Childhood insomnia: why Chris can’t sleep

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In a perfect world, all children go to bed between 8:00 PM and 10:00 PM, quickly go to sleep, and remain asleep in their own beds until they awake between 7:00 AM and 8:00 AM. Parents achieve an uninterrupted night’s sleep. During the day, young children take a 1- or 2-hour nap, and older children and parents remain alert and productive in school and on the job. In the real world, however...

Chris A. is a 2-year-old girl who has never been a good sleeper since birth. She falls asleep with her mother lying next to her. She is a light sleeper and frequently awakens crying and only goes back to sleep with her mother back in bed with her. Her mother is frustrated and severely sleep deprived, so much so that she has had to quit her daytime job.

Chris B. is a 4-year-old boy who, two or three times a week, awakens suddenly approximately an hour after going to sleep. He screams and seems to be terrified. His parents wake him and ask if he has been dreaming, which he denies. He reports that he has no memory of the episodes. Recently he has started sleepwalking, and his parents are anxious because he has gone out the front door during a sleepwalking episode.

Chris C. is a 9-year-old boy who goes to bed at 9:00 PM but does not fall asleep until 1:00 AM. He experiences frequent arousals and snores during sleep. He is afraid to be in a dark room. At school he has difficulty with attention and concentration. He has a short temper and conduct problems. He takes methylphenidate, 40 mg (slow release preparation), each morning.

Chris D. is a 16-year-old teen who goes to bed at 11:00 PM but does not fall asleep until 2:00 AM or later. She is sleepy when her parents wake her at 6:15 AM so she can be on time for her 7:30 AM class. She drives to school and sleeps during most of her first two or three classes. On the weekend she goes to sleep at 4:00 AM and gets up at 3:00 PM on Saturday.

Sleep disturbances occur frequently in children of all ages. These problems may be under identified because parents commonly do not voice their concerns about their children’s sleeping habits to their child’s pediatrician. For many pediatricians, questions concerning a child’s sleep are not part of the routine office visit.
Childhood sleep disturbances may manifest themselves as bedtime resistance, refusal to go to bed at a parentally described time, sleep-onset delay, or inability to fall asleep within a reasonable time (typically defined as 30–60 minutes) and prolonged nighttime awakenings or inability or unwillingness to return to sleep without assistance after waking during the night [1]. These disturbances are typically defined as more than three awakenings at least four nights per week, being awake for more than 20 minutes at a time, or needing to be taken into the parents’ bed to return to sleep [1,2]. Between 10% and 45% of otherwise healthy preschool- and school-aged children have sleep disturbances [1–3]. The prevalence varies according to the specific sleep problem and the age of the child [1]. Up to 40% of infants experience difficulty settling and frequent nighttime awakenings [4–6]. Bedtime resistance, delayed sleep onset, and disruptive nighttime awakenings occur in 25% to 50% of preschool-aged children [3,7,8]. As many as 15% of school-aged children may exhibit bedtime resistance [3]. In a US community-based survey of children aged 5 to 12 years, sleep problems included bedtime resistance (27%), problems waking in the morning (17%), complaints of fatigue (17%), sleep-onset delays (11%), and night awakenings (7%) [9]. Sleep disturbances in children may be persistent [10]. A study reported that 84% of sleep-disturbed children aged 15 to 48 months at initial assessment also demonstrated sleep disturbances 3 years later, but only 3% of the children with no sleep disturbances at initial assessment had sleep disturbances at the 3-year follow-up visit [11].

Sleep disturbances frequently occur in otherwise healthy children. Certain populations of children are at particular risk for sleep disturbances [12–14], including developmentally delayed or mentally retarded children, blind or visually impaired children, children with neurologic disorders (eg, attention deficit hyperactivity disorder [ADHD] [15], Tourette’s syndrome [16], or epilepsy), children with neurodevelopmental disorders (eg, autism or Rett syndrome [13]), children with acute or chronic pain conditions [17], children with chronic medical conditions (eg, asthma or cystic fibrosis [13]), and hospitalized children [18]. Of mentally handicapped children, 81% to 86% aged 0 to 12 years may experience sleep disturbances, such as night waking and sleep-onset delays [19]. Blind children are more likely to achieve nocturnal sleep duration of less than 7 hours and excessive daytime sleepiness than sighted controls [20]. Parents of children with ADHD are more likely to report problems with their children settling and going to sleep, disruptions during sleep, and disturbances of morning activities than parents of controls [21]. As many as 50% of autistic children (average age 5 years) experience severe sleep disturbances [2,14,22]. Hospitalized 3- to 8-year-old children frequently may experience sleep-onset delays that result in up to 25% of normal sleep [18]. Sleep disturbances in children in these high-risk populations are often persistent. Of severely mentally handicapped children, 50% to 65% may experience sleep disturbances that persist for at least 3 years [23].

Childhood sleep disturbances have a wide-ranging impact on children’s health, behavior, mood, school performance, and family life [14]. Of the elementary school-aged children reported to have sleep disturbances, one study observed that 20% of these children failed at least 1 year of school [24]. The negative impact of
sleep disturbances may be attributable to daytime somnolence, which is associated with impairment in selective attention, cognition, and memory [13,25,26]. Many sleep-disturbed children exhibit an ADHD behavior characterized by irritability, distractibility, and physical hyperactivity rather than daytime somnolence [13]. This ADHD profile may be seen in sleep-disturbed mentally handicapped and learning-disabled children and in intellectually normal children [14]. Sleep-disturbed children may become excessively physically active, irritable, impulsive, and distractible [13,25]. The degree to which sleep disturbances are causally related to the alterations and mood and behavior in children requires more extensive studies; it is possible that the causal relationships between sleep disturbances and mood or behavioral disturbances are reciprocal [27]. The impact of sleep disturbances on children’s cognitive function is revealed by decrements in selective attention, vigilance, and memory. A study conducted on sleep restriction in children demonstrated that 10- to 14-year-old children who were restricted on a single night to 5 hours in bed compared with control children, who received 11 hours in bed, showed impairment of verbal creativity assessed in a battery of tests and decrements in abstract thinking assessed with the Wisconsin Card Sorting Test [26].

Sleep disturbances during childhood also have been linked to depression and anxiety. The causal relationship between sleep disturbances and depressive symptoms has not been established [27]. Maternal reports suggest that children with sleep disturbances are significantly more likely than children without them to be anxious and depressed [28]. One study found that 3-year-old children with persistent sleep problems were more likely than children without such problems to exhibit tantrums and behavioral management problems [10]. Although the relationship between sleep disturbances and behavioral disorders remains to be determined, it is possible that sleep disturbances cause behavioral disorders.

Childhood sleep disturbances also affect interactions with parents and social interactions with other family members and peers. Mothers of poor sleepers compared with mothers of good sleepers more frequently demonstrate negative emotions and behaviors (ambivalence and irritability) toward their children. Parental sleep deficits may impact parents’ mood and behavior and influence their interaction with the sleep-disordered child. Mothers of poor sleepers compared with mothers of good sleepers are more likely to exhibit depressed mood (46% versus 19%) and demonstrate ambivalence toward their children (85% versus 35%) [29]. Alleviation of childhood sleep disturbances often improves parental symptoms. Total sleep time and parents’ mood and marital satisfaction improve with successful treatment of their children’s sleep disorders [2,30]. When sleep disturbances affect a child’s short- and long-term health and the well-being of the child’s family, intervention should be considered.

### Defining childhood insomnia

Compared with adult insomnia, pediatric sleep disturbances are poorly studied and described. Like insomnia in adults, sleep disturbance in children may be char-
acterized by disturbances in initiation and maintenance of sleep or by nonrestorative sleep. Insomnia is a descriptive term rather than a diagnostic one, and there are multiple possible etiologies for the same constellation of symptoms. The assessment and treatment of insomnia in children, unlike adults, are complicated by several factors, including the occurrence of developmental changes in sleep habits that may blur the distinction between abnormal and normal sleep. Caregivers, rather than the insomnia sufferer, typically voice the complaint of insomnia. A caregiver’s expectations and dictated bedtime schedules and sleep practices may be in conflict with a child’s “normal” sleep behavior. The child’s sleep disturbance may have significant and adverse night- and daytime consequences for all family members [27].

Primary insomnia, as defined by the criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), occurs only rarely in children [31]. The following DSM-IV–adapted criteria have been suggested and take into account the unique aspects of pediatric insomnia, including normal developmental changes and sleep habits, the fact that caregivers rather than the insomnia sufferer typically voice the complaint of insomnia, and the potential consequences of childhood insomnia on the family [27].

1. The complaint involves significant difficulty (defined by frequency, severity, or chronicity) initiating or maintaining sleep.
2. The sleep disturbance causes significant impairment in daytime function, including school performance, behavior, mood, learning, or development, for the child as reported by the child or a caregiver.
3. The sleep disturbance does not occur exclusively in the context of sleep disorders, such as narcolepsy, restless leg syndrome, sleep-related breathing disorders, circadian rhythm disorders, or parasomnias.
4. The sleep disturbance is not attributable to either the direct physiologic effect of a drug or the abuse or misuse of a prescribed medication.

This definition recognizes that insomnia in children has unique features characterized by the interplay of mental and maturational factors, parental style and interactions, and child temperament. This definition recognizes that insomnia is a symptom that may be caused by a primary sleep disorder or associated with other sleep, medical, or psychiatric disorders. It also recognizes, however, that when childhood insomnia occurs in association with sleep disorders or medication use, intervention may be directed primarily or solely to correction of those problems.

**Developmental features of sleep in children**

Identifying and determining the significance of sleep disturbances in children may be complicated by the occurrence of rapid developmental changes in normal
sleep habits. Normal sleep and disordered sleep are often manifested differently during childhood than adulthood because of developmental changes that occur in children [27].

**Infants (0 to 2 years)**

Normal newborns require 16 to 20 hours of sleep over a 24-hour period and typically sleep in 2- to 4-hour periods separated by 1- to 2-hour intervals of wakefulness [27]. During the first 3 months of life, nocturnal/diurnal rhythm begins to develop; settling (sleeping from 12:00 to 5:00 AM or sleeping through the night) begins at 3 to 6 months and has occurred in 70% of children by 9 months. Infants transition from an ultradian to a circadian sleep-wake cycle, in which most episodes of sleep occur during the night, and episodes of waking occur during the day [32]. At 1 year of age, infants sleep approximately 13 to 16 of every 24 hours, 2 or 3 hours of which occur during the day [32,33]. Normal infants wake periodically at night; a sleep problem may arise when infants are unable to return to sleep without a parent and remain awake for prolonged periods [34]. The most common complaints during this period are typically parental reports of recurrent and prolonged night awakenings and early morning awakenings [35]. Prolonged night awakenings are common and may account for 88% of sleep disturbance-related consultations for infants up to 2 years of age [34]. The prevalence of night awakenings ranges from 10% to 44% [32]. For toddlers (1–2 years), bedtime resistance is a frequent manifestation of power struggles between the infant and parents. Nighttime fears are common, and the use of transitional objects (eg, thumb, blanket) becomes common. Environmental and social influences, such as parent-child interactions, impact significantly on an infant’s developing sleep habits and schedule. Parent-child interactions that influence a child’s sleeping behavior may include overly lenient or strict parental attitudes at bedtime and during night awakenings, parental moods and mental health, and practices such as prolonged breast-feeding or co-sleeping. Other important influences include a child’s temperament, environmental factors (eg, erratic nap times and bedtimes), and acute or recurrent childhood illnesses (eg, otitis media) [27].

**Preschool-aged children (3 to 5 years)**

The daily sleep requirement for 2- to 5-year-old children gradually decreases from approximately 13 hours at 2 years of age to 11 hours at 5 years of age [32]. Daytime naps shorten and become less frequent through the age of 5 years, when most children give up napping [33]. Night awakenings gradually become less frequent from 2 to 5 years of age. Of 3-year-old children, 30% awaken at night, in contrast to 10% of 5-year-old children [34]. The incidence of complaints of night and early morning awakenings declines in this age group. Most insomnia-related complaints for 2- to 5-year-old children relate to sleep delays. Bedtime struggles (resistance to going to bed or to sleep) may occur in 8% of preschool-aged children.
[11]. Environmental and social modulators of sleep habits remain important in this age group.

**School-aged children (6 to 12 years)**

The duration of nocturnal sleep continues to decrease somewhat between the ages of 5 and 12 years [32]. Children in this age group typically do not nap during the day. Bedtime struggles are less frequent. Sleep complaints, such as nighttime fears and anxious dreams, are common among school-aged children [34,36]. Problematic sleep behaviors as assessed by parents may be reported in 37% of children in this age group [1]. Sleep disturbances in this age group include daytime sleepiness (11.8%), bedtime resistance (15.1%), anxiety around sleep (10.7%), shortened sleep duration (9.9%), sleep-onset delay (8.1%), night awakenings (6.7%), and sleep-disordered breathing (3.7%) [3,27]. Parents may underrecognize sleep problems in this age because older children may not always report difficulties falling and remaining asleep [1].

**Adolescents (13 to 18 years)**

Sleep requirements that range from 8.5 to 9.25 hours are observed in this age group [27]. Factors that impact sleeping and contribute to variable sleep-wake schedules include differing parental bedtime rules for school nights versus non-school nights, less parental supervision, environmental factors (eg, use of television and Internet and consumption of alcohol, nicotine, and caffeine), and more competition from jobs, peers, and school for sleep time. Sleep changes in adolescents include a relative phase delay that occurs around puberty. The phase delay leads to later sleep onset and rise times. Daytime alertness decreases in mid-adolescence. Adolescents frequently report waking tired and exhibit daytime sleepiness. Sleep loss in adolescents may negatively affect academic performance and may prompt increased use of stimulants, such as caffeine and nicotine. Sleep disturbances may occur in as many as 11% to 30% of adolescents [1,27].

**Diagnostic classification of childhood sleep disturbances**

Most of the current diagnostic schemes for sleep disorders do not facilitate the identification and treatment of childhood sleep disturbances. These diagnostic classifications currently are tailored to adult sleep disorders; pediatric insomnia is not recognized as a distinct classification in any of these schemes. The International Classification of Sleep Disorders: Diagnostic and Coding Manual includes a listing of insomnias specific to childhood and insomnias experienced by children and adults [37]. Currently the manual categorizes sleep disorders as dyssomnias (further classified as intrinsic versus extrinsic insomnias [1,37]), which result in difficulty in initiating or maintaining sleep; circadian rhythm disturbances [38]; and parasomnias [1,27,39], which result in disruption in sleep after it has been initiated.
Extrinsic dyssomnias develop as a result of influences outside the body (eg, parental discipline, style, medication used); intrinsic dyssomnias are biologic based and include primary sleep disorders, such as obstructive sleep apnea and restless leg syndrome. These biologically based disorders sometimes may be difficult to distinguish from behavioral sleep disorders because the clinical manifestations (eg, bedtime resistance, prolonged nighttime awakenings) of the two classes of sleep disorders may overlap [1].

**Intrinsic dyssomnias**

Narcolepsy is characterized by daytime excessive sleepiness that often culminates in frequent sleep episodes and is accompanied by cataplexy (sudden bilateral loss of muscle tone). This disorder, with a typical onset during the teenage years, rarely has been diagnosed in preadolescents.

Obstructive sleep apnea is characterized by episodes of cessation of breathing because of upper airway obstruction or inadequate respiratory muscle activity during sleep. Enlarged tonsils or adenoids often cause obstructive sleep apnea in children. Apneic episodes may be associated with sleep disruption and gas exchange abnormalities and can result in daytime attention and learning problems.

Restless legs syndrome is characterized by uncomfortable sensations in the legs accompanied by the urge to move them. Inactivity exacerbates the sensations of this syndrome. Restless legs syndrome may be accompanied by periodic limb movements in sleep: repetitious jerks that last approximately 2 seconds and occur approximately every 5 to 90 seconds during early stages of sleep. An association between this disorder and daytime problems, such as ADHD, has been reported [15].

Psychophysiologic insomnia, in which attention is focused on the inability to sleep, is reported to occur rarely in children. Psychophysiologic insomnia may be precipitated by stress or similar stimuli that prevent sleep, with the result that a child tries increasingly harder to sleep on successive nights. This focus on inability to sleep arouses the child and exacerbates the insomnia.

**Extrinsic dyssomnias**

Adjustment sleep disorder is insomnia that accompanies an acute stressor (eg, first day of school) or a change in the environment (eg, a move to a new home). Children may exhibit bedtime resistance and experience prolonged night awakenings [1]. Attributed to emotional arousal, adjustment sleep disorder typically subsides when the precipitating event is removed or resolved [27]. Adjustment sleep disorder is often associated with anxiety and nighttime fears [1].

Limit-setting sleep disorder is characterized by the failure to initiate sleep by virtue of refusing to go to bed. Parents are unable or unwilling to set and enforce a consistent bedtime [1]. It is estimated that one in ten children manifest limit-setting sleep disorder, which is amenable to behavioral treatment involving caregiver-enforced routines and limits [2].
Sleep-onset association disorder is characterized by prolonged night wakings that occur when a child requires external conditions, such as parental presence, to fall asleep at bedtime and after night wakings. Prolonged night wakings result when these objects or circumstances are absent on normal periods of nighttime awakenings [1]. Two in ten children aged 6 months to 3 years manifest sleep-onset association disorder, which naturally subsides thereafter in most children [2].

Nocturnal eating or drinking syndrome is insomnia caused by the inability to initiate or return to sleep without eating or drinking. Like sleep-onset association disorder, nocturnal eating or drinking syndrome generally subsides naturally after the age of 3 years [1,2].

Inadequate sleep hygiene is composed of habits that interfere with the initiation or maintenance of sleep. Excessive caffeine intake or napping during the day may interfere with attempts at nighttime sleep [1].

Circadian rhythm disturbancesAdvanced sleep phase syndrome is uncommon and occurs mainly in infants and toddlers. The routine over the whole of the 24-hour period may be shifted, including bedtime and sleep onset, naps, and meals.

Delayed sleep phase syndrome is a cause of bedtime resistance or sleep-onset delay, involves a shift in the circadian sleep-wake cycles such that sleep onset time and morning rise time are significantly delayed, and is in conflict with the individual’s daytime responsibilities. Teens may experience this problem as a result of physiologic changes in circadian rhythms that result in delayed sleep onset at the time of puberty combined with interactions with social and environmental factors.

Regular but inappropriate schedules frequently result when parents’ expectations concerning bedtime and sleep requirement conflict with a child’s actual requirements. These problems include early bedtime and early waking, bedtime struggles before the child can go to sleep, and extended middle-of-the-night waking.

Irregular sleep schedules can occur in the absence of environmental cues, such as light in the case of blind children, or if parents or caregivers fail to set and maintain consistent routines.

Parasomnias

Confusional arousals are episodes of confusion and disorientation when waking during the night out of non-REM sleep. Often accompanied by slowed speech and sluggish motor responses, confusional arousals occur in most children younger than 5 years and typically resolve without treatment as the child grows older. (See the article on parasomnias in childhood elsewhere in this issue.)

Somnambulism is the performance of complex motor acts during non-REM sleep, such as sitting up or walking, which are normally performed while awake. Approximately 15% of children experience at least one episode of somnambulism; up to 6% are chronic sufferers [2,35]. Often, somnambulism resolves without treatment during adolescence.
Night terrors are fearful episodes that coincide with arousal from slow-wave sleep and often are accompanied by screaming, crying, and agitation. Sleep terrors occur in up to 6% of children and are more common in boys than girls [2, 39]. Like somnambulism, night terrors usually resolve without treatment during adolescence.

Nightmares are terrifying dreams that often involve a child being attacked, falling, or dying. Night terrors occur during arousal from slow-wave sleep (non-REM), whereas nightmares are observed during REM sleep. Up to 50% of children aged 3 to 6 years experience nightmares [37]. Like somnambulism and night terrors, nightmares decrease in frequency as the child grows older, although some children continue to experience them into adulthood.

Sleep bruxism is grinding of the teeth during sleep. Sleep bruxism occurs in at least 50% of infants. Little research has been conducted on the causes, consequences, or treatment of pediatric sleep bruxism [27].

Sleep enuresis is persistent bedwetting after the age of 5. Sleep enuresis, estimated to occur in 1 out of 10 children aged 6 years and 1 out of 20 children aged 10 years, is more common in boys than girls [2].

**Evaluation of children with sleep disorders**

Questions concerning how a child is sleeping and the impact of a child’s sleep disturbances on the family should be integral parts of the initial evaluation and follow-up visits for well-child and acute care. The assessment begins with a parental description of their child’s perceived sleep disturbance, including time of occurrence, character of the disturbance, duration, and parent-child interactions. The latter includes the parents’ response to the episode and the child’s response to the parental intervention. Determination of chronicity of the problem and characterization of those times when the child has slept without problems provide information concerning the severity of the problem and potential success of intervention schemes. The assessment includes characterization of the child’s 24-hour wake-sleep schedule. This may begin by determining whether there is a pre-bedtime ritual and characterizing the activities of the child and the roles of the parents during this time. Other pertinent information includes bedtimes of the child and other family members, occurrence of a smooth transition or struggle to go to bed, sleep onset (immediate or delayed), location of initial sleep onset (eg, in the parent’s arms, in the child’s or parents’ bed, on the couch), and the sleep environment (eg, own bed, own room, shared room, parents’ room or bed). The timing and frequency of arousals after going to sleep should be determined and characterized as to sleep factors (eg, snoring, leg movements, nightmares), environmental factors (eg, a wet diaper, a parent returning home from work, a barking dog), and parental response (eg, giving a bottle, getting in bed with the child or taking the child to their bed, turning on the television).

Information concerning the child’s sleep behavior should be complemented by information about daytime sleepiness, daytime naps, and other behaviors, such as
difficulties with attention and concentration, school failures that may be associated with nighttime sleep disruption, or daytime somnolence in children. Information concerning behavioral and cognitive problems from other sources, such as teachers, may be helpful in this regard. The child’s report of sleep disturbances also should be used in assessing sleep behaviors not always observed by parents. Children may self-report more frequent or more severe sleep problems than do parents [1,40–42]. The development of an intervention scheme that provides a realistic and feasible approach and addresses the concerns and needs of the child and family depends on understanding the experiences and goals of the caregivers. The parents should be allowed to describe their agenda, whether and to what success they have attempted behavioral approaches or used over-the-counter or prescribed medications, their family support resources, and the household environment (eg, a two-bedroom home for four children and two parents, the sleepwalking child whose bedroom is on the second story). The contribution of other medical problems (eg, recurrent otitis media, colic, gastroesophageal reflux, seizures, visual and auditory impairments, chronic pain syndromes, anxiety disorders) and medications also should be considered.

Useful information concerning regularity of sleep-wake schedules, severity of the child’s sleep disturbance, and daytime sleepiness may be obtained from sleep logs or diaries. The parents and child are asked to keep a 1- to 2-week record of the child’s bedtime, sleep onset, awakenings and times awake during the night, and daytime naps and sleep periods for each 24-hour period. Videotaping by the caregiver of the child’s nighttime behaviors also may provide useful information concerning the character of the sleep disturbance [27]. In selected cases, overnight, in-laboratory polysomnography (sleep study) or a daytime multiple sleep latency test may be indicated to assess sleep disturbances and excessive daytime sleepiness. These tests may be considered when non–behavioral-related sleep disturbances, such as sleep apnea, are suspected or when the child experiences excessive daytime sleepiness not accounted for by nighttime sleep behaviors, sleep-wake scheduling factors, or age. Children may have more than one type of sleep disturbance, and an overnight study may be considered when behavioral approaches fail to correct the sleep disturbance despite consistent caregiver compliance.

Management of insomnia in children

The prevalence, persistence, and enduring consequences of childhood sleep disturbances emphasize the need for effective interventions [1,14,27,43]. Effective treatment must consider the etiology of the sleep disturbance. The clinician must determine whether the sleep problem constitutes a behaviorally or medically based sleep disorder or is a symptom of another primary medical problem. In general, two approaches are used for the management of insomnia in children: (1) behavioral and cognitive behavioral approaches and (2) pharmacotherapy [1,43]. Behavioral approaches apply the principles of learning (stimulus and response) theory to affect changes in observable behaviors [1]. Cognitive-behavioral approaches use behav-
ioral methods and cognitive approaches. Cognitive approaches include manipulation of thoughts, attitudes, and beliefs to change observable behaviors and unobservable behaviors, such as cognition or emotions. Cognitive-behavioral approaches require verbal communication and are commonly used with older, more cognitively sophisticated children [1].

Behavioral/cognitive-behavioral approaches can be used alone or in combination with pharmacotherapy. In addition to explaining their “benign” character and providing for the safety of the child, partial arousal parasomnias, such as night terrors or sleepwalking, may require no intervention because they tend to remit spontaneously as children mature. If significantly disruptive to the child and the family, a combination of behavioral and pharmacologic therapy may be required [1]. Although there is an increasing acceptance of pharmacologic management for childhood sleep disorders, there is a lack of data from controlled studies to support the use of one or another pharmacologic agent [14,43]. In addition to these approaches, institution of a comprehensive program of sleep hygiene and appropriate attention to sleep-wake patterns across the 24-hour period is necessary. The routine should be realistic for school and extracurricular activities of the child. Some variation in some aspects of sleep hygiene programs may depend on specific treatment protocols (eg, bedtime delays for circadian rhythm disorders). In general, the following protocols have been suggested [44]:

- Establish appropriate caretaker and child/adolescent expectations.
- Fix and consistently enforce morning wake time. Morning wake time is the most powerful time for entrainment of the sleep-wake time.
- Fix and enforce bedtime, with some flexibility for normal family lifestyle. Bedtime should be developmentally age appropriate.
- Establish pre-bedtime ritual with a period of “stepping down” to provide cues for easy onset of sleep.
- Avoid vigorous activity for 1 to 2 hours before bedtime. A warm bath before bed may provide cues for onset of sleep by the subsequent drop in body temperature. For some young children, however, this activity may be stimulating and may be moved to the morning.
- Avoid excessive bedtime and nocturnal fluids, food or beverages that contain caffeine (eg, soft drinks, chocolate, tea, and coffee), and medications that contain alcohol or caffeine for several hours before bedtime.
- Provide a sleeping environment that is quiet and dark (a dim nightlight may be allowed) without television, telephone, stereo, or computer (Internet and games).
- Ensure that the environmental temperature is generally less than 75°F; excessively hot temperature can disturb sleep continuity.
- Ensure that children and adolescents fall asleep on their own without parental intervention or environmental factors, such as television.
- Ensure that time in bed allows possibility of an appropriate amount of sleep according to age of the child and is not excessive.
- Ensure that naps are developmentally appropriate.
Behavioral and cognitive-behavioral approaches

Sleep disorders, such as sleep-onset association disorder, limit-setting sleep disorder, and adjustment sleep disorder, are behavioral disorders for which behavioral/cognitive-behavioral approaches are appropriate [1]. (See the article on nonpharmacologic treatment of pediatric sleeplessness elsewhere in this issue.)

Behavioral approaches involve not only the child but also the parents [1]. Parents play an important role in the development and maintenance of sleep difficulties. Children and parents learn to modify their behaviors to be more conducive to a child sleeping. Researchers also have noted that children can be affected by more than one behavioral sleep disorder and may suffer behavioral and biologic-based sleep disorders, such as obstructive sleep apnea. Thus, it is necessary to address both aspects of the sleep disorder [1,45].

Numerous behavioral strategies for childhood sleep disturbances have been described [1]. Of these strategies, extinction (brief periods during which parents ignore the child except for safety purposes) is the best studied [45]. Standard extinction meets the criteria for a well-established technique, and extinction-attributed improvements in sleep may be maintained over long periods of time [1,46]. Extinction may be a difficult technique to implement, however, because of low parental acceptance of the requirement to ignore the child and parents’ inability to outlast extinction bursts [1]. These bursts are characterized by an increase in frequency and intensity of the undesired behavior that occurs with initial attempts to ignore it. When parents attend to the child during an extinction burst, the efficacy of extinction is undermined. A better accepted technique is gradual extinction [1,45]. This technique allows parents to check the child according to his or her schedule, gradually decreasing frequency. For example, an initial delay of 3 to 5 minutes is followed by the parents entering the room to briefly check on the child in a matter-of-fact manner without negative or positive feedback to the child. Longer delays of an additional 3 to 5 minutes (to a maximum of 15–20 minutes) are scheduled until the child falls asleep. This sequence is repeated for subsequent arousals. Either of these treatments—standard extinction or gradual extinction—has been observed to be successful when compared with no intervention at approving bedtime and nighttime sleep disturbances [1,45]. Graduated extinction is associated with less maternal stress and better compliance with the behavioral regiment [47].

Another technique that may be efficacious is scheduled waking [1]. This technique alters the sleep staging by waking a child 15 to 30 minutes before a spontaneous awakening and allows the child to resettle as usual. Positive bedtime routines, such as setting initial treatment bedtime later at a time when rapid sleep onset is likely and making nighttime bedtime successfully earlier (fading) until the desired bedtime is achieved, also may be efficacious [1]. These strategies may be especially helpful in the management of sleep disturbances, such as sleep-onset association disorder and bed resistance, that are consequent to age-inappropriate parental expectations for sleep onset.

The use of other cognitively based strategies may be more helpful in older children. Stimulus control techniques restrict activities in bed to sleeping and
minimizing the amount of time awake in bed to strengthen the associations between sleep and the stimulus conditions under which it typically occurs [1]. Sleep restriction entails curtailing the amount of time spent in bed to the actual or estimated amount of sleep time and then gradually increasing until optimal sleep duration is achieved [1]. These two methods are effective in treating adult psychophysiological insomnia and may be helpful in the management of other insomnias experienced by children [1]. Other cognitive interventions may include strategies such as positive self-statements, self-control, and coping strategies, systemic desensitization, positive reinforcement, and relaxation techniques [1]. These individual behavior strategies are seldom used alone and are more often used in combination customized to the needs of the individual child and family.

A key determinant of any behavioral intervention is parental compliance [1]. Reasons cited for parental difficulty in complying with the proposed behavioral intervention include parental exhaustion or sleep deprivation, parental depression or other mental illnesses, lack of parental acceptance of the treatment plan, and lack of parental understanding of aspects of the treatment plan [1]. Characteristics of the home environment also have been noted to affect the success of behavioral interventions [1]. Problems such as close living quarters or shared bedrooms, competing priorities such as caring for other children or job-related duties, and monetary resources may affect the success of these behavioral strategies. The presence of other medical, neurologic, or developmental problems also may impact on the success of these behavioral programs. Handicapped children and children with comorbid conditions, such as ADHD, may respond to the same behavioral interventions that otherwise healthy children do [1]. Problems such as blindness or impaired language skills may lower the likelihood of the success of these behavioral techniques. Children with self-injurious nighttime behavior are probably not appropriate candidates for techniques such as extinction, which require the parents to ignore the child [1].

**Pharmacologic management**

There is a lack of data from controlled studies to support the use of pharmacologic agents in the management of children with insomnia [43]. (See the article on pediatric sleep pharmacology elsewhere in this issue.) The use of pharmacologic agents is frequently undertaken by parents acting on the recommendations of a physician or independently without a physician’s advice. Use of medications for childhood sleep disturbances is common in children from infancy to adolescence. One study reported that as many as 25% of first-born infants had been given sedatives by the time they reached 18 months of age [48]. Another study indicated that sleep disturbances were the most common reason for prescribing medications to children aged 2 to 5 years; 23% of the children in this study were given drug therapy for sleep disturbances [49]. Drug therapy for sleep disturbances among preschool-aged children is not only common but also often protracted [50]. Many clinicians are reluctant to prescribe medications for childhood sleep disturbances,
however. The primary reason cited is the lack of clinical efficacy and tolerability data involving the use of medications for sleep in children. No study has used rigorous techniques, such as randomization using placebo-controlled group or masking of study personnel and subjects, to study the use of these agents in children [14,43].

Several classes of soporific drugs, including benzodiazepines, antihistamines, and tricyclic antidepressants, have been prescribed to children for their sedative properties. The most frequently prescribed medications include benzodiazepines, chloral hydrate, antihistamines, clonidine, and melatonin [45].

Benzodiazepines

Benzodiazepines [43,44] have been used to control night terrors and partial arousals. Benzodiazepines decrease the frequency of arousals that occur during transitions from sleep stages. Benzodiazepines, however, may mask symptoms rather than improve sleep, may induce tolerance, and are associated with rebound partial arousals [43,44]. Benzodiazepines decrease the duration of stages 3 and 4 non-REM sleep ("deep sleep") in children, which may have adverse affects on daytime functioning [43]. Optimum soporific doses of benzodiazepines for children generally have not been established, and benzodiazepines are not labeled by the US Food and Drug Administration for use in children [43]. A reported dose (at bedtime) for clonazepam is 0.01 mg/kg; diazepam, 0.04 to 0.25 mg/kg, and lorazepam, 0.05 mg/kg [44]. Potential side effects of these drugs include residual daytime sedation and rebound insomnia. Neurologically impaired children who receive clonazepam may experience increased drooling and motor (gait) impairments.

Chloral hydrate

Chloral hydrate is indicated for nighttime sedation in children [43,44]. The reported hypnotic dose is 50 mg/kg (maximum 2 g) at bedtime; sedation and anxiety dose is 25 to 50 mg/kg every 8 hours [44]. Chloral hydrate has been suggested to be ineffective in managing insomnia in adult patients, however [51]. Chloral hydrate has poor tolerability in safety profiles [52]. It may cause gastrointestinal distress, nausea, and vomiting. Neurologic side effects include drowsiness, dizziness, malaise, and fatigue. Children may experience idiosyncratic reactions characterized by confusion, disorientation, and paranoia. Used chronically, chloral hydrate is habit forming and associated with tolerance; therefore, limited use (less than 2 weeks) is recommended [44]. Discontinuation of chloral hydrate after prolonged use may precipitate severe withdrawal characterized by delirium and seizures [43]. Respiratory depression has been reported after administration of chloral hydrate, and chloral hydrate should be used cautiously in patients with sleep-disordered breathing [43,44].

Antihistamines

Antihistamines [43,44] primarily are used in the treatment of allergies, motion sickness, and vertigo. At the recommended doses for treatment of these problems
they are also weak soporifics. Diphenhydramine hydrochloride is one of the most popular antihistamines used to induce sleep in children. A dose of 1 mg/kg given at bedtime reduces sleep latency and number of nighttime awakenings [43]. Typical bedtime doses are 12.5–25 mg for children 2 to 6 years of age; 25 mg for children 6 to 12 years of age; and 25–50 mg for children over 12 years of age [44]. It does not affect restlessness, incidence of nightmares, or difficulty awakening. Antihistamines may disrupt sleep quality. The resultant daytime sleepiness may contribute to daytime cognitive and behavior deficits [53]. Other side effects may include nervousness, excitability, and hypertension [44].

**Clonidine**

Clonidine [43,44], a central α-adrenergic receptor agonist used as an antihypertensive, is not recommended for sleep disturbances in healthy children. It is reported to cause insomnia in adults [43,44]. Its use for management of sleep disturbances experienced by children with ADHD [13] and children with neurologic impairments has been reported, however [38]. One study noted that the use of clonidine as a soporific was associated with significant parent-reported improvement in the sleep disturbances of adolescents with ADHD and that this improvement was sustained over a 3-year follow-up period [54]. In this study the clonidine bedtime dose ranged from 50 to 800 μg; a suggested bedtime dose is 2.5 to 5 μg/kg [44]. Potential side effects of clonidine include sedation, dry mouth, and marked bradycardia [43]. Rebound hypertension and dysphoria after discontinuation have been reported [43]. Clonidine suppresses REM sleep; the potential impact on daytime functioning is not known [44].

**Melatonin**

Melatonin [43,44] is available over the counter. The over-the-counter preparations may contain other ingredients. It is used widely for sleep promotion and jet lag. Its beneficial use in children with irregular sleep-wake patterns has been reported, including children with blindness and neurologic disorders [55–60]. One study reported an increase in seizure activity in children with epilepsy; otherwise, no significant safety problems have been reported [44]. Melatonin has been poorly studied, however, and there is a need for well-designed, double-blinded, well-controlled studies before definitive conclusions can be made concerning its efficacy, tolerability, and safety. Reported starting doses in children typically have been 2.5 to 5 mg (range 0.5–10 mg) given 1 to 5 hours before bedtime [43,44].

Several other drugs have been used less frequently for the management of childhood sleep disturbances. Tricyclic antidepressants have been used to control partial arousals and enuresis [43]. These drugs alter sleep architecture, including reduction in REM sleep, and are associated with tolerance and rebound partial arousals. The usefulness of the phenothiazines—trimeprazine and niaprazine—has been reported for treatment of sleep-onset delay and awakenings in infants and
Although parent reports indicated that trimeprazine improved sleep over baseline and placebo, its use was associated with continued frequent nighttime awakenings. The use of nonbenzodiazepines, such as zolpidem and zaleplon, and atypical antidepressants, such as trazodone, for management of sleep disturbances has been reported in adults but has not been studied in children.

For most cases of childhood insomnia, the initial and primary therapy is behavioral-cognitive intervention and the management of associated sleep disorder and medical, psychiatric, and behavioral problems. There may be times when pharmacologic therapy alone or, more frequently, combined with a behavioral approach may be warranted, however. For example, the infant or child with a behaviorally determined sleep-onset or nighttime awakening problem may be disruptive to the point of causing significant stress that makes it impossible to complete the behavior program or may harm the child. This situation may warrant a short course of a hypnotic agent in combination with the behavior program. Parasomnias associated with frequent nightly and potentially harmful episodes may warrant treatment with a medication such as a benzodiazepine. Other examples may include childhood insomnia associated with neurologic (eg, ADHD, pervasive developmental disorders, syndromic developmental disorders), psychiatric (eg, anxiety, depression), and medical (eg, chronic pain syndrome) disorders. Medication combined with behavior approaches may be indicated when the primary treatment for these disorders does not resolve the sleep disorder. Currently, except for a few examples in neurologically impaired children, there is no convincing evidence for the use of available sedatives or hypnotics in the management of pediatric sleep disturbances. Little information is available to guide decisions concerning appropriate dosing or duration of drug therapy for pediatric sleep disturbances. Further studies are indicated to address these issues.

References