Pediatric sleep disorders are common, affecting approximately 25% to 40% of children and adolescents [1]. Although there are several different types of sleep disorders that affect youth, each disorder can have a significant impact on daytime functioning and development, including learning, growth, behavior, and emotion regulation [2]. Although the relationship between sleep and psychiatric disorders has been established in adults, researchers are only beginning to uncover the interaction between sleep and psychiatric disorders in children and adolescents, including depression, attention-deficit/hyperactivity disorder (ADHD), and autism. The purpose of this article is to review normal sleep and sleep disorders in children and adolescents, the assessment of sleep in pediatric populations, common pediatric sleep disorders, and sleep in children who have common psychiatric disorders.

**SLEEP IN CHILDREN**

Parents often ask practitioners how much sleep their child needs. This can be a difficult question to answer as sleep needs not only change with developmental stages, but recent studies and surveys show that there is a large variability in both children’s sleep need, especially in the first few years of life [3], as well as the actual amount of sleep that youth in America are getting [4,5]. Table 1 describes what typically is seen in terms of sleep patterns in children across development.

**Newborns (0 to 3 Months)**

There is no clear sleep pattern in the first few weeks of life; however, most newborns sleep between 10 and 18 hours per day, although this may be longer if infants are premature. This total sleep time is divided into many short sleep periods across the 24-hour clock, with no differentiation between day and night. This polyphasic sleep schedule (multiple sleep periods), although age appropriate, often is difficult for new parents. The discrepancy between newborn sleep...
patterns and parental expectations and need for prolonged nighttime sleep may result in parents stating that their baby “never sleeps.”

**Infants (3 to 12 Months)**
Sleep patterns begin to consolidate by 3 months of age, with babies beginning to show a diurnal cycle of sleep at night and wakefulness during the day. Infants typically sleep approximately 10 to 12 hours at night and up to 3 or 4 hours during the day (divided into two or three daytime naps). At approximately 6 months of age, 90% of infants take only two naps, with their nighttime sleep progressively lengthening. It is important to keep in mind that with the onset of each developmental milestone (eg, pulling to standing or walking), children’s sleep can become disrupted for several nights to weeks before and after the milestone occurs [6].

All children wake for brief periods during the night, with many infants able to return to sleep independently (self-soothers). Parents should be encouraged from an early age to put their babies to bed drowsy, but still awake, at bedtime in order for babies to learn how to fall asleep independently. In contrast, infants who are nursed or rocked to sleep are more likely to develop behavioral insomnia of childhood, sleep-onset association type, which presents as frequent night wakings (see later discussion for further description) [2]. Other common sleep disorders in infants include confusional arousals, bedtime problems, and rhythmic movement disorders (RMD).

**Toddlers (12 Months to 3 Years)**
By 18 months of age, the majority of toddlers transition from two daytime naps to one and continue to sleep approximately 10 to 12 hours at night. Approximately 25% to 30% of toddlers have sleep problems [1], with bedtime resistance (behavioral insomnia of childhood, limit-setting type) and frequent night wakings (behavioral insomnia of childhood, sleep-onset association type) the two primary disorders in this age group. In addition, daytime behavior is markedly worse in children who are poor sleepers.

**Preschool-Aged Children (3 to 5 Years)**
Sleep amounts in preschool-aged children decrease, mostly the result of the discontinuation of daytime naps. By the age of 5 years, 75% of children have given up their nap and sleep a total of 11 to 12 hours at night. As children develop language, cognitive reasoning, and imagination, they also can develop

<table>
<thead>
<tr>
<th>Age group</th>
<th>Years</th>
<th>Total sleep need</th>
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<tr>
<td>Infants</td>
<td>3 to 12 months</td>
<td>14 to 15 hours</td>
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<tr>
<td>Toddlers</td>
<td>1 to 3 years</td>
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<td>Preschoolers</td>
<td>3 to 5 years</td>
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<td>School-aged</td>
<td>6 to 12 years</td>
<td>10 to 11 hours</td>
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<tr>
<td>Adolescents</td>
<td>12 to 18 years</td>
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difficulties initiating sleep. Many children in this age group test limits at bedtime, making bedtime refusal a common sleep complaint by parents. In addition, many children develop fears of the dark and monsters, also resulting in bedtime resistance, and an increase in nightmares. Contrary to the popular belief that young children outgrow their sleep difficulties, research has found that sleep problems in preschoolers can become chronic [7]. Furthermore, two physiologic sleep disorders, obstructive sleep apnea and partial arousal parasomnias, peak during this developmental stage.

School-Aged Children (6 to 12 Years)
Almost all children in this developmental stage have a single sleep period at night, lasting 10 to 11 hours, and are alert and awake during the day, with rare naps. Recent surveys and data indicate that approximately one third of school-aged children experience sleep problems [4,8,9]. The most common complaints are bedtime resistance, difficulty initiating sleep because of anxiety, and daytime sleepiness. These symptoms may be a result of obstructive sleep apnea, insufficient sleep, poor sleep hygiene, and/or an anxiety disorder. Sleep restriction in this age group has been shown to be related to difficulties with attention, memory, learning, and behavior [10–12].

Adolescents (12 to 18 Years)
Although adolescents clearly have been shown to need 9 to 9.25 hours of sleep per night through studies conducted in a laboratory setting [13], most get only 7 hours of sleep each night [14]. This cumulative sleep debt has many causes and many consequences for daytime functioning. With the onset of puberty, hormonal changes and a shift in melatonin secretion lead to adolescents experiencing a 2-hour shift in their circadian sleep phase, resulting in a later sleep onset and morning wake time [13]. In addition, some adolescents experience a physiologic need for a short sleep period in the early afternoon, especially given their chronic partial nighttime sleep deprivation. These physiologic sleep needs are in conflict with the early start times of most junior high and high schools, resulting in sleep-deprived adolescents who are asked to learn at a time when their body should be sleeping [15]. In addition, the increased number of demands on adolescents (eg, homework, sports, activities, and work) often results in delaying bedtime further and increasing sleep debt. To help them function during the day, 75% of adolescents report relying on caffeinated or energy drinks [5]. Sleep deprivation can have an impact on mood, attention, memory, behavior, and academic performance [16]. In addition, many adolescents report driving drowsy [5], increasing the likelihood of an accident for these new young drivers. Common sleep disorders in adolescents include delayed sleep phase syndrome (DSPS), poor sleep hygiene, insomnia, narcolepsy, and restless legs syndrome (RLS)/periodic limb movements in sleep (PLMS).

**PEDIATRIC SLEEP DISORDERS**
Although sleep disorders in children and adolescents are common, they are varied in nature and presentation, ranging from bedtime resistance and
frequent night wakings that are behavioral in nature to obstructive sleep apnea or narcolepsy, two physiologic sleep disorders. Regardless of the type of sleep disorder, the majority of pediatric sleep disturbances most likely persist if left untreated and can have a significant impact on mood, behavior, development, and functioning. Thus, a careful screening for each of the following disorders is necessary for all pediatric patients.

**Behavioral Insomnia of Childhood**

Behavioral insomnia of childhood manifests most commonly as bedtime resistance and/or frequent night wakings [17] and occurs in approximately 10% to 30% of infants and toddlers [18]. These sleep difficulties can be linked to an identified behavior in the parent or child, and thus are classified into three subtypes.

*Sleep-onset association type*

Sleep-onset associations are certain conditions that must be present to help children fall asleep, and without the association, sleep onset may be prolonged and night wakings more frequent. Positive sleep associations are ones that children can facilitate for themselves (eg, sucking the thumb or holding a cuddly object), whereas a negative sleep association is one that involves another person, typically a parent (eg, nursing or rocking an infant to sleep or laying with the toddler at bedtime) or external stimuli (eg, riding in the car to fall asleep). As all children have a brief arousal 2 to 6 times during the night [19], a child who is dependent on a negative sleep association at bedtime also requires this association to be present in the middle of the night, resulting in the parental complaint of frequent night wakings.

Sleep-onset association type occurs primarily in infants and toddlers, ages 6 months to 3 years [17]. Before 6 months, a diagnosis of behavioral insomnia of childhood is not appropriate, as sleeping for an extended period of time is a developmental skill that may not have developed [20]. Although some sleep associations naturally cease with development (eg, nursing to sleep stops after weaning), other sleep associations (eg, lying with a child at bedtime) persist; thus, frequent and persistent night wakings may continue. Behavioral treatments (eg, extinction, graduated extinction, and positive routines) have been found to be highly effective for sleep-onset association type [18,21].

*Limit-setting type*

The limit-setting type of behavioral insomnia of childhood typically manifests as bedtime stalling (eg, repeated requests to use the bathroom or one more goodnight story) or bedtime refusal (eg, refusal to get ready for bed or stay in bed) at an age-appropriate bedtime [17]. If limits are set, children typically fall asleep quickly and easily. As with sleep-onset association type, limit-setting type occurs in approximately 10% to 30% of toddlers and preschoolers, with this disorder persisting into childhood, with approximately 15% of parents of children ages 4 to 10 years also reporting problems with bedtime behaviors [1]. Limit-setting type results in prolonged sleep onset, thus, generally a shorter total sleep time. Once children are asleep, however, their sleep quality typically is normal.
Limit-setting type sometimes is related to normal child development, with young children who are learning independence during the day often asserting their newfound refusal skills at bedtime. Parents commonly exhibit two types of responses to these behaviors, either setting no limits (eg, allowing children to set their own bedtime or allowing children to fall asleep in front of television) or setting unpredictable or inconsistent limits (eg, allowing six books on one night but only one book on the next night), often resulting in bedtime temper tantrums. As children get older, parental involvement with bedtime typically decreases, reducing the opportunity for problematic behaviors at bedtime. Behavioral approaches also are shown to be highly efficacious in the treatment of limit-setting type [18,21].

Combined type
This new diagnostic category recognizes that some children may experience both the limit-setting type and sleep-onset association type of behavioral insomnia of childhood. For example, children who stall and request frequent parent attention at bedtime (limit-setting type) may be unable to go to sleep until a parent sits with them at bedtime, and then they have frequent night wakings after which a parent must return to the room to help them return to sleep (sleep-onset association type).

Insufficient or Inadequate Sleep
The most common cause of daytime sleepiness in children is insufficient sleep, with adequate sleep sacrificed in order for children to complete their homework, participate in extracurricular activities, or because of poor sleep hygiene habits (eg, staying up late to watch television). Sleep deprivation can have a cumulative effect, resulting in children and adolescents being late or missing school, falling asleep during school, fatigue, illness, and irritability. Recent poll data indicate that 28% of high school students report falling asleep in school at least once a week and 14% report being late to school or missing school as a result of oversleeping [5]. Furthermore, insufficient sleep can be fatal for adolescents who fall asleep while driving.

Although sleep needs vary across the developmental stages, many parents may be unaware of either their children’s sleep needs or how much sleep their children actually are getting [5,8]. Signs that children or adolescents are not getting enough sleep include (1) needing to be awakened for school or day care in the morning, (2) sleeping 2 hours more on weekends and vacations compared with weekdays, (3) falling asleep in school or at other inappropriate times, and (4) behavior and mood differing on days after getting more sleep. It is important to address sleep needs and appropriate sleep hygiene with all family members, as many children and adolescents perceive that their school work or activity schedule is inflexible, preventing adequate sleep. Alternatively, many parents model poor sleep practices, including irregular sleep schedules, oversleeping on weekends, and falling asleep with the television on in the bedroom. Behavioral contracts may be effective in helping children and their families
target sleep behaviors that need to change (e.g., regular sleep schedule) and the steps that need to be taken to achieve these goals.

**Delayed Sleep Phase Syndrome**

DSPS is seen most commonly in adolescents, although it also can occur in younger children. DSPS is a circadian rhythm disorder where the habitual sleep-wake times are delayed significantly and persistently by 2 or more hours beyond the desired bedtime, interfering with environmental demands (e.g., school) [17,22]. In addition, in this chronic condition, sleep patterns are not coordinated with the environmental cues for sleep and wakefulness (e.g., dark and light). Many adolescents report an inability to fall asleep before 2:00 AM or 3:00 AM, with any attempts to fall asleep sooner resulting in sleep onset insomnia. If adolescents go to bed at the delayed hour, however, they fall asleep quickly. Once asleep, adolescents who have DSPS have normal sleep quality. Most adolescents who have DSPS present in clinic with their parents complaining about how difficult they are to awaken in the morning. Approximately 5% to 10% of adolescents have DSPS [2,23], with significant negative effects on academic performance resulting from tardiness or missed school days.

Treatment for DSPS is difficult and requires highly motivated adolescents who are willing to keep a consistent sleep schedule 7 nights a week [2,23]. When the difference between the actual and desired bedtime is less than 3 hours, phase advancement is the best approach. Using this technique, adolescents are not to go to bed until the delayed bedtime (e.g., 2:00 AM) and then advance their bedtime by 15 minutes every few nights (or once they are falling asleep quickly at each new bedtime). Chronotherapy, or phase delay, is effective if the phase delay is greater than 3 hours. In this schedule, the bedtime and wake time are shifted 2 to 3 hours later every day until the desired sleeping time is reached. For example, on day 1 the adolescent should sleep 3:00 AM to 10:00 AM; day 2, 6:00 AM to 1:00 PM; and so on. Once the desired schedule is reached, the adolescent must adhere strictly to the new sleep schedule, with even one night’s deviation potentially returning him/her to the delayed sleep phase pattern. A family systems approach that explores family expectations, problem-solves ways to improve adherence, and discusses of the chronicity of the disorder may be beneficial [23]. This approach, however, has not been studied empirically.

The use of melatonin also may be helpful in advancing the circadian clock in adolescents who have DSPS [24]. There is no clear consensus about the timing and dosing of melatonin, and currently melatonin can be purchased only as an over-the-counter supplement, leaving questions about the actual concentration of melatonin that patients are taking. It has been suggested, however, that melatonin should be administered 1 to 2 hours before desired sleep-onset time in combination with the blocking of light exposure in the afternoon and evening and the increase of exposure to bright light in the morning [23]. In children, a dose of 0.3 to 5 mg has been suggested [23,25,26], but studies on the
Sleep-Disordered Breathing

Sleep-disordered breathing (SDB) in children can range from primary snoring to obstructive sleep apnea syndrome (OSAS) and is related to significant cognitive and behavioral sequelae, including learning, attention, concentration, hyperactivity, and aggressive behavior. The incidence of habitual snoring has been reported at 3% to 12% of the general pediatric population, with OSAS seen in 1% to 3% of children [2,27]. Although recent evidence suggests that snoring itself is related to negative neurobehavioral functioning [28,29], OSAS is a more serious disorder that poses significant risk for the developing brain [27].

The clinical presentation of OSAS differs from that in adults, where the typical presentation is obese individuals who snore and are excessively sleepy during the day. In contrast, children who have OSAS may or may not be obese; the typical cause of this disorder in children is enlarged tonsils and adenoids. Although snoring alone is not indicative of OSAS in children, the American Academy of Pediatrics recommends that all children who have habitual snoring should be evaluated for OSAS [30]. Additional symptoms of OSAS in children include restless sleep, sleeping in an upright position or with the neck hyperextended (to keep the airway open), noisy breathing, and frequent infections of the tonsils or inner ear [27]. Although children may present typical symptoms of daytime sleepiness (eg, difficulty waking in the morning, falling asleep in school, or frequent naps that are not age appropriate), some children actually may be hyperactive, especially as they get more tired. Neurobehavioral problems also may be present in children with OSAS, including mood lability, aggression or other acting out behaviors, ADHD-like symptoms (eg, inattention or hyperactivity), and learning problems [31–33]. Studies find that academic functioning improves in children who have OSAS who have been treated with adenotonsillectomy compared with children who were not treated [32,34].

OSAS occurs in children of all ages and both genders, although the peak prevalence of this disorder is seen in preschool-aged children (3 to 5 years). Children who have craniofacial abnormalities, Down syndrome, or micrognathia are at increased risk for OSAS. In addition, with the rise in childhood obesity, increasingly more children are at risk for OSAS because of their weight, similar to adults.

For 70% of children, symptoms of OSAS are alleviated with a tonsillectomy and/or adenoidectomy [27,35]. A follow-up overnight sleep study post surgery is recommended. For children who are overweight, weight loss is the recommended treatment. Pharmacologic approaches may be indicated for children who have chronic nasal congestion that interferes with the quality of their breathing during sleep. Finally, in children in whom a tonsillectomy or adenoidectomy is contraindicated or unsuccessful, nasal continuous positive airway pressure (CPAP) may be appropriate. CPAP can be a successful treatment for children and adolescents; however, young children and children
who have developmental delays may have greater difficulty tolerating this
treatment and may need to participate in systematic desensitization to im-
prove compliance with wearing the CPAP during sleep [36].

Narcolepsy
Narcolepsy is a chronic neurologic disorder that involves excessive daytime
sleepiness, cataplexy (sudden loss of muscle control in response to strong emo-
tional stimuli), hypnagogic hallucinations (vivid dreams at sleep onset), sleep
paralysis, and fragmented nighttime sleep [17]. Although the onset of narco-
lepsy previously was believed to be in late adolescence or adulthood, it now
seems that the symptoms of narcolepsy, most notably excessive daytime sleep-
iness, may begin to manifest in some individuals during childhood [37]. The
prevalence of narcolepsy in children is difficult to establish, with retrospective
studies reporting that approximately 34% of adults who have narcolepsy expe-
renced the onset of symptoms before age 15 [38].

As sleepiness may be the only symptom present in children, the diagnosis of
narcolepsy is more difficult in children and adolescents than in adults [39]. The
symptoms of cataplexy and hypnagogic hallucinations may not be present or
may be difficult to elicit in clinic from a child or the parent’s history. Further,
in young children, a diagnosis of narcolepsy may be confounded by a child’s
developmental need for regular naps. Polysomnography (PSG) with a multiple
sleep latency test (MSLT) may provide clear evidence of narcolepsy, but in
children, results are not always conclusive, and repeat studies may be necessary
for a final diagnosis.

The current treatment recommendations for narcolepsy in children are sim-
ilar to that of adults, and include education, sleep hygiene, and pharmacologic
interventions. Education must be conducted not only with the family but also
the other systems within which the child functions, including school and peer
networks. Appropriate sleep scheduling is essential, with a consistent bedtime,
wake time, and good sleep hygiene (eg, no TV in the bedroom and sleeping in
a cool, dark environment). In addition, children and adolescents who have nar-
colepsy may benefit from a scheduled daily nap in the early afternoon. Medi-
cations commonly are used to target the primary symptoms of narcolepsy:
daytime sleepiness and cataplexy. Stimulants are the class of drugs prescribed
most commonly to counteract daytime sleepiness [37,40]. Modafinil (Provigil)
also is reported to be effective in improving alertness and improved perfor-
ance; however, most studies have been conducted with adults, with few pe-
diatric trials completed [41,42]. Cholinergic pathways mediate cataplexy; thus,
medications with anticholinergic properties are used to treat cataplexy, includ-
ing clomipramine and imipramine. Currently, there are no Food and Drug Ad-
ministration (FDA)–approved medications for the treatment of narcolepsy
(either the symptoms of daytime sleepiness or cataplexy).

Disorders of Arousal
Disorders of arousal, more commonly referred to as partial arousal parasom-
nias, are common pediatric sleep disorders that tend to cease with
development. These events occur during the transition from slow wave sleep (stages 3 and 4) to lighter sleep, rapid eye movement (REM) sleep, or a brief arousal, with transitions most common during the first few hours after sleep onset (at bedtime and during naps). Partial arousal parasomnias include confusional arousals, sleep terrors, sleep talking, and sleepwalking [17,43]. Events generally last a few minutes but can last much longer for some children. During an event, although children are asleep, they may appear awake (eyes open), talk, or seem frightened or confused (eg, screaming in the case of sleep terrors). During a partial arousal parasomnia, children may not recognize their parents and resist attempts to be comforted or soothed, with attempts to wake the child often prolonging the event. Typical parasomnias resolve spontaneously with children rapidly returning to a deep sleep.

A common feature of these disorders is retrograde amnesia, with children having no recollection of the event in the morning. In addition to the amnesia, partial arousal parasomnias are distinguishable from nightmares by the timing of the events, with sleep terrors occurring in the first part of the evening and nightmares in the early hours of the morning (during REM sleep). Clinically, practitioners often say that when parents are more upset by the episode, it usually is a sleep terror. Alternatively, when a child can recount vividly why he/she was terrified after waking, the child likely is experiencing nightmares.

There is a strong genetic component to partial arousal parasomnias, with a family history typically reported [44]. In addition, studies find little evidence that these events are related to anxiety, depression, or other psychological problem, although there is an increased rate of psychiatric issues in adolescents who have sleep terrors [45]. Partial arousals are more likely to be triggered by insufficient sleep, a disruption to the sleep environment or sleep schedule, stress, illness, or certain medications (eg, chloral hydrate or lithium). In addition, SDB is found in approximately 60% of school-aged children who have sleep terrors [44].

Treatment for partial arousal parasomnias includes providing families with information about creating a safe sleep environment (eg, preventing windows from opening or putting alarms or bells on doors to alert if a sleep walker is up), education about the events, and how to interact with children appropriately during an event. Finally, as some children may develop a fear of going to sleep (because they are afraid of having a partial arousal event) and a prolonged sleep onset in turn increases the likelihood of an event occurring, parents should be encouraged to not discuss these events in the morning with the child or other children in the home. Medications rarely are used to treat this sleep disorder but may be indicated if partial arousal events are very frequent, highly disruptive to the family, or when the child or others in the home are in danger because of the behavior. Additional information about parasomnias in general are provided elsewhere in this issue.

Restless Legs Syndrome and Periodic Limb Movement Disorder

Although the prevalence of RLS and periodic limb movement disorder (PLMD) is not well defined in the general pediatric population, it is worthy of discussion
because of the strong relationship between these disorders and ADHD (discussed later). RLS manifests as uncomfortable sensations in the legs that worsen in the evening and with long periods of inactivity (eg, long car ride or movie) [17]. Sensations often are described as creepy-crawly or tingling feelings, most commonly in the legs, which can be alleviated temporarily with movement. In children, this can include running and jumping around. Symptoms also sometimes can be improved if the affected area is rubbed or stretched. PLMD commonly co-occurs with RLS but also may appear independently. PLMS are brief repetitive movements or jerks, lasting on average 2 seconds and occurring every 5 to 90 seconds during stages 1 and 2 of sleep [17,46]. PLMD occurs when PLMS are associated with frequent, but brief, arousals from sleep.

Pharmacologic treatment for RLS and PLMD in children and adolescents may include benzodiazepine and dopaminergic medications, although these medications have not been studied adequately in these age groups. In addition, some children who have RLS or PLMD have low iron/ferritin and many of these children and adolescents respond favorably to iron therapy [47]. At this time, there are no FDA-approved medications available to treat RLS and PLMD in children.

Sleep-Related Rhythmic Movement Disorders

Sleep-related RMD include head banging and body rocking and are considered to be a sleep-wake transition disorder, occurring as children attempt to fall asleep at bedtime, naptime, or after a normal nighttime arousal [17,48]. The etiology for RMD is unknown and, although they are common in infants (60% of 9 month olds), the behaviors tend to resolve spontaneously with development (only 8% of 4 year olds demonstrate these behaviors), but they can continue into adolescence and adulthood [49]. Events typically last 5 to 15 minutes, but prolonged events can go for several hours. The rhythmic behaviors generally are benign and self-limiting in normal children, with children rocking side to side, rocking back and forth while elevated on all four limbs, or banging their head against the pillow.

It is important to ensure that children are safe and protected from injury when they engage in these behaviors, and although treatments for this disorder are suggested, most are supported only anecdotally. In cases that result in injury, or when the behavior may be highly disruptive to others for a short duration (eg, family vacation or overnight sleepover), benzodiazepines may be indicated. For more severe cases or when the behavior persists past the age of 3 years, however, a thorough psychiatric and neurologic evaluation is recommended to rule out other disorders, such as autism, pervasive developmental disorder, or hypnogenic dystonia.

EVALUATION OF SLEEP PATTERNS AND SLEEP DISORDERS IN CHILDREN AND ADOLESCENTS

Unlike the evaluation of sleep problems in adults, information about a child’s sleep and functioning most likely is presented by a parent or other primary
caregiver. Although in general the sleep history is similar to that of adults (e.g., sleep patterns and daytime functioning), the social and environmental context of a child’s daily life also needs to be considered. This context includes the impact of the child’s sleep problems on the family, including parent sleep and functioning, and the effects on other siblings in the home. The psychosocial history needs to include questions about parental marital status and living arrangements, as children’s sleep patterns are influenced greatly by their environment and inconsistencies in parenting practices or sleeping environments also can disrupt sleep. Finally, daytime sleepiness can present differently across the lifespan, with young children getting more active and seemingly energetic when they get sleepy, while older children and adolescents become moody and more fatigued.

A thorough sleep history should cover all areas of a child’s sleep habits, keeping in mind that sleep patterns can differ significantly from weekdays to weekends and from school days to summer vacation and holidays. Starting with bedtime behavior, it is important to assess children’s evening routine, bedtime, sleep environment (e.g., cosleeping, shared room or bed, or television in the bedroom), behavior at bedtime (e.g., bedtime stalling, bedtime refusal, or difficulties falling asleep independently), and sleep-onset latency. Nocturnal behaviors should be discussed, including night wakings, symptoms of SDB (e.g., snoring or pauses in breathing), sleep terrors or sleepwalking, seizures, and enuresis. Daytime behaviors also should be reviewed, including children’s morning wake time (and difficulty waking in the morning), daytime sleepiness, fatigue, naps, meals, and caffeine or energy drink consumption.

Additional information about daytime functioning also is needed, including mood, school performance, social interactions, and significant life events. Children and adolescents are greatly affected by their day-to-day environment, including home and school, and changes or stressors in either area may affect children’s sleep quality and sleep quantity. Events that may have an impact on children’s sleep include the death of a family member, social and peer pressure, the birth of a new sibling, a recent move, or marital discord between the parents. In particular, children who “worry” more than their peers are at risk for difficulties with sleep onset and prolonged night wakings because of rumination over social interactions, academic expectations, family problems, or even current events (e.g., September 11th, Hurricane Katrina, or the war in Iraq).

Along with a detailed sleep history, sleep diaries provide a wealth of information about children’s sleep patterns. If completed on a daily basis, diaries can provide information about the consistency of a child’s bedtime, duration of sleep onset, occurrence of night wakings, and whether or not the child over sleeps on weekends and holiday mornings. In addition, the timing, frequency, and duration of naps can provide additional information about why a child may have difficulty falling asleep at a given bedtime.

Objective measures of sleep include actigraphy and PSG. An actigraph is a small device the size of a watch worn on a child’s wrist or ankle that measures
sleep-wake patterns for extended periods of time (eg, 3 days to 2 weeks). By measuring children’s movements and activity levels, a clearer picture of their bedtime, wake time, night wakings, and naps can be provided (Figs. 1 and 2). The strength of actigraphy is that it can be collected easily for an extended period of time in children’s natural sleeping environment. The two primary clinical limitations for using actigraphy are the need for an accurate sleep diary to interpret actigraphy patterns and the inability of actigraphy to provide information on sleep architecture or underlying sleep disruptors (eg, SDB or periodic movements during sleep).

PSG is considered the gold standard for assessing sleep stages and underlying sleep disruptors, such as OSA and PLMD. As with adults, the MSLT is used in combination with an overnight PSG for the diagnosis of narcolepsy, although normative values for children and adolescents differ by Tanner stage [37]. Although PSG can be conducted in the home, it is done more commonly in a laboratory where the child stays overnight. Many physiologic measures are recorded (eg, electroencephalogram [EEG], electromyogram, electro-oculogram, EKG, and oxygen saturation), providing information about the quantity and quality of children’s sleep. PSG has several drawbacks, including cost and availability. In addition, PSG is only a single night measure, which does not provide information about sleep patterns over time. In addition, there is some concern about children’s ability to sleep comfortably in a strange environment (in particular young children). Finally, as discussed, PSG is expensive, and laboratories that are child friendly, with appropriately trained technicians, are limited.

Fig. 1. Actigraph printout of consistent sleep onset and offset.
Sleep difficulties are common in many different populations of children, including children and adolescents who have developmental disabilities, chronic health conditions, and psychiatric disorders. The three groups of children who have persistent sleep problems seen most commonly in psychiatric practice are children who have ADHD, autism, and mood/anxiety disorders [50]. The following is a brief review of the complex relationship between sleep and these disorders in children and adolescents.

**Attention-Deficit/Hyperactivity Disorder**
Sleep problems are common in children who have ADHD, affecting approximately 25% to 50% of children who have this diagnosis [51]. Sleep clearly has been shown to differ between children who have and who do not have ADHD. Using parent report, actigraphy, and PSG, children who have ADHD have been found to have greater variability in their sleep patterns, greater difficulty with sleep onset, more activity during sleep, restless sleep and poor sleep quality, shortened sleep duration, and daytime sleepiness. Further, medications used to treat ADHD (eg, stimulants) can prolong sleep-onset latency and result in poorer sleep quality. These studies suggest that ADHD disrupts a child’s sleep significantly.

The relationship between sleep problems and ADHD, however, is complex and bidirectional [52]. Although children who have ADHD have greater difficulties with sleep, children who have SDB display an increase in daytime behavior symptoms that mimic ADHD or exacerbate underlying ADHD.
symptoms. In studies of children who have SDB, including snoring and OSAS, an increase in hyperactivity, inattentive behaviors, poor emotion regulation, and peer problems is found [28,33,53]. When these sleep disorders were treated, many of the ADHD symptoms also resolved [54,55]. Finally, higher rates of RLS/PLMD are found in children who have ADHD compared with children who do not have ADHD [56,57]. When the PLMD was treated with dopamine agonists, sleep quality, sleep quantity, and ADHD symptoms that previously were resistant to psychostimulants improved [58]. More research is needed to help elucidate the relationship between sleep and ADHD in children and adolescents, but this population is at risk for increased sleep difficulties that should be evaluated and treated when appropriate.

**Autism Spectrum Disorders**

Sleep problems commonly are reported in children who have autism spectrum disorders (ASDs), affecting 44% to 83% of children who have ASDs [59–61]. The sleep problems reported most commonly include prolonged sleep onset, frequent and prolonged night wakings, early morning wakings, and shorter total sleep time, with differences reported by parent questionnaires and actigraphy [61–64]. The etiology of sleep problems in children who have ASDs is unclear, although suggested causes include alterations in the timing of melatonin production, anxiety, abnormal sleep EEG, or brain pathology.

Although knowledge is limited by the few studies conducted, sleep problems in children who have ASDs seem to be related to daytime functioning. In particular, sleep problems have been shown to be related to more energetic, excited, and problematic daytime behaviors [59]. In addition, shorter total sleep time is related to social skills deficits and increased stereotypic behaviors in children who have ASDs [65]. Behavioral interventions have been used, although with limited to moderate success. Pediatric sleep specialists agree that children who have ASDs have a lower response rate to behavioral interventions for sleep problems, and this population recently was identified as the highest priority in terms of clinical trials for the pharmacologic management of pediatric sleep problems [66].

**Depression and Anxiety**

As with ADHD, the relationship between mood/anxiety disorders and sleep is complex and bidirectional. Sleep disturbances (eg, hypersomnia or insomnia) are a symptom of anxiety and depression; at the same time, the consequences of disrupted or insufficient sleep often exacerbate these disorders. Ninety percent of children who have major depressive disorder report sleep disturbances, with insomnia or difficulty initiating sleep the most common complaint [67,68]. Hypersomnolence, or sleeping too much, also is a common complaint in depressed adolescents [69]. These typically are subjective reports, however, as objective measures of sleep do not always capture these sleep disturbances. Sleep complaints also are common in children who have anxiety disorders. Along with generalized anxiety, children who experience severe stress reactions,
adjustment disorders, fears and phobias, or separation anxiety also experience increased difficulties with sleep.

As sleep disturbances and mood/anxiety disorders often are comorbid complaints, the most effective treatment is a multimodal integrated approach that addresses both the sleep difficulties and the mood/anxiety problems [68]. When treating mood/anxiety disorders pharmacologically, it is important to consider the impact of the medication on a child or adolescent’s sleep, especially as some antidepressants may exacerbate sleep problems. Having a clear and consistent sleep routine and schedule helps ensure that children or adolescent’s are getting sufficient sleep. Relaxation strategies (eg, diaphragmatic breathing or imagery) also may be used to improve sleep-onset latency and decrease bedtime fears and worries. Finally, the inclusion of a cognitive component (eg, positive self-statements or restructuring sleep-onset expectations) also can be highly effective in addressing sleep disturbances and mood/anxiety disorder.

SUMMARY

Sleep disturbances are common in children and range from behaviorally based sleep disorders, including behavioral insomnia of childhood and DSPS, to physiologically based sleep disorders, including OSAS, narcolepsy, RLS, and PLMD. Given that children and adolescents who have psychiatric issues commonly experience sleep disorders, it is critical that child psychiatrists conduct a thorough sleep assessment on all patients. Furthermore, not only are sleep disorders frequently comorbid with psychiatric illness but, in many cases, contribute significantly to daytime symptoms and daytime functioning.

References


