

FIRST OF 2 PARTS

Pediatric insomnia: Assessment and diagnosis

A thorough evaluation can identify modifiable factors and guide treatment

Sleep problems are common among children and adolescents,¹ with prevalence rates of 25% to 40%.²⁻⁴ Young children most commonly exhibit what is referred to as bedtime problems and night awakenings, whereas children in middle childhood (age 4 to 12) through adolescence (age 13 to 17) report insomnia. For many children, these problems persist.³ Insufficient sleep in children and adolescents worsens inattention, daytime fatigue, and cognitive and behavioral deficits.⁵ Assessment and treatment of sleep problems in children and adolescents is critical because poor sleep among youth increases the risk for depression, self-harm, and suicide,^{6,7} increases family stress, and decreases parental well-being.¹

This 2-part article describes the assessment, diagnosis, and treatment of sleep problems among children and adolescents. In part 1, we focus on:

- sleep architecture (circadian rhythms, stages of sleep)
- sleep in healthy youth (age 6 to 17) and those with attention-deficit/hyperactivity disorder (ADHD), depressive disorders, and anxiety
- how to assess sleep, and the differential diagnosis of behavioral sleep problems in pediatric patients.

In Part 2, we will cover psychotherapeutic and psychopharmacologic interventions for youth with insomnia,

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Many adolescents experience delayed sleep phase syndrome or delayed sleep-wake phase disorder



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and describe an effective approach to consultation with pediatric sleep medicine specialists.

How much sleep do children and adolescents need?

Throughout their development, children spend 40% to 50% of their time asleep. Sleep schedules are based on circadian rhythms, which are physical, mental, and behavioral changes that follow an approximately 24-hour cycle. Human circadian rhythm varies between 24 and 25 hours and is vital in determining our sleep patterns. Exposure to sunlight drives our circadian rhythm, sending signals to our bodies to “turn on” melatonin production at night (ie, 9 PM melatonin secretion starts) and “turn off” melatonin secretion in the morning (ie, 7:30 AM) in adults. Exposure to sunlight also drives circadian rhythms for children, and melatonin secretion production occurs earlier in the evening for children. Families are encouraged to expose children to bright light in the morning by taking an early walk, eating breakfast in a sunny room, or having adolescents open up the window shades rather than keeping their eyes shielded from the sun.² How sleepy or alert a child could be is determined by the duration and quality of a child’s previous sleep, and how long they have been awake (“sleep drive”).² The 3 states of sleep architecture are wake; non-rapid eye movement sleep; and rapid eye movement sleep (“dreaming” sleep) (*Box, page 11*).

Sleep needs also change predictably throughout the lifespan. The National Sleep Foundation guidelines for sleep duration provide clinicians and parents with a range of recommended sleep for each stage of development. Infants require 14 to 17 hours of sleep, whereas adolescents need 8 to 10 hours by age 14 to 17.⁸ The key for clinicians is to determine if the child is within the recommended range, and how they are functioning on the number of hours of sleep they report. This allows for variation in how much sleep an individual child might need while acknowledging that some children within a specific age group might need

more or less sleep than other children of the same age.

Sleep in healthy youth: Middle childhood

School-age children (age 6 to 12) typically need 9 to 10 hours of sleep over a 24-hour period.² This developmental period is especially important for children to develop healthy sleep habits; however, developmentally appropriate cognitive and social/emotional factors might interfere with the quality and quantity of sleep. Middle childhood is a time when children can understand the dangers of the outside world (ie, violence, health problems) and resulting anxiety can disrupt sleep. Parents usually are less involved in bedtime as children approach adolescence, which leads to later bedtimes. At this stage, many children begin to take on more serious roles in their academics and extracurricular activities, peer relationships become more important, and use of electronics (eg, television, video games, internet, and handheld devices) increases—all of which compete with sleep.⁹ Frequent sleep issues during middle childhood include:

- irregular sleep-wake schedules
- later bedtimes
- decreased nighttime sleep
- increased caffeine intake
- reduced parental presence at bedtime
- daytime sleepiness.³

In school-age children, regular napping, falling asleep during short car rides, and daytime fatigue at school or home are cause for concern. When these symptoms are present, an evaluation is warranted.

Sleep in healthy youth: Adolescence

The National Sleep Foundation recommends adolescents obtain 8 to 10 hours of sleep per night; for some adolescents, as much as 11 hours of sleep per night might be appropriate.⁸ However, this contrasts with findings from the National Sleep Foundation’s Sleep in America Poll, which revealed that 75% of 12th graders report <8 hours of sleep nightly.¹⁰ Many adolescents experience delayed sleep phase syndrome or

Sleep architecture: An overview

Sleep architecture consists of 3 states: wake; non-rapid eye movement (NREM) sleep; and rapid eye movement (REM) sleep (“dreaming” sleep).² These stages have distinct polysomnographic features of electroencephalographic EEG patterns, eye movements, and muscle tone.² NREM sleep can be further divided into 3 stages: stage 1 (N1), stage 2 (N2), and stage 3 (N3). Stage 1 is the lightest stage and lasts for 30 seconds to 5 minutes; it is easy to wake up from stage 1 sleep. During stage 2 sleep, the body moves into a deeper sleep stage that is considered “true” sleep. This sleep stage is characterized by bursts of rhythmic rapid EEG activity known as spindles, as well as high-amplitude slow-wave spikes called K complexes.² Stage 2 sleep lasts for 10 to 45 minutes. Stage 3, better known as “deep sleep,” slow-wave sleep, or delta sleep, is the most restorative sleep.² Respiration is low and parasympathetic activity is high.² It is difficult to be awakened during deep sleep, and if aroused, the person likely will feel confused or groggy. Deep sleep is followed by a return to lighter stage of sleep

before the first REM sleep period begins.

REM sleep is the active stage of sleep. Breathing and heart rate become irregular, and the body experiences muscle atonia, or temporary paralysis, of arms and legs. When in REM sleep, individuals have the highest brain metabolic rates, and periodic bursts of eye movements.² Most individuals move through stages of NREM and REM sleep in predictable ways, meaning they experience NREM sleep, return to a lighter stage of sleep after deep sleep, then move into REM sleep before the cycle repeats. It takes approximately 90 minutes for most adults to complete the NREM sleep cycle, and then REM sleep occurs before returning to NREM sleep.

In children, especially in infants and babies, sleep cycles are closer to 50 to 60 minutes. Newborns spend approximately 50% of their sleep in REM sleep, whereas adults spend 20% to 25% of their sleep in REM sleep. Children will spend more time in REM sleep until the third and fourth years of life, at which point REM gradually decreases to 20% to 25% by adulthood.

delayed sleep-wake phase disorder, which involves a persistent phase shift of >2 hours in the sleep-wake schedule that conflicts with the adolescent’s school, work, or lifestyle demands.¹¹ Such circadian rhythm disorders typically result from a poor match between the sleep-wake schedule and the demands of the adolescent’s life, or a failure to synchronize their internal clock with a 24-hour circadian clock.¹² Children typically become tired after sunset, but puberty is associated with reduced slow-wave sleep and changes in circadian rhythms. As a result, a 3-hour delay (delayed phase preference) is common among adolescents. At approximately age 20, people start to become tired after sunset and awaken earlier in the morning—a pattern driven by sunlight and the timing of melatonin release that will remain stable until the sixth decade of life.

Effects of chronic sleep deprivation

Most older studies of sleep loss examined the impact of total sleep loss (sleep deprivation) rather than the effect of partial sleep loss or sleep restriction, a more

commonly experienced phenomenon. More recent research shows that a cumulative sleep deficit could cause the body to override voluntary wakefulness and a sleep-deprived individual can experience brief “microsleeps” where they are unaware and lose attention/wakefulness for several seconds.² This can be deadly if a sleep-deprived adolescent experiences microsleeps while driving.¹³

There is a well-studied correlation between chronic sleep deprivation and increased body mass index in children.¹⁴ This might be caused by reduction in physical activity as well as alterations in the “hunger hormones”—ghrelin and leptin—that have been observed with sleep deprivation.¹⁵⁻¹⁷ Other studies have noted decreased glucose tolerance, reduced insulin sensitivity, and catecholamine and cortisol secretion abnormalities, which place children at higher risk for metabolic syndrome and hypertension.^{13,18} Sleep deprivation also is associated with mood and anxiety disorders and is an independent risk factor for substance use and suicidal ideation among adolescents.¹⁹ Sleep deprivation increases impairments in impulse control, concentration, and

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Sleep deprivation is an independent risk factor for substance use and suicidal ideation among adolescents



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Assess the consistency of the bedtime, the nature of bedtime routines, where the routine occurs, and if electronic devices play a role

Table

Elements of the sleep history: What to assess

Bedroom environment
Sleep and wake cycle
Daytime somnolence
Parental role at bedtime or in the middle of the night
Meals, exercise, and exposure to light during the day
Quality of sleep
Sleep apnea, restless leg syndrome, night terrors/parasomnias, narcolepsy, hypnagogic imagery, or sleep paralysis
Nightmares
History of earlier sleep problems

attention, which could be especially problematic in school-age children.

How sleep is assessed

The sleep history is the first step in evaluating a child or adolescent for a sleep disorder. The sleep history includes exploring the chief complaint, sleep patterns and schedules, bedtime routines, and nocturnal and daytime behaviors (*Table*).

Chief complaint

Behavioral sleep specialists will assess the primary problem with everyone involved in the child's bedtime.²⁰ This might include parents (custodial and noncustodial), grandparents, or stepparents as well as the child/adolescent. This important step can reveal a sleep disorder or an inappropriately early bedtime relative to the child's development. During this assessment, ask detailed questions about how long the sleep problem has persisted, the frequency of sleep problems, and any precipitating stressors. Parents and caregivers can review strategies they have tried, and for how long and to what extent interventions were implemented consistently to result in change.

Sleep patterns and schedules

Review the child/adolescent's typical sleep patterns and behaviors. Ask parents and

caregivers, as well as the patient, about general sleep schedules for the past few weeks or a typical 2-week time period.² A behavioral assessment of sleep should include asking families about how the child/adolescent sleeps during the week and over the weekend, and if school-year sleep differs from summer or holiday sleep schedules. These questions can illuminate how long a sleep problem has been occurring and what sleep habits might be contributing to the problem.

Bedtime

Determine if there is a set bedtime or if the child goes to bed when they wish. It is important to ascertain if the bedtime is age-appropriate, if weekday and weekend bedtimes differ, and to what extent extracurricular activities or school demands impact bedtime. Assess the consistency of the bedtime, the nature of bedtime routines (eg, is the child engaging in stimulating activities before bed), where the bedtime routine occurs (eg, sibling's room, parents' room, child's room), and what role (if any) electronic devices play.²

Nocturnal behaviors

Assessment should include a series of questions and age-specific questionnaires to focus on what behaviors occur at night, including awakenings. Parents should be asked how frequent night awakenings occur, how long arousals last, and how the child signals for the parent (eg, calling out, climbing into parents' bed).² Additionally, ask how parents respond and what is required to help the child fall back asleep (eg, rocking, soothing, feeding). The presence of nightmares, night terrors, parasomnias, and sleep-related breathing disorders also must be assessed.²⁰

Daytime behaviors

A sleep history should include assessment of daytime functioning, including daytime sleepiness, fatigue, morning waking, and functioning during school, extracurriculars, and homework. For children and teens, falling asleep in the car, while in school, or during passive activities (meals, conversation) suggests insufficient sleep, sleep disruption, or excessive daytime sleepiness.²

Sleep disruption in youth with psychiatric disorders

Disordered sleep is common across psychiatric disorders. The National Comorbidity Survey Adolescent Supplement—a nationally representative cross-sectional survey of adolescents (N = 10,123)—found that a later weeknight bedtime, shorter weeknight sleep duration, and greater weekend bedtime delay increased the risk of developing a mood, anxiety, or substance use (including nicotine) disorder, and suicidality. These risk factors also were associated with lower “perceived mental and physical health.”²¹ Clinicians should routinely obtain a sleep history in children and adolescents with these disorders. Consider using the sleep screening tool BEARS:

- Bedtime issues
- Excessive daytime sleepiness
- Awakenings
- Regularity and duration of sleep
- Snoring.

ADHD

Up to one-half of children and adolescents with ADHD experience sleep problems,^{22,23} including delayed sleep onset, bedtime resistance, daytime fatigue, and feeling groggy in the morning beyond what is typical (>20 minutes). Pharmacotherapy for ADHD contributes to sleep disturbances^{24,25} while sleep deprivation exacerbates inattention and hyperactivity. In youth with ADHD, restless leg syndrome, periodic limb movement disorder, and sleep-disordered breathing disorder are more common than in the general population.

Depressive disorders

Up to three-quarters of depressed children and 90% of depressed adolescents report sleep disturbances, including initial, middle, and terminal insomnia as well as hypersomnia.²⁶ Disrupted sleep in pediatric patients with major depressive disorder could be moderated by the patient’s age, with depressive symptoms more common among adolescents (age 12 to 17) than among younger children (age 6 to 11).²⁷ Successful treatment of depression fails to relieve dyssomnia in 10% of children. Sleep problems that persist after

successfully treating a depressive episode could increase the risk of another depressive episode.²⁸

Anxiety disorders

Sleep problems are common among children and adolescents with anxiety disorders.²⁹ Longitudinal data from >900 children found that symptoms of sleep disturbance in early childhood were correlated with experiencing an anxiety disorder 20 years later.³⁰ Fears related to the dark or monsters under the bed that are developmentally appropriate for younger children may interfere with sleep. However, in anxious children, fears might also be related to separation, sleeping alone, worry about the loss of a loved one, concerns about personal safety, fear of frightening dreams, or concerns about academics and social relationships. Anxious individuals ruminate about their worries, and this might be especially true for children at bedtime, when there are limited distractions from ruminative fears.³¹ Bedtime resistance, parental involvement in bedtime rituals, and cultural factors related to sleep also could play a role for children with anxiety symptoms and sleep problems.

Having an anxiety disorder is significantly associated with an increased risk of insomnia; however, 73% of the time anxiety symptoms precede an insomnia diagnosis.²⁹ Sleep problems and anxiety symptoms might have a reciprocal influence on one another; tiredness that results from sleep problems could exacerbate anxiety, which further worsens sleep problems.

A large body of research on sleep and anxiety reveals that abuse or exposure to trauma significantly affects sleep.³¹ Common sleep problems for children with posttraumatic stress disorder include difficulty falling asleep, maintaining sleep, and parasomnias of bedwetting and nightmares.^{31,32} Compared with depressed and non-abused children, those with history of abuse have prolonged sleep latency, decreased sleep efficiency, and higher levels of activity during the night.³³ In addition to the relationship between anxiety disorders and sleep disorders, many of the selective serotonin reuptake inhibitors—which are the first-line pharmacotherapy for pediatric

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It is important to ascertain if the bedtime is age-appropriate, and if weekday and weekend bedtimes differ



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Pharmacotherapy for ADHD contributes to sleep disturbances, and sleep deprivation exacerbates inattention and hyperactivity

Related Resources

- Baroni A, Lunsford-Avery JR, eds. Sleep disorders in children and adolescents. *Child Adolesc Psychiatr Clin N Am*. 2021;30(1 theme issue):1-282.
- Ophoff D, Slaats MA, Boudewyns A, et al. Sleep disorders during childhood: a practical review. *Eur J Pediatr*. 2018;177(5):641-648. doi:10.1007/s00431-018-3116-z

anxiety disorders^{34,35}—could affect sleep in anxious youth.³⁶

A bridge to treatment

A thorough assessment can help identify modifiable factors and guide treatment selections. In Part 2 of this article, we will describe healthy sleep practices, cognitive-behavioral therapy for insomnia, when pharmacotherapy might be indicated, and the evidence supporting several medications commonly used to treat pediatric insomnia. We also will discuss factors to consider when seeking consultation with a pediatric behavioral sleep specialist.

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Bottom Line

Poor sleep among youth increases the risk for depression, self-harm, and suicide; increases family stress; and decreases parental well-being. A thorough, developmentally appropriate sleep assessment in youth should include exploring the chief complaint; sleep patterns and schedules; bedtime routines; and nocturnal and daytime behaviors.

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