SLEEP DISORDERS IN CHILDREN AND ADOLESCENTS

A PRACTICAL GUIDE

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Bernardo Strozzi: Sleeping Child. Residenzgalerie, Salzburg (Wikipaintings)

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More than 2000 years ago, sleep was defined by the Roman poet and philosopher Lucretius as the "absence of wakefulness" (Chokroverty, 2009). The notion of sleep as a state characterized by a suspension of voluntary functions continued to be predominant until the 19th century. Current sleep medicine conceptualizes sleep not as a simple absence of wakefulness and perception or a suspension of sensorial processes but the result of a combination of a passive withdrawal of afferent stimuli to the brain and functional activation of certain neurons in specific brain areas. As such, sleep is considered an active rather than a passive process. Despite remarkable progress in the field of sleep medicine in the past century, the answer to the question: why do we sleep? remains elusive. However, a large amount of empirical evidence shows that alterations in sleep quantity or quality do impact on cognitive, affective and, more generally, psychological functions. Therefore, an understanding of a patient's health includes consideration of the state of the patient asleep as well as awake.

The present chapter is intended as a practical guide to help clinicians recognize, diagnose and manage the more common sleep disturbances in children and adolescents according to available empirical evidence or clinical experience rather than as an overview of the science of pediatric sleep medicine. Nonetheless, before discussing the presentation and management of the most relevant sleep disorders in children, we will provide an introduction to the basic principles of sleep and sleep medicine to better understand disorders of sleep. Finally, given the international readership to which this chapter is addressed, we will discuss some issues pertaining to pediatric sleep medicine in low- and middle-income countries.

NORMAL SLEEP IN CHILDREN AND ADOLESCENTS

Definition of sleep

The state of sleep (and wakefulness) can be defined based on behavioral as well as physiological criteria. The former include posture, mobility, response to stimulation, level of alertness, eyelids, and eye movement (Table I.4.1). The latter are based on parameters from electroencephalography (EEG), electromiography (EMG) to assess muscle tone, and electro-oculography, to record eye movements (Table I.4.2).

Basic neurophysiologic aspects

Based on EEG, EMG and electro-oculography patterns, four types (or stages) of sleep can be identified (Table I.4.3 and Figure I.4.1). In an individual without sleep abnormalities, non-rapid eye movement (NREM) and rapid eye movement (REM) phases alternate in a cyclic manner, each cycle lasting on average from 90 to 110 minutes. During a normal sleep period in adults, 4–6 such cycles are noted (Figure I.4.2). It is important to be aware of this alternation because certain abnormal motor activities are characteristically associated with NREM or REM stages.

The term *sleep macro-architecture* refers to the description of sleep in terms of sleep states (wakefulness *vs*. sleep) and stages, sleep cycles (NREM/REM), sleep

Table I.4.1 Behavioral criteria for wakefulness and sleep*

Criteria	Non-rapid eye movement (NREM) sleep	Rapid eye movement (REM) sleep
Posture	• Recumbent	• Recumbent
Mobility	• Slightly reduced or immobile	• Moderately reduced or immobile • Myoclonic jerks may be present
Response to stimulation	• Mildly to moderately reduced	• Moderately reduced or no response
Level of alertness	• Unconscious (reversible)	• Unconscious (reversible)
Eyelids	• Closed	• Closed

*Adapted from Chokroverty (2009)

latency (defined as time to the first sleep stage) and sleep efficiency (defined as sleep time divided by total time in bed).

Sleep micro-structure includes more 'subtle' phenomena such as:

- Arousals (transient events resulting in fragmented sleep without behavioral awakening)
- Cyclic alternating pattern (an endogenous rhythm present in NREM sleep characterized by a periodic EEG activity with sequences of transient electrocortical activations [phase A of the cycle] that are distinct from background EEG activity [phase B of the cycle] allowing quantification of the oscillating arousability)
- Sleep spindles (bursts of brain waves of 12-14 Hz, during stage 2), and
- K complexes (brief negative high-voltage peak, followed by a positive complex and a final negative peak) (Figure I.4.3).

Table I.4.2 Physiologic criteria for wakefulness and sleep*

Criteria	Non-rapid eye movement (NREM) sleep	Rapid eye movement (REM) sleep
Electroencephalography	• Synchronized	• Theta or saw-tooth waves • Desynchronized
Electromiography (muscle tone)	• Mildly reduced	• Moderately to severely reduced or may be absent
Electro-oculography	• Slow rolling eye movements	• Rapid eye movements

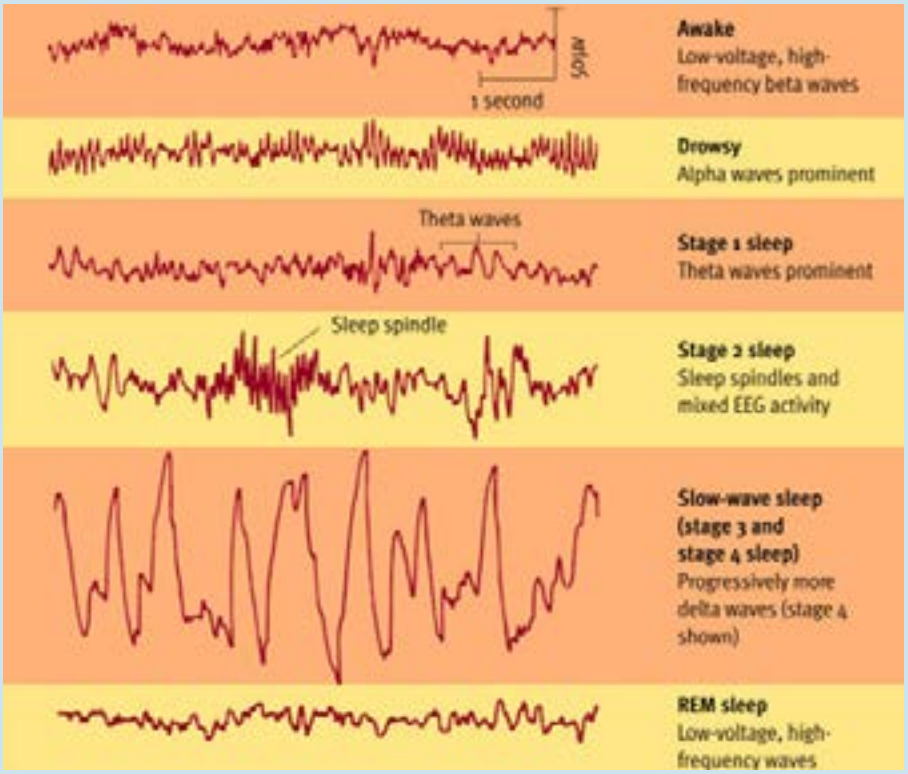
*Adapted from Chokroverty (2009).

In 1913, French Scientist Henri Pieron (see image) authored a book entitled *Le Probleme Physiologique du Sommeil*, which was the first text to examine sleep from a physiological perspective. This work is usually regarded as the beginning of the modern approach to sleep research. Dr Nathaniel Kleitman, now known as the "Father of American sleep research," began work in Chicago in the 1920s questioning the regulation of sleep and wakefulness and of circadian rhythms. Kleitman's crucial work included studies of sleep characteristics in different populations and the effect of sleep deprivation. In 1953 he and one of his students, Dr Eugene Aserinsky, made the landmark discovery of rapid eye movement (REM) during sleep.

Another of Kleitman's students, Dr William C Dement, extended Dr Kleitman's path of research. Dement described the "cyclical" nature of nocturnal sleep in 1955, and in 1957 and '58 established the relationship between REM sleep and dreaming. In 1958, Dement published a paper on the existence of a cyclic organization of sleep in cats. This finding (sleep cycles in species other than humans) created an explosion of fundamental research that pulled together researchers from many different fields (electro-physiology, pharmacology, biochemistry) for the next 20 years.

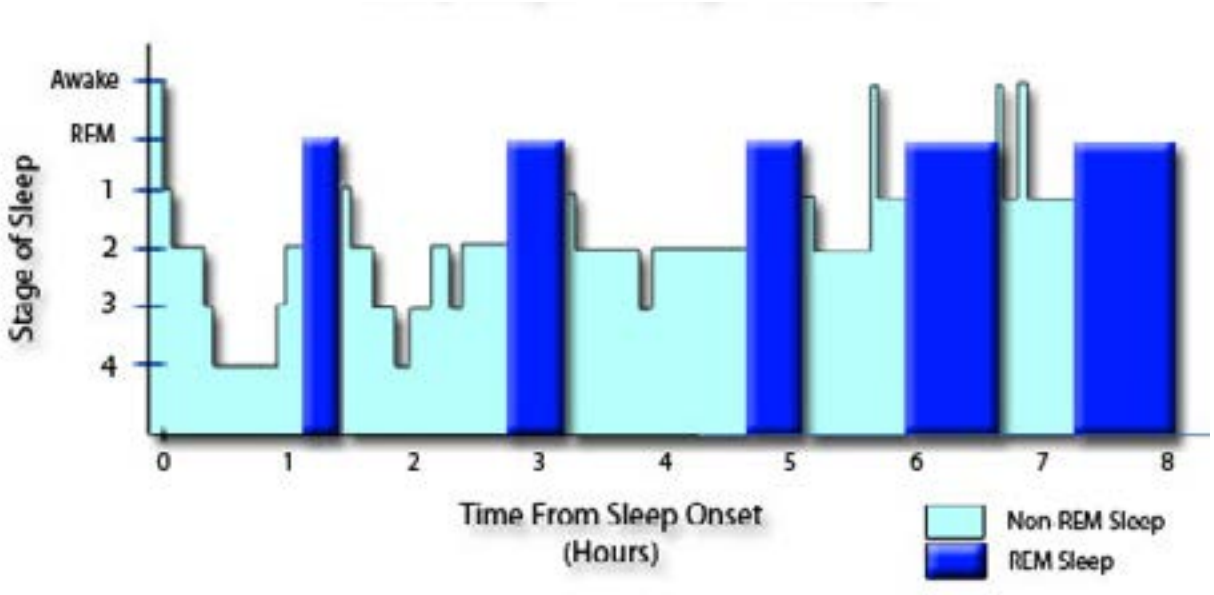
Source http://www.stanford.edu/~dement/history.html

Figure I.4.1 Sleep stages in electroencephalogram*



*From http://siobhancallaghan.files.wordpress.com/2012/01/101-sleep-stages.jpg

Figure I.4.2 Sleep stages based on neurophysiologic factors*



*http://www.end-your-sleep-deprivation.com/stages-of-sleep.html

Developmental aspects of sleep

Several normative changes in sleep macro- and micro-structure occur during development. In general, sleep requirements decrease from the newborn (about 16 h/day of sleep) to the young child (3-5 years old: 11 h/day), to the older child (10-11 years old: 10 h/day), to the adult (7.5-8 h/day). Sleep cycles last about 45 minutes in young children, 60 minutes in 9-year-olds, and 90-110 minutes after the age of 10 (as in adults). The percentage of REM and NREM sleep are approximately the same in the newborn; there is then a progressive decrease in the percentage of REM sleep as we grow older. Spindles and K complex are fully formed by the age of 3 and 6 months, respectively. For an example of REM sleep in a polysomnogram, see Figure I.4.4.

HEALTHY SLEEP PRACTICES OR 'SLEEP HYGIENE'

Healthy sleep practices, commonly referred to as *good sleep hygiene*, include modifiable daytime, bedtime, and nighttime practices that positively impact on sleep initiation, maintenance, quantity, quality, and sleep environment (Tables I.4.4 and I.4.5). Recommendations for healthy sleep usually include guidance across a wide range of activities such as adoption of a bedtime routine, consistent bedtime and wake time, a quiet, dark and cool bedroom, avoidance of caffeinated products, and daily physical activities. Healthy sleep practices are also a fundamental component of sleep education designed to prevent sleep problems from developing (primary prevention), to address poor sleep quality (secondary prevention), and to treat existing sleep disorders. Education about sleep hygiene is a standard component of treatment for typically developing children with sleep problems as well as for those with chronic medical conditions and psychiatric disorders.

Table I.4.3 Sleep stages

Stage	EEG	EMG	Electro-oculogram	% of total sleep duration (in adults)
NREM stage N1	Low amplitude, mixed frequency; theta rhythm (4-7 Hz), with vertex sharp waves (biphasic waves, ≤ 0.5 sec.)	Slight decrease in tonic muscle activity	Slow eye movements	3-8
NREM stage N2	Low-voltage activity with sleep spindles (11-16 Hz) and K-complexes (biphasic waves ≥ 0.5 sec.)	Further decrease in muscle activity	No eye movements	45-55
NREM stage N3 *(or slow wave)*	High-amplitude (≥ 75 µV), slow (≤ 2 Hz) waves lasting ≥ 20% of the epoch	Low tonic activity	No eye movements	15-20
REM sleep	Low-voltage, saw-tooth waves (2-6 Hz), predominant theta activity	Muscle atonia (phasic twitches may be present)	Rapid-eye movements	20-25

EEG: electroencephalography; EMG: electromiography; REM: rapid eye movement sleep; NREM: non-rapid eye movement sleep.

Figure I.4.3 Sleep spindle and K complex

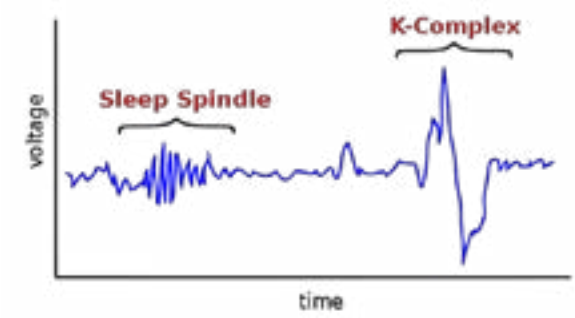
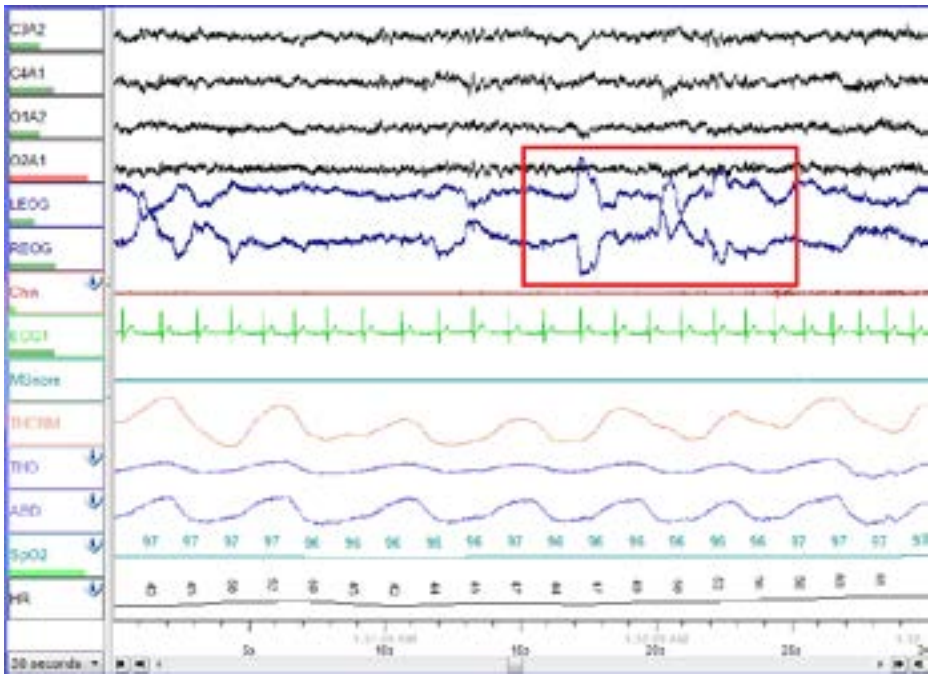


Figure I.4.4 Polysomnogram of a person in REM sleep. Eye movements highlighted by red box.*



*http://en.wikipedia.org/wiki/Sleep

Healthy sleep practices are potential mediating factors between biological sleep needs and environmental circumstances which facilitate or impede sleep. For example, one of the most important elements of a healthy sleep practice is a regular sleep and wake schedule. A consistent bedtime and wake time helps to reinforce circadian rhythms and optimize the *sleep drive*, processes which are instrumental in regulating healthy sleep-wake cycles. Because a child must be awake long enough during the day—and thus build up a sufficient sleep drive in order to feel sleepy at bedtime— sleeping in on weekends often creates a situation in which it becomes more difficult to initiate sleep the following night.

Another important aspect of healthy sleep practices involves ensuring adequate opportunity for sleep. While there is some variability in sleep needs across individuals, guidelines exist for recommended sleep amounts in children across different ages (Table I.4.5). When assessing individual sleep needs, it is important to also educate parents about clues which suggest that a child is not

Sleep drive, sleep homeostasis and regulation

Sleep drive refers to the need to sleep that gradually builds up with prolonged wakefulness and is related to sleep homeostasis—the property of a system to keep its internal environment stable. Homeostatic sleep/wake regulation refers to the capability of the brain to compensate for transient sleep loss by increases in sleep duration and sleep intensity.

The two-process model of sleep/wake regulation assumes two independent but interacting processes, a circadian process (process C) and a homeostatic process (process S) that equally participate in the regulation of sleep. Process C determines the circadian variation of a wake signal independent from prior wake time. Process S can be considered as drive for sleep that is proportional to prior wake time. Process S is low in the morning after awakening from sleep and steadily increases with the time spent awake. Once sleep debts have accumulated, sleep only occurs if the circadian propensity for sleep is appropriate, i.e., if the circadian process opens a 'sleep window' during which the possibility to fall asleep increases.

Table I.4.4 Healthy sleep practices*

Recommended	Not recommended
• Going to bed about the same time every night • Going to bed in the same place • Sleeping alone • No caffeine and naps 4 hours before bedtime • A calming bedtime routine • Relaxing activities before bedtime • Geting out of bed about the same time every morning	• Drinking lots of liquids before bedtime • Doing things that are stimulating before bedtime • Using the bed for activities other than sleep • Putting the child to bed after falling asleep elsewhere • Staying up past usual bedtime

*Selected items adapted from the Children's Sleep Hygiene Scale (CSHQ); modified from Harsh et al (2002)

Table I.4.5 Recommended sleep amounts in children and adolescents*

Age	Hours
Newborns (0-2 months)	12-18
Infants (3-11 months)	14-15
Toddlers (1-3 years)	12-14
Preschoolers (3-5 years)	11-13
School-age children (6-10 years)	10-11
Teens (10-17 years)	8.5-9.25

*From the National sleep Foundation
http://www.sleepfoundation.org

getting sufficient sleep (e.g., the child sleeps longer on weekends and during school vacations, is difficult to wake in the morning or dozes off during the day).

ASSESSMENT OF SLEEP IN CHILDREN AND ADOLESCENTS

The assessment of sleep and sleep disturbances in children (as well as in adults) is performed by means of subjective (i.e., based on information reported by the child and/or parents) or, when needed, objective tools (i.e., neurophysiological). Subjective assessment relies either on unstructured questions that explore the most relevant sleep-related behaviors (see Table I.4.6) or structured questionnaires, such as the Sleep Disturbances Scale for Children, the Child Sleep Questionnaire, and the Children's Sleep habits Questionnaire. A quick memory aid to assess sleep is known as BEARS, which provides a comprehensive screening tool for sleep disorders in children (Table I.4.7).

In order to assess sleep patterns over time, especially if sleep complaints are found during the interview, the clinician may also ask the child or parents (depending on the child's age and ability level) to complete a sleep diary. Parents, and children if appropriate, are asked to write details about what time the child goes to bed, how long does it take to fall asleep, the frequency and duration of nighttime awakenings, the timing and duration of daily naps, the time of waking up in the morning, and the total duration of sleep. A graphic sleep diary is preferable to information in written format. Free graphic sleep diaries are available from the US National Sleep Foundation (Figure I.4.5).

Table I.4.6 Subjective sleep parameters

Parameter	Description
Bedtime resistance	Behaviors such as the child refusing to get ready for bed, refusing to remain in the bed, or requiring a parent to be present at bedtime. These are often called limit setting sleep disorders, which are often the result of parental difficulties in setting limits and managing the child's behavior.
Sleep onset difficulties	Difficulty with falling asleep (within 20 minutes after going to bed, according to some authors). Factors that may contribute to sleep onset difficulties include psychiatric conditions (e.g., mood disorders), poor sleep hygiene, or objective sleep disorders (e.g., restless legs syndrome).
Night awakenings	Night wakings that require parental intervention for the child to return to sleep are often related to inappropriate sleep onset associations (conditions the child learns to need in order to fall back to sleep): e.g., prolonged night awakenings may occur when a child gets used to falling sleep in circumstances that are not readily available during the night, such as having a parent present.
Sleep duration	Duration of total sleep, as perceived by the parent or the child. Sleep duration is variously defined as the time asleep at night, or as time asleep plus time in bed awake at night, or as the total time asleep across 24 h.
Difficulties with morning awakenings	Behaviors such as the child refusing to wake up by himself or difficulties getting out of bed in the morning. They may be the consequence of inadequate sleep or the result of parental difficulties in setting limits and managing behavior.
Daytime sleepiness	It is characterized by persistent tiredness and lack of energy with a tendency to fall asleep during the day. Causes of daytime sleepiness include: • Sleep deprivation • Underlying conditions that disrupt sleep (e.g., obstructive sleep apnea, restless legs syndrome, and periodic limb movements in sleep) • Psychiatric disorders (e.g., mood disorders) • Neurologic causes (e.g., post-traumatic hypersomnia) • Excessive daytime sleepiness with an irresistible urge to fall asleep is the hallmark of narcolepsy.
Sleep disordered breathing	A clinical spectrum that includes: • Primary snoring • Upper airway resistance syndrome (characterized by snoring and increased respiratory effort) • Partial obstructive hypoventilation hypopneas (characterized by snoring, increased respiratory effort, and arousals), and • Obstructive sleep apnea (characterized by snoring, apneic pauses, and arousals) • The diagnosis of sleep disordered breathing requires a polysomnographic recording. Parents may report some of the associated symptoms (e.g. snoring, pauses in breathing, etc.).
Restless sleep	Sleep characterized by excessive movements of some parts of the body or the whole body.
Parasomnias	Parasomnias are undesirable physical events or experiences that occur during entry into sleep, within sleep, or during arousal from sleep. They include: • Sleepwalking • Sleep terrors • Nightmare disorder • Nocturnal enuresis • Sleep-related groaning etc.

Table I.4.7 BEARS: memory aid to evaluate sleep problems*

	Toddler / pre-schooler (questions to parent)	School-aged (questions to parent)	Adolescent (questions to adolescent)
B edtime problems	• Problems going to bed or falling asleep?	• Problems at bedtime?	• Problems falling asleep at bedtime?
E xcessive daytime sleepiness	• Naps or seem over-tired or sleepy a lot during the day?	• Difficulty waking in the morning, feels sleepy during the day or takes naps?	• Very sleepy during the day? At school? While driving?
A wakenings	• Wakes up a lot at night?	• Wakes up a lot at night or has 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 in school days? • Weekends? • Is this is enough sleep?	• What time do you usually go to bed on school nights? • Weekends? • How much sleep do you usually get?
S noring	• Snores a lot or has difficulty breathing at night?	• Snores loudly or has breathing difficulties at night?	• Snores loudly? (question to parent)

*Adapted from Mindell & Owens (2010)

Objective tools, described in Table I.4.8, are needed to diagnose some sleep disorders. These include:

- Polysomnography
- Actigraphy
- Multiple sleep latency test, and
- Infrared video camera.

Most mental health professionals would not use these tools in their practice but should be aware of them and of when to refer their patients to a specialist for objective sleep assessment. Table I.4.8 summarizes the main objective sleep parameters.

CLASSIFICTION OF SLEEP DISORDERS IN CHILDREN AND ADOLESCENTS

The International Classification of Diseases (ICD), 10th edition and the Diagnostic and Statistical Manual of Mental Disorders, DSM-5 (American Psychiatric Association, 2013) do not specifically classify sleep disorders in childhood. Rather, they lump children and adults together, although in some instances developmental features of particular sleep disorders are specified. Sleep disorders included in DSM-5 are reported in Table I.4.10. DSM-5 underscores

Figure I.4.5 Click on the image to access the National Sleep Foundation sleep diary

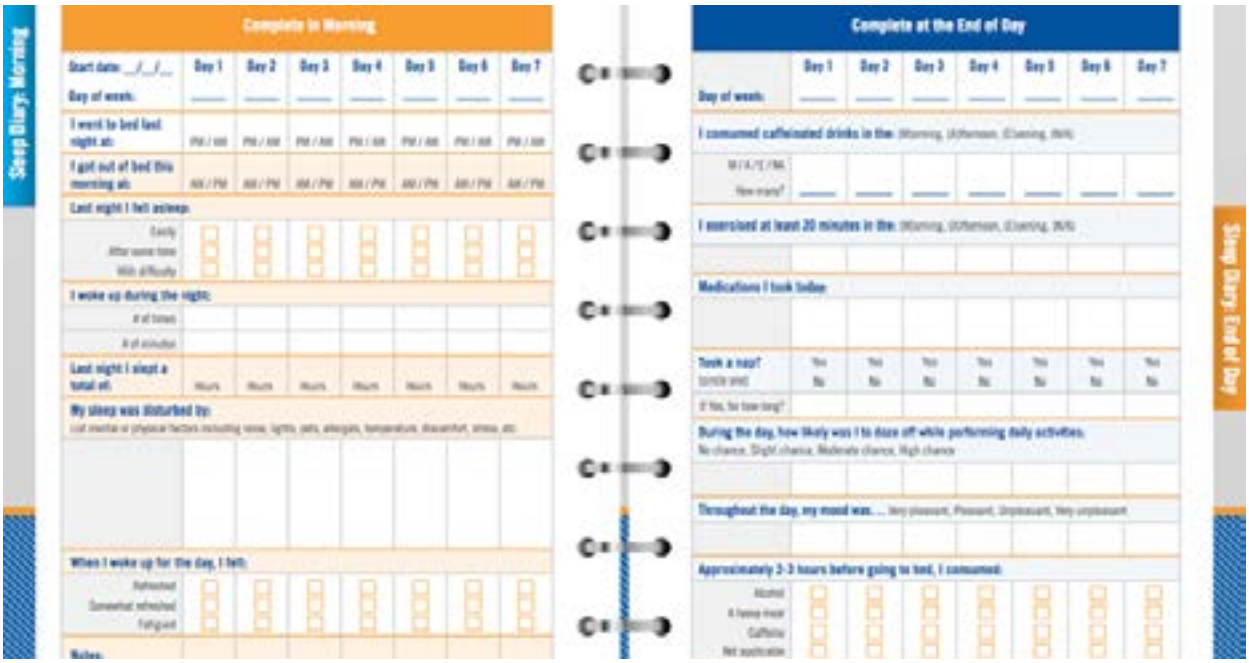


Table I.4.8 Objective tools used to study sleep

Polysomnography	Recording physiologic parameters during sleep including: • Brain electrical activity (EEG) • Eye and jaw muscle movement • Leg muscle movement • Airflow • Chest and abdominal excursion • Oxygen saturation • Electrocardiogram
Actigraphy	Monitoring cycles of physical activity and rest by means of an actimetry sensor (a wrist-watch-like device worn on the wrist or ankle that continually records movement). Sleep parameters (sleep/wake periods, total duration of sleep, number of arousals, and length of sleep onset) are inferred by the patterns of rest/movement.
Multiple sleep latency test	It consists of four or five 20-30 minute opportunities to have a nap given at 2-hour intervals during the day. The basic parameters measured are latency to sleep onset and latency to REM sleep on the polysomnographic recording. The multiple sleep latency test measures an individual's level of daytime sleepiness
Infrared video camera	To monitor body movements during sleep in the dark

Table I.4.9 Objective sleep parameters.

Sleep onset latency evaluated with polysomnography	The time in minutes from lights-off to the first occurrence of stage 2 sleep
Number of stage shifts in total sleep time	Number of shifts from one sleep stage to another during the total sleep time
Percentage of stage 1	Percentage of stage 1 sleep in total sleep time (equals total sleep episode less awake time)
Percentage of stage 2	Percentage of stage 2 sleep in total sleep time
Percentage of slow-wave sleep	Percentage of stage 3 in total sleep time
REM sleep latency	The time from sleep onset to the first occurrence of REM sleep lasting longer than 2 minutes
Percentage of REM sleep	Percentage of REM sleep in total sleep time
Sleep efficiency assessed with polysomnography	Ratio of total sleep time, assessed with polysomnography, to nocturnal time in bed
Average times to fall asleep at multiple sleep latency test	Means of average times on all multiple sleep latency test naps (opportunities to fall asleep). The lower it is, the higher the sleepiness during daytime
Apnea-hypopnea index	The number of apnea and hypopnea episodes per hour (apnea is defined as a cessation of airflow for at least 10 seconds; hypopnea is defined as a 50% reduction in airflow [measured with a valid technique] or a reduction in airflow associated with a 3% fall in arterial oxygen saturation or an arousal)

Child sleeping with an ambulatory cardiorespiratory monitoring

Table I.4.10 Main sleep-wake disorders according to DSM-5*

Diagnosis	Brief description
Insomnia disorder	Inadequate quantity or quality of sleep
Hypersomnolence disorder	Excessive daytime sleepiness
Narcolepsy	Periods of extreme daytime sleepiness, often accompanied by loss of muscle tone
Obstructive sleep apnea hypopnea	Blood oxygen desaturation due to respiratory obstruction during sleep
Circadian rhythm sleep-wake disorders	Disruption of alignment between the endogenous and exogenous rhythm of sleep/wake
Parasomnias	Non-epileptic paroxysmal events during sleep
Non-rapid eye movement sleep arousal disorders	Sleepwalking and sleep terrors
Nightmare disorders	Nightmares
Rapid eye movement sleep behavior disorder	Repeated episodes of arousal associated with vocalizations and movements such as jumping or kicking (dream-enacting behaviors). Rarely seen in children
Restless legs syndrome	Urge to move the legs or other body parts accompanied by uncomfortable sensations

*American Psychiatric Association (2013)

the need to treat a sleep disorder regardless of whether other comorbid mental or medical problems present. Since it is impractical to present the diagnostic work-up and the management of each disorder, we will focus on the most common and relevant in clinical practice with children and adolescents.

SPECIFIC SLEEP DISORDERS

Insomnia

Insomnia is "a persistent difficulty with sleep initiation, duration, consolidation, or quality that occurs despite adequate opportunity and circumstances for sleep, and results in some form of daytime impairment" (American Academy of Sleep Medicine, 2014). DSM-5 integrates pediatric and developmental criteria and replaces *primary insomnia* with the diagnosis of *insomnia disorder*, to avoid the primary/secondary distinction when this disorder co-occurs with other conditions. DSM-5 introduced a duration criterion (more than 3 'bad nights' per week for the last 3 months).

Prevalence of pediatric insomnia is estimated at about 1% to 6% in general pediatric populations, with a much higher prevalence in children with neurodevelopmental and chronic medical and psychiatric conditions (Owens & Mindell, 2011). When bedtime resistance and disruptive nighttime awakenings are included, the prevalence of sleep-disrupted behavior approaches 25% to 50% in preschool children (Owens & Mindell, 2011). Conversely, psychiatric symptoms

have been reported in almost 50% of children with persistent insomnia. It has been proposed that persistent insomnia may also represent an early sign of emotional distress in susceptible children with poor sleep homeostasis (Ivanenko et al, 2004).

The term *behavioral insomnia of childhood* (see Table I.4.11) refers to sleep difficulties that result from inappropriate sleep associations or inadequate parental limit setting. The diagnosis of sleep-onset behavioral insomnia relies on the presence of maladaptive and inappropriate sleep associations such as rocking, watching television, and falling asleep in the parents' bed. The child is usually unable to fall asleep in the absence of these conditions at both bedtime and on waking up during the night. Inadequate parental limit setting can also result in a form of behavioral insomnia characterized by a delay in sleep onset secondary to a child's refusing to go to bed or stalling.

Controlled crying

Randomized trials have demonstrated the short- to medium-term effectiveness of behavioral infant sleep interventions (also known as 'controlled crying' or 'controlled comforting'). Controlled comforting is a behavioural strategy for dealing with persistent settling and waking problems in young children. The aim is to help children learn how to settle themselves to sleep, rather than parents feeding, patting or cuddling them to sleep. It involves brief checks and reassurance of babies while they are learning to settle.

There have been concerns that these techniques may harm children's emotional development and subsequent mental health. A 5-year follow up study of children with sleep problems at 7 months found that behavioral sleep techniques had no long-lasting effects (positive or negative) on them by age 6. The authors concluded that parents and health professionals can confidently use these techniques to reduce the short- to medium-term burden of infant sleep problems and maternal depression (Price et al, 2012).

How to implement controlled crying/comforting*

- Establish a consistent bedtime routine.
- When it's time to say goodnight, put your baby in his cot and tuck him in. Either talk to and/or pat your baby until he's quiet, or for one minute.
- As soon as your baby is quiet, or after one minute, say goodnight and leave the room. Leave before your baby is asleep.
- Stay out of the bedroom and give your baby a chance to settle by himself. Ignore grizzling.
- If your baby starts to really cry, wait for the set amount of time before going back to your baby (for example, two minutes at first).
- Leave your baby for a sequence of set time intervals (for example, 2, 4, 6, 8 and 10 minutes, or 5, 10 and 15 minutes). Set your own intervals of time based on how long you think you can manage.
- After each time interval has passed, return briefly to your baby if he's still crying. Talk to your baby or pat him for one minute, or continue talking or patting until he's quiet (depending on your preference). Try to soothe him without picking him up if you can.
- Keep an eye on his nappy. If it's soiled, change him under low light and with minimal fuss.
- As soon as he's quiet (or after one minute), but before he's asleep, leave the room again and wait for the next set time interval. What you're trying to do here is give him the opportunity to learn to go to sleep by himself.
- This process is continued until your baby falls asleep by himself.
- When your baby wakes overnight, follow the same routine.

Important points about controlled comforting

- Controlled comforting takes between three and 14 days to work.
- Use a clock to time intervals – four minutes can seem like a very long time.
- Turn off all baby monitors.
- Don't wait outside your baby's bedroom. Go into another room and distract yourself, perhaps making a cup of tea and turning on the TV. Only go back to check on your baby when the set time is up.
- Talk to your partner first to make sure that you both agree with what's going on. Work out what role each of you will play (for example, helping with resettling or timing the intervals). Consider taking turns each night.
- Avoid important commitments for the first few days after you start controlled comforting. You need to be able to see it through without a major change to the baby's routine.
- Remember to leave your baby's room before she falls asleep.

*Reproduced from Raising Children Network

Table I.4.11 Behavioral insomnia of childhood*

Disorder	Typical age of onset	Characteristics
Association type	From 6 months of age	The child requires a specific stimulus (for example parental presence or feeding) to initiate sleep and at times of night waking
Limit setting type	From 18 months of age	The child has difficulty establishing limits, including bedtime routines and sleep onset
Mixed type		

*According to the International Classification of Sleep Disorders (American Academy of Sleep Medicine, 2005)

Good sleep practices (see section on sleep hygiene above) and behavioral interventions such as extinction or bedtime fading (see Table I.4.12) are the first recommended treatments for pediatric insomnia (Meltzer, 2010). Caregivers play a key role in establishing and maintaining normal children's sleep. Therefore, it is important to discuss parents' knowledge and beliefs as well as strategies they have used to help address their child's sleep problems. Providing parents with accurate information about children's sleep is an essential component of behavioral sleep interventions.

Behavioral strategies should be adapted to the child's age and to the family's situation (co-sleeping, shared rooms, etc.). Graduate extinction techniques and controlled crying are more appropriate for younger children, whereas cognitive and coping strategies are better suited to school-aged children. See Table I.4.12 for controlled crying/comforting techniques.

Table I.4.12 Behavioral techniques in the treatment of insomnia*

Unmodified Extinction	The child is placed in bed while awake, left alone until asleep and night wakings are ignored. The infant learns to self-soothe when realizing that nighttime crying does not result in parental attention
Extinction with parent presence	The parent remains in the room during extinction, acting as a reassurance for the child but providing little interaction
Graduate extinction	This involves ignoring negative behaviors (i.e., crying) for a given amount of time before checking on the child. The parent gradually increases the amount of time between crying and parental response. Parents provide reassurance through their presence for short durations and with minimal interaction
Bedtime fading	This technique involves delaying bedtime closer to the child's target bedtime. The goal is for the child to develop a positive association between being in bed and falling asleep rapidly. Bedtime can be gradually moved earlier.
Sleep scheduling	Scheduling regular, appropriate sleep and wake times that allow adequate opportunities to sleep
Cognitive strategies	Used to address nonproductive beliefs about sleep, including the belief that children cannot change their sleep difficulty
Coping strategies (for children)	Are also included (e.g., relaxation skills such as abdominal breathing)

*Adapted from www.insomniarounds.ca

Medication

Because of the paucity of data available with regards to dosing, efficacy, tolerability, and safety profiles of medications as well as a lack of well-designed clinical trials, hypnotic medications are currently not approved for the pediatric population by the US Food and Drug Administration. Additional research is needed for evidence-based pediatric sleep pharmacotherapy. However, this provides little solace to a desperate family having to cope with a child's chronic sleep problems, often without the resources to obtain professionally competent behavioral support. The choice to use off label pharmacological treatment should emerge from a balance of ethical principles, economy and evidence. Medication should always be administered in combination with behavioral interventions. In the absence of empirical evidence, several medications have been traditionally used in pediatric insomnia, such as benzodiazepines, α-2–receptor agonists (e.g., clonidine and guanfacine), pyrimidine derivatives (e.g., zaleplon and zolpidem), sedating antidepressants (e.g., trazodone and mirtazapine), melatonin, and sedating antihistamines (e.g., diphenhydramine and hydroxyzine) (Pelayo & Yuen 2012).

Melatonin is an effective, safe and well-tolerated agent, especially in cases of sleep-initiation insomnia caused by circadian factors. Several placebo-controlled studies of melatonin in adults and children (in some studies as young as 3 years of age) showed that melatonin administered at bedtime reduces sleep-onset latency time and increases total sleep time (Ferracioli-Oda et al, 2013).

Evidence for the use of the *non-benzodiazepine hypnotic agents* zolpidem, zaleplon, ramelteon, and eszopiclone is limited, especially in pediatric populations. Table I.4.14 focuses specifically on agents often used for children with developmental disabilities.

Parasomnias

Parasomnias are disruptive physical behaviors that occur during sleep and are typically classified by the sleep stage (NREM or REM) in which they arise. We focus here on NREM parasomnias; these include somnambulism, night terrors, somniloquy (sleep-talking), bruxism, and rhythmic movement disorders (enuresis is not dealt with here, see chapter C.4 of the Textbook). NREM parasomnias usually occur in the first few hours of the sleep cycle. These behaviors arise when the cortex incompletely arouses from deep NREM sleep, often due to comorbid conditions that provoke repeated arousal or promote sleep inertia (defined as extreme difficulty waking accompanied by confusion or sleep-drunkenness).

Although the prevalence of psychiatric disorders in children with NREM parasomnias is quite low, the overall prevalence of at least one parasomnia by the age of 13 years has been reported as being as high as 78% (Laberge et al, 2000). These conditions, although rarely requiring clinical intervention, can be very troubling for parents.

Sleepwalking

Sleepwalking or somnambulism is the combination of ambulation with the persistence of impaired consciousness after arousal from sleep. Although a large percentage of children have at least one episode of somnambulism, far fewer

Table I.4.14 Selected medications for the treatment of insomnia in children with developmental disabilities

Medication	Dosage	Adverse effects	Indicated in	Evidence of effectiveness
Chloral hydrate	25-50 mg/ kg	• Sedation • Respiratory suppression • Hepatic disease • Do not use concurrently with SSRIs	• Insomnia refractory to other treatments	Yes (in adults)
Niaprazine	1 mg/kg	• Sedation • Anticholinergic effects	• Intellectual disability • Epilepsy	Yes
Nitrazepam	5-10 mg	• Sedation • Respiratory depression • Drooling	• Epilepsy	
Melatonin	3-6 mg	• Headache • Nausea	• Delayed sleep phase disorder in ASD or ADHD • Angelman's Syndrome	Yes
Ramelteon	4-8 mg		• Sleep onset insomnia in intellectual disability or ASD	Yes (in adults)
Mirtazapine	7,5 mg-30 mg	• Sedation • Weight gain • Xerostomia	• Sleep onset and sleep maintenance difficulties • ASD • Depression	Yes (in adults)
Clonidine	O,05-0,1 mg	• Sedation • Cardiac arhytmias	• ADHD • Disruptive behavior disorders	Yes
Gabapentin	300-900 mg	• Sedation • Leucopenia	• Restless legs syndrome • Epilepsy • Resistant sleep onset insomnia	Yes
Clonazepam	0,25-0,5 mg	• Sedation • Dizziness	• Epilepsy • Restless legs syndrome • Resistant sleep onset insomnia • Bruxism • Rhythmic movement disorder • Frequent arousals	Yes

present with recurrent and disruptive episodes. Children typically have amnesia of the event and the behaviors are often inappropriate (such as urinating in a wastebasket, moving furniture around haphazardly or climbing out of a window). Sleepwalkers are sometimes able to navigate familiar surroundings but are prone to bumping into objects or to fall down.

Click on the image for tips and advice on sleepwalking

Sleepwalking is relatively common in childhood with annual prevalence rates approaching 17% (Szelenberger et al, 2005). Attempting to arouse the child is often difficult and may paradoxically worsen confusion and disorientation. Although somnambulism rarely results in harm to the subject, it is possible for an episode of somnambulism to become a confusional arousal (disoriented behavior during an arousal from NREM sleep, often with vocalizations and poor recall of events the following day), in which the likelihood of accidental violence (to oneself or others) is greater.

Sleep terrors

Sleep terrors or night terrors are episodes of intense fear initiated by a sudden cry or loud scream and accompanied by increased autonomic nervous system activity. They most commonly occur in preadolescent children. Parents usually describe the child as being inconsolable during the episode. Several studies have demonstrated a relationship between anxiety levels and parasomnias in children, showing that increased anxiety correlates with increased prevalence of night terrors and awakenings (Kovachy et al, 2013). Sleep terrors are different from nightmares (Table I.4.15)

Sleep-talking

Sleep-talking or somniloquy is considered the most common parasomnia, with a reported prevalence greater than 50% in children between the ages of 3 and 13 (Laberge et al, 2000). Somniloquy is often comorbid with sleepwalking and night terrors, suggesting an underlying common pathophysiology.

Click on the image to see a pediatrician describing the difference between nightmares and night terrors

Treatment

The treatment of NREM parasomnias has received minimal study. Most children tend to grow out of these experiencies as they become older and do not require treatment apart from education and reassurance for parents. If needed,

Table I.4.15 Differences between sleep terrors and nightmares

Sleep Terrors	Nightmares
Children are asleep	Children awaken
Children have no recall after the episode	Children can recall details
Children are difficult to comfort during the episode	Children can be comforted during the episode and respond to others communicating with them
Children may sit up, walk around, or may even talk during the event	Children have limited movement or vocalisation until after waking up

Safety measures for NREM parasomnias

In general, safety precautions must be highly individualized to the specific child and situation:

- Avoid the child getting too tired and try to prevent insomnia because this can trigger sleepwalking
- If possible, the bedroom should be on the ground floor or basement to prevent accidental fall from a window
- Windows and doors of the bedroom should be locked
- Windows should be covered with heavy drapes to prevent cutting injuries that may result by crashing through them while sleepwalking
- Bed should be lowered to the floor to avoid falls
- Furniture including nightstands, tables, dressers, and desks should be removed from the edge of the bed
- Knives and other potential weapons should be secured
- Car keys should be locked away to prevent access and unconsciously driving in sleep.

Scheduled awakening

Ask parents to:

- Keep a sleep diary to determine the times the child usually has an episode of parasomnia (e.g., sleep terror)
- Wake their child 30 minutes prior to the time they usually experience a sleep terror. If there is a broad range of times in which the child has sleep terrors, then ask parents to wake the child 30 minutes prior to the earliest sleep terror episode. A gentle touch or quiet talk until the child opens their eyes is enough. Following this waking, allow the child to fall back to sleep on his own.
- Repeat this plan each night. When the child achieves 7 nights without a night terror, skip one night during the next week. If the child experiences another sleep terror, it may be helpful to go back to the initial scheduled awakenings.

safety measures need to be considered as the first line approach (see Box) as well as scheduled awakenings (this involves waking the child half an hour before the time they usually have an episode) and naps (sleep terrors, for example, are often associated with children not getting enough sleep). Some experts suggest that, in severe, protracted cases, clonazepam or tricyclic antidepressants may be useful, especially in patients with very frequent and disruptive episodes or living in special family circumstances (e.g., sharing room with brothers and sisters; unsafe home etc.) following a careful weighting of the cost/effectiveness of the intervention (Bruni et al, 2004).

Sleep disordered breathing

Definition

The spectrum of sleep-disordered breathing includes clinical conditions ranging from habitual snoring to upper airway resistance syndrome, to obstructive sleep apnea. Snoring is one of the cardinal features of sleep-disordered breathing along with mouth-breathing, restless sleep, episodes of gasping for air during sleep and breathing pauses in sleep. Snoring may vary in severity from soft, intermittent, to loud snoring. Common symptoms and consequences of sleep-disordered breathing are summarized in Table I.4.16.

Prevalence

Habitual snoring is reported in up to 27 % of children (Montgomery-Downs et al, 2004) while prevalence rates of obstructive sleep apnea in children range from 1.2 % to 5.7%, depending on the diagnostic criteria used and the population studied. Peak prevalence in children is between 2 and 8 years of age—largely due to hypertrophy of tonsils and adenoids. The recent epidemic of obesity among children and adolescents has contributed to a growing incidence of sleep-disordered breathing with only mild lymphadenoid hypertrophy. Other predisposing factors include craniofacial abnormalities and neuromuscular disorders.

Click on the picture to view a home video of a three-year-old with obstructive sleep apnea

Table I.4.16 Clinical symptoms and consequences of sleep-disordered breathing in children

Symptoms of sleep-disordered breathing	Consequences of sleep-disordered breathing
• Snoring • Mouth breathing • Restlessness • Witnessed breathing pauses in sleep • Diaphoresis in sleep • Frequently associated symptoms: • Night terrors • Nocturnal enuresis • Unusual sleeping position • Nasal congestion • Hypertrophy of tonsils and adenoids • Allergic rhinitis/sinusitis	**Neurobehavioral:** • Somnolence • Hyperactivity • Inattention • Disruptive behaviors • Social withdrawal • Depression, anxiety, low self-esteem **Cardiovascular:** • Systemic hypertension • Cor pulmonale • Left ventricular hypertrophy • Dyslipidemia • Insulin resistance

Diagnosis

Overnight polysomnography is the gold standard for the diagnosis of obstructive sleep apnea The American Academy of Pediatrics and the American Thoracic Society have published guidelines for polysomnography in children and adolescents (American Academy of Pediatrics 2002).

Neurobehavioral consequences of obstructive sleep apnea

Neurobehavioral and cognitive dysfunction are well documented in children with obstructive sleep apnea. Behavioral dysregulation is a common feature in children with obstructive sleep apnea who can present with increased impulsivity, hyperactivity, aggression and disorders of conduct. Memory deficits, inattention, executive dysfunction and poor academic performance have been also reported (O'Brien, 2009). Treatment of obstructive sleep apnea has been shown to be effective in reversing neurobehavioral deficits and improving academic outcomes.

Click on the image to access the clinical practice guideline Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome (American Academy of Pediatrics)

Treatment

According to the most recent clinical practice guidelines, adenotonsillectomy is very effective in treating obstructive sleep apnea in children (Marcus et al, 2012. Continuous positive air pressure devices also have sufficient evidence to support their use in pediatric patients. They are recommended in cases that fail to respond to surgical treatment or in whom adenotonsillectomy is not indicated. Other adjunctive strategies include treating nasal allergies, reducing weight, and avoiding environmental irritants.

Restless legs syndrome and periodic limb movement disorder

Restless legs syndrome is a sensorimotor disorder characterized by an irresistible urge to move the legs, often associated with uncomfortable sensations

Paul Gustave Doré. A Couple and Two Children Sleeping on a London Bridge. Berger Collection, Denver, Colorado.

in the legs or, less frequently, other body parts. Although the restless legs syndrome has been traditionally considered a disorder of middle and old age, several studies (summarized in Picchietti & Picchietti, 2008) have shown that it can occur in childhood (see proposed research criteria in Table I.4.17). The Pediatric Restless Legs Syndrome Severity Scale (Arbuckle et al, 2010)—a scale completed by children and complemented by a separate parent questionnaire—may be used to quantify the severity and the functional impact of symptoms (Arbuckle et al, 2010), although it has not been validated yet. In order to decide the need for treatment, it is pivotal to assess not only the severity of symptoms but also their impact on sleep, cognition and mood.

Diagnosis of *periodic limb movement disorder* requires a polysomnographic recording (Allen et al, 2003). Based on evidence from biochemical, neuroimaging and post-mortem studies suggesting a role for iron deficiency in the pathophysiology of restless legs syndrome (Allen & Earley, 2007), and reports of low serum ferritin (summarized in Picchietti & Picchietti, 2010), a marker of peripheral iron status, some authors have recommended to screen and monitor serum ferritin levels in children with suspected restless legs syndrome. However, there is no consensus about the level indicating iron deficiency in children; 50µg/L has been proposed as indicative of increased risk of restless legs syndrome in adults. Moreover, serum ferritin levels need to be interpreted with caution since they can vary considerably, particularly after a febrile illness (Eskeland et al, 2002).

Table I.4.17 Proposed criteria for the diagnosis of restless legs syndrome in children by the International Restless Legs Syndrome Study Group*

- (A) The child meets all four essential adult criteria for restless legs syndrome: (a) urge to move the legs because of an unpleasant sensation in the legs, (b) that begins or worsens with rest or inactivity, (c) that occur mostly in the evening or night, and (d) these sensations are relieved by movement.

and

- The child relates a description in his or her own words that is consistent with leg discomfort (the child may use terms such as oowies, tickle, spiders, boo-boos, and a lot of energy in my legs to describe symptoms. Age-appropriate descriptors are encouraged)

or

- The child meets all four essential adult criteria for restless legs syndrome, as in (A)

and

- Two of three of the following criteria are present: (a) sleep disturbance for age, (b) a biologic parent or sibling has definite restless legs syndrome, (c) the child has a polysomnographically documented periodic limb movement index of 5 or more per hour of sleep.

*Allen et al (2003)

Differential diagnoses of restless legs syndrome include (Picchietti & Picchietti 2010):

- Positional discomfort
- Sore leg muscles
- Ligament sprain/tendon strain
- Bruises
- Orthopedic disorders
- Dermatitis.

Management

The management of restless legs syndrome/periodic limb movement disorder is non-pharmacological for mild to moderate cases (i.e., cases with mild to moderate impact on sleep, cognition, and behavior). This includes establishing healthy sleep habits, physical exercise and avoiding putative exacerbating factors such as insufficient sleep for age, irregular sleep schedule, low body iron stores, pain, caffeine, nicotine, alcohol, and certain drugs (e.g., SSRIs, antihistamines, and neuroleptics) (Picchietti & Picchietti 2010).

Evidence about the effectiveness of pharmacological treatment is quite limited and, to date, no drug has received FDA approval for the treatment of restless legs syndrome in children. For severe cases, off-label use of L-Dopa or other dopaminergic agents has been suggested in consultation with a pediatric sleep specialist**.** Although there is no consensus on serum ferritin levels, some experts have recommended oral iron supplementation with low iron stores (50–65 mg of elemental iron once or twice a day), and then recheck serum ferritin in 2–3 months (Picchietti & Picchietti 2010).

Narcolepsy

Diagnosis and management of narcolepsy should be carried out by a sleep specialist (and therefore it will be mentioned here only briefly). However, it is important for child mental health professionals to be aware of its clinical features since children with narcolepsy are commonly misdiagnosed with other neurological or psychiatric disorders, such as epilepsy, ADHD, mood disorders, and psychotic disorders. In retrospective case series, about one third of adults with narcolepsy reported onset prior to 15 years of age and roughly 15% prior to 10 years of age.

Excessive, uncontrollable daytime sleepiness is the most common presentation of narcolepsy in school-aged children but, as already highlighted, daytime sleepiness is also the manifestation of many other sleep problems such as insomnia and obstructive sleep apnoea. A more specific symptom of narcolepsy is *cataplexy* (a sudden weakness of the muscles of the body, especially the legs but also the face and neck, which is often brought on by a strong emotion, especially laughing). Up 50% to 70% of patients with childhood narcolepsy present with cataplexy. Sleep paralysis and hallucinations can be present but are less common. Only 10% to 25% of affected individuals show these four symptoms (uncontrollable daytime sleepiness, cataplexy, sleep paralysis, and hallucinations) during the course of their illness. These symptoms are the result of a sudden burst of REM sleep in patients who are awake. Diagnosis of narcolepsy requires sleep laboratory assessment, including nocturnal polysomnography and multiple sleep latency tests (Guilleminault & Pelayo, 2000).

Click on the image to view "Narcolepsy—Does Your Child Have It?"

Most people with narcolepsy have low levels of the neurotransmitter hypocretin, which promotes wakefulness. The majority of cases appear in individuals with no known family history of the disorder although family clusters occur, particularly in those who show cataplexy. Recently, several cases of narcolepsy in Irish, Finnish and Swedish children were found after vaccination with GlaxoSmithKline's H1N1 flu vaccine Pandemrix®.

Click on the image to view cataplexy in a child

The management of narcolepsy in children and adolescents includes establishing a regular sleep schedule, providing extensive education on sleep hygiene, implementing scheduled daytime naps if possible, and medication. Narcolepsy is commonly treated with psychostimulants such as methylphenidate and dextroamphetamine. Modafinil has also been used (in doses from 100mg/day to 600mg/day, in divided doses). There are reports of off-label use of sodium oxybate (γ –hydroxybutyrate [GHB]) (Mansukhani & Kotagal 2012).

Click here to access a Narcolepsy Fact Sheet produced by the US National Institute of Neurological Disorders and Stroke.

Click on the image to access the Practice Parameters for the Treatment of Narcolepsy and other Hypersomnias of Central Origin by the American Academy of Sleep Medicine

Kleine-Levin syndrome

Another uncommon disorder of hypersomnolence is the Kleine-Levin syndrome. It will be mentioned here only briefly since it is usually managed by a specialist (see diagnostic criteria in Table I.4.18).

Kleine-Levin syndrome is a rare condition that affects mainly adolescents; it starts during the second decade in about 80% of cases, with a male/female ratio of 2:1. Kleine-Levin syndrome is characterised by periods of extreme somnolence

Table I.4.18 Diagnostic criteria* for Kleine-Levin syndrome

Criteria A to E must be met

A. The patient experiences at least two recurrent episodes of excessive sleepiness and sleep duration, each persisting for two days to five weeks.

B. Episodes recur usually more than once a year and at least once every 18 months.

C. The patient has normal alertness, cognitive function, behavior, and mood between episodes.

D. The patient must demonstrate at least one of the following during episodes:

1. Cognitive dysfunction.
2. Altered perception.
3. Eating disorder (anorexia or hyperphagia).
4. Disinhibited behavior (such as hypersexuality).

E. The hypersomnolence and related symptoms are not better explained by another sleep disorder, other medical, neurologic, or psychiatric disorder (especially bipolar disorder), or use of drugs or medications.

*International Classification of Sleep Disorders-Third Edition (ICSD-3, 2014)

alternating with hyperphagia (excessive hunger or ravenous appetite), psychological changes and behavioural symptoms. The cause and pathogenesis of Kleine-Levin syndrome is currently unknown. Important psychiatric differential diagnoses include depression, bipolar disorder, seasonal affective disorder, and somatoform disorder.

Although a wide range of drugs (including psychostimulants, anti-epileptic, antidepressants, and antipsychotic) has been used to manage the syndrome, there is no evidence supporting the effectiveness of any of them. A recent Cochrane systematic review concluded that no methodologically sound randomised controlled trials have been conducted (Oliveira et al, 2013).

SLEEP DISTURBANCES IN CHILDREN AND ADOLESCENTS WITH PSYCHIATRIC DISORDERS

Mood disorders

Sleep disturbance (insomnia or hypersomnia) is one of the diagnostic criteria for depression. Common sleep disturbances in pediatric depression include delayed sleep onset, intermittent nocturnal awakenings, hypersomnia (excessive daytime sleepiness) and difficult morning awakenings. Systematic investigation of sleep complaints in depressed children indicates that significant insomnia (difficulty initiating and maintaining sleep) is more common (75%) than hypersomnia (10%); the presence of both symptoms (10%) is associated with increased severity of depression. Insomnia is more likely associated with psychomotor agitation, excessive worrying and somatic complaints, whereas hypersomnia is more likely associated with youth experiencing psychomotor retardation, fatigue, reduced appetite, hopelessness, and helplessness. Longitudinal studies have shown that persistent sleep difficulties increase the likelihood of developing major depressive

disorder and anxiety in the next few years (Gregory et al, 2009). In addition, sleep disturbances, particularly insomnia and nightmares, have also been linked to increased suicidal ideation and suicide attempts in youth (Goldstein et al, 2008).

Studies using polysomnography most commonly report reduced REM latency and increased sleep latency in depressed youth. Although complaints about sleep are reported by a majority of depressed children, subjective reports of sleep disturbance do not correlate with objective findings. In fact, youth reporting significant sleep problems such as non-restorative sleep and daytime fatigue did not have identifiable changes on polysomnography (Ivanenko et al, 2005).

There are very few studies examining the effect of depression treatment on comorbid sleep problems or, conversely, that of treatment of sleep problems on depression. Generally, non-pharmacological approaches—sleep hygiene, psychoeducation and psychotherapy—are considered first line interventions (see Table I.4.19). Although cognitive behavioral therapy (CBT) is commonly utilized for depression, the usual CBT format does not appear to be effective for comorbid insomnia (McCarty & Weisz, 2007). Therefore, a modified CBT for insomnia (CBT-I) with specific components to identify and address sleep-related issues may be more appropriate. In case of circadian rhythm disturbances, increased exposure to bright light using a light therapy box may be useful (Armitage et al, 2004). Given the impairing nature of sleep disturbance, concurrent treatment of depressive symptoms and sleep in the form of a combination of an antidepressant and behavioral interventions for insomnia is recommended. The use of hypnotics should be judicious since there are no approved agents for the pediatric age group.

Anxiety disorders

About 90% of children with anxiety disorder report at least one or more sleep problems. The more common are nightmares, waking up frequently during the night, bedtime resistance (worrying about going to bed), refusal to sleep alone, and difficulty falling asleep (Alfano et al, 2007). Anxiety symptoms in the younger age group may present as nighttime fears—mostly in the context of witnessing violent or frightening scenes on screen—resulting in refusal to go to bed, nightmares, frequent nighttime awakenings, and inability to sleep alone (Muris et al, 2000). Recent research indicates a bidirectional relationship and physiological interaction between anxiety and sleep disturbance with one exacerbating the effects of the other (Gregory et al, 2009). Several epidemiological investigations suggest that persistent sleep problems early in life are associated with the development of anxiety and anxiety disorders during adolescence and adulthood (Goldstein et al, 2008). Interestingly, in contrast with depression, parents and children with anxiety disorders tend to underreport sleep problems (Hudson et al, 2009).

Research suggests that the nature and rates of sleep problems vary among different anxiety disorders. Children with separation anxiety disorder are reported to exhibit more parasomnias, such as sleep walking, night terrors and bedwetting (Alfano et al, 2007). Children with post-traumatic stress disorder (PTSD) often present with subjective reports of sleep problems that are similar irrespective of the type of trauma (Kovachy et al, 2013). Few studies using actigraphy in children with PTSD have found increased sleep onset latency, nocturnal activity, and fragmentation of sleep (Sadeh et al, 1995). Studies suggest that up to 90% of

Table I.4.19 Behavioral interventions for sleep problems in children with mental health disorders

Sleep hygiene	• Make bedroom dark, peaceful, comfortable and soothing • Keep consistent wake up time and bedtime • Create a consistent and predictable bedtime routine • Eliminate high energy activities and media exposure prior to bedtime • Avoid daytime naps in children older than 5 years • Avoid caffeine or stimulants later in the day • Keep a sleep diary to track and address triggers
Specific interventions for depression	***To address cognitive misperceptions*:** • CBT-Insomnia: focusing on conditioned arousal, stimulus control and reduction of sleep-related worry • Worry periods during times other than bedtime (e.g., identify specific moments during the day to think about worries). ***To address circadian dysfunction*:** • Light therapy using light box • Structured exposure to ambient lighting.
Specific interventions in anxiety disorders	***Reduce anxiety prior to bedtime*:** • Progressive muscle relaxation • Breathing exercises
Specific interventions in ASD	***To address transition problems*:** • Use of picture schedule with visual cues about bedtime routines • Avoid exposure to screen and media prior to bedtime ***To address bedtime resistance*:** • *Standard extinction*, that involves parents ignoring all bedtime disruptions (i.e., the parent puts the child to bed and there is no interaction until morning) • *Graduated extinction* entails parents ignoring disruptive bedtime behaviors (e.g., crying out) for a predetermined period. At the end of that time, if the child is still engaging in disruptive behaviors, the parent settles the child back in bed. Throughout, the parent is instructed to minimize interaction with the child. • *Faded bedtime* involves first determining a time at which it is likely that the child will fall asleep within 15 minutes of going to bed. Once the child falls asleep at this time with little resistance, the bedtime is set earlier and earlier each night until the desired bedtime is achieved. In addition, the child is awakened at the same time each morning and not allowed to sleep outside the prescribed sleep times (Vriend et al, 2011). • *Faded bedtime with response cost*. This involves fading bedtime, as described above. However, if the child does not fall asleep within a certain period of time, faded bedtime with response cost involves the additional component of removing the child from bed (response cost) to increase the motivation to fall asleep. After a predetermined time (typically about 30 minutes), the child is returned to bed. The procedure is repeated until the child falls asleep. Once successful at the target bedtime, an earlier bedtime is set as the goal (Vriend et al, 2011). • *Stimulus fading*: gradually removing parent from the child's room ***To address night terrors:*** • Scheduled awakenings about 30 minutes prior to expected episode.

children with generalized anxiety disorder experience difficulty sleeping (Alfano et al, 2007). Subjectively, children with generalized anxiety disorder report initial and intermittent insomnia and daytime sleepiness. Objective changes in these children indicate increased sleep onset latency, reduced REM latency, increased total REM, and reduced sleep efficiency (Alfano et al, 2013).

Behavioral sleep interventions are the first line treatment for sleep related difficulties in anxious children (see Table I.4.19). Some effective methods for reducing nighttime fears and difficulty falling asleep are avoiding on-screen scary or disturbing content, creating soothing sleep rituals that reduce arousal at bedtime, maintaining a safe environment, pre-sleep relaxation to reduce arousal, and sleep consolidation by delaying bedtime. Specific therapeutic interventions such as progressive muscle relaxation, exposure and response prevention, systematic desensitization, dream rehearsal techniques, and guided imagery are helpful in reducing pre-sleep worries (Ollendick et al, 1991).

Studies exploring pharmacologic options for sleep-related problems in anxious children are limited. In general, reduction of anxiety with SSRI medication may reduce sleep related problems. Fluvoxamine can reduce both anxiety and sleep problems. On the other hand, other SSRIs, such as fluoxetine, are known to interfere with sleep by inhibiting REM sleep and increasing the number of arousals (Dorsey et al, 1996). Hypnotic medications are usually avoided due to lack of safety data in the pediatric age group.

Autism spectrum disorder

Sleep-related problems are more common in autism spectrum disorder (ASD) as compared with typically developing children and those with intellectual disability, prevalence ranging from 50%-80% (Richdale & Schreck, 2009). Sleep disturbances in children with ASD have been associated with lower nocturnal level of melatonin due to abnormal secretion and aberrant expression of the sleep regulating neurotransmitter GABA due to disrupted GABAergic inter-neurons (Levitt et al, 2004). Other factors contributing to sleep problems may include hypersensitivity to environmental stimuli, poor self-regulation, ritualistic behaviors, comorbid gastrointestinal, neurological and psychiatric problems, and the medications used to treat these conditions (Reynolds & Malow 2011).

It is important to identify and address sleep disturbances in these patients since they are linked to higher rates of stereotypic behaviors, poor daytime

Jacob Riis: Children sleeping in Mulberry Street, 1890. (From the Collections of the Museum of the City of New York)

functioning, and worsening of core social and communication deficits (Johnson et al, 2009). The more commonly reported sleep issues are difficulty falling asleep, frequent night waking, early morning waking, reduced sleep duration, lack of sleep routine, and frequent night time fears and nightmares (Johnson et al, 2009). Large cohort studies suggest that sleep disturbances, particularly reduced sleep duration, appear as early as at 30 months of age and persist through adolescence although the specific type of sleep problem may change with age. Younger children experience bedtime resistance, sleep anxiety, night waking and nightmares, whereas older children report delayed sleep onset, shorter sleep duration, and daytime sleepiness (Goldman et al, 2012). Objective sleep problems detected with actigraphy and polysomnography include lower sleep efficiency, short sleep time, longer sleep latency, and REM abnormalities including reductions in REM sleep, increased density of eye movements, and shorter REM latency (Reynolds & Malow, 2011).

Sleep problems in autism are a coexisting symptom that can influence the course and severity of the disorder and hence effective treatment to address them is important. A study suggests that associations between media exposure and videogames and sleep problems are more pronounced in children with ASD than in typically developing children (Engelhardt et al, 2013); good sleep hygiene practices are therefore of prime importance. Several behavioral interventions have been successfully used to address the specific problematic behaviors, promote sleep routine using visual and behavioral cues, and promote self-soothing using sleep restriction, stimulus fading and extinction methods (see Table I.4.19). There is good evidence that melatonin before bedtime is effective for the treatment of insomnia in ASD; 1mg to 3mg of melatonin per day reduces sleep latency and improves sleep duration (Rossignol & Frye, 2011). Some evidence also exists for the use of clonidine (Ming et al, 2008). Clinically, it is often suggested to use the medications for coexisting psychiatric and neurological disorders to promote sleep by using drugs with sedating properties at night and to prevent insomnia by avoiding drugs with stimulating effects before bedtime (Reynolds & Malow, 2011).

Attention-deficit/hyperactivity disorder (ADHD)

There has been an increasing interest in sleep problems associated with ADHD (Cortese et al, 2009; Cortese et al, 2013). Sleeping difficulties in these children are of relevance because:

- Sleep disturbances may be a source of distress for the child and the family
- Sleep problems may worsen ADHD symptoms as well as associated emotional disorders
- Quantitative or qualitative alterations of sleep may cause problems with mood, attention, and behavior,
- Sleep disturbances may mimic ADHD symptoms in children misdiagnosed with ADHD.

Therefore, symptoms of inattention, hyperactivity and impulsivity may be improved or even eliminated by treating the primary sleep disorder. A meta-analysis on sleep in children diagnosed with ADHD found that children or their parents reported bedtime resistance, sleep-onset difficulties, night awakenings,

difficulty waking up in the morning, sleep breathing problems, and daytime sleepiness significantly more often than healthy comparison individuals (Cortese et al, 2009). Although no sleep problem specific to ADHD has been found, the most commonly reported is 'difficulty falling asleep'.

Causes of sleep problems in children with ADHD include:

- One or more specific sleep disorders, such as behaviorally-based insomnia, circadian rhythm sleep disorder, or restless legs syndrome
- Poor sleep practices (e.g., use of electronics before bedtime)
- Psychiatric comorbidities (e.g., mood/anxiety disorders)
- Associated medical conditions and their treatment (e.g., asthma, obesity).

Recently, a group of experts in ADHD and sleep provided clinical guidance on the assessment and management of the most common sleep disturbances associated with ADHD (Cortese et al, 2013):

- Before addressing the specific management of sleep disorders, implement healthy sleep practices. There is insufficient evidence to recommend a specific dietetic regimen
- Behavioral interventions—adapted for ADHD children (more warnings, instructions by parents one step at a time, pictorial representations, etc.) should be the first-line treatment
- If behavioral strategies are not effective, pharmacological treatment may be considered for sleep-onset difficulties (melatonin has the best evidence of effectiveness)
- Therapeutic options for circadian rhythm disorder include bright light therapy, chronotherapy (moving bedtime and rising time each day, around the clock, until the child is sleeping on a normal schedule), and melatonin.
- An *apnea-hypopnea index* >1 on polysomnography should alert the practitioner to consider adeno-tonsillectomy.
- Avoid factors that may exacerbate restless legs syndrome (e.g., pain, caffeine, nicotine, alcohol). Oral iron supplementation if serum ferritin is <50 mg/L may be considered. For severe cases consider off-label use of L-DOPA or other dopaminergic agents, in consultation with a sleep specialist.

CULTURAL ISSUES

Sleep patterns are influenced both by biologic and cultural factors and their interaction. As such, perceptions of sleep problems by parents and healthcare providers are influenced by cultural norms. Unfortunately, empirical research on cross-cultural differences in pediatric sleep practices across countries, including low- and middle-income countries, is limited.

In a study (Mindell et al, 2010) of 29,287 infants and toddlers from predominantly-Asian and predominantly-Caucasian countries, parents of children from predominantly-Asian countries reported significantly later bedtimes, shorter total sleep times, increased perception of sleep problems, and significantly more bed-sharing and room-sharing. Differences in the percentage of bed-sharing

were striking: in predominantly Asian countries 64.7% of children shared a bed and 87.5% shared a room compared with 11.8% and 22.0% respectively in predominantly-Caucasian countries. Given the need for internet access to participate in the survey, results were biased towards urban populations.

These results were replicated in another study by the same group (Mindell et al, 2013) that found significant differences in bedtime (e.g., 3 hours later in India compared to Australia), napping (persistence of daytime napping in most children in predominantly-Asian countries) and bed and room sharing (more common in predominantly-Asian countries).

Louis and Govindama (2004) examined children aged 12 to 24 months from France and la Réunion island and found a significantly higher prevalence of sleep problems in Réunion than in France. Bedtime routines and interactions, co-sleeping and parental presence at bedtime until infant falls asleep were significantly associated with sleep problems. These results underscore the importance of considering specific cultural beliefs in making recommendations for healthy sleep practices.

In many low-income countries children often share a bed

- Do you have questions?
- Comments?

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PLEASE GO TO APPENDIX I.4.1 FOR SELF-ASSESSMENT QUESTIONS

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Appendix I.4.1

SELF-ASSESSMENT QUESTIONS

MCQ I.4.1 The first step in the treatment of pediatric insomnia…

1. Is pharmacological
2. Includes a combination of sleep hygiene and behavioral treatment
3. Treatment is not necessary because this is a benign condition
4. Does not require preliminary diagnostic assessment
5. Includes melatonin

MCQ I.4.2 Obstructive sleep apnea in children…

1. Is uncommon
2. Does not require objective tools for diagnosis
3. Is always associated with obesity
4. Is always associated with dysmorphic features like microretrognathia (a developmental hypoplasia of the mandible in which the mandible is mislocalised posteriorly)
5. Is relatively common and requires a specific treatment

***MCQ I.4.3 Melatonin is indicated (choose one)**:*

1. In adolescents
2. In patients with intellectual disabilities with circadian delay
3. In young people with sleep onset difficulties
4. Only if first-line pharmacological treatment has failed
5. Only in children with multiple nocturnal awakenings

MCQ I.4.4 The parents of an 11 year old boy report that he often appears tired despite sleeping through the night. On further questioning, parents report that lately the child has been unusually emotional and sad, cries often, lost interest in his favorite sport activity, his academic performance has declined and he is losing weight. Physical examination and basic laboratory testing are within normal limits. If polysomnography were performed, the most likely finding is:

1. Reduced sleep onset latency
2. Reduced REM latency
3. Reduced REM density
4. Increased total sleep time
5. Increased sleep efficiency

MCQ I.4.5 A 7 year old child with separation anxiety struggles with frequent nightmares and resists going to bed every night. She often cries when parents leave the room, screams until they come and check on her, and goes to parents' bedroom when she wakes up in the middle of the night. The first line intervention for this child's sleeping problems would be…

1. An SSRI for separation anxiety
2. To allow the child to sleep in the parents' room
3. Behavioral interventions
4. Benzodiazepines
5. Watchful waiting

MCQ I.4.6 Which one of these medications is more effective in the treatment of insomnia in children with autism?

1. Clonazepam
2. Chloral hydrate
3. Aripiprazole
4. Melatonin
5. Risperidone

MCQ I.4.7 The parents of a 6 year old boy report that he snores loudly, has very restless sleep and episodes during which he stops breathing followed by gasping for air. He wets the bed nightly and has been irritable, aggressive and impulsive. His school teacher has mentioned that his concentration is poor and falls sleep in class often. What would you do to clarify the diagnosis?

1. Monitor his sleep
2. Obtain an audio-video recording of his breathing during sleep
3. Obtain a neck x-ray
4. Conduct overnight polysomnography
5. Perform skin allergy tests

MCQ I.4.8 A 10 year old girl was recently diagnosed with obstructive sleep apnea. Her parents asked your advice about treatment options. You explained the following treatments are being used for obstructive sleep apnea in children except:

1. Adenotonsillectomy
2. Bariatric surgery
3. Continuous positive airway pressure therapy
4. Nasal steroids
5. Weight loss

MCQ I.4.9 NREM parasomnias are…

1. Characterized by partial awakening in the first few hours of sleep
2. Specific of adult patients
3. Specific of the first year of life
4. Gender specific
5. A type of epilepsy

MCQ I.4.10 Which one of the factors listed below does not usually contribute to sleep disturbances in ADHD?

1. Poor sleep practices (e.g., use of electronics before bedtime)
2. The effects of psychiatric comorbidities
3. Comorbid specific sleep disorders, such as circadian rhythm disorders
4. Anxiety about falling sleep
5. ADHD medication

ANSWERS TO MCQs

- **MCQ I.4.1** Answer: 2 (includes a combination of sleep hygiene and behavioral treatment). Please, see pages 12 to 15.
- **MCQ I.4.2** Answer: 5 (is relatively common and requires a specific treatment). Please, see pages 18 and 19.
- **MCQ I.4.3** Answer: 2 (in patients with intellectual disabilities with circadian delay). Please, see pages 15, 16, 27, 28
- **MCQ I.4.4** Answer: 2 (reduced REM latency). Please, see page 24
- **MCQ I.4.5** Answer: 3 (behavioral interventions). Please, see page 26
- **MCQ I.4.6** Answer: 4 (melatonin). Please see page 27.
- **MCQ I.4.7** Answer: 4 (conduct overnight polysomnography). Please, see page 19.
- **MCQ I.4.8** Answer: 2 (bariatric surgery). Please see page 19.
- **MCQ I.4.9** Answer: 1 (characterized by partial awakening in the first few hours of sleep). Please, see page 15.
- **MCQ I.4.10** Answer: 4 (anxiety about falling sleep). Please, see page 28.