/unintentional nap	Daytime Sleepiness
9	Takes more than 20 minutes to fall asleep	Sleep Onset
10	Seems to sleep too little	Sleep Duration/Quality
11	Complains of poor/inadequate sleep	Sleep Duration/Quality
12	Wakes early (before desired time)	Sleep Duration/Quality
13	Wakes up to urinate	
14	Wakes up during the night (except to urinate)	Sleep Duration/Quality
15	Gets out of bed during the night (except to urinate)	Sleep Duration/Quality
16	Wakes and goes into parent's bed	Sleep Duration/Quality
17	Difficulty falling back to sleep when wakens	Sleep Duration/Quality
18	Wakes up easily to any sound	Sleep Duration/Quality
19	Tosses and turns excessively in sleep	Sleep Duration/Quality
20	Does not have a bedtime routine	Sleep Hygiene
21	Does not fall asleep in own bed	Sleep Hygiene
22	Falls asleep in place other than own bed	Sleep Hygiene
23	Naps in afternoon (scheduled)	Sleep Hygiene
24	Naps in evening (scheduled)	Sleep Hygiene
25	Irregular bedtime (varies more than 1 hr.)	Sleep Hygiene
26	Sleep schedule varies more than 1 hour on weekends compared with	Sleep Hygiene
27	Does not comply with bedtime routine	Bedtime Resistance
28	Engages in prolonged or elaborate bedtime routine	Bedtime Resistance
29	Argues with parents about bedtime	Bedtime Resistance
30	Requests parent to repeatedly enter room	Bedtime Resistance
31	Stalls or protests bedtime	Bedtime Resistance
32	Calls out to parents after "lights out"	Sleep Anxiety/Transitioning
33	Insists on taking particular object to bed (i.e., blanket, stuffed animal)	Sleep Anxiety/Transitioning
34	Fearful of sleeping alone	Sleep Anxiety/Transitioning
35	Sucks fingers or thumb in bed	Sleep Anxiety/Transitioning
36	Needs parent in room to fall asleep	Sleep Anxiety/Transitioning
37	Requests/requires nightlight	Sleep Anxiety/Transitioning
38	Fearful of dark	Sleep Anxiety/Transitioning
39	Expresses fearfulness at bedtime	Sleep Anxiety/Transitioning
40	Reports nightmares	Parasomnias/Other Sleep Disturbance
41	Talks in sleep	Parasomnias/Other Sleep Disturbance
42	Bangs head or rocks during sleep	
43	Grinds teeth during sleep	
44	Sleepwalks	Parasomnias/Other Sleep Disturbance
45	Complains of body pain/leg cramps during the night	Parasomnias/Other Sleep Disturbance
46	Suddenly wakes up frightened	Parasomnias/Other Sleep Disturbance
47	Sits up, cries, or screams out suddenly during sleep	
48	Snores	Sleep-Disordered Breathing
49	Wets the bed	
50	Bothersome leg sensations while relaxing or just before falls asleep	Restless Legs Syndrome
51	Repetitive limb movements during sleep	
52	Leg sensations can only be helped by walking or moving body vigorously	
53	Snorting sounds that wake child up	Sleep-Disordered Breathing
54	Gags or chokes during sleep	Sleep-Disordered Breathing
55	Loud or heavy breathing while asleep	
56	Morning headaches	
57	Snores loudly (it disturbs others)	Sleep-Disordered Breathing

APPENDIX I

SLEEP QUESTIONNAIRE FOR CHILDREN: FINAL SUBSCALE ITEMS

Number	Sleep Item	Subscale
1	I have a hard time waking up in the morning	Morning Difficulty
2	I feel grouchy in the morning when I wake up	
3	I feel sleepy during the day	Daytime Sleepiness
4	I accidentally fall asleep during the day (like at school or when watching TV)	
5	I have about the same bedtime every school night and weekend night	Sleep Hygiene
6	I fall asleep in my parents' or brother/sister's bed	
7	It is hard for me to fall asleep/I lie in bed wide awake	Sleep Onset
8	I do not feel rested after a night's sleep	Sleep Duration/Quality
9	I think that I don't sleep enough	Sleep Duration/Quality
10	I wake up earlier in the morning than I need to	Sleep Duration/Quality
11	I wake up during the night to go to the bathroom	
12	I wake up during the night even when I don't have to go to the bathroom	Sleep Duration/Quality
13	I wake up and go into my parent's bed	Sleep Duration/Quality
14	I have trouble falling back to sleep when I wake up during the night	Sleep Duration/Quality
15	I am awake when my parents think I am asleep	
16	I fight with my parents about having to go to bed	Bedtime Resistance
17	I want to have a night light on in my bedroom	Sleep Anxiety/Transitioning
18	I am scared of the dark	Sleep Anxiety/Transitioning
19	I take a special thing to bed with me (like a blanket, doll, or stuffed animal)	Sleep Anxiety/Transitioning
20	I am scared of sleeping by myself	Sleep Anxiety/Transitioning
21	I suck my fingers or thumb in bed	Sleep Anxiety/Transitioning
22	I ask my parents to stay with me in my room until I fall asleep	Sleep Anxiety/Transitioning
23	I feel like I toss and turn a lot while sleeping	
24	I wet my bed	
25	I have nightmares or bad dreams	
26	I have pain in my legs just before I sleep	Restless Legs Syndrome

APPENDIX J

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE ADHD GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
1	5 (15%)	7 (21%)	17 (52%)	4 (12%)
2	7 (21%)	5 (15%)	17 (52%)	4 (12%)
3	3 (9%)	6 (18%)	20 (61%)	4 (12%)
4	1 (3%)	5 (15%)	24 (73%)	3 (9%)
5	1 (3%)	5 (15%)	22 (67%)	5 (15%)
6	0 (0%)	1 (3%)	28 (85%)	4 (12%)
7	0 (0%)	4 (12%)	24 (73%)	5 (15%)
8	0 (0%)	1 (3%)	27 (82%)	5 (15%)
9	9 (27%)	6 (18%)	13 (39%)	5 (15%)
10	9 (27%)	4 (12%)	15 (45%)	5 (15%)
11	6 (18%)	2 (6%)	20 (61%)	5 (15%)
12	4 (12%)	2 (6%)	23 (70%)	4 (12%)
13	2 (6%)	1 (3%)	26 (79%)	4 (12%)
14	7 (21%)	1 (3%)	22 (67%)	3 (9%)
15	7 (21%)	2 (6%)	21 (64%)	3 (9%)
16	6 (18%)	1 (3%)	22 (67%)	4 (12%)
17	6 (18%)	2 (6%)	20 (61%)	5 (15%)
18	2 (6%)	4 (12%)	24 (73%)	3 (9%)
19	4 (12%)	2 (6%)	21 (64%)	6 (18%)
20	0 (0%)	3 (9%)	27 (82%)	3 (9%)
21	0 (0%)	1 (3%)	29 (88%)	3 (9%)
22	2 (6%)	1 (3%)	27 (82%)	3 (9%)

APPENDIX J (continued)

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE ADHD GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
23	0 (0%)	0 (0%)	31 (94%)	2 (6%)
24	0 (0%)	0 (0%)	31 (94%)	2 (6%)
25	1 (3%)	3 (9%)	26 (79%)	3 (9%)
26	1 (3%)	2 (6%)	24 (73%)	6 (18%)
27	4 (12%)	2 (6%)	23 (70%)	4 (12%)
28	7 (21%)	3 (9%)	17 (52%)	6 (18%)
29	8 (24%)	4 (12%)	17 (52%)	4 (12%)
30	5 (15%)	2 (6%)	24 (73%)	2 (6%)
31	10 (30%)	4 (12%)	16 (48%)	3 (9%)
32	6 (18%)	5 (15%)	19 (58%)	3 (9%)
33	2 (6%)	1 (3%)	26 (79%)	4 (12%)
34	3 (9%)	1 (3%)	26 (79%)	3 (9%)
35	1 (3%)	1 (3%)	30 (91%)	1 (3%)
36	3 (9%)	1 (3%)	27 (82%)	2 (6%)
37	1 (3%)	0 (0%)	28 (85%)	4 (12%)
38	2 (6%)	3 (9%)	23 (70%)	5 (15%)
39	3 (9%)	0 (0%)	26 (79%)	4 (12%)
40	1 (3%)	3 (9%)	24 (73%)	5 (15%)
41	1 (3%)	1 (3%)	28 (85%)	3 (9%)
42	0 (0%)	0 (0%)	32 (97%)	1 (3%)
43	3 (9%)	2 (6%)	27 (82%)	1 (3%)

APPENDIX J (continued)

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE ADHD GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
44	1 (3%)	0 (0%)	30 (91%)	2 (6%)
45	3 (9%)	4 (12%)	22 (67%)	4 (12%)
46	2 (6%)	2 (6%)	26 (79%)	3 (9%)
47	2 (6%)	0 (0%)	30 (91%)	1 (3%)
48	1 (3%)	2 (6%)	27 (82%)	3 (9%)
49	3 (9%)	1 (3%)	29 (88%)	0 (0%)
50	3 (9%)	2 (6%)	26 (79%)	2 (6%)
51	2 (6%)	1 (3%)	28 (85%)	2 (6%)
52	0 (0%)	0 (0%)	32 (97%)	1 (3%)
53	0 (0%)	1 (3%)	31 (94%)	1 (3%)
54	0 (0%)	0 (0%)	32 (97%)	1 (3%)
55	0 (0%)	2 (6%)	28 (85%)	3 (9%)
56	5 (15%)	2 (6%)	28 (85%)	3 (9%)
57	1 (3%)	1 (3%)	28 (85%)	3 (9%)

APPENDIX K

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE CONTROL GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
1	1 (3%)	3 (9%)	28 (85%)	1 (3%)
2	0 (0%)	1 (3%)	31 (94%)	1 (3%)
3	0 (0%)	1 (3%)	31 (94%)	1 (3%)
4	0 (0%)	1 (3%)	31 (94%)	1 (3%)
5	0 (0%)	3 (9%)	29 (88%)	1 (3%)
6	0 (0%)	1 (3%)	32 (97%)	0 (0%)
7	0 (0%)	1 (3%)	32 (97%)	0 (0%)
8	0 (0%)	0 (0%)	33 (100%)	0 (0%)
9	0 (0%)	2 (6%)	30 (91%)	1 (3%)
10	0 (0%)	2 (6%)	31 (94%)	0 (0%)
11	0 (0%)	2 (6%)	31 (94%)	0 (0%)
12	0 (0%)	0 (0%)	32 (97%)	1 (3%)
13	0 (0%)	0 (0%)	32 (97%)	1 (3%)
14	0 (0%)	2 (6%)	30 (91%)	1 (3%)
15	0 (0%)	2 (6%)	30 (91%)	1 (3%)
16	0 (0%)	2 (6%)	31 (94%)	0 (0%)
17	0 (0%)	2 (6%)	31 (94%)	0 (0%)
18	0 (0%)	2 (6%)	30 (91%)	1 (3%)
19	0 (0%)	1 (3%)	31 (94%)	1 (3%)
20	0 (0%)	1 (3%)	31 (94%)	1 (3%)
21	0 (0%)	0 (0%)	33 (100%)	0 (0%)

APPENDIX K (continued)

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE CONTROL GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
22	0 (0%)	1 (3%)	32 (97%)	0 (0%)
23	0 (0%)	0 (0%)	33 (100%)	0 (0%)
24	0 (0%)	0 (0%)	33 (100%)	0 (0%)
25	0 (0%)	1 (3%)	31 (94%)	1 (3%)
26	0 (0%)	1 (3%)	31 (94%)	1 (3%)
27	0 (0%)	1 (3%)	31 (94%)	1 (3%)
28	1 (3%)	2 (6%)	29 (88%)	1 (3%)
29	1 (3%)	5 (15%)	26 (79%)	1 (3%)
30	0 (0%)	2 (6%)	31 (94%)	0 (0%)
31	1 (3%)	5 (15%)	26 (79%)	1 (3%)
32	0 (0%)	1 (3%)	32 (97%)	0 (0%)
33	0 (0%)	0 (0%)	33 (100%)	0 (0%)
34	0 (0%)	1 (3%)	32 (97%)	0 (0%)
35	0 (0%)	0 (0%)	33 (100%)	0 (0%)
36	0 (0%)	1 (3%)	32 (97%)	0 (0%)
37	0 (0%)	0 (0%)	33 (100%)	0 (0%)
38	0 (0%)	0 (0%)	32 (97%)	1 (3%)
39	0 (0%)	1 (3%)	32 (97%)	0 (0%)
40	0 (0%)	0 (0%)	32 (97%)	1 (3%)
41	0 (0%)	0 (0%)	32 (97%)	1 (3%)
42	0 (0%)	0 (0%)	33 (100%)	0 (0%)

APPENDIX K (continued)

PARENTS' RATINGS OF PROBLEMATIC SLEEP FOR THE CONTROL GROUP

	Degree of Problem			
Sleep Item Number	"Yes"	"Somewhat"	"No"	Missing
43	0 (0%)	0 (0%)	33 (100%)	0 (0%)
44	0 (0%)	1 (3%)	32 (97%)	0 (0%)
45	0 (0%)	0 (0%)	33 (100%)	0 (0%)
46	0 (0%)	0 (0%)	32 (97%)	1 (3%)
47	0 (0%)	0 (0%)	33 (100%)	0 (0%)
48	0 (0%)	1 (3%)	31 (94%)	1 (3%)
49	0 (0%)	0 (0%)	33 (100%)	0 (0%)
50	0 (0%)	0 (0%)	33 (100%)	0 (%)
51	0 (0%)	0 (0%)	33 (100%)	0 (0%)
52	0 (0%)	0 (0%)	33 (100%)	0 (0%)
53	0 (0%)	0 (0%)	33 (100%)	0 (0%)
54	0 (0%)	0 (0%)	33 (100%)	0 (0%)
55	0 (0%)	0 (0%)	33 (100%)	0 (0%)
56	0 (0%)	0 (0%)	33 (100%)	0 (0%)
57	0 (0%)	1 (3%)	32 (97%)	0 (0%)

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Gregg, S.G., & Turner, D.M. (September 1999). *Childhood Bipolar Disorder in the Classroom.* Presented at the 9th Annual Virginia Beach Conference on Children and Adolescents with Emotional, Behavioral, and Developmental Disorders, Virginia Beach, VA.

Rzepski, B., & Turner, D.M. (November 2000). *Psychotherapy Supervision.* Presented at Institute of Living Psychology Departmental Meeting, Hartford, CT.

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