Pediatric Insomnia

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KEYWORDS

• Insomnia • Pediatric insomnia • Children • Adolescents
• Cognitive behavior therapy for insomnia • Sleep • Sleep hygiene

KEY POINTS

- Insomnia is prevalent among children and adolescents worldwide, but there is a discrepancy between high prevalence rates and low numbers of diagnoses by clinicians.
- Pediatric insomnia has a 24-hour impact. Although it is a nighttime sleep disorder, daytime functioning (eg, alertness, decision-making, academic functioning, and interpersonal relations) suffers as a result.
- Many factors contribute to pediatric insomnia, including hyperarousal and stress, screen use, and the presence of comorbid psychiatric disorders.
- Cognitive Behavioral Therapy for Insomnia (CBT-I) is the first-line recommendation for the treatment of pediatric insomnia. Melatonin has the best data for efficacy among medications.

INTRODUCTION

Insomnia is a global epidemic. Insufficient and disordered sleep results in readily observable physical and psychological impairments and subsequent problems in academic, occupational, and interpersonal functioning.[1] Although most studies to date have focused on adult populations, youth are equally affected and, akin to their adult counterparts, often go undiagnosed.[2] Given the importance of sleep for development, the effects of insomnia on children can be particularly detrimental, impacting their ability to learn, manage mood and anxiety, develop relationships, avoid accidents, and stay physically healthy.[3] To ensure the well-being of all children and teens, accurate and thorough screening, diagnosis, and treatment of insomnia is critical. This article describes how insomnia presents, contributing factors, the impact of twenty-first century technology, and most importantly, how pediatric insomnia should be assessed and treated by clinicians.

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Prevalence of Pediatric Insomnia

From infancy through adolescence, sleep is vital for development. Children's brains are malleable, and sleep is necessary to promote the plastic processes that accompany neurodevelopment.[4] Bedtime, however, can be tricky for children and parents. With fear of nightmares and bedtime resistance, ensuring children receive adequate sleep is often stressful for parents. Nearly all children periodically struggle with sleep; yet when we look beyond routine sleep troubles, such as occasional difficulties falling asleep, diagnosable sleep pathologies are pervasive among youth. Depending on factors such as age, gender, and cultural habits, the percentage of sleep complaints in children can reach as high as 80% in various regions of the world.[5] Parental indicators and definitions of sleep problems vary across cultures, but prevalence rates of sleep disturbances among youth populations remain consistently high. Our best data suggests that at least 25% of children suffer a clinically significant sleep pathology at some point in childhood.[6]

Pediatric sleep problems range from night awakenings to sleep-related breathing disorders, hyper and parasomnias, circadian rhythm disorders, and sleep-related movement disorders, with insomnia being the most common. One in 5 young children and preadolescents, in fact, report symptoms of insomnia,[7] and among adolescents, symptoms of insomnia are nearly ubiquitous. A representative US sample of 13-year-olds to 16-year-olds found a 30-day prevalence of insomnia disorder of 9.4% and a lifetime prevalence of 10.7%. In addition, 88% of the adolescents with a lifetime history of insomnia reported current sleep difficulties, further indicating the chronicity of insomnia among youth.[8]

These and other epidemiologic studies demonstrate that prevalence rates of pediatric insomnia and other sleep disorders are high, yet they remain largely underdiagnosed by care providers and parents alike. One of the first studies to review electronic medical records for ICD-9 diagnoses given by primary care providers found that only 3.7% of a sample of more than 150,000 children were diagnosed with a sleep disorder, far below what would be expected.[2] Given the discrepancy between low diagnosis rates and high prevalence rates, it is resoundingly clear that insomnia and other pediatric sleep disorders remain largely neglected.

Presentation of Pediatric Insomnia

Insomnia is often described as an overall difficulty with sleep, or an inability to turn off the brain at night.[9] The *Diagnostic and Statistical Manual of Mental Disorders* (5th Edition) (DSM) defines insomnia disorder by the following criteria: (1) dissatisfaction with quantity and quality of sleep accompanied with complaints of one or more of the following: difficulty initiating and/or maintaining sleep (in children, this may manifest as difficulty initiating/maintaining sleep *without caregiver intervention*), and early morning awakenings; (2) significant distress or interference with personal functioning in daily living caused by sleep difficulty; (3) sleep difficulty occurring at least 3 nights a week; (4) sleep difficulty present for at least 3 months; (5) sleep difficulties occurring despite adequate circumstances and opportunity for sleep; (6) coexisting mental and/or sleep disorders do not explain the predominant insomnia complaint; and (7) symptoms cannot be attributed to physiologic effects of a drug or other substance.[10] Although symptoms may begin at bedtime, daytime symptoms often include mood disturbances, fatigue, excessive daytime sleepiness, and decreased daytime alertness.[10] These daytime symptoms prove the extent of this disorder's 24-hour reach; although insomnia may be a sleep disorder, it causes problems around the clock.

The presentation of pediatric insomnia will vary depending on the age of the child. Behaviorally, insomnia among toddlers and preschoolers most often presents with bedtime stalling and resistance; sleep-onset associations such as sucking thumbs, nursing, rocking, or driving in the car to induce sleep; night awakenings; and/or refusal. Night awakenings and sleep-onset associations are believed to occur in 25% to 50% of children between 6 and 12 months, 30% of 1-year-olds, and 15% to 20% of children between 1 and 3 years of age. Bedtime resistance and stalling is found in 10% to 30% of children.[11]

As children grow into adolescents, both their autonomy and expectations increase. Unlike children, teens are expected to juggle hours of nightly homework, earlier school start times, an increase in responsibilities, time-consuming extracurricular activities, and an active social life. These demands, compounded by adolescents' natural tendency toward a delayed circadian rhythm, typically result in later bedtimes and excessive daytime sleepiness, which have been well studied. Compared with children and even adults, adolescents exhibit higher levels of sleep deprivation.[12] Among a sample of more than 10,000 adolescents, roughly two-thirds reported a sleep-onset latency exceeding 30-minutes and a sleep deficiency of 2 hours on weekdays.[13] Adolescents, overall, are struggling to receive adequate amounts of sleep, and as a result, their daytime attentiveness is suffering.[14] Lower grade point averages and standardized test scores, more automobile accidents, increased risky behavior, and higher rates of anxiety and depression are but a few of the many well-established consequences of inadequate sleep during adolescence.[15–18]

These observations further demonstrate the pressing need for health care providers and parents to treat pediatric insomnia appropriately. Although not every sleep-deprived adolescent meets criteria for a diagnosis of insomnia, poor sleep habits can, over time, increase the likelihood of a diagnosis if left untreated. Among the aforementioned sample of more than 10,000 adolescents exhibiting sleep deficiency, there was a high rate of insomnia, ranging from 13.6% to 23.6% depending on diagnostic criteria. Insomnia disorder among adolescents is often characterized by nonrestorative sleep, difficulty maintaining sleep, anxiety around the inability to fall asleep, excessive napping, and the aforementioned sleep phase delay.[19,20] As symptoms of the disorder are ubiquitous among adolescents, it is the responsibility of the clinician to pay close attention to reports of prolonged symptoms, be familiar with DSM criteria, monitor their patients long-term, and address early symptoms. To assist clinicians, many comprehensive screening assessments have been designed to help recognize insomnia and other sleep disorders among children and adolescents, two of which are discussed further in this article.

Predisposing, Precipitating, and Perpetuating Factors

To treat pediatric insomnia comprehensively, it is imperative to understand the multifactorial nature of the disorder's etiology. Insomnia represents a "constellation of symptoms" that arise from a wide range of medical, behavioral, and biological causes.[21] Hyperarousal, comorbid sleep and/or mental health disorders, stress, trauma, screen-time and other environmental factors have been shown to predispose, precipitate, and perpetuate symptoms of insomnia.[3] Here, we address a few of these factors in depth (**Box 1**).

→ *Hyperarousal and stress-responses*

Hyperactive neurobiological and psychological systems contribute to difficulty with sleeping, driven, at least in part, by the hypothalamic-pituitary-adrenal axis. As our research tools have improved in recent years, so too has our understanding of

Box 1
Predisposing, precipitating, and perpetuating factors

Contributing Factors
- Predisposing factors
  - Personality/genetic
  - Sleep-wake cycle
  - Circadian rhythm
  - Coping mechanisms
  - Age
- Precipitating factors
  - Situational
  - Environmental
  - Medical
  - Psychiatric
  - Medications
- Perpetuating factors
  - Conditioning
  - Substance abuse
  - Performance anxiety
  - Poor sleep hygiene

Data from Brown KM, MD, Malow BA, MD. Pediatric insomnia. Chest. 2016;149(5):133–9; and Spielman AJ, Caruso LS, Glovinsky PB. A behavioral perspective on insomnia treatment. Psychiatr Clin North Am. 1987;10(4):541–53.

hyperarousal.[22] We now know that patients with insomnia commonly experience atypical hormone secretion, increased metabolic activity, an increase in sympathetic nervous system engagement, elevated heart rate, and unexpected electroencephalogram (EEG) activation patterns during sleep.[23,24] One study discovered that pediatric insomnia is associated with increased beta activity (as observed on EEG) during sleep, suggesting that cortical hyperarousal occurs in individuals with insomnia as early as adolescence.[25]

Stressors vary greatly in terms of source, potency, and duration.[22] Generally, those who suffer from insomnia demonstrate exaggerated and dysfunctional neurobiological and cognitive-emotional reactivity to stressors, which contributes to hyperarousal. One study found that 37% of the variance in vulnerability to stress-induced insomnia in siblings was accounted for by familial aggregation.[26] Although it may be assumed that a larger number of stressful events would correspondingly increase the vulnerability to insomnia, studies have contradicted this notion by finding that, rather, vulnerability is heightened based on the "appraisal of stressors and the perceived lack of control over stressful events."[27] This observation mirrors precisely what is known about anxiety: it is not so much the worry itself, it is one's appraisal of the value of the worry that causes problems.[28]

These findings are particularly pertinent for clinicians, as treatment plans for pediatric insomnia must include helping children to accurately appraise stress and enhance their coping skills. Hyperarousal and stress reactivity are key players in the onset and exacerbation of insomnia, and must not be overlooked by parents, educators, and clinicians.

→ *Comorbid mental health disorders*

Prevalence rates of insomnia are highest among youth with comorbid mental health disorders. Among a representative US sample of adolescents, 52.8% of those diagnosed with insomnia had a comorbid psychiatric disorder.[8] Insomnia is highly prevalent among children with autism spectrum disorder, with estimates ranging from 50%

to 80%.[29] In addition, at least 50% of children and adolescents with attention-deficit/hyperactivity disorder are affected by sleep problems, making them 2 to 3 times more likely to suffer than typical youth, and further exacerbating their symptoms of inattention and hyperactivity.[30,31]

Insomnia has traditionally been conceptualized as a symptom of other disorders; however, longitudinal studies now suggest that insomnia is also a risk factor for new onset of psychiatric disorders, including depression, anxiety, and substance use disorders. In a study conducted at a pediatric sleep center, 50% of the youth patients presenting for insomnia had an existing psychiatric diagnosis, and the remaining 50% had elevated psychological impairment scores.[32] As with most psychiatric disorders, we are learning that the onset of insomnia during childhood is more commonly the rule than the exception.[33] With 1 in 4-to-5 youth in the United States meeting criteria for a psychiatric disorder over the course of their lifetime, the "chicken and egg" bidirectional relationship between sleep and mental health is critical for clinicians to understand.[34] A thorough sleep history must be a key component of every psychiatric evaluation.

The relationship between sleep and mental health extends as far as suicide. Plentiful evidence points to a strong relationship between poor sleep and suicidal behavior in individuals with comorbid psychiatric disorders.[35,36] Numerous explanations have been offered to explain the association between suicide and insomnia. Most obviously, individuals with insomnia are at higher risk for experiencing a depressive episode, which is a well-recognized risk factor for suicidal ideation; alternatively, with less sleep, we become more impulsive and have greater difficulty making decisions.[37] Regardless, mounting data support the correlation of suicide and insomnia, which demands that clinicians always screen for insomnia among their youth with mental illness.

→ *Screen-time*

Technological advancements over the past several decades have propelled screen use among youth to an all-time high. *We Are Social's* 2019 Global Statshot reports that 5.11 billion individuals own a cell phone, representing roughly 66% of the world's population, and the United Nations estimates that more people worldwide have access to smartphones than toilets.[38,39] The statistics on technology use among children and adolescents are staggering. A 2019 Census examined a nationally representative sample of more than 1600 youths and discovered that technology ownership is near universal: 53% have their own smartphone by age 11, and 69% by age 12 (**Fig. 1**). The census paints a vivid picture of a typical day for an American child, finding that on average 62% spend more than 4 hours a day on screen media, and 29% use screens for upward of 8 hours a day.[40]

As technology among youth populations becomes ubiquitous, there has been an increase in research exploring the effect of screen use on sleep habits and sleep efficiency.[41,42] Among a large sample of American youth in 2011, 90% reported using a cell phone in the hour before bed, including a preponderance of adolescents (72%). The amount of technology used in the hour before bed was significantly related to both difficulty falling asleep and the frequency of reports of "unrefreshing" sleep, suggesting that cognitive and physiologic stimulation from these devices almost certainly interferes with sleep. In addition, 57% of these individuals left their cell phones and ringers on overnight, with 1 in 10 reporting an inability to maintain sleep a few nights per week.[43]

In addition to psychological and physiologic arousal, the bright light from screens offers yet another explanation for screens' negative effects on sleep. Light moderates

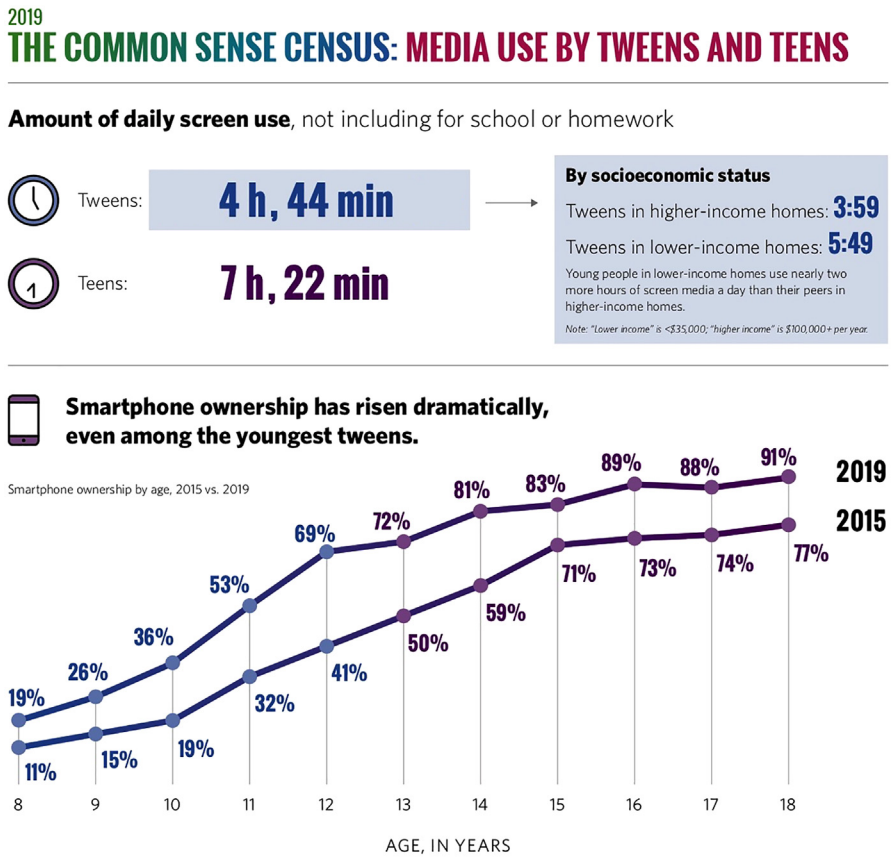

Fig. 1. Statistics on screen use among tweens and teens. (*From* Rideout V, Robb MB. The common sense census: Media use by tweens and teens. 2019. https://sleepeducation.org/resources/sleep-diary/; with permission.)

the circadian rhythms that organize our 24-hour sleep and wake patterns.[44,45] When light is removed and we are in darkness, our bodies secrete melatonin, a naturally occurring hormone that decreases alertness and promotes sleep.[46] In addition to window or lamp light, exposure to luminous devices suppresses melatonin levels, which shifts our circadian clock, elongates sleep onset, and decreases morning alertness levels.[47,48]

The growing literature on the negative relationship between screen use and sleep for adolescents indicates a pressing need for intervention.[49] Poor quality of sleep diminishes every adolescent's potential to excel, and therefore it is every clinician and parent's duty to educate their teens on the detriments of screen use and to monitor electronic device usage.

Screening and Assessment

Despite the importance of sleep in the healthy development of children and adolescents, only approximately one-third of pediatricians routinely ask about sleep habits.[50] Numerous tools are available, however, to aid practitioners in this endeavor.

The user-friendly "BEARS" pediatric sleep screening tool is the easiest place to start. This validated survey addresses 5 domains of common sleep irregularities: bedtime problems, excessive daytime sleepiness, awakenings, regularity and duration of sleep, and snoring. Each domain includes a set of both parent-oriented and child-oriented questions (**Table 1**). Clinicians can use this survey during clinical sessions to obtain sleep-related information and identify potential sleep problems. Using BEARS has been shown to double the likelihood that primary care physicians will identify sleep problems.[46,51] Further assessment and treatment planning is advised if difficulties within 2 or more domains are identified.

To gather more precise information about a patient's sleep, clinicians will find a sleep diary highly effective.[52] Many varieties of sleep logs are available, but each tracks sleep and habits that affect sleep, such as exercise, caffeine-use, and medications (**Fig. 2**).

Many additional sleep screening tools are available with varying validity and psychometric measurements.[53] After completing a routine screening such as the BEARS, clinicians may consider a survey such as the Insomnia Severity Index (ISI), which maps symptoms onto DSM-IV criteria for insomnia and measures 7 items using a 5-point Likert scale. One particular benefit to the ISI is its demonstrated validity in measuring the efficacy of CBT-I treatment (see later in this article).[54] The ISI is freely available for providers to download online.

For an objective assessment of a patient's sleep, actigraphy is an outstanding choice, although most clinicians do not have access to this technology. Actigraphs are wearable devices that, unlike the aforementioned assessments, gather objective data on an individual's sleep timing and duration based on movement tracking. The main limitation of actigraphy is that waking motionless states cannot be differentiated from sleep, but when used in conjunction with a sleep diary, it can prove to be a thorough assessment measure.[55] As personal fitness trackers such as Fitbits improve, they will undoubtedly also assist in gathering accurate data on sleep; however, to date, fitness trackers have generally shown great variability and inaccuracy.[56]

Current Approaches to Treatment

Behavioral treatments are preferred as the first-line treatment for children and adolescents because they are effective, lead to rapid improvements, and have long-lasting results.[57] CBT-I is an evidence-based method particularly effective at treating the psychological and behavioral factors that perpetuate insomnia once it has begun. CBT-I includes components of sleep education, stimulus control, sleep restriction therapy, sleep hygiene, cognitive therapy, and relaxation training, and routinely leads to improvements in sleep latency, wake-after sleep onset, and sleep efficiency. Numerous trials have demonstrated that CBT-I can benefit adolescents and that many of its component parts can be applied to the treatment of prepubertal insomnia as well.[58,59] See **Table 2** for further details on the treatment.

Proper sleep hygiene education, a component of CBT-I, is essential to use to effectively treat insomnia and educate patients about various behavioral practices that interfere with sleep. Limiting exposure to blue light via screens, caffeine, and alcohol and drugs, such as marijuana, along with managing the timing of exercise and creating a comfortable sleep environment with limited light and noise are additional strategies that augment the techniques of CBT-I.[46] Although sleep hygiene alone has not been shown to be adequately effective for the treatment of pediatric insomnia, sleep hygiene is often advised by practitioners as part of a treatment plan.[60]

Pharmacologic interventions are a second line of treatment for pediatric insomnia, and despite the lack of medications approved by the Food and Drug Administration,

Table 1
BEARS sleep screening tool

	Toddler/Preschooler (Questions to Parents)	School-Aged (Questions to Parents)	Adolescent (Questions to Patient)
*B*edtime problems	• Any problems going to bed or falling asleep?	• Any problems at bedtime?	• Any problems falling asleep at bedtime?
*E*xcessive daytime sleepiness	• Napping or seeming overtired or sleepy a lot during the day?	• Difficulty waking in the morning, feels sleepy during the day or naps?	• Very sleepy during the day? At school? While driving?
*A*wakenings	• Waking up a lot at night?	• Waking up a lot at night or having trouble getting back to sleep? • Sleepwalking or nightmares?	• Do you wake up a lot at night or have trouble getting back to sleep?
*R*egularity and duration of sleep	• Regular bedtime and wake up time? What are they?	• At what time does your child go to bed and get up on school days? Weekends? • Is this enough sleep?	• What time do you usually go to bed on school nights? Weekends? • How much sleep do you usually get?
*S*noring	• Snoring a lot or having difficulty breathing at night?	• Snoring loudly or having breathing difficulties at night?	• Snoring loudly? (question to parent)

From Owens JA, Dalzell V. Use of the 'BEARS' sleep screening tool in a pediatric residents' continuity clinic: A pilot study. Sleep Med. 2005;6(1):68–9; with permission.

TWO WEEK SLEEP DIARY

AASM | SLEEP EDUCATION

INSTRUCTIONS:
(1) Write the date, day of the week, and type of day: Work, School, Day Off, or Vacation. **(2)** Put the letter "C" in the box when you have coffee, cola or tea. Put "M" when you take any medicine. Put "A" when you drink alcohol. Put "E" when you exercise. **(3)** Put a "B" in the box to show when you go to bed. Put a "Z" in the box that shows when you think you fell asleep. **(4)** Put a "Z" in all the boxes that show when you are asleep at night or when you take a nap during the day. **(5)** Leave boxes empty to show when you wake up at night and when you are awake during the day.

SAMPLE ENTRY BELOW: On a Monday when I worked, I jogged on my lunch break at 1 PM, had a glass of wine with dinner at 6 PM, fell asleep watching TV from 7 to 8 PM, went to bed at 10:30 PM, fell asleep around Midnight, woke up and couldn't got back to sleep at about 4 AM, went back to sleep from 5 to 7 AM, and had coffee and medicine at 7 AM.

Date	Day of the week	Type of Day (Work, School, Day Off, Vacation)	Noon	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Midnight	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM
sample	Mon.	Work		E					A	Z			B		Z	Z	Z	Z		Z	Z	C M				

week 1

week 2

Fig. 2. Sleep diary example, American Academy of Sleep Medicine. (*From* American Academy of Sleep Medicine. Two week sleep diary. Available at: https://sleepeducation.org/resources/sleep-diary/; with permission.)

Table 2
Components of Cognitive Behavioral Therapy for Insomnia

Therapy Component	Description
Stimulus control	Aims to break conditioned arousal between the bed and wakefulness/worry, and rather strengthen the association between the bed and sleep.
Sleep restriction	Limits the time allowed in bed to the patient's average reported actual sleep time, and subsequently and slowly increases the time allowed in bed as sleep improves.
Cognitive therapy	Targets beliefs and thoughts that directly interfere with sleep by increasing arousal in bed, or indirectly by interfering with adherence to stimulus control and sleep restriction.
Sleep hygiene education	Teaches patients about sleep and encourages them to limit caffeine intake, avoid alcohol prior to bedtime, incorporate daily exercise, and keep the bedroom quiet, dark, and at a comfortable temperature.
Relaxation techniques	Incorporates techniques such as diaphragmatic breathing, progressive muscle relaxation, and visual imagery to reduce psychic and somatic anxiety related to sleep.

From Siebern AT, Manber, RM. New developments in cognitive behavioral therapy as the first-line treatment of insomnia. Psychology Research and Behavior Management 2011:4 21-28 - Originally published by and used with permission from Dove Medical Press Ltd.

it is common practice for many clinicians to prescribe medication for the management of the disorder.[61,62] Alpha-2 agonists, trazodone, and sedating antidepressants are among the most-prescribed medications; however, melatonin, a dietary supplement, has the most data supporting efficacy at this time (eg, 1 to 5 mg administered 30–60 minutes before bedtime).[62–66]

When compared with commonly prescribed medications, placebo, alternative treatments, and/or no treatment, behavioral methods prove favorable; these methods are cost-effective, portable, devoid of potential side effects, and will continue to work long-term, whereas medications work only as long as they are taken.[67,68] Therefore, we strongly advise clinicians to primarily intervene behaviorally with weekly sessions of comprehensive CBT-I. If this proves unsuccessful as a stand-alone treatment, or when treating patients with comorbid conditions, pharmacologic intervention can be used in conjunction with behavioral treatment strategies.

SUMMARY

The impact of insomnia on youth is increasingly evident. In an ever busy, fast-paced twenty-first century society, children and adolescents are under more pressure than ever before to perform at their best, yet sleep is all too often compromised in an effort to meet these expectations. To maximize every child's potential, clinicians must assess and treat sleep disorders among their patients.

CLINICS CARE POINTS

- Clinicians must be properly educated on the presentation of pediatric insomnia across childhood, to adequately screen for the disorder.
- All youth patients and their parents would benefit from instruction on proper sleep hygiene and the long-term consequences of poor sleep. Education on adequate sleep hygiene, notably the ramifications of excessive screen use, is critical.
- Clinicians can gather useful clinical information on the sleep of their pediatric patients by using a sleep diary and an age-appropriate screening tool.
- CBT-I is the recommended first-line treatment for pediatric insomnia, and melatonin is the most effective medication in doses of 1 to 5 mg administered 30 to 60 minutes before bedtime.

DISCLOSURE

The authors have nothing to disclose.

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