

# Attention Deficit/ Hyperactivity Disorder and Sleep in Children



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## KEYWORDS

- Attention deficit/hyperactivity disorder • Obstructive sleep apnea
- Periodic limb movement disorder • Sleep apnea

## KEY POINTS

- ADHD is well known to be associated with sleep problems; problems with attention and hyperactivity are known manifestations of sleepiness in children.
- ADHD may be associated with objectively recorded sleep disruption.
- ADHD may be associated with excessive daytime sleepiness.
- ADHD is frequently associated with a comorbid psychiatric diagnosis in which case the comorbid condition is associated with disrupted sleep.
- Obstructive sleep apnea, snoring, and periodic limb movement disorder, are associated with ADHD.
- Stimulant medication in children with ADHD may disrupt sleep.
- Melatonin, and not zolpidem, is effective in treating sleeping problems in children with ADHD.
- ADHD often appears comorbidly with anxiety, depression, or bipolar disorder.
- Children with ADHD frequently have mild sleep apnea. Treating the sleep apnea with adenotonsillectomy alleviates the symptoms of ADHD more than stimulants without the undesirable side effects.

## INTRODUCTION

Attention deficit/hyperactivity disorder (ADHD) is a psychiatric diagnosis that describes symptoms including hyperactivity, inattentiveness, and impulsivity of sufficient magnitude to impair normal functioning in children and adults. It is a common syndrome in children and in some cases persists in adults. The Diagnostic and Statistical Manual of Mental Disorders-IV, describes how 6 of 9 symptoms must be present to describe either the inattentive type or the hyperactive type. If an individual meets criteria for both, he or she is diagnosed with the combined type.

The manual also describes how most of the symptoms of ADHD are common in normal

children; therefore, symptoms must persist for at least 6 months and must be present in more than one setting. For example, a child who meets ADHD criteria at home but not at school or vice versa would not meet criteria for ADHD. The symptoms must emerge before age 7. The symptoms cannot be explained by another mental disorder, such as depression, anxiety, or bipolar disorder.

In children especially, hyperactivity and difficulties with attention are common manifestations of insufficient sleep. A recent study found that 1 hour of sleep restriction for 6 nights in children with subclinical ADHD pushed two-thirds into the clinically impaired range on a test of daytime performance.<sup>1</sup>

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The 2004 National Sleep Foundation's *Sleep in America* poll of children found that 1 in 4 parents reported that their child was not getting enough sleep and two-thirds reported that their child had one or more sleep problems a few nights a week.<sup>2</sup> These findings suggest that many vulnerable children may inadvertently be pressured into hyperactivity by chronic insufficient sleep. Such a sleep-deprived, tired, hyperactive or inattentive child is then prescribed a stimulant to ameliorate his or her symptoms, obviously not a desired treatment.

This article discusses how children with insufficient sleep, or with sleep disorders such as restless legs syndrome/periodic limb movement disorder (PLMD), or obstructive sleep apnea are more likely to manifest symptoms of ADHD. Children with insufficient sleep may exhibit hyperactivity and impulsivity, leading to the diagnosis of ADHD. This article also discusses the findings and controversies linking sleep difficulties to ADHD. It reviews current pharmacologic and non-pharmacologic treatments for ADHD.

A vast array of nonmedical literature addresses the diagnosis and treatment of ADHD from psychiatric, psychoanalytic, behavioral, and dietary perspectives. There are many publications in psychiatric, psychological, and nutritional journals and many textbooks addressing ADHD and its treatment that are outside of the medical literature. These journal articles and textbooks inform health care professionals in school and workplace settings. Sleep issues appear principally in the medical literature. Psychological/behavioral issues appear mainly in the nonmedical literature. Entering the search terms "ADHD" and "sleep" in PubMed pulls up 743 journal articles. Entering the search term "ADHD" in the "books" category of [Amazon.com](http://Amazon.com) pulls up more than 5000 publications. In scanning the first 100 publications at [Amazon.com](http://Amazon.com), there was no obvious overlap with its search results and those of PubMed. This article focuses exclusively on ADHD and sleep, a topic given scant notice in the nonmedical literature.

### **IS THE SLEEP OF CHILDREN WITH ATTENTION DEFICIT/HYPERACTIVITY DISORDER DISTURBED?**

This question is surprisingly difficult to answer definitively. A recent meta-analysis concluded that parents of children with ADHD perceive them to have more bedtime resistance, more difficulty falling asleep, more nighttime awakenings, greater difficulty waking up in the morning, and more daytime sleepiness. Parents of ADHD children also

report that they snore more than controls. The same analysis also reviewed results of polysomnography and actigraphy for more objective measures. This analysis found increased sleep-onset latency on actigraphy, more stage shifts per hour, lower sleep efficiency on polysomnography, and shorter total sleep time.<sup>3</sup> However, another meta-analysis of polysomnographic studies found no differences between ADHD children and controls with the exception that children with ADHD had more periodic leg movements (PLMs) than controls.<sup>4</sup>

The journal articles in PubMed were reviewed, comparing the sleep of normal controls with sleep of children of the same age with ADHD. No single objective abnormality characterizes the sleep of children with ADHD compared with controls. The subjective (parent reported) variable of increased bedtime resistance consistently differentiates children with ADHD from controls.<sup>5</sup> But actigraphy<sup>6,7</sup> and polysomnographic studies<sup>8</sup> do not corroborate longer latencies to sleep onset or shorter total sleep times or increased arousals in children with ADHD.

Studies of children with ADHD have been performed by questionnaire, by parents filling out logs, by actigraphy, and by polysomnography (PSG). Many use more than one of the above measurement techniques. Several studies find the sleep of children to be the same as control children by PSG or by actigraphy. Several studies find parental questionnaires to indicate sleep-onset problems and sleep maintenance problems in children with ADHD,<sup>9</sup> but PSG studies fail to verify this. Many PSG and actigraphy studies find a difference between children with ADHD and normal controls, but the differences between children with ADHD and normal controls are not consistent from one publication to the next. For example, several studies have found shorter sleep or greater wake after sleep onset in children with ADHD. Other studies report longer sleep in children with ADHD than controls. There are more publications that describe some form of sleep disorder, albeit different in each publication, than there are publications that describe no sleep abnormalities.

About the same number of publications reports no differences comparing children with ADHD with controls, and one reports longer total sleep time in children with ADHD as measured by actigraphy. Others report differences in rapid eye movement (REM) latency or total REM sleep time only.

Even if the sleep of children with ADHD is not different from that of normal controls, it does not rule out the possibility that both groups are sleep deprived to some extent but that children with ADHD are more vulnerable to sleep deprivation.

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