SLEEP IN CHILDREN:

A PEDIATRIC GUIDE FOR COUNSELING FAMILIES

EDITOR:
ASST. PROF. MD. YUSUF DENIZ

BİDGE
Yayınları

BİDGE Yayınları

Sleep in Children: A Pediatric Guide For Counseling Families

Editör: Asst. Prof. MD. YUSUF DENİZ

ISBN: 978-625-5436-14-6

1. Baskı
Sayfa Düzeni: Gözde YÜCEL
Yayınlama Tarihi: 2026-11-01
BİDGE Yayınları

Bu eserin bütün hakları saklıdır. Kaynak gösterilerek tanıtım için yapılacak kısa alıntılar dışında yayıncının ve editörün yazılı izni olmaksızın hiçbir yolla çoğaltılamaz.

Sertifika No: 71374
Yayın hakları © BİDGE Yayınları
www.bidgeyayinlari.com.tr - bidgeyayinlari@gmail.com
Krc Bilişim Ticaret ve Organizasyon Ltd. Şti.
Güzeltepe Mahallesi Abidin Daver Sokak Sefer Apartmanı No: 7/9 Çankaya / Ankara

İÇİNDEKİLER

Sleep and Brain Development in Early Childhood 1
ERKAN YETMİŞ

Sleep Duration and Sleep Need in Children: From the Newborn Period To Adolescence 24
YUSUF DENİZ

Basic Approaches To Age-based Sleep Training in Children 38
EMRE ÇELİK

Nutrition and Sleep in Children: A Bidirectional Interaction 58
EBRU BULDU

Screen Exposure and Sleep in Children 70
ZEYNEP DURAK

Sleep and Growth Failure in Children 85
FUAT BUĞRUL

Sleep in Children with Chronic Illnesses: A Pediatrician's Perspective 102
ŞEYMA ŞİMŞİRGİL KARA

Postoperative Sleep in Children 120
SABİT DERE

Sleep in Children with Neurodevelopmental Disorders 134
UMUT DURAK

Play Therapy in Childhood Sleep Disorders: Clinical Applications and Evidence-based Approaches 160
HAKAN CANDAN

Families' Use of Artificial Intelligence in Sleep Counseling: Opportunities, Risks, and Principles Of Safe Use 173
SÜMEYYE ERTEK

BÖLÜM 1

SLEEP AND BRAIN DEVELOPMENT IN EARLY CHILDHOOD

Erkan YETMİŞ[1]

Introduction

The first years of life constitute one of the periods in which the human brain changes most rapidly in both structural and functional terms. Brain volume increases rapidly during the first two years after birth, while cortical architecture, white matter tracts, and the functional connections between different brain regions are extensively reorganized. Sensory and motor systems mature relatively early, whereas the networks associated with language, attention, social cognition, and executive functions continue to develop throughout early childhood and, in some domains, into adolescence and young adulthood (Gilmore et al., 2018).

A substantial portion of this period of rapid development is spent asleep. A newborn spends most of the day sleeping, and by the age of one year approximately half of life is still spent in sleep. For this reason, sleep in early childhood should not be regarded merely as a passive period of rest defined by the absence of wakefulness. During sleep, the electrical activity of the developing brain continues, and processes such as the processing of experience-dependent neural representations, memory consolidation, and the reorganization of neural networks take place (de Groot et al., 2024; O'Connor et al., 2026).

Nevertheless, a linear cause-and-effect proposition of the form “children who sleep well develop better brains” does not

[1] MD, Department of Pediatrics, University of Health Sciences, Gazi Yaşargil Training and Research Hospital, Diyarbakır, Türkiye, ORCID: 0000-0003-2721-1353

accurately reflect the current scientific evidence. A 2024 systematic review examining the relationship between sleep and cognitive and psychomotor development in infants reported that findings were mixed in most of the 22 studies covering children aged 0-18 months, and that a significant association with developmental outcomes could not be demonstrated in a substantial proportion of the studies examining nighttime and total sleep duration (Butler et al., 2024). Thus, although sleep is one of the important biological components of early neurodevelopment, sleep duration alone is not a variable that determines a child's developmental future.

It should also be borne in mind that the relationship between sleep and neurodevelopment is bidirectional. A child's neurodevelopmental characteristics can influence sleep patterns, while insufficient, irregular, or disease-related fragmented sleep can in turn affect the child's daytime functioning. Parental mental health, family routines, caregiving conditions, the socioeconomic environment, nutrition, physical activity, and the child's health status may exert shared effects on both sleep and development.

Accordingly, sleep in early childhood should be considered not as the sole determinant of development, but as a developmental process in continuous interaction with genetic characteristics, environmental experiences, caregiving relationships, and health status.

Why Is Brain Development in Early Childhood Special?

The human brain is not an organ that has completed its development at birth. In the years following birth, synaptogenesis, synaptic remodeling, myelination, and the strengthening of connections between brain networks continue intensively.

Early in life, the number of synaptic connections increases rapidly. Subsequently, in relation to experience and use, some connections are strengthened while others are weakened or eliminated. This process is one of the fundamental components of the plasticity that allows the developing brain to adapt to environmental conditions.

White matter development and myelination also accelerate during this period. The myelin sheath makes neural conduction faster and more efficient, and contributes to the coordinated functioning of

distant brain regions. In the progressive organization of motor control, language, attention, and cognitive functions, what matters is not only the development of specific brain regions but also the maturation of the connections between them.

Yet the distinguishing feature of early development is not rapid growth alone. The brain is also sensitive to experience. An infant watching the caregiver's face, orienting to sounds, being touched and carried, receiving a response when crying, reaching for objects, moving, establishing joint attention, hearing words, and playing all contribute to the shaping of the developing neural networks.

Wakefulness is the period in which new experiences are acquired, while sleep is the period that allows part of these experiences to be processed and the neural networks to be reorganized.

The First 1000 Days: A “Critical Period” for Sleep?

The period extending from the beginning of pregnancy to approximately the end of the second year of life is frequently described as the first 1000 days. This period is extraordinarily active with respect to the formation and migration of neurons, synaptogenesis, myelination, the organization of sensory systems, and the development of early social-cognitive networks.

The first 1000 days are therefore regarded as an important sensitive period for neurodevelopment. The term “critical period” should, however, be used with caution. A critical period refers to situations in which a specific experience must occur within a limited time window and is very difficult to compensate for afterwards. In many developmental domains of the human brain, plasticity continues beyond the first two years.

A 2025 commentary published in Developmental Medicine & Child Neurology defines the first 1000 days as a special window for the shaping of neurodevelopmental pathways, while emphasizing that outcomes in this period cannot be explained by any single factor. Genetic characteristics, caregiving relationships, nutrition, stress, illnesses, and environmental experiences are all parts of these developmental trajectories (Dan, 2025).

Sleep is one component of this multifactorial developmental system. The abundance of sleep in the fetal and neonatal period, and the markedly higher proportion of REM/active sleep compared with later ages, have long suggested that sleep may play a special role for the developing central nervous system. Current data support associations between sleep and neural plasticity, cortical organization, and functional connectivity, but the extent to which these processes are causal in humans has not been fully clarified (de Groot et al., 2024).

The deterministic inference that a child who does not sleep sufficiently well in the first two years will suffer permanent impairment of brain development is not scientifically supported.

Infant Sleep Is Not a Miniature Copy of Adult Sleep

Newborn sleep differs markedly from adult sleep. In the early period, sleep is generally classified as active sleep, quiet sleep, and indeterminate sleep. Active sleep can be considered the precursor of the later-maturing REM sleep, and quiet sleep the precursor of NREM sleep.

In the newborn, the proportion of active sleep is very high. With advancing age, active sleep decreases, and within quiet sleep more organized structures resembling the adult NREM stages emerge. Sleep spindles, slow waves, and other EEG features change with development.

In parallel, sleep is also reorganized behaviorally. The numerous short sleep episodes of the newborn period gradually give way, over the first year, to longer periods of nighttime sleep. The number of daytime naps decreases, and the sleep-wake rhythm becomes more strongly aligned with the environmental day-night cycle.

The consolidation of an infant's nighttime sleep over time therefore signifies more than “more restful sleep” from the parents' perspective; it is a behavioral indicator of the maturation of the nervous system, homeostatic sleep mechanisms, and the circadian system.

Active Sleep and REM Sleep: A Special Period for the Developing Brain

The fact that newborns spend most of their sleep in active sleep has long attracted the attention of researchers. The ontogenetic sleep hypothesis, proposed in the 1960s, suggested that the high amount of REM/active sleep in early life might provide endogenous stimulation to the developing central nervous system.

During active sleep, eye movements, facial and limb movements, and brief muscle twitches are common. It is thought that these small movements may not be merely “random movements” for the developing sensorimotor systems, but may contribute to the calibration of sensory feedback between the body and the brain.

Current neurophysiological studies support some aspects of this hypothesis. However, no linear relationship of the form “this amount of REM sleep produces this cognitive skill” has been demonstrated in humans.

A comprehensive 2024 review notes that prenatal and postnatal sleep may be important for brain plasticity and functional connectivity, while emphasizing the need for stronger longitudinal and mechanistic human studies in this field (de Groot et al., 2024).

Synaptic Plasticity and Reorganization During Sleep

In the first years of life, a child encounters an enormous amount of new information. Every day brings new experiences of faces, sounds, words, movement patterns, and social relationships. It is biologically and functionally impossible for the brain to retain all of these experiences at the same level.

Some synaptic connections must be strengthened, others weakened, and neural networks rendered more efficient. The slow waves, sleep spindles, and hippocampal-cortical interactions that occur during sleep are thought to contribute to this restructuring.

Particularly in older children and adults, there is strong experimental evidence for the relationship between sleep and memory consolidation. In infancy, the evidence is more limited and heterogeneous.

It is therefore more appropriate to state that sleep contributes to synaptic plasticity and to the reorganization of learning-related

neural networks, rather than to use oversimplified expressions such as “synapses are pruned while the child sleeps.”

Sleep, the Hippocampus, and Memory Formation

When a child has a new experience, the first trace of the memory is formed. For this information to become permanent and usable in long-term memory, additional processing is required. This process is called memory consolidation.

Sleep is known to play an important role particularly in hippocampus-dependent declarative memory. The large amount of slow-wave sleep present in childhood is thought to contribute to the reprocessing of learned information between the hippocampus and neocortical areas (Wilhelm et al., 2012).

This process is of particular importance for early childhood, because the young child does not learn only structured, school-like information. The child is continuously learning who provides care, which faces are familiar, how objects are used, what words mean, in what order events occur, and the rules of daily life.

Memory consolidation therefore underlies almost every domain of early childhood development.

Daytime Naps and Learning

Daytime naps in early childhood are sometimes viewed merely in terms of the child's rest or the convenience of the parents' daily routine. Yet the daytime nap is part of the physiological sleep organization of early childhood.

Experimental studies in infants show that a daytime nap occurring shortly after learning may confer an advantage for certain memory tasks. In a study of 15-month-old infants, those who slept after learning an artificial language structure were later better able to remember the rule underlying that structure (Hupbach et al., 2009).

In another study of 9- to 16-month-old infants, children who slept after learning not only retained specific word-object associations but were also able to generalize the information to new exemplars. It is particularly noteworthy that this performance was associated with sleep spindle activity (Friedrich et al., 2015). Similar findings have been reported in studies of word learning and

phonological generalization (Belia et al., 2025; Horváth et al., 2016).

That said, the findings in the literature are not entirely unidirectional. For some tasks, wakefulness after learning has also been shown to support generalization (Werchan & Gómez, 2014).

A daytime nap is not an intervention that increases intelligence; age-appropriate daytime sleep may contribute to the consolidation and generalization in memory of certain learning experiences in early childhood.

Sleep and Language Development

Language acquisition is one of the most complex learning processes the brain faces in early childhood. The infant must first segment the stream of speech in the environment, recognize different phonemes, perceive frequently recurring sound sequences as words, and over time associate them with objects, people, actions, and concepts.

These words subsequently cease to be merely individually memorized items and are transformed into categories and grammatical structures. Sleep is of particular interest with respect to this second stage.

Various experimental studies show that sleep after learning may contribute to the retention of new words in memory and, in some cases, to their generalization to broader categories (Belia et al., 2025; Friedrich et al., 2015; Horváth et al., 2016). The concept of generalization is important here. The child must learn that the word “dog” does not refer only to the particular animal at home, and that dogs of different colors and sizes belong to the same category.

The brain's construction of a common structure from individual experiences is one of the fundamental cognitive processes of development. However, sleep is no substitute for language development itself. Reciprocal conversation with the child, establishing joint attention, responding to the child's communicative bids, shared book reading, and the provision of a rich but developmentally appropriate language environment are the principal determinants of language development.

Good sleep is not an intervention that replaces these experiences; it is one of the factors that support the biological environment in which learning takes place.

White Matter, Myelination, and Functional Connectivity

One of the important features of early brain development is that different brain regions begin to work together with increasing efficiency. This requires not only the presence of neurons but also the efficient operation of the connections between them.

Parallels have been demonstrated between developmental changes in the sleep EEG and the development of white matter and functional connectivity. Associations have been reported between the regional distribution of slow-wave activity and cortical maturation and myelination (Riggins et al., 2024).

Neuroimaging studies in recent years have shown associations between sleep duration and certain sleep characteristics on the one hand, and white matter volume or functional connectivity on the other (Uchitel et al., 2022). However, a substantial proportion of these studies have been conducted in older children, and data from infancy remain limited.

Families should therefore not be given messages of the form “more sleep increases myelination.” Sleep is part of the developmental biology of the brain, but it is not the sole regulator of brain development.

Sleep and the Developing Brain in the Preterm Infant

In preterm infants, sleep is a matter of particular importance. An infant born very early spends in the neonatal intensive care unit an important neurodevelopmental period that would normally be spent in the intrauterine environment.

During this period the brain is growing rapidly, cortical folding is increasing, thalamocortical connections are developing, and white matter organization is ongoing. The neonatal intensive care environment, however, differs markedly from the physiological fetal environment.

Noise, light, monitor alarms, respiratory support, caregiving procedures, blood sampling, position changes, and other medical interventions can interrupt the infant's sleep-wake states. A 2025

review in Pediatric Research identifies noise, light, respiratory support, and clinical interventions as among the principal environmental factors that can disrupt sleep and circadian organization in high-risk infants (Neukamm et al., 2025).

These conditions further underscore the importance of developmental care approaches in the neonatal intensive care unit (Rohmah et al., 2025). An important scientific distinction must nonetheless be made: the fact that protecting the preterm infant's sleep is physiologically sensible does not mean that any specific sleep intervention has been proven to improve long-term neurodevelopmental outcomes.

For example, the imitation of a day-night light cycle in the neonatal intensive care unit has been studied for a long time. The 2024 Cochrane review included 20 studies involving 1633 preterm infants, but concluded that the evidence regarding the effect of cycled lighting on growth or neurodevelopment is of very low certainty. There are also insufficient data with respect to major neurodevelopmental disability (Morag et al., 2024).

In the care of the preterm infant, the aim is therefore to preserve the physiological sleep-wake pattern as far as possible, to reduce unnecessary light and noise, and to provide care responsive to the infant's individual behavioral cues; claims that specific environmental sleep protocols definitively improve long-term development should be avoided.

Development of the Circadian System in the First Years

The infant is not born with a day-night rhythm as pronounced as that of adults. Circadian organization becomes progressively more distinct over the first months of life.

The suprachiasmatic nucleus in the hypothalamus serves as the central biological clock. This system is, however, influenced by environmental time cues, the most important of which is light. Feeding times, physical activity, social interactions, and family routines may also play a role in the organization of the daily rhythm.

Sleep is also regulated by homeostatic mechanisms. The longer a child stays awake, the higher the sleep pressure rises; it decreases with sleep. The circadian system, in turn, promotes a

tendency toward wakefulness or sleep at particular times of day. These two systems are not entirely independent of each other.

A young child's becoming ready for sleep in the evening hours therefore cannot be explained solely by “being tired.” Duration of wakefulness, the biological clock, and environmental time cues operate together.

Evening Light, Melatonin, and the Young Child

It is now known that the effect of evening light on sleep is not unique to adults. In a controlled experiment, exposure of 10 preschool children with a mean age of about four years to approximately 1000 lux of bright light for one hour before bedtime produced an average melatonin suppression of 87.6%, and the effect was shown to persist after the light ended (Akacem et al., 2018). Although the sample was small, the study is important in demonstrating that the circadian system of young children can respond strongly to evening light.

Subsequent studies also suggest that the circadian response to evening light may be pronounced in preschool children. These results should nevertheless be interpreted with caution. Light applied in the laboratory at a specific intensity and spectral composition is not equivalent to a child watching a tablet for a few minutes.

Intense light exposure and screen use in the evening hours can affect the circadian system and the transition to sleep; the effect of screens may arise not only from blue light but also from content, arousal, duration of use, and the delay of bedtime.

Screen Use, Sleep, and Brain Development

When evaluating the effects of screen use, consequences for sleep should be distinguished from those for neurodevelopment. Generalizations to the effect that a given digital content directly “disrupts brain development” go beyond the scientific data in most cases. The relationship between screen use and sleep, by contrast, is more consistent.

The recent technical report of the American Academy of Pediatrics states that there is strong evidence that digital media use around bedtime in children and adolescents is associated with shorter sleep, delayed sleep onset, and poorer sleep quality. Possible

mechanisms include, in addition to the circadian effect of light, stimulating content, the presence of the device in the bedroom, and the displacement of sleep time by screen use (Munzer et al., 2026).

Particularly in early childhood, the “displacement” effect is important. If a child watches a screen for 45 minutes before bed, this time may not be taken from sleep alone. It may also replace developmentally valuable activities such as book reading, conversation with the caregiver, free play, and winding down.

Reducing screen use to a mere count of minutes is therefore insufficient. What is watched, with whom, at what hour, and which activity the screen replaces also matter.

The Bedtime Routine Is Not Merely a Technique for Inducing Sleep

A regular bedtime routine can provide predictability for the circadian system. For early childhood development, however, the bedtime routine has a further dimension.

Activities such as book reading, singing, calm conversation, and physical closeness are at the same time opportunities for reciprocal interaction between caregiver and child.

In a longitudinal study following 4274 children, the presence at age three of language-based bedtime routines such as regular book reading, storytelling, or singing was associated at age five with longer nighttime sleep and higher verbal test scores. It should be remembered, however, that families who use such routines may differ in other respects as well, and that an observational association does not by itself demonstrate causality (Hale et al., 2011).

Evaluations of bedtime routines support the association of consistent and calm routines with better sleep outcomes (Cook et al., 2024; Mindell & Williamson, 2018).

The bedtime routine can thus serve two fundamental functions at once: signaling the approach of biologically timed sleep, and creating a space of high-quality, reciprocal interaction with the child.

Sleep, Executive Functions, and Self-Regulation

One of the important developmental achievements of early childhood is the child's growing ability to regulate behavior and

emotions. Sustaining attention, inhibiting a behavior, being able to wait, shifting between activities, and coping with intense emotions are components of the self-regulation system.

These skills are related to the development of the prefrontal cortex and of other cortical and subcortical networks. Insufficient sleep can impair attention and cognitive control performance, particularly in older children. Observational research in early childhood has likewise reported associations between sleep characteristics and self-regulation (Breitenstein et al., 2021).

The relationship is, however, bidirectional. A child with poor self-regulation may have difficulty leaving play at bedtime, disengaging from environmental stimuli, or reducing their own arousal level. As a result, the transition to sleep may be prolonged.

Insufficient or fragmented sleep can in turn make it harder for the child to regulate themselves the following day. A mutually reinforcing cycle between sleep and behavior can thus develop.

For this reason, a detailed sleep history is important in young children evaluated for hyperactivity, irritability, or attention difficulties.

Sleep and Emotional Regulation

Among sleep-related effects, emotional regulation is one of the domains most readily observed by parents in daily life. Young children with insufficient sleep may show crying, restlessness, temper outbursts, and reduced frustration tolerance.

Studies examining the relationship between sleep and emotional regulation generally show that poorer sleep is associated with greater difficulty in emotional regulation (Tomaso et al., 2022). This relationship is likewise not unidirectional.

Anxiety, sensory sensitivity, stress, tension within the family, and neurodevelopmental differences can affect both the child's emotional behavior and their sleep. In clinical evaluation, a biopsychosocial approach should therefore be adopted instead of the two extreme interpretations that “the behavior problem is caused by sleep” or “the sleep problem is caused by behavior.”

Sleep Duration: How Many Hours Are Enough?

One of the questions families ask most frequently is how many hours a child should sleep per day. According to AASM recommendations, 12-16 hours of sleep per 24 hours including naps is recommended for infants aged 4-12 months, 11-14 hours for ages 1-2 years, and 10-13 hours for ages 3-5 years (Paruthi et al., 2016).

The WHO guidelines on 24-hour movement behaviors for children under five similarly emphasize age-appropriate, good-quality sleep with regular sleep and wake times. For ages 1-2 years, 11-14 hours are recommended, and for ages 3-4 years, 10-13 hours (World Health Organization, 2019).

These ranges should not, however, be used as rigid thresholds in clinical evaluation. Individual sleep requirements vary. The child's development, daytime alertness, behavior, physical health, and overall 24-hour sleep pattern should be evaluated together.

For example, it is not scientific to conclude from the fact that one child sleeps 11 hours and 5 minutes and another 10 hours and 45 minutes that the first child's brain development will be better.

Sleep Duration or Sleep Quality?

Total duration alone does not account for sleep health. A child may spend the recommended number of hours in bed yet experience numerous respiratory arousals. Another child may appear to sleep enough while their bedtimes and wake times shift by several hours from day to day.

In evaluating a child's sleep, at a minimum, total duration, timing, sleep onset, night wakings, daytime naps, snoring or breathing difficulty, circadian regularity, and daytime functioning should therefore be assessed together.

Particularly when snoring, apnea, sleep-related breathing difficulty, or markedly restless sleep is present, a mere count of total hours is not sufficient.

Do Night Wakings Harm Brain Development?

No. Night wakings in infancy are in most cases physiological. Especially in the first months, expecting adult-type uninterrupted nighttime sleep is unrealistic because of small stomach

capacity, feeding needs, a still-developing circadian system, and short sleep cycles.

Over the first year, sleep becomes progressively consolidated into the night and longer sleep blocks emerge (Acosta et al., 2025). The thought that “my baby still wakes at night, so their brain cannot rest enough” therefore creates unnecessary anxiety in most cases.

What matters clinically is whether the wakings are age-appropriate and whether an underlying problem is present. Recent systematic reviews covering children under three years of age have reported that better sleep consolidation was associated in some studies with cognitive, language, and social-emotional outcomes, but that the findings were heterogeneous.

It is therefore not correct to regard physiological night waking as developmental harm.

Why Is the “More Sleep = Better Brain” Equation Wrong?

Brain development cannot be reduced to a linear equation of sleep duration. Insufficient and chronically disrupted sleep may be associated with certain developmental and behavioral outcomes. However, there is no evidence that sleeping beyond biological need increases a child's intelligence, language development, or executive functions.

In the 2024 systematic review, most of the studies evaluating nighttime sleep duration in infants aged 0-18 months, and the majority of those evaluating total sleep duration, found no significant association with developmental outcomes (Butler et al., 2024).

Meeting the sleep requirement is important; but sleep should not be treated as an “intervention” aimed at enhancing cognitive performance.

Does Going to Bed Earlier Develop the Brain Better?

No such conclusion can be drawn from bedtime alone. Not every child who falls asleep at 7:30 p.m. is neurodevelopmentally advantaged over a child who falls asleep at 9:00 p.m.

What matters here is the child's biological sleep timing, morning wake time, total sleep duration, and the family's routine. For example, a three-year-old who must get up at 6:30 a.m. and falls asleep at 10:30 p.m. may be chronically sleep deprived. By contrast,

for a child who wakes at 9:00 a.m. because of the family's daily routine, going to bed at 9:30 p.m. is not in itself an indicator of neurodevelopmental risk.

Sleep counseling should therefore be based on the child's total 24-hour sleep pattern rather than on fixed clock-time prescriptions.

Frequently Asked Questions from Families

Is my child's brain really developing during sleep?

Yes; but brain development does not occur only during sleep. Brain development continues 24 hours a day. During wakefulness the child interacts with the environment and gains experience; during sleep, part of these experiences are processed, integrated with memory, and the neural networks are reorganized.

The child learns from the environment while awake; sleep enables the developing brain to process these experiences.

If I make my child sleep more, will their intelligence increase?

No. An age-appropriate amount of good-quality sleep is part of healthy development; however, sleeping beyond biological need has not been shown to increase intelligence.

Is it better to give up the daytime nap as late as possible?

No. The daytime nap is a physiological need in infancy and early toddlerhood and may contribute to the consolidation of some learning processes. As the child grows, however, the need for daytime sleep decreases.

If a long, late-afternoon nap has begun to delay nighttime sleep, the child's 24-hour sleep schedule should be re-evaluated. Giving up the daytime nap should be judged not by chronological age alone but by the child's individual sleep need.

Does night waking harm brain development?

Normal physiological night wakings are not an indicator of harm. Especially in infancy, night wakings are a normal part of development. However, if there is pronounced snoring, apnea, breathing difficulty, very prolonged wakeful periods, or severe sleep fragmentation affecting daytime functioning, the underlying cause should be investigated.

Is giving a tablet before bed really harmful?

The central issue here is not a simplified claim that “the tablet damages the brain.” Evening screen use can delay sleep onset; the content can arouse the child, the light can affect the circadian system, and screen use can displace book reading or calm parent-child interaction.

Limiting screen use around bedtime and keeping screens out of the bedroom is therefore a practical sleep health recommendation (Munzer et al., 2026).

Is reading a book before sleep beneficial for brain development?

Book reading is valuable for two reasons. First, it can be part of a calm and predictable bedtime routine. Second, and more importantly, it creates a reciprocal language and communication experience with the child.

Its benefit therefore cannot be explained solely by “the book putting the child to sleep.” It also carries developmental value in terms of joint attention, word learning, and caregiver-child interaction.

Is it a problem if they stay up late on weekends?

There are no data showing that occasional variations cause neurodevelopmental harm. However, continual large shifts in sleep and wake times can disturb circadian regularity. Particularly in early childhood, maintaining a generally predictable rhythm is beneficial.

The aim is not to create a rigid schedule, but to provide a consistent routine that can be adapted to family life.

If we cannot establish a perfect sleep routine, will our child's development be affected?

No. Child development does not depend on a single bedtime routine. Families differ in working hours, siblings, living conditions, and cultural practices.

The purpose of scientific sleep recommendations is not to create a new performance pressure on parents, but to support a sustainable sleep environment as far as possible.

When Is Medical Evaluation Needed for Sleep Problems?

In particular, when there is pronounced snoring or sleep-related breathing difficulty, observed apnea, persistent mouth breathing, very restless sleep, markedly short sleep for age, excessive daytime sleepiness, marked sleep-related behavioral change, developmental regression, or the new emergence of severe sleep problems not previously present, “sleep hygiene” advice alone should not be considered sufficient.

In these children, possible causes such as sleep-related breathing disorders, neurological problems, iron deficiency-related movement disorders, medication effects, and neurodevelopmental conditions should be evaluated within the clinical context.

A Family-Centered Approach

There is no single universal method for healthy sleep in early childhood. Culture, the family's working conditions, the number of children at home, the caregivers' health status, and the child's temperament can all affect the sleep routine.

Sleep counseling should therefore not be reduced to a prescriptive approach of the form “your child must be in bed at 8:00 p.m.” A sustainable routine should be developed together with the family.

A calm and repeatable bedtime routine, exposure to natural light in the morning and during the day, age-appropriate physical activity, progressively less stimulating activities in the evening, and attention to the child's individual sleep cues constitute workable basic principles for most families.

The WHO likewise addresses early childhood not through sleep alone but through a 24-hour movement behavior framework, recommending that adequate sleep, physical activity, and sedentary behaviors be evaluated together (World Health Organization, 2019).

This holistic approach also provides a more appropriate framework for neurodevelopment, because brain development requires not only good sleep but also movement, play, social interaction, language experience, nutrition, and secure relationships.

The Limits of the Evidence

Although the field of sleep and early brain development offers strong biological rationales and numerous striking findings, important methodological limitations also exist. Long-term sleep deprivation experiments cannot ethically be conducted in infants and young children. Most studies are therefore observational.

Parent-reported sleep durations may not correspond exactly to actual sleep durations. Actigraphy provides more objective data but cannot distinguish sleep stages as well as polysomnography. Polysomnography and detailed EEG, in turn, are difficult to apply in large samples.

It is also difficult to determine the direction of the relationship between sleep and development. Sleep may be influencing development; developmental characteristics may be influencing sleep; or the family environment, genetic makeup, or health conditions may be influencing both.

In the early childhood sleep literature, the concepts of association, prediction, and causation must therefore be kept distinct. The 2024 systematic review, which did not conclude that a definitive relationship exists between infant sleep and cognitive and psychomotor development, illustrates these limitations well (Butler et al., 2024).

The most scientifically prudent approach is to acknowledge that sleep is an important part of the biological environment of early neurodevelopment, while not presenting bedtime or sleep duration as an independent metric that determines the child's future cognitive capacity.

Conclusion

Early childhood is a period in which the structural and functional organization of the brain changes at an extraordinary pace. During these years the child also spends a far greater proportion of life asleep than in any later period.

Sleep therefore cannot be regarded as a passive period of rest. The available scientific evidence shows that sleep is associated with synaptic plasticity, memory consolidation, the generalization of learned information, the maturation of functional brain networks, language learning, and emotional-behavioral regulation. In

particular, there is experimental evidence that sleep following learning supports certain types of memory.

By contrast, the relationship between total sleep duration in infancy and later cognitive or psychomotor development is less consistent than commonly assumed. The scientific message for early childhood therefore cannot be summarized as “the more sleep, the better the brain.”

The developing brain needs age-appropriate, sufficient, and good-quality sleep; but development is not determined by sleep alone.

Sleep is not the opposite of the experiences gained during wakefulness but their complement. While awake, the child sees, hears, moves, relates, and learns. During sleep, the developing brain selects, processes, and integrates part of these experiences with prior knowledge.

In early childhood, healthy sleep should therefore be viewed not as a special performance intervention that “enhances” neurodevelopment, but as one of the biological conditions necessary for healthy development to take place.

Kaynakça/References

Acosta, J., Schmarder, K. M., & Tapia, I. E. (2025). Optimizing infant and toddler sleep: A review on evidence-based approaches to promote sleep consolidation. *Paediatric Respiratory Reviews*. Advance online publication.

Akacem, L. D., Wright, K. P., Jr., & LeBourgeois, M. K. (2018). Sensitivity of the circadian system to evening bright light in preschool-age children. *Physiological Reports, 6*(5), e13617. https://doi.org/10.14814/phy2.13617

Belia, M., Keren-Portnoy, T., & Vihman, M. (2025). Word form generalization across voices: The role of infant sleep. *Journal of Experimental Child Psychology*, *249*, 106106. https://doi.org/10.1016/j.jecp.2024.106106

Breitenstein, R. S., Hoyniak, C. P., McQuillan, M. E., & Bates, J. E. (2021). Sleep and self-regulation in early childhood. *Advances in Child Development and Behavior, 60*, 111-145.

Butler, B., Burdayron, R., Mazor Goder, G., Lewis, C., Vendette, M., Khoury, B., & Pennestri, M.-H. (2024). The association between infant sleep, cognitive, and psychomotor development: A systematic review. *Sleep, 47*(11), zsae174. https://doi.org/10.1093/sleep/zsae174

Cook, G., Carter, B., Wiggs, L., & Southam, S. (2024). Parental sleep-related practices and sleep in children aged 1-3 years: A systematic review. *Journal of Sleep Research, 33*(4), e14120. https://doi.org/10.1111/jsr.14120

Dan, B. (2025). The first 1000 days: A critical window for neurodevelopmental trajectories and interventions - and for parents. *Developmental Medicine & Child Neurology, 67*. https://doi.org/10.1111/dmcn.16386

de Groot, E. R., Dudink, J., & Austin, T. (2024). Sleep as a driver of pre- and postnatal brain development. *Pediatric Research, 96*, 1503-1509. https://doi.org/10.1038/s41390-024-03371-5

Friedrich, M., Wilhelm, I., Born, J., & Friederici, A. D. (2015). Generalization of word meanings during infant sleep. *Nature Communications, 6*, 6004. https://doi.org/10.1038/ncomms7004

Gilmore, J. H., Knickmeyer, R. C., & Gao, W. (2018). Imaging structural and functional brain development in early childhood. *Nature Reviews Neuroscience, 19*(3), 123-137. https://doi.org/10.1038/nrn.2018.1

Hale, L., Berger, L. M., LeBourgeois, M. K., & Brooks-Gunn, J. (2011). A longitudinal study of preschoolers' language-based bedtime routines, sleep duration, and well-being. *Journal of Family Psychology, 25*(3), 423-433. https://doi.org/10.1037/a0023564

Horváth, K., Liu, S., & Plunkett, K. (2016). A daytime nap facilitates generalization of word meanings in young toddlers. *Sleep, 39*(1), 203-207. https://doi.org/10.5665/sleep.5348

Hupbach, A., Gomez, R. L., Bootzin, R. R., & Nadel, L. (2009). Nap-dependent learning in infants. *Developmental Science, 12*(6), 1007-1012. https://doi.org/10.1111/j.1467-7687.2009.00837.x

Mindell, J. A., & Williamson, A. A. (2018). Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Medicine Reviews, 40*, 93-108. https://doi.org/10.1016/j.smrv.2017.10.007

Morag, I., Xiao, Y.-T., & Bruschettini, M. (2024). Cycled light in the intensive care unit for preterm and low birth weight infants. *Cochrane Database of Systematic Reviews, 2024*(12), CD006982. https://doi.org/10.1002/14651858.CD006982.pub5

Munzer, T., Milkovich, L. M., Madigan, S., Tomopoulos, S., Parga-Belinkie, J., Ajumobi, T., Cross, C., & Gerwin, R. (2026). Digital ecosystems, children, and adolescents: Technical report. *Pediatrics, 157*(2), e2025075321. https://doi.org/10.1542/peds.2025-075321

Neukamm, A. C., Quante, M., Poets, C. F., Shellhaas, R. A., Naulaers, G., de Groot, E. R., Dudink, J., Dereymaeker, A., Boylan, G. B., & Austin, T. (2025). The impact of sleep in high-risk infants. *Pediatric Research, 98*(6), 2073-2081. https://doi.org/10.1038/s41390-025-04049-2

O'Connor, C., Ventura, S., Proietti, J., O'Sullivan, M. P., Boylan, G. B., Shellhaas, R. A., Quante, M., Naulaers, G., de Groot, E. R., Dudink, J., Dereymaeker, A., & Austin, T. (2026). Sleep and infant development in the first year. *Pediatric Research*. Advance online publication. https://doi.org/10.1038/s41390-026-04780-4

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Riggins, T., Ratliff, E. L., Horger, M. N., & Spencer, R. M. C. (2024). The importance of sleep for the developing brain. *Current Sleep Medicine Reports, 10*(4), 437-446. https://doi.org/10.1007/s40675-024-00307-7

Rohmah, I., Mukminin, M. A., Hasan, F., et al. (2025). Comparative effects of nonpharmacological interventions on sleep-wake states among preterm infants in neonatal intensive care units: A systematic review and network meta-analysis. *Intensive and Critical Care Nursing, 91*, 104168.

Tomaso, C. C., Johnson, A. B., & Nelson, T. D. (2022). Associations of sleep and emotion regulation processes in childhood and adolescence - a systematic review, report of methodological challenges and future directions. *Sleep Science, 15*(4), 490-514. https://doi.org/10.5935/1984-0063.20220082

Uchitel, J., Vanhatalo, S., & Austin, T. (2022). Early development of sleep and brain functional connectivity in term-born and preterm infants. *Pediatric Research, 91*(4), 771-786. https://doi.org/10.1038/s41390-021-01497-4

Werchan, D. M., & Gómez, R. L. (2014). Wakefulness (not sleep) promotes generalization of word learning in 2.5-year-old children. *Child Development, 85*(2), 429-436. https://doi.org/10.1111/cdev.12149

Wilhelm, I., Prehn-Kristensen, A., & Born, J. (2012). Sleep-dependent memory consolidation - What can be learnt from children? *Neuroscience & Biobehavioral Reviews, 36*(7), 1718-1728. https://doi.org/10.1016/j.neubiorev.2012.03.002

World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. World Health Organization.

BÖLÜM 2

SLEEP DURATION AND SLEEP NEED IN CHILDREN: FROM THE NEWBORN PERIOD TO ADOLESCENCE

Yusuf DENİZ[1]

Introduction

The question, “How many hours should a child sleep?” cannot be answered with a single number because sleep changes with development. The pediatric recommendations of the American Academy of Sleep Medicine and the World Health Organization guideline for children younger than 5 years define age-based ranges. These ranges consider normative distributions and health outcomes (Paruthi et al., 2016a, 2016b; World Health Organization, 2019). They support clinical communication but do not prove sleep adequacy or provide a diagnostic threshold for an individual child.

Observed sleep duration is shaped by school schedules, family routines, culture, and the measurement method, as well as biological need. Total sleep duration decreases across childhood, while nighttime sleep becomes more consolidated and daytime sleep declines (Galland et al., 2012; Iglowstein et al., 2003). The same total duration may therefore represent fragmented sleep in an infant and continuous nighttime sleep in a school-aged child.

The literature usually reports recommended sleep duration or observed sleep duration, whereas individual sleep need cannot be measured directly. This chapter examines recommended sleep duration, observed sleep duration, sleep opportunity, and individual sleep need together. These concepts are not adequately distinguished in the literature. The aim is to synthesize this distinction for clinical

[1] Asst. Prof., MD, Department of Pediatrics, Karabük University Faculty of Medicine, Karabük, Türkiye, ORCID: 0000-0003-3684-2421

practice using developmental evidence (Matricciani et al., 2013; Sawyer et al., 2019). Health outcomes are discussed only when they help clarify this central question.

This approach helps avoid two common errors. The first is to regard every value below the recommended range as pathological. The second is to consider short sleep adequate when the child reports no clear complaint. Young children may be unable to describe sleepiness. Older children may believe that they have adapted to chronic sleep restriction. Sleep duration and daytime function are therefore complementary parts of the same assessment (Matricciani et al., 2013; Sawyer et al., 2019).

Four Core Concepts

Recommended and Observed Sleep Duration

Recommended sleep duration is the population range considered compatible with health. Observed sleep duration is measured by a diary, questionnaire, or actigraphy. Thresholds for “short” and “long” sleep vary across pediatric studies. This variation limits the use of study findings as a single universal cutoff (Sawyer et al., 2019). Parent reports, sleep diaries, and actigraphy also differ in how accurately they capture sleep onset and nighttime wakefulness (Meltzer et al., 2012; Werner et al., 2008).

Sleep Opportunity and Individual Sleep Need

Sleep opportunity is the period during which the child can sleep. Actual sleep may be shorter. Individual sleep need is the amount of sleep required for refreshed waking and age-appropriate daytime function. It cannot be observed directly (Matricciani et al., 2013). This distinction matters. Short observed sleep duration may reflect inadequate sleep opportunity, difficulty initiating or maintaining sleep, or a lower individual sleep need.

These four concepts can be applied in a clinical sequence. First, the age-based recommendation provides a reference point. The child's actual sleep duration and the sleep opportunity in which it occurs are then determined. Finally, morning waking, daytime alertness, and catch-up sleep on free days are assessed. Eight hours of sleep may indicate marked restriction in a school-aged child. In

some adolescents, the same duration is at the lower limit of the recommended range (Matricciani et al., 2013; Paruthi et al., 2016a).

The trajectory of observed sleep duration is more informative than a single measurement. The expected gradual decline with age differs from a marked reduction over a few weeks. Likewise, a temporary increase during a growth spurt, recovery from illness, or intense physical activity may not indicate a persistently high sleep need. Assessment should compare the child with both peers and the child's own previous pattern (Galland et al., 2012; Matricciani et al., 2013).

Conceptual focus of the chapter

Recommended sleep duration is a reference, observed sleep duration is a measurement, and sleep opportunity is an environmental condition. Individual sleep need is estimated clinically and may vary with development. These four concepts should not be used interchangeably (Matricciani et al., 2013; Paruthi et al., 2016a).

How Can Individual Sleep Need Be Estimated?

Direct evidence shows that age-based recommendations provide population-level ranges. It also shows that sleep diaries, parent reports, and actigraphy may measure the same sleep components differently (Matricciani et al., 2013; Meltzer et al., 2012; Paruthi et al., 2016a; Werner et al., 2008). Current studies do not define a validated observation period or a stepwise “sleep need test” for determining individual sleep need.

Given these limitations, the following approach is a practical clinical synthesis rather than a validated algorithm. An adequate observation period of several days to one week may be useful. It should include days not constrained by school or childcare schedules. A diary may record bedtime and wake time, estimated sleep onset, nighttime awakenings, daytime sleep, and catch-up sleep on free days. This period is a flexible sampling range, not a fixed threshold. Its purpose is to reduce the effect of night-to-night variation.

After a regular and age-appropriate sleep opportunity is provided, spontaneous waking, morning refreshment, daytime

sleepiness, irritability, and attention can be monitored. Better function and less catch-up sleep on free days after sleep opportunity is increased may suggest that the previous schedule was inadequate. This is an interpretation based on the clinical response, not a direct measurement of biological need. Persistent functional impairment despite adequate opportunity warrants assessment for a sleep disorder or another clinical cause rather than simply extending sleep time (Kteish et al., 2026; Matricciani et al., 2013).

Parent reports are more informative when they focus on specific indicators rather than a general judgment of adequacy. These indicators include the pattern of waking, daytime alertness, and catch-up sleep on free days. Actigraphy can provide additional information when needed, but device data do not replace the clinical history (Meltzer et al., 2012; Werner et al., 2008).

Recommended Sleep Duration by Age

Table 1. Age-based framework for total sleep duration in healthy children

Age group	**Recommended total duration**	**Daytime sleep**	**Clinical interpretation**
0-3 months	Approximately 14-17 hours/24 hours*	Multiple and variable	The physiological range is wide.
4-12 months	12-16 hours/24 hours	Included in the total	Nighttime sleep gradually consolidates.
1-2 years	11-14 hours/24 hours	Included in the total	The transition to one nap varies.
3-5 years	10-13 hours/24 hours	Included in the total if present	The need for daytime sleep decreases.
6-12 years	9-12 hours/24 hours	Usually absent	The schedule may reduce sleep opportunity.
13-18 years	8-10 hours/24 hours	Not routinely expected	Circadian delay is common.

Source: Paruthi et al. (2016a, 2016b); World Health Organization (2019); for ages 0-3 months, the National Sleep Foundation recommendation (Hirshkowitz et al., 2015). *The AASM has not issued a recommendation for infants younger than 4 months because of insufficient evidence.

Developmental Periods

Newborn Period and Infancy

Newborn sleep consists of multiple periods across 24 hours because of feeding needs and an immature circadian system. Reported total sleep duration varies widely. A pattern observed over several days should therefore be assessed instead of a single night. Feeding effectiveness, weight gain, quality of wakefulness, and respiratory symptoms should also be considered (Galland et al., 2012; Hirshkowitz et al., 2015; Iglowstein et al., 2003). After 4 months, nighttime sleep becomes longer and daytime sleep becomes more predictable. A total sleep range of 12-16 hours is used (Paruthi et al., 2016a, 2016b; World Health Organization, 2019). Development during this period involves not only a reduction in total hours but also the organization of fragmented sleep toward nighttime.

During infancy, a parent's observation that the infant “wakes too often” or “sleeps too long” may be more informative than the total number of hours. The context must still be explored. Age-appropriate waking for feeding may be recorded as pathological fragmentation. Quiet wakefulness may be recorded as sleep. Because of this measurement uncertainty, the direction of change is often more useful than a single total. Progressively longer nighttime sleep periods and alert wake periods are consistent with maturation (Galland et al., 2012; Iglowstein et al., 2003).

Toddler and Preschool Periods

A total of 11-14 hours is recommended at ages 1-2 years, and 10-13 hours at ages 3-5 years (Paruthi et al., 2016a, 2016b; World Health Organization, 2019). The transition from two naps to one and then to no daytime sleep should not be judged by chronological age alone. Nighttime sleep onset, total sleep duration, and daytime behavior provide a better guide. Reviews and meta-analyses show wide age-related variation in nap patterns. Mandatory or late naps

may delay nighttime sleep in some children (Staton et al., 2020; Thorpe et al., 2015). This evidence suggests that naps should not be classified as “good” or “bad.” They should be assessed as part of the total 24-hour sleep pattern.

Associations between short sleep in preschool children and later behavioral or cognitive outcomes are generally small and context-dependent (Guerlich et al., 2024). Daytime restlessness should not therefore be attributed to sleep duration alone. Sleep opportunity should still be reviewed when sleep has recently shortened or when difficulty waking or a change in function is present.

School Age

The recommended duration for ages 6-12 years is 9-12 hours (Paruthi et al., 2016a, 2016b). School start times fix the morning wake time, while homework, travel, and evening activities may reduce sleep opportunity. Time awake after going to bed and nighttime awakenings should be considered when calculating actual sleep duration (Meltzer et al., 2012; Werner et al., 2008). Markedly longer sleep on weekends may suggest a weekday sleep deficit. The clinical aim is not to prevent catch-up sleep but to reduce the loss of sleep opportunity on weekdays.

Adolescence

Adolescents are advised to obtain 8-10 hours of sleep, but circadian delay and early school start times affect sleep opportunity in opposing directions (Crowley et al., 2018; Paruthi et al., 2016a, 2016b). The increase in sleep duration with later school start times shows that short sleep cannot be explained by individual choice alone (Bowers & Moyer, 2017; Dunster et al., 2018). Late or irregular timing may also be associated with functional outcomes. Because these associations may be bidirectional, sleep duration, timing, and daytime function should be assessed together during the clinical interview (Dutil et al., 2022; Walsh et al., 2025).

How Is Sleep Duration Associated with Health Outcomes?

Systematic reviews associate short sleep with adiposity and some measures of emotional, cognitive, and school functioning (Chaput et al., 2016; Miller et al., 2018; Short et al., 2018).

However, the effects are generally small, measurement methods are heterogeneous, and the possible pathways are bidirectional. This evidence does not provide a single “healthy duration” for an individual child. It supports assessing a persistent pattern below the age-appropriate range together with daytime function and related behaviors.

Longitudinal data strengthen the observed associations between short sleep and some neurocognitive and mental health outcomes, but do not establish causality on their own (Yang et al., 2022). The reported association with self-harm or suicidal ideation in adolescents should not be interpreted as a specific effect of sleep. It should prompt a broader mental health assessment (Chiu et al., 2018). These health outcomes support the chapter's central argument that individual sleep need cannot be inferred from duration alone.

Factors That Affect Sleep Duration

Screen use may affect sleep opportunity through content, timing, and the presence of a device in bed. A meta-analysis of portable screen-based devices associated access or use with adverse sleep outcomes (Carter et al., 2016). In contrast, a 2026 within-person meta-analysis found only a small association between greater daily screen use and later sleep onset. It found no significant daily association with total sleep duration, sleep latency, sleep efficiency, or overall sleep quality (Bourke et al., 2026). Taken together, the evidence does not support the broad claim that screens impair every dimension of sleep. It supports asking specifically about use near bedtime and the resulting loss of sleep opportunity.

Sleep opportunity does not depend only on the choices of the child or parent. A systematic review included children and adolescents. It found that neighborhood socioeconomic conditions, safety, noise, and other physical features may be associated with sleep duration or sleep problems (Mayne et al., 2021). Most of the evidence is observational, so these factors cannot be interpreted as causes at the individual level. Clinically, short sleep should not immediately be attributed to a low biological need or inadequate parental effort.

Clinical Assessment and Counseling

A brief clinical assessment covers sleep times on weekdays and free days, daytime sleep, sleep onset, and nighttime awakenings. It also covers snoring, difficulty waking in the morning, and daytime function. A change from the child's previous pattern, growth, neurodevelopment, mental health, medication use, and the family schedule guide interpretation. This interview applies the practical framework presented earlier in this chapter. It is not a separate algorithm for determining an optimal duration.

Habitual snoring accompanied by breathing pauses, labored breathing, morning headache, or growth, learning, or behavioral problems warrants assessment for obstructive sleep apnea (Marcus et al., 2012). Persistent difficulty initiating or maintaining sleep and impaired daytime function despite adequate sleep opportunity warrant assessment for pediatric insomnia (Kteish et al., 2026). Persistent excessive sleepiness also requires investigation of causes other than sleep duration (Kteish et al., 2026). When thoughts of self-harm are present, sleep management alone is insufficient and a comprehensive mental health assessment is required (Chiu et al., 2018).

Parent counseling should address the identified problem. Options include a consistent morning wake time, developmentally appropriate daytime sleep, a calm bedtime routine, and fewer stimulating activities near bedtime. Behavioral interventions may improve sleep onset and nighttime awakenings in young children. Their effects vary by intervention type and outcome measure (Lecuelle et al., 2024; Meltzer & Mindell, 2014). Response should be monitored through changes in actual sleep and daytime function, not bedtime alone.

The feasibility of counseling is as important as the scientific basis of the recommendation. An ideal schedule may not be sustainable if family work hours, siblings' routines, or room sharing are ignored. Instead of changing the entire routine at once, the factor that most limits sleep opportunity can be addressed first. After a small and measurable change, the response in actual sleep and morning and daytime function can be assessed. If there is no benefit,

the initial assumption should be reconsidered (Lecuelle et al., 2024; Mayne et al., 2021; Meltzer & Mindell, 2014).

Brief framework for clinical practice

1) Record sleep across 24 hours. 2) Distinguish sleep opportunity from actual sleep. 3) Use the age-based range as a starting reference. 4) Monitor the child's sleep pattern together with daytime function. 5) Arrange further assessment for habitual snoring or breathing pauses, persistent excessive sleepiness, or thoughts of self-harm (Chiu et al., 2018; Kteish et al., 2026; Marcus et al., 2012).

Knowledge Gaps

Individual sleep need cannot currently be measured directly. It is estimated from observed sleep duration and daytime function (Matricciani et al., 2013; Meltzer et al., 2012; Werner et al., 2008). Duration, timing, and regularity often vary together in studies, which makes their independent effects difficult to separate. It also remains unclear how age-based population ranges should be translated into clinical adequacy for an individual child. Future longitudinal studies should combine sleep opportunity, objective measurements, and daytime function in the same design.

Conclusion

Sleep in children is a developmental pattern with changing distribution and timing, not simply a total number of hours that decreases with age. Age-based recommendations provide a starting reference for interpreting this change. They do not directly measure individual sleep need.

Recommended sleep duration, sleep opportunity, and actual sleep should be distinguished, and the numerical value should be interpreted together with the child's own trajectory and daytime function. No validated test can determine individual sleep need. A pattern observed over an adequate period supports clinical interpretation but does not provide a fixed threshold. If functional impairment or respiratory, insomnia, or mental health warning signs persist despite an age-appropriate sleep opportunity, the assessment should extend beyond total sleep duration.

Kaynakça/References

Bourke, M., Maddren, C. I., Sippel, F., & Thomas, G. (2026). Within-person association between daily screen use and sleep in youth: A systematic review and meta-analysis. *JAMA Pediatrics, 180*(5), 500-509. https://doi.org/10.1001/jamapediatrics.2025.6490

Bowers, J. M., & Moyer, A. (2017). Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: A meta-analysis. *Sleep Health, 3*(6), 423-431. https://doi.org/10.1016/j.sleh.2017.08.004

Carter, B., Rees, P., Hale, L., Bhattacharjee, D., & Paradkar, M. S. (2016). Association between portable screen-based media device access or use and sleep outcomes: A systematic review and meta-analysis. *JAMA Pediatrics, 170*(12), 1202-1208. https://doi.org/10.1001/jamapediatrics.2016.2341

Chaput, J.-P., Gray, C. E., Poitras, V. J., Carson, V., Gruber, R., Olds, T., Weiss, S. K., Connor Gorber, S., Kho, M. E., Sampson, M., Belanger, K., Eryuzlu, S., Callender, L., & Tremblay, M. S. (2016). Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism, 41*(6, Suppl. 3), S266-S282. https://doi.org/10.1139/apnm-2015-0627

Chiu, H.-Y., Lee, H.-C., Chen, P.-Y., Lai, Y.-F., & Tu, Y.-K. (2018). Associations between sleep duration and suicidality in adolescents: A systematic review and dose-response meta-analysis. *Sleep Medicine Reviews, 42*, 119-126. https://doi.org/10.1016/j.smrv.2018.07.003

Crowley, S. J., Wolfson, A. R., Tarokh, L., & Carskadon, M. A. (2018). An update on adolescent sleep: New evidence informing the perfect storm model. *Journal of Adolescence, 67*, 55-65. https://doi.org/10.1016/j.adolescence.2018.06.001

Dunster, G. P., de la Iglesia, L., Ben-Hamo, M., Nave, C., Fleischer, J. G., Panda, S., & de la Iglesia, H. O. (2018). Sleepmore in Seattle: Later school start times are associated with more

sleep and better performance in high school students. *Science Advances, 4*(12), eaau6200. https://doi.org/10.1126/sciadv.aau6200

Dutil, C., Podinic, I., Sadler, C. M., da Costa, B. G., Janssen, I., Ross-White, A., Saunders, T. J., Tomasone, J. R., & Chaput, J.-P. (2022). Sleep timing and health indicators in children and adolescents: A systematic review. *Health Promotion and Chronic Disease Prevention in Canada, 42*(4), 150-169. https://doi.org/10.24095/hpcdp.42.4.04

Galland, B. C., Taylor, B. J., Elder, D. E., & Herbison, P. (2012). Normal sleep patterns in infants and children: A systematic review of observational studies. *Sleep Medicine Reviews, 16*(3), 213-222. https://doi.org/10.1016/j.smrv.2011.06.001

Guerlich, K., Avraam, D., Cadman, T., Calas, L., Charles, M.-A., Elhakeem, A., Fernández-Barrés, S., Guxens, M., Heude, B., Ibarluzea, J., Inskip, H. M., Julvez, J., Lawlor, D. A., Murcia, M., Salika, T., Sunyer, J., Tafflet, M., Koletzko, B., Grote, V., & Plancoulaine, S. (2024). Sleep duration in preschool age and later behavioral and cognitive outcomes: An individual participant data meta-analysis in five European cohorts. *European Child & Adolescent Psychiatry, 33*(1), 167-177. https://doi.org/10.1007/s00787-023-02149-0

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donnell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. C., Setters, B., Vitiello, M. V., Ware, J. C., & Adams Hillard, P. J. (2015). National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health, 1*(1), 40-43. https://doi.org/10.1016/j.sleh.2014.12.010

Iglowstein, I., Jenni, O. G., Molinari, L., & Largo, R. H. (2003). Sleep duration from infancy to adolescence: Reference values and generational trends. *Pediatrics, 111*(2), 302-307. https://doi.org/10.1542/peds.111.2.302

Kteish, R., Ednick, M., & Kier, C. (2026). Pediatric insomnia. *Pediatrics in Review, 47*(1), 15-24. https://doi.org/10.1542/pir.2024-006687

Lecuelle, F., Leslie, W., Gustin, M.-P., Franco, P., & Putois, B. (2024). Treatment for behavioral insomnia in young children with neurotypical development under 6 years of age: A systematic review. *Sleep Medicine Reviews, 74*, 101909. https://doi.org/10.1016/j.smrv.2024.101909

Marcus, C. L., Brooks, L. J., Draper, K. A., Gozal, D., Halbower, A. C., Jones, J., Schechter, M. S., Sheldon, S. H., Spruyt, K., Ward, S. D., Lehmann, C., & Shiffman, R. N. (2012). Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics, 130*(3), 576-584. https://doi.org/10.1542/peds.2012-1671

Matricciani, L., Blunden, S., Rigney, G., Williams, M. T., & Olds, T. S. (2013). Children's sleep needs: Is there sufficient evidence to recommend optimal sleep for children? *Sleep, 36*(4), 527-534. https://doi.org/10.5665/sleep.2538

Mayne, S. L., Mitchell, J. A., Virudachalam, S., Fiks, A. G., & Williamson, A. A. (2021). Neighborhood environments and sleep among children and adolescents: A systematic review. *Sleep Medicine Reviews, 57*, 101465. https://doi.org/10.1016/j.smrv.2021.101465

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *Journal of Pediatric Psychology, 39*(8), 932-948. https://doi.org/10.1093/jpepsy/jsu041

Meltzer, L. J., Montgomery-Downs, H. E., Insana, S. P., & Walsh, C. M. (2012). Use of actigraphy for assessment in pediatric sleep research. *Sleep Medicine Reviews, 16*(5), 463-475. https://doi.org/10.1016/j.smrv.2011.10.002

Miller, M. A., Kruisbrink, M., Wallace, J., Ji, C., & Cappuccio, F. P. (2018). Sleep duration and incidence of obesity in infants, children, and adolescents: A systematic review and meta-analysis of prospective studies. *Sleep, 41*(4), zsy018. https://doi.org/10.1093/sleep/zsy018

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016a). Consensus statement of the American Academy of Sleep Medicine on the recommended amount of sleep for healthy children: Methodology and discussion. *Journal of Clinical Sleep Medicine, 12*(11), 1549-1561. https://doi.org/10.5664/jcsm.6288

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016b). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Sawyer, E., Heussler, H., & Gunnarsson, R. (2019). Defining short and long sleep duration for future paediatric research: A systematic literature review. *Journal of Sleep Research, 28*(6), e12839. https://doi.org/10.1111/jsr.12839

Short, M. A., Blunden, S., Rigney, G., Matricciani, L., Coussens, S., Reynolds, C. M., & Galland, B. (2018). Cognition and objectively measured sleep duration in children: A systematic review and meta-analysis. *Sleep Health, 4*(3), 292-300. https://doi.org/10.1016/j.sleh.2018.02.004

Staton, S., Rankin, P. S., Harding, M., Smith, S. S., Westwood, E., LeBourgeois, M. K., & Thorpe, K. J. (2020). Many naps, one nap, none: A systematic review and meta-analysis of napping patterns in children 0-12 years. *Sleep Medicine Reviews, 50*, 101247. https://doi.org/10.1016/j.smrv.2019.101247

Thorpe, K., Staton, S., Sawyer, E., Pattinson, C., Haden, C., & Smith, S. (2015). Napping, development and health from 0 to 5 years: A systematic review. *Archives of Disease in Childhood, 100*(7), 615-622. https://doi.org/10.1136/archdischild-2014-307241

Walsh, R. F. L., Maddox, M. A., Smith, L. T., Olino, T., Zee, P. C., Nusslock, R., & Alloy, L. B. (2025). Sleep regularity in

adolescents: Associations with sleep, rest-activity indices, and prospective substance use and depression. *Journal of Sleep Research*, *34*(6), e14468. https://doi.org/10.1111/jsr.14468

Werner, H., Molinari, L., Guyer, C., & Jenni, O. G. (2008). Agreement rates between actigraphy, diary, and questionnaire for children's sleep patterns. *Archives of Pediatrics & Adolescent Medicine, 162*(4), 350-358. https://doi.org/10.1001/archpedi.162.4.350

World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. https://www.who.int/publications/i/item/9789241550536

Yang, F. N., Xie, W., & Wang, Z. (2022). Effects of sleep duration on neurocognitive development in early adolescents in the USA: A propensity score matched, longitudinal, observational study. *The Lancet Child & Adolescent Health, 6*(10), 705-712. https://doi.org/10.1016/S2352-4642(22)00188-2

BÖLÜM 3

BASIC APPROACHES TO AGE-BASED SLEEP TRAINING IN CHILDREN

Emre ÇELİK[1]

Introduction

Sleep is one of the most invisible yet most decisive components of child health. According to the widely cited definition of Buysse (2014), good sleep health is characterized by "subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours." When this multidimensional definition is adapted to pediatrics, the "RU-SATED" model emerges: Regularity, Satisfaction, Alertness, Timing, Efficiency, and Duration. Meltzer et al. (2021) emphasize that among these six dimensions, "regularity" occupies a more central place in pediatrics than in the adult sleep-health literature, because a child's sleep is shaped from the outside by family routines, the caregiving environment, and the developmental stage. In other words, while an adult can largely influence their own sleep health through their own choices, an infant's or young child's sleep health is a direct consequence of the decisions made by the adults around them.

The clinical implications of this are not trivial. The primary-care review by Honaker and Meltzer (2015) reports that the prevalence of obstructive sleep apnea reaches 1-3%, while pediatric insomnia can reach 20-30%; yet the rate of sleep screening in primary care remains low, because physicians receive limited sleep training and parents also lack information. The authors recommend integrating a simple screening tool that can be used in routine visits,

[1] MD, Department of Pediatrics, Bursa City Hospital, Bursa, Türkiye, ORCID: 0000-0003-3658-8275

BEARS (Bedtime problems, Excessive daytime sleepiness, Awakenings, Regularity, Snoring), into clinical practice. This screening framework also indirectly supports this chapter's central thesis: “sleep problem” is not a single category; different questions must be asked, different norms applied for comparison, and different solutions proposed depending on age.

The systematic review of 59 studies by Petrin et al. (2026) demonstrates this differentiation empirically: while 77.8% of behavioral sleep interventions aimed at infants (0-2 years) focus on sleep independence and self-soothing skills, this proportion drops to 43.5% in programs aimed at preschool children (3-5 years); conversely, a focus on sleep hygiene and daily habits rises from 36.1% in infants to 65.2% in preschoolers. The same study found that preschool interventions were markedly more likely than infant interventions to directly involve the child and/or educators in the process (17.3% versus roughly 3%). These figures are not coincidental; while sleep in infancy is largely regulated externally by the caregiver, as the child grows they become the agent of their own sleep, and the nature of interventions must change accordingly.

The aim of this chapter is to systematically lay out, across the developmental journey from birth to the middle of school age (0-12 years), what sleep difficulties can be expected at each stage, which approaches are evidence-based, which techniques are not recommended at that age, and what real options families have.

0-6 Months: A Period of Maturation — Support and Safety, Not “Training”

What Does Sleep Physiology Tell Us in This Period?

The first six months of life are not, in a formal sense, a “sleep training” period; this is a transitional process during which the central nervous system gradually matures the circadian rhythm. According to the review by Gilchrist et al. (2025), which spans 35 studies, total nocturnal sleep averages 7-8 hours at birth, increases up to weeks 15-20, and reaches approximately 9.5 hours by week 24. The longest uninterrupted sleep stretch remains stable at roughly 2.5 hours during the first 10 weeks but, by week 24, can extend to 6.5 hours according to parent diaries; the frequency of night wakings

decreases gradually from birth through week 16. The circadian rhythm typically settles into a consistent day-night pattern between 3 and 6 months. As Gradisar et al. (2016) note, homeostatic sleep pressure begins to develop around the second month, and the major maturational leaps occur after the circadian rhythm stabilizes at 3-6 months. This is why frequent night waking in an infant younger than 6 months is not a “problem” but an expected state of immaturity.

Environmental factors add to this picture. The longitudinal study by Quante et al. (2022) of 313 infants in the Rise & SHINE cohort showed that sleep environment and feeding practices reported at one month predicted sleep outcomes measured by actigraphy at five months: a sleep environment that was not always dark was associated with an average of 28 fewer minutes of nighttime sleep, and bringing the infant into the parents' bed upon night waking was associated with 18 fewer minutes of nighttime sleep; conversely, a filling bottle feed at bedtime was associated with an average 62-minute increase in the longest uninterrupted sleep stretch. The authors emphasize that a dark sleep environment and a filling pre-bedtime feed are low-cost, modifiable targets that could partly reduce sleep disparities associated with race/ethnicity and parental education level.

Why Are “Extinction”-Based Techniques Not Recommended at This Age?

The “Plan B” framework of Blunden and Dawson (2020) states that methods based on gradually reducing parental assistance (Responsive with Decreasing Assistance – RwDA) should specifically be targeted at infants older than 6 months, because current evidence shows that reducing assistance before 6 months does not reduce crying. This aligns with a widespread clinical principle: none of the formal “extinction”-based techniques are recommended in infants younger than 6 months; at this age, an infant waking at night to request feeding or closeness is not pathological but expected behavior.

Instead, two forms of intervention stand out during this period. The first is parent education and anticipatory guidance. A randomized controlled trial conducted in Thailand by Sinthong and Ngernlangtawee (2024) showed that even a 15-minute educational

video for parents of 4-month-old infants — covering normal sleep development, a safe sleep environment, and sleep hygiene — was effective: infants in the intervention group had, on average, 89 more minutes of nighttime sleep at 6 months compared with the control group (585 min versus 496 min, $p<.001$), and their night-waking duration was significantly shorter (61 min versus 90 min, $p<.001$). Honaker and Meltzer (2014) similarly report that this kind of brief group education, delivered at four months, reduces the later development of problematic sleep associations. The second is establishing a safe sleep environment. The meta-analysis by Pease et al. (2016), combining four case-control studies, showed that the association between swaddling and the risk of sudden infant death syndrome (SIDS) interacts with the infant's age and sleep position: the risk rises markedly in infants older than 6 months who have begun to roll (OR 2.53); when a swaddled infant is placed prone, the risk is considerably higher still. For this reason, official guidelines in countries with low SIDS rates recommend that swaddling be discontinued from the moment the infant begins trying to roll, and in any case before 6 months.

Mother-infant co-sleeping, breastfeeding, and their relationship to SIDS remain a nuanced area in the literature. The review by Marinelli et al. (2019), which integrates historical, epidemiological, and anthropological perspectives, recommends that — outside high-risk conditions such as smoking, alcohol/substance use, or sleeping on a sofa — bed-sharing that arises in the context of breastfeeding should not be categorically prohibited, but rather that families should be given balanced information about safe-practice conditions. Nonetheless, the core recommendation of mainstream pediatric guidelines remains clear: supine sleep position, a firm, flat surface, an environment free of soft bedding, pillows, and toys, and sleeping in the same room as the parents but on a separate surface (room-sharing).

Summary of this period: In the 0-6 month period, the goal is not to “train” the infant but to support normal physiological maturation, establish a dark and predictable sleep environment, provide a filling pre-bedtime feed, inform parents about realistic expectations, and establish safe sleep practices (supine position,

timely discontinuation of swaddling, room-sharing). Classic extinction-based techniques are not recommended at this age.

6-12 Months: The Starting Point of Behavioral Sleep Training

From six months onward, two developmental thresholds are crossed: the circadian rhythm has largely matured, and the infant begins to have the capacity to fall asleep without parental assistance. According to the classification of Honaker and Meltzer (2014), the most common clinical presentation in this period is the "Sleep Onset Association Type" — the most common presentation between 6 and 36 months, in which an infant who falls asleep while being rocked or nursed needs the same support again upon waking at night.

Classic Behavioral Techniques and Their Levels of Evidence

The most frequently studied methods with the strongest evidence in the literature are as follows (Honaker & Meltzer, 2014; Meltzer & Mindell, 2014):

- **Unmodified extinction ("cry it out"):** The infant is placed in the crib while awake; the parent leaves the room and does not return until morning (aside from safety checks). It is one of the methods with the strongest empirical support, but it is difficult for families who cannot tolerate prolonged crying, and adherence is low in these families.
- **Graduated extinction ("controlled crying"):** The parent makes brief checks at increasing intervals (for example, 5-10-15 minutes); interaction is kept to a minimum during checks, lights are not turned on, and play does not occur.
- **Fading parental presence ("camping out"):** The parent first stays in the room, sitting in a chair that is gradually moved toward the door; the distance is increased gradually every 3-7 nights.
- **Bedtime fading:** A bedtime close to the time the infant actually falls asleep is set and moved approximately 15 minutes earlier each night; this relies on the principle of sleep homeostasis — accumulated sleep pressure makes falling asleep easier.
- **Scheduled awakenings:** The infant is woken 15-30 minutes before their typical spontaneous waking time and resettled;

because it requires waking to an alarm, it is rarely chosen in clinical practice, but it can work for frequent wakings that recur at a predictable time.

A randomized controlled trial by Gradisar et al. (2016), conducted with 43 infants aged 6-16 months, showed that both graduated extinction and bedtime fading significantly reduced sleep latency, the number of night wakings, and time spent awake at night compared with the control group. In the same study, no differences were found between groups in salivary cortisol, maternal stress, or mother-infant attachment security at 12 months — meaning that, in this sample, neither method showed a measurable adverse effect on the infant's stress physiology or attachment. The systematic review and meta-analysis of 16 controlled studies by Meltzer and Mindell (2014) confirms this picture: behavioral interventions in young children provide moderate evidence — with effect sizes ranging from small to large (SMD 0.28-0.44) — for sleep latency, and the frequency and duration of night wakings; in contrast, the number of controlled studies in school-age children and adolescents remains very small (only three studies, 214 participants), and the quality of available evidence is rated “very low” according to GRADE criteria. This finding alone is important because it shows that the strongest scientific foundation for behavioral sleep training belongs to infancy and early childhood.

A Point of Controversy: The Effect of Allowing Crying on Physiological Stress

A concern frequently raised in this field is whether a parent's non-response leads to physiological stress in the infant. A frequently cited source is the study by Middlemiss et al. (2012), conducted with 25 infants examining a 5-day residential extinction program: by the third day, although infants no longer showed behavioral signs of distress (that is, they had “stopped crying”), their salivary cortisol levels remained elevated, while the mother's cortisol level had fallen — indicating a dissociation (asynchrony) between the infant's behavioral calm and their physiological stress. However, this study's sample is small, it has no control group, and it is based on an intensive, 5-day residential clinical program; it is not directly comparable to the standard graduated-extinction protocols parents

apply at home in everyday life. By contrast, the larger, controlled, home-based study by Gradisar et al. (2016) found a small-to-moderate decrease — not an increase — in cortisol with standard graduated extinction and bedtime fading, and found no difference in attachment security or behavior problems at 12 months. When Honaker and Meltzer (2014) reviewed the literature, they likewise reported that they found no consistent published finding of an adverse effect of behavioral sleep treatments — including interventions that involve crying — on attachment, general parenting behavior, or emotional health. In short, the literature does not offer consistent evidence that brief protest crying causes lasting harm; but it should also not be overlooked that families genuinely differ in their concern and preference on this matter — which brings us to the next subsection.

A Model Centering Parental Preference: "Plan B"

Blunden and Dawson (2020), emphasizing that roughly a third of parents find it behaviorally or value-wise difficult to "ignore" their infant and that treatment discontinuation rates are high in these families, propose — instead of a polarized debate between extinction and full responsiveness — a menu of options ranked by level of responsiveness (Table 1).

Table 1. Behavioral options ranked by level of responsiveness

Level	Technique	Level of responsiveness
1	Extinction	Full ignoring
2	Graduated extinction	Periodic ignoring
3	Graduated extinction + staying in the room	Presence in the room, periodic ignoring inside/outside
4	Responsive with Decreasing Assistance (RwDA)	Presence in the room, responding while gradually reducing assistance
5	Supportive parental presence	Staying in the room continuously, providing support until the infant

		falls asleep
6	Sleeping in the same room	Full responsiveness

Source: Adapted from Blunden & Dawson (2020).

Within this framework, the “Responsive with Decreasing Assistance” (RwDA) approach — recommended particularly after 6 months — never leaves the infant unattended; the parent always responds verbally, but gradually reduces physical intervention (picking up → patting the back → staying at the crib and touching by hand → verbal response only). The authors state that although this approach has not been studied as systematically as extinction in the literature, growing evidence suggests it offers a less stressful path to consolidating sleep for both parent and infant. The clinically important point is this: there is no evidence that any one method is “more effective” than another; what truly matters is choosing a sustainable method that fits the infant's temperament and the family's values (Honaker & Meltzer, 2014).

Summary of this period: 6-12 months is the period in which classic behavioral techniques have the strongest evidence. But even here there is no “single correct method” — offering a menu ranging from extinction to full responsiveness, tailored to the family's tolerance level, increases adherence and therefore the likelihood of success.

1-3 Years: Consistency and Limits in Toddlerhood

While “sleep-onset association” problems characteristic of infancy may still persist in this period, a new dynamic specific to toddlerhood emerges: as the child's cognitive and motor skills develop, behaviors such as climbing out of the crib, repeatedly calling for a parent, and actively resisting bedtime become prominent. This is the period in which, in the classification of Honaker and Meltzer (2014), the transition to the “Limit-Setting Type” begins; this type typically becomes more dominant between ages 2 and 5 and is intertwined with the child testing parental authority and with a developmentally expected search for autonomy.

The Critical Role of the Bedtime Routine

In this age group, the single strongest, cheapest, and most broadly evidenced intervention on its own is a consistent bedtime routine. The comprehensive review by Mindell and Williamson (2018) proposes that a well-structured bedtime routine should include activities spanning four domains: nutrition (for example, a light snack), hygiene (bathing, toothbrushing), communication (reading a book, singing, talking about the day), and physical contact (massage, cuddling). The authors report that language-based components (reading, singing, storytelling) are particularly strongly associated with nighttime sleep duration, and that these components support not only sleep but also language development, literacy, emotional self-regulation, and the parent-child bond. This makes the bedtime routine not merely "preparation for sleep" but one of the most concentrated one-on-one interaction moments of the day.

A longitudinal study by Lam et al. (2023), conducted with 40 toddlers, shows that this effect extends to socioemotional development: children with a more consistent bedtime routine at 12 months showed less behavioral dysregulation at 15 months; children who did not have a consistent routine at 15 months showed more externalizing and internalizing problems at 24 months. A notable finding is that this protective effect was particularly pronounced among children of caregivers with a high-school education or less — meaning a consistent bedtime routine may serve an additional protective function in socioeconomically disadvantaged families. This finding makes it possible to view the bedtime routine not merely as an individual parenting preference but as an accessible, low-cost equity tool from a public-health perspective.

Honaker and Meltzer (2014) note that an effective bedtime routine should be kept short and enjoyable (30-45 minutes, 3-4 soothing activities), and that a visual bedtime chart (a picture-based, step-by-step schedule) can facilitate understanding and predictability in children with developmental delay or in younger children.

Techniques That Can Be Used at This Age

- **Fading parental presence ("camping out") and the "excuse-me drill":** The parent generates brief excuses to leave the room, and upon returning, praises the child verbally

for tolerating this short period alone; the length of the departure is gradually extended each night (Honaker & Meltzer, 2014).

- **Bedtime fading + positive routines:** In clinical practice, these two techniques are generally recommended for children over age 3; younger children and toddlers may become overtired with a delayed bedtime, which can make settling more difficult (Honaker & Meltzer, 2014).
- **Removal from bed / "response cost":** The child is temporarily removed from bed and returned once drowsy; this aims to reduce time spent awake in bed, but it can be clinically demanding to implement and requires consistency.

Summary of this period: Ages 1-3 form a transitional period in which behavioral techniques remain valid, but routine and consistency become at least as decisive as technique itself. The intervention with the highest return on effort at this age is a short, predictable, and linguistically rich bedtime routine.

3-5 Years: Active Child Participation in the Preschool Period

In the preschool years, the child's capacity for language, memory, and self-regulation increases markedly, which changes the nature of sleep interventions. Data from Petrin et al. (2026) show this shift clearly: while 77.8% of infant-directed programs focus on sleep independence/self-soothing, this proportion drops to 43.5% in preschool programs; conversely, a focus on sleep hygiene and daily habits rises from 36.1% in infants to 65.2% in the preschool period.

The Importance of Involving the Child in the Process

The scoping review by Dias and Loureiro (2026) of child-focused interventions delivered in healthcare settings for children aged 3-12 offers an important caution: although isolated interventions such as games, animated videos, or yoga increase children's sleep knowledge, this knowledge is difficult to translate into lasting behavior change; the authors emphasize that the child's active participation (rather than passive information transfer) is essential for durable outcomes. Petrin et al. (2026) similarly note that preschool children have the cognitive and social maturity to understand simple explanations, play-based modeling, and visual

charts, so involving the child in the process can increase engagement, emotional security, and adherence to the routine.

Techniques That Can Be Used at This Age

- **The bedtime pass:** The child is given one or a few "passes" (for example, a paper ticket) at bedtime; each pass can be redeemed for one request (water, a brief parental visit). Once the passes are used up, further requests are gently but firmly ignored; a child who still has a pass in the morning is given a small reward. Two studies have shown that this method reduces bedtime resistance in the 3-6 age group and that the effect persists at 3-month follow-up (Honaker & Meltzer, 2014).
- **Sticker charts and the "sleep fairy":** Used to reinforce each step of the routine (putting on pajamas, brushing teeth, etc.); in the "sleep fairy" technique, a small gift is left under the child's pillow after they fall asleep, which encourages falling asleep quickly and staying in bed (Honaker & Meltzer, 2014).
- **Intervention for nighttime fears:** In the "Huggy Puppy" technique developed by Kushnir and Sadeh, a child experiencing nighttime fear is given a stuffed animal that is said to "protect" them; this simple intervention reduced nighttime fears, with the effect persisting at 6-month follow-up (Honaker & Meltzer, 2014).
- **Bedtime fading + positive routines:** This age group is the range in which this technique is most often recommended in clinical practice, because the child can now understand delay and actively participate in the routine (Honaker & Meltzer, 2014).

An important clinical note: Honaker and Meltzer (2014) state that positive-reinforcement strategies (sticker charts, the sleep fairy, and similar techniques) may not be effective in infants and young toddlers, who have not yet developed the ability to delay gratification, and that these methods are truly most powerful in the preschool and school-age years. This is further evidence that techniques are not "transferable" across ages — each age group needs a toolkit suited to its own cognitive capacity.

Summary of this period: Ages 3-5 mark the transition from "doing something to the child" to "doing something with the child." Sticker charts, the bedtime pass, and play-based participation techniques are especially effective at this age; in contrast, programs based solely on passive information delivery have limited lasting effect.

6-12 Years: Sleep Hygiene and Autonomy in the School-Age Period

School age is the period least covered by behavioral sleep research. The meta-analysis by Meltzer and Mindell (2014) found only three controlled studies (214 participants in total) in school-age children and adolescents, and reported that the quality of evidence from these studies remained "very low" according to GRADE criteria. This does not mean that sleep problems are unimportant at school age — on the contrary, this age group represents a clear research gap, and clinical practice largely relies on principles adapted from early childhood.

Current evidence indicates that, at this age, the center of gravity of intervention shifts from behavioral "extinction" techniques toward sleep hygiene education and self-management skills. A systematic review and meta-analysis by Decker et al. (2024), which examined 37 interventions aimed at increasing sleep duration in children aged 1-18 using a Behavior Change Technique (BCT) taxonomy, found that the most commonly used techniques were instruction on how to perform the behavior (29 studies), practical social support (22 studies), and behavioral practice/rehearsal (22 studies). The same study showed that interventions combining information transfer, education about natural consequences, and behavioral comparison (for example, peer comparison) achieved nearly twice the effect size of those that did not include these elements: an average increase of 14 minutes of additional sleep per night, compared with 8 minutes. This finding demonstrates that information alone is insufficient; the behavior must be concretely demonstrated and put into practice.

A case study included in the review by Dias and Loureiro (2026) showed that, in elementary school-age children, combining sleep education with self-monitoring techniques — for example,

having the child themselves track concrete behaviors such as a fixed wake time, staying away from screens before bed, and avoiding naps after school, using a diary or chart — increased both sleep knowledge and actual sleep duration, with these gains persisting at follow-up interviews. In contrast, the effects of a one-time, school-based sleep education program alone were reported to generally be small and transient. This suggests, just as in the preschool period, that one-way information transfer is likewise insufficient on its own at school age; lasting change requires the child to monitor and practice their own behavior.

In this age group, screen exposure and the intensity of academic/social schedules also come into play as new variables affecting sleep timing differently than in early childhood. Core principles recommended in clinical practice include turning off screens at least 1 hour before bedtime, limiting the difference between weekday and weekend bed/wake times, and involving the child in setting their own sleep goal (for example, through a “sleep contract”).

Summary of this period: Although the research base is weak at school age, current evidence indicates that concrete habits the child can implement themselves — a fixed wake time, screen limits, and self-monitoring — are more effective than one-time, purely informational education sessions.

Principles That Cross Age Groups

No Method Is “the Best” — Fit Matters

Honaker and Meltzer (2014) emphasize that there is no evidence that any technique is superior to another; what truly determines success is choosing a method that fits the infant's/child's temperament and the family's preferences. The “Plan B” model of Blunden and Dawson (2020) embodies this same principle: roughly a third of parents discontinue treatment when they are unable to implement classic extinction-based methods, and when these families are offered extinction as the only option, they typically try no method at all. For this reason, clinicians and parenting resources offering a menu of options ranked by level of responsiveness increase adherence and therefore the likelihood of success.

Parental Wellbeing Matters as Much as the Child's Sleep

The meta-analysis of 10 studies by Park et al. (2022) found that behavioral sleep interventions significantly reduced children's sleep problems (OR 0.51) and markedly improved maternal sleep quality (mean difference −1.30); however, no significant difference was found in the number of night wakings or in maternal depression scores. The meta-analysis by Kempler et al. (2016), focusing on the postpartum period, showed that psychosocial sleep interventions increased infants' reported total nighttime sleep duration (Hedge's g=0.204) and produced a small but significant improvement in maternal mood (g=0.152) — although the authors noted this second finding may have been affected by publication bias. These results support the view that sleep interventions should be seen not only as an investment in the child but also in the family system; indeed, an infant's sleep problem is consistently identified in the literature as an important predictor of maternal depression (Quante et al., 2022).

Long-Term Importance: Why Early Sleep Problems Should Not Be Overlooked

A longitudinal study by Touchette et al. (2024), following 2,120 children from age 2.5 to age 15, showed that children who followed a pattern of prolonged sleep latency throughout childhood carried a significantly higher risk of depression, attention-deficit/hyperactivity disorder, conduct problems, and oppositional symptoms at age 15. The authors emphasize that addressing difficulty falling asleep throughout childhood at an early stage offers an important window of opportunity for protecting adolescent mental health. This finding is important because it shows that the age-sensitive, early intervention discussed in this chapter is not merely short-term relief but a long-term protective investment.

The Sleep Environment Operates in the Background at Every Age

A World Health Organization European Region systematic review examining the effect of environmental noise on sleep reports that children's noise-related arousal threshold is approximately 10 dB higher than adults' (that is, relatively less sensitive), but that children are nonetheless considered a sensitive group because of

their developmental status and different sleep patterns; there is moderate-quality evidence that children exposed to traffic noise are more likely to report sleep problems (Basner & McGuire, 2018). Read alongside the finding of Quante et al. (2022) that a dark sleep environment in infancy is associated with longer sleep, this reminds us that, regardless of age, a quiet, dark, and predictable sleep environment should remain a basic constant.

Screening in Clinical Practice: Why It Is Necessary to Ask Early

The primary-care review by Honaker and Meltzer (2015) shows that sleep problems often do not come up spontaneously during routine visits, because both physicians and families may neglect to directly ask about or report them. Integrating a brief, age-adapted screening framework such as BEARS into every check-up is a practical tool that ensures the age-specific approaches described in this chapter are deployed in time.

Summary Table: A Map of Approaches by Age

Table 2. A map of approaches by age group

Age group	Core sleep task	Not recommended	Recommended approaches	Level of evidence
0-6 months	Circadian maturation, safe environment	Extinction-based techniques, reducing assistance (RwDA)	Parent education, a dark/quiet environment, a filling pre-bedtime feed, a safe sleep position	Moderate (education); maturation data strong
6-12 months	Acquiring the ability to fall asleep independently	—	Graduated extinction, bedtime fading, the “Plan B” menu (including RwDA)	Moderate-strong (SMD 0.28-0.44)

1-3 years	Consistency, limit-setting	Prolonged removal from bed on its own	A consistent, linguistically rich bedtime routine, fading parental presence, the excuse-me drill	Moderate (strong observational/ longitudinal evidence for routines)
3-5 years	Active participation, self-regulation	Passive information delivery alone	The bedtime pass, sticker charts, the sleep fairy, play-based participation	Moderate (isolated studies)
6-12 years	Autonomy, sleep hygiene	A one-time school seminar alone	Self-monitoring, a fixed wake time, screen limits, behavior change techniques	Low-very low (few controlled studies)

Source: Prepared by the author.

Conclusion: A Developmentally Sensitive, Individualized Framework

The literature reviewed in this chapter shows that “sleep training” is not a single prescription, but a set of options that must be adapted to the child's age, cognitive maturity, and family values. In the first six months, the priority is to support biological maturation and ensure safety; the 6-12 month period is when classic behavioral techniques have the strongest evidence, yet even here there is no single “correct” method — offering a menu sensitive to parental preference (Plan B) increases adherence. In toddlerhood, a consistent, linguistically rich bedtime routine on its own becomes the intervention with the highest return; in the preschool years, the child's active participation is decisive; at school age, although the

research base is weak, self-monitoring and concrete habits come to the fore.

The transitions between these age bands are not sharply delineated; every child progresses at their own developmental pace, and factors such as temperament, health status, and family structure require this map to be individualized. Still, a shared pattern is clear: the center of gravity of intervention shifts from adjustments the parent makes on the infant's behalf in infancy, to practices carried out together with the parent in the preschool years, to habits the child carries out on their own at school age. This shift maps precisely onto the child's overall developmental trajectory — that familiar line running from dependence toward autonomy.

As Petrin et al. (2026) also emphasize, the future of the field lies in approaches that address not only nighttime sleep but the 24-hour sleep pattern — including daytime sleep — holistically; that see the child not as a passive “treatment target” but as an active participant; and that integrate the emotional dimension of the parent-child relationship with behavioral strategies. The practical takeaway for practitioners and parents is clear: the right question is not “which method is best?” but “which approach is both effective and sustainable for this child, at this age, in this family?”

Kaynakça/References

Basner, M., & McGuire, S. (2018). WHO environmental noise guidelines for the European region: A systematic review on environmental noise and effects on sleep. *International Journal of Environmental Research and Public Health, 15*(3), 519. https://doi.org/10.3390/ijerph15030519

Blunden, S., & Dawson, D. (2020). Behavioural sleep interventions in infants: Plan B – Combining models of responsiveness to increase parental choice. *Journal of Paediatrics and Child Health, 56*(5), 675-679. https://doi.org/10.1111/jpc.14818

Buysse, D. J. (2014). Sleep health: Can we define it? Does it matter? *Sleep, 37*(1), 9-17. https://doi.org/10.5665/sleep.3298

Decker, J. E., Morales, K. H., Fair, M. A., Vallecorsa, G., Subramanyam, S., Fiks, A. G., Mayne, S., Williamson, A. A., & Mitchell, J. A. (2024). Classifying intervention components used in sleep duration interventions for children: A systematic review and meta-analysis. *Sleep Medicine Reviews, 78*, 101995. https://doi.org/10.1016/j.smrv.2024.101995

Dias, A. P., & Loureiro, F. (2026). Mapping evidence on child-focused interventions for promoting healthy sleep habits: A scoping review. *Clocks & Sleep, 8*(2), 17. https://doi.org/10.3390/clockssleep8020017

Gilchrist, A., Aylward, B. S., Laine, C. M., & Karp, H. (2025). Maturation of infant sleep during the first 6 months of life: A mini-scoping review. *Frontiers in Neuroscience, 19*, 1581325. https://doi.org/10.3389/fnins.2025.1581325

Gradisar, M., Jackson, K., Spurrier, N. J., Gibson, J., Whitham, J., Sved Williams, A., & Kennaway, D. J. (2016). Behavioral interventions for infant sleep problems: A randomized controlled trial. *Pediatrics, 137*(6), e20151486. https://doi.org/10.1542/peds.2015-1486

Honaker, S. M., & Meltzer, L. J. (2014). Bedtime problems and night wakings in young children: An update of the evidence. *Paediatric Respiratory Reviews, 15*(4), 333-339.

Honaker, S. M., & Meltzer, L. J. (2015). Sleep in pediatric primary care: A review of the literature. *Sleep Medicine Reviews, 25*, 31-39.

Kempler, L., Sharpe, L., Miller, C. B., & Bartlett, D. J. (2016). Do psychosocial sleep interventions improve infant sleep or maternal mood in the postnatal period? A systematic review and meta-analysis of randomised controlled trials. *Sleep Medicine Reviews, 29*, 15-22.

Lam, J. T. Y., Williamson, A. A., Salih, Z., Heere, M., & Mindell, J. A. (2023). Bedtime routines, development, and caregiver educational attainment in toddlerhood. *Frontiers in Sleep, 2*, 1197297. https://doi.org/10.3389/frsle.2023.1197297

Marinelli, K. A., Ball, H. L., McKenna, J. J., & Blair, P. S. (2019). An integrated analysis of maternal-infant sleep, breastfeeding, and sudden infant death syndrome research supporting a balanced discourse. *Journal of Human Lactation, 35*(3), 510-520. https://doi.org/10.1177/0890334419851797

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *Journal of Pediatric Psychology, 39*(8), 932-948. https://doi.org/10.1093/jpepsy/jsu041

Meltzer, L. J., Williamson, A. A., & Mindell, J. A. (2021). Pediatric sleep health: It matters, and so does how we define it. *Sleep Medicine Reviews, 57*, 101425. https://doi.org/10.1016/j.smrv.2021.101425

Middlemiss, W., Granger, D. A., Goldberg, W. A., & Nathans, L. (2012). Asynchrony of mother-infant hypothalamic-pituitary-adrenal axis activity following extinction of infant crying responses induced during the transition to sleep. *Early Human Development, 88*(4), 227-232. https://doi.org/10.1016/j.earlhumdev.2011.08.010

Mindell, J. A., & Williamson, A. A. (2018). Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Medicine Reviews, 40*, 93-108. https://doi.org/10.1016/j.smrv.2017.10.007

Park, J., Kim, S., & Lee, K. (2022). Effectiveness of behavioral sleep interventions on children's and mothers' sleep quality and maternal depression: A systematic review and meta-analysis. *Scientific Reports, 12*, 4172.

Pease, A. S., Fleming, P. J., Hauck, F. R., Moon, R. Y., Horne, R. S. C., L'Hoir, M. P., Ponsonby, A.-L., & Blair, P. S. (2016). Swaddling and the risk of sudden infant death syndrome: A meta-analysis. *Pediatrics, 137*(6), e20153275. https://doi.org/10.1542/peds.2015-3275

Petrin, R., Beauchamp, K., Perreault, A., & Forest, G. (2026). Behavioral sleep interventions in children aged 0-5 years: A systematic review of content, delivery, and 24-hour sleep outcomes. *Sleep Medicine, 144*, 108966.

Quante, M., McGee, G. W., Yu, X., von Ash, T., Luo, M., Kaplan, E. R., Rueschman, M., Haneuse, S., Davison, K. K., Redline, S., & Taveras, E. M. (2022). Associations of sleep-related behaviors and the sleep environment at infant age one month with sleep patterns in infants five months later. *Sleep Medicine, 94*, 31-37.

Sinthong, A., & Ngernlangtawee, D. (2024). Early sleep intervention for improving infant sleep quality: A randomized controlled trial, preliminary result. *BMC Pediatrics, 24*, 306. https://doi.org/10.1186/s12887-024-04771-6

Touchette, E., Fréchette-Boilard, G., Petit, D., Geoffroy, M.-C., Pennestri, M.-H., Côté, S., Tremblay, R. E., Petitclerc, A., Boivin, M., & Montplaisir, J. (2024). Longitudinal study of childhood sleep trajectories and adolescent mental health problems. *Sleep Advances, 5*(1), zpae013. https://doi.org/10.1093/sleepadvances/zpae013

BÖLÜM 4

NUTRITION AND SLEEP IN CHILDREN: A BIDIRECTIONAL INTERACTION

Ebru BULDU[1]

Introduction

Sleep and nutrition are among the fundamental determinants of growth, neurodevelopment, metabolic health, and overall quality of life in childhood and adolescence. Sleep is not merely a passive period of rest; it is an active biological process closely tied to hormonal regulation, energy metabolism, appetite control, and learning. Nutrition, likewise, is not limited to supplying energy and nutrients; it interacts reciprocally with the child's daily rhythm and sleep pattern (A. L. Miller et al., 2015).

The relationship between these two domains is bidirectional: insufficient or irregular sleep can affect a child's food choices and appetite, while the timing and content of meals and nighttime feeding habits can, in turn, shape the sleep pattern (Córdova et al., 2018; Ward et al., 2020). This chapter addresses the neurobiological foundations of this bidirectional relationship, its effects in both directions, its features specific to each period of life—infancy, early childhood, and adolescence—and evidence-based recommendations for parents, in the light of the current literature.

The Conceptual Framework of the Bidirectional Relationship Between Sleep and Nutrition

The relationship between sleep and nutrition is described in the literature as a bidirectional association. In a systematic review of

[1] Asst. Prof., MD, Department of Pediatrics, University of Health Sciences, Beyhekim Training and Research Hospital, Konya, Türkiye, ORCID: 0000-0002-1198-1380

fifty studies covering 72,491 children aged 0-5 years, children with poorer sleep had higher energy intake and lower diet quality; conversely, certain dietary patterns were also shown to be associated with sleep duration and regularity (Ward et al., 2020). A more recent study by the same group covering school-aged children (6-12 years) confirmed a similar bidirectional picture: sleep duration and quality were associated with dietary intake, and dietary intake with sleep parameters (Ward et al., 2021).

Clinically, this bidirectionality carries the risk of a vicious circle: a child who sleeps poorly may turn to energy-dense foods the next day, while irregular, high-energy eating can in turn make that evening's transition to sleep more difficult. The relationship should therefore be treated not as a one-way chain of cause and effect, but as two mutually reinforcing components of the child's 24-hour daily rhythm.

The Neurobiological Basis: The Tryptophan-Serotonin-Melatonin Pathway

The synthesis pathways of the neurotransmitters that regulate the sleep-wake cycle—serotonin, melatonin, dopamine, GABA, and others—depend directly on nutrients obtained from the diet. The most extensively studied mechanism is the metabolic chain in which tryptophan, an essential amino acid, is converted first to serotonin and then, in darkness, to melatonin in the pineal gland. Tryptophan is found in red meat, poultry, dairy products, eggs, legumes, and whole grains (Trakada, 2023).

Large studies conducted in Japan have shown that consuming foods rich in tryptophan and vitamin B6 at breakfast, combined with exposure to morning sunlight, supports nighttime melatonin secretion and eases sleep onset in children and young people aged 0-15 years (Harada et al., 2007; Wada et al., 2013). This finding suggests that the content of breakfast may matter not only for daytime energy balance but also for that night's sleep quality. Even so, it is not scientifically appropriate to treat any single food or food group as a "sleeping aid" on its own; the real determinant is the overall dietary pattern.

Effects of Insufficient Sleep on Eating Behavior

A systematic review and meta-analysis covering thirty studies reported that the likelihood of unhealthy eating behavior—consumption of high-energy snacks and irregular meal patterns—was significantly higher in children with short sleep (Córdova et al., 2018). The mechanisms underlying this relationship include the way sleep restriction lengthens the time spent awake and thus the opportunities for eating, disrupts the secretion of the appetite-regulating hormones leptin and ghrelin, increases the pull toward high-calorie foods through the reward system, and impairs glucose tolerance by disturbing carbohydrate metabolism.

It would nevertheless be incomplete to explain this relationship through hormonal mechanisms alone; shared variables such as screen use, physical activity level, family eating habits, and socioeconomic conditions can influence both behaviors (Ward et al., 2021). In a child who sleeps little, therefore, rather than concluding simply that "they eat more," meal patterns, snack consumption, screen time, and physical activity should be examined together.

Effects of the Dietary Pattern on Sleep

Overall Diet Quality and Sleep Duration

A systematic review examining the relationship between dietary patterns and sleep in children and adolescents reported that longer sleep duration was consistently associated with healthier dietary patterns containing vegetables, fruit, and good-quality protein sources, whereas findings on the relationship between diet quality and subjective sleep quality were more heterogeneous, and the direction of causality remains unclear (Alibabaei et al., 2021). Rather than recommending a "special food for sleep," it is therefore more appropriate to support regular meals and a balanced, varied dietary pattern.

Caffeine Consumption

Caffeine is the most widely consumed psychoactive substance among children and adolescents; it can be taken in through coffee, energy drinks, some teas, cola drinks, and chocolate. In a polysomnography study, children and adolescents aged 10-16 years who regularly consumed caffeine had later bedtimes and markedly

reduced deep sleep compared with controls (Aepli et al., 2015). In adolescents with attention-deficit/hyperactivity disorder, afternoon caffeine consumption has additionally been reported to be more strongly associated with parent-reported difficulties falling asleep (Cusick et al., 2020). In a child with a sleep problem, therefore, it is not only screen use that should be questioned but also at what times of day caffeine is consumed.

Iron Deficiency and Restless Legs Syndrome

Iron is a critical micronutrient in sleep regulation because it serves as a cofactor in dopamine synthesis. Insufficient brain iron stores play a central role in the pathophysiology of restless legs syndrome and periodic limb movement disorder (Dosman et al., 2012). In children with low serum ferritin—particularly those with low red meat consumption—discomfort in the legs, bedtime resistance, and frequent night awakenings may be observed more often. Because young children cannot express these symptoms verbally, they are frequently misjudged as simply "a child who sleeps poorly"; in children with unexplained restless sleep, the dietary history should be explored and ferritin measured when indicated.

Meal Timing, the Evening Meal, and Nighttime Snacks

It is not only the content of nutrition that matters for sleep but also its timing. Consuming large or energy-dense meals very close to bedtime can make the transition to sleep harder in some children, through gastrointestinal discomfort or reflux complaints. Because children differ in age, growth rate, and energy needs, however, a rigid rule of "no food within X hours of bedtime" is not appropriate for all children; the real aim is to eat the evening meal at a regular hour and to avoid making high-energy snacking near bedtime a routine.

Regular late-night consumption of energy-dense snacks—sugary drinks such as fruit juice and soft drinks, chocolate, biscuits, and crisps—has been associated with both short sleep duration and an unhealthy dietary pattern (Córdova et al., 2018). The aim here is not to deny the child sweets altogether, but to prevent such foods from becoming part of the nighttime sleep routine. By contrast, a

balanced evening meal containing age-appropriate amounts of protein, vegetables, and complex carbohydrate sources may reduce both nighttime hunger and difficulty falling asleep.

The Nutrition-Sleep Interaction in Infancy and Early Childhood

Breast Milk, Formula, and Sleep

A systematic review covering twenty-one studies and 6,225 infants reported that, before six months of age, exclusively breastfed infants woke more often at night than formula-fed infants, but that in most studies there was no significant difference between the two groups in total nighttime sleep duration. After the sixth month, the majority of the studies examined reported that breastfed infants' total sleep duration was somewhat shorter than that of formula-fed infants (Fu et al., 2021). This difference is explained by the easier digestion of breast milk, which leads infants to need feeding more often, and it is no justification for stopping breastfeeding.

Night Feeding and Sleep Associations

Night feeding can be developmentally normal and necessary, particularly in infancy, and its complete elimination should not be the goal during this period. In older infants and children, however, repeated bottles, milk, or fruit juice through the night should be evaluated in terms of the sleep pattern, dental health, and total energy intake. When breastfeeding or the bottle becomes the sole method for every transition to sleep, it can over time turn into a learned "sleep association" (Mindell et al., 2006). This is not always pathological; but if the child wakes frequently every night and can fall back asleep only by this route, it must be distinguished whether the feeding truly reflects hunger or has become a learned behavior.

The Complementary Feeding Period and Responsive Feeding

Complementary feeding begins at around six months and the period from 6 to 23 months constitutes a critical developmental window in which the foundations of healthy eating patterns are laid (World Health Organization, 2023a). The approach of "giving more solid food so that the baby sleeps longer at night" is not supported scientifically; indeed, the timing of the transition to complementary

feeding has been reported to show no significant relationship with sleep duration (Fu et al., 2021). Instead, the World Health Organization recommends responsive feeding, in which the caregiver recognizes the infant's hunger and satiety cues and responds accordingly (World Health Organization, 2023a, 2023b).

Milk Before Bed: Evaluating a Myth

Parents frequently ask whether giving milk before bed helps the child sleep better. The value of milk as part of a healthy diet must be separated from treating it as a "sleeping aid"; trying to solve a healthy child's sleep problem solely by giving milk at bedtime is not an evidence-based approach. Drinking milk before bed can continue as a family routine, but if milk is consumed repeatedly through the night, this should be evaluated separately with respect to dental health and total energy intake (Fu et al., 2021).

Sleep, Nutrition, and Childhood Obesity

In a large systematic review and meta-analysis, the great majority of the prospective studies examined found a significant relationship between short sleep duration and increased incidence of obesity in infants, children, and adolescents (M. A. Miller et al., 2018). In another review of 112 studies covering school-aged children, a significant inverse relationship between sleep duration and body weight was found in 86 of the 103 articles examined, while it was emphasized that fewer studies have addressed the relationship of other sleep dimensions, such as sleep quality and regularity, to weight status (Morrissey et al., 2020).

The mechanisms underlying this relationship include the disruption of the leptin-ghrelin balance by sleep deprivation, an increased pull toward high-calorie foods through the reward system, and the co-occurrence of short sleep with sedentary behavior (A. L. Miller et al., 2015). Explaining childhood obesity by sleep duration alone would nevertheless be incomplete; genetic characteristics, physical activity, screen exposure, and socioeconomic conditions also play their parts. In a child with excess weight, therefore, the sleep history should be explored as an inseparable part of the dietary history.

Nutrition and Sleep in Adolescence

In adolescence the relationship becomes more complex: the biological delay of the sleep phase, early school start times, academic load, and screen use can combine to shorten sleep duration. In the same period, behaviors such as skipping breakfast, consuming high-calorie snacks after school, and eating late at night are common, and short sleep duration has been reported to be associated with such unhealthy eating behaviors (Alibabaei et al., 2021; Córdova et al., 2018). When assessing adolescents, sleep and wake times, the weekday-weekend difference, breakfast habits, night eating behavior, and energy drink and caffeine consumption should be explored together.

Common Misconceptions

- **"A child with a full stomach sleeps longer."** Satiety matters for healthy sleep, but overfeeding does not lengthen sleep; in some children it can cause gastrointestinal discomfort.
- **"If I give milk at night, the child will certainly sleep longer."** This may be a routine in some families, but there is insufficient evidence that it increases sleep duration in all children.
- **"If the child wakes at night, they must be hungry."** Particularly in older infants and children, not all night awakenings can be explained by hunger; learned sleep associations may also play a role.
- **"A sleep problem calls for a special vitamin or food."** In healthy children, routinely treating sleep problems with a particular supplement is not recommended; the sleep schedule and the dietary pattern should first be evaluated as a whole.

Recommended Sleep Durations by Age

In the consensus statement published by the American Academy of Sleep Medicine and endorsed by the American Academy of Pediatrics, the recommended daily sleep durations by age group are as follows (Paruthi et al., 2016) (Table 1).

Table 1. Recommended daily sleep durations by age group

Age group	Recommended sleep duration (per 24 hours, naps included)
4-12 months (infant)	12-16 hours
1-2 years	11-14 hours
3-5 years	10-13 hours
6-12 years	9-12 hours
13-18 years (adolescent)	8-10 hours

Source: Adapted from Paruthi et al. (2016).

An Illustrative Clinical Scenario

A seven-year-old girl is evaluated for refusal to go to bed in the evening, frequent night awakenings, and restlessness in her legs. The history reveals low red meat consumption, evening meals eaten at irregular hours, and the occasional consumption of colored, energy-drink-like beverages after school. In this picture, iron deficiency-related restless legs syndrome and hidden sources of caffeine, both discussed earlier in this chapter, should come to mind together. A detailed dietary history, measurement of serum ferritin, and regulation of the evening meal and caffeine intake can be recommended as the first-line approach. This example is offered only to show how the findings in this chapter may translate into clinical practice; every child should be evaluated individually by their own physician.

Evidence-Based Recommendations for Parents

- Adopt the sleep duration recommended for your child’s age as a goal (Table 1).
- Keep meals and bedtime as regular and predictable as possible.
- Plan the evening meal at least one to two hours before bedtime, with a balanced protein-carbohydrate combination; avoid heavy, fatty foods.
- Do not make energy-dense late-night snacks such as sugary drinks, chocolate, and crisps a routine.

- Watch for hidden sources of caffeine taken in through cola drinks, energy drinks, chocolate, and tea, particularly in the afternoon and evening.
- In infants, support responsive feeding guided by hunger and satiety cues; avoid the assumption that more solid food means longer sleep.
- In children with unexplained restless sleep or bedtime resistance and low red meat consumption, discuss an assessment of iron status with your pediatrician.
- Do not force-feed a child to solve a sleep problem, and do not use any particular food or supplement as a "sleeping aid."
- When evaluating the nutrition and sleep pattern, consider screen use and physical activity together with them.

Conclusion

Nutrition and sleep are two fundamental life behaviors that shape each other throughout childhood and adolescence and cannot be addressed separately. The tryptophan-serotonin-melatonin metabolic pathway, the pharmacological effects of stimulants such as caffeine, and the role of micronutrients such as iron in dopaminergic function stand out as the main mechanisms explaining the effect of nutrition on sleep, while insufficient sleep can in turn alter children's food preferences unfavorably by affecting the leptin-ghrelin balance and the reward system (Córdova et al., 2018; Ward et al., 2020, 2021).

Parents and health professionals who are aware of this bidirectional relationship can develop a more holistic approach by exploring the dietary history when evaluating sleep problems and sleep habits when evaluating feeding problems. The core message for parents is not to search for a "special food for sleep," but to build regular meals, a balanced and varied diet, age-appropriate sleep duration, and a healthy daily rhythm.

Kaynakça/References

Aepli, A., Kurth, S., Tesler, N., Jenni, O. G., & Huber, R. (2015). Caffeine consuming children and adolescents show altered sleep behavior and deep sleep. *Brain Sciences*, *5*(4), 441-455. https://doi.org/10.3390/brainsci5040441

Alibabaei, Z., Jazayeri, S., Vafa, M. R., Feizy, Z., & Sajadi Hezaveh, Z. (2021). The association between dietary patterns and quality and duration of sleep in children and adolescents: A systematic review. *Clinical Nutrition ESPEN*, *45*, 102-110. https://doi.org/10.1016/j.clnesp.2021.07.012

Córdova, F. V., Barja, S., & Brockmann, P. E. (2018). Consequences of short sleep duration on the dietary intake in children: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *42*, 68-84. https://doi.org/10.1016/j.smrv.2018.05.006

Cusick, C. N., Langberg, J. M., Breaux, R., Green, C. D., & Becker, S. P. (2020). Caffeine use and associations with sleep in adolescents with and without ADHD. *Journal of Pediatric Psychology*, *45*(6), 643-653. https://doi.org/10.1093/jpepsy/jsaa033

Dosman, C., Witmans, M., & Zwaigenbaum, L. (2012). Iron's role in paediatric restless legs syndrome—A review. *Paediatrics & Child Health*, *17*(4), 193-197. https://doi.org/10.1093/pch/17.4.193

Fu, X., Lovell, A. L., Braakhuis, A. J., Mithen, R. F., & Wall, C. R. (2021). Type of milk feeding and introduction to complementary foods in relation to infant sleep: A systematic review. *Nutrients*, *13*(11), 4105. https://doi.org/10.3390/nu13114105

Harada, T., Hirotani, M., Maeda, M., Nomura, H., & Takeuchi, H. (2007). Correlation between breakfast tryptophan content and morningness-eveningness in Japanese infants and students aged 0-15 yrs. *Journal of Physiological Anthropology*, *26*(2), 201-207.

Miller, A. L., Lumeng, J. C., & LeBourgeois, M. K. (2015). Sleep patterns and obesity in childhood. *Current Opinion in Endocrinology, Diabetes and Obesity*, *22*(1), 41-47.

Miller, M. A., Kruisbrink, M., Wallace, J., Ji, C., & Cappuccio, F. P. (2018). Sleep duration and incidence of obesity in infants, children, and adolescents: A systematic review and meta-analysis of prospective studies. *Sleep, 41*(4), zsy018. https://doi.org/10.1093/sleep/zsy018

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1263-1276. https://doi.org/10.1093/sleep/29.10.1263

Morrissey, B., Taveras, E., Allender, S., & Strugnell, C. (2020). Sleep and obesity among children: A systematic review of multiple sleep dimensions. *Pediatric Obesity*, *15*(4), e12619. https://doi.org/10.1111/ijpo.12619

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Trakada, G. (2023). Dietary nutrient intake and sleep. *Nutrients, 15*(10), 2276. https://doi.org/10.3390/nu15102276

Wada, K., Yata, S., Akimitsu, O., Krejci, M., Noji, T., Nakade, M., Takeuchi, H., & Harada, T. (2013). A tryptophan-rich breakfast and exposure to light with low color temperature at night improve sleep and salivary melatonin level in Japanese students. *Journal of Circadian Rhythms, 11,* 4. https://doi.org/10.1186/1740-3391-11-4

Ward, A. L., Jospe, M., Morrison, S., Reynolds, A. N., Kuroko, S., Fangupo, L. J., et al. (2021). Bidirectional associations between sleep quality or quantity, and dietary intakes or eating behaviors in children 6-12 years old: A systematic

review with evidence mapping. *Nutrition Reviews*, *79*(10), 1079-1099. https://doi.org/10.1093/nutrit/nuaa125

Ward, A. L., Reynolds, A. N., Kuroko, S., Fangupo, L. J., Galland, B. C., & Taylor, R. W. (2020). Bidirectional associations between sleep and dietary intake in 0-5 year old children: A systematic review with evidence mapping. *Sleep Medicine Reviews*, *49*, 101231. https://doi.org/10.1016/j.smrv.2019.101231

World Health Organization. (2023a). *WHO guideline for complementary feeding of infants and young children 6-23 months of age*. World Health Organization.

World Health Organization. (2023b). *Infant and young child feeding* [Fact sheet]. World Health Organization.

BÖLÜM 5

SCREEN EXPOSURE AND SLEEP IN CHILDREN

Zeynep DURAK[1]

Introduction

Television, smartphones, tablets, computers, video games, and social media platforms have become an important part of children's daily lives. Although digital technologies offer significant opportunities for education, communication, entertainment, and social interaction, the marked increase in time spent in front of screens has also heightened interest in the possible effects of screen use on development and health during childhood and adolescence. Among these effects, sleep occupies a particularly important place. Adequate, good-quality sleep in childhood and adolescence is a fundamental requirement for neurodevelopment, learning, attention, behavior, emotional regulation, metabolic health, and overall well-being (Paruthi et al., 2016).

The relationship between screen exposure and sleep is not one-directional. Screen use before bedtime may delay sleep onset, shorten sleep duration, and impair sleep quality. At the same time, children who sleep insufficiently or irregularly may also increase their screen use during the day. The relationship between screen use and sleep should therefore be viewed as a reciprocal, multidimensional interaction (Hale & Guan, 2015; Hale et al., 2018).

The current approach emphasizes that, rather than focusing solely on “how many hours a day” a child uses screens, attention should also be paid to the purpose and content of screen use, the time

[1] MD, Division of Pediatric Endocrinology, Department of Pediatrics, Necmettin Erbakan University Faculty of Medicine, Konya, Türkiye, ORCID: 0009-0008-7724-2995

of day and setting in which it occurs, and the behaviors it displaces. The American Academy of Pediatrics (AAP), in its updated policy statement and technical report published in 2026, likewise recommends that digital media use be evaluated together with children's sleep, physical activity, play, family interaction, and other developmental needs (Munzer, Milkovich, et al., 2026; Munzer, Parga-Belinkie, et al., 2026).

When sleep is evaluated, questioning total sleep duration alone is not sufficient either. Sleep-onset latency, night awakenings, sleep continuity, bedtimes and wake times, and daytime sleepiness should also be assessed. This chapter addresses the nature of the relationship between screen exposure and sleep, the possible mechanisms underlying this relationship, findings that differ across age groups, and mediating and moderating variables. In line with current clinical guidelines, it also discusses approaches to evaluating screen use and sleep patterns in children.

The Relationship Between Screen Exposure and Sleep

A large number of studies have shown a negative association between electronic media use and sleep in children and adolescents. In particular, screen use before bedtime and the presence of electronic devices in the bedroom have been associated with shorter sleep duration, poorer sleep quality, and daytime sleepiness (Carter et al., 2016; Hale & Guan, 2015; He et al., 2025).

It has been suggested that the relationship is not one-directional and that a bidirectional cycle forms between screen use and sleep disturbances: prolonged screen exposure can disrupt the circadian rhythm and thereby impair the sleep pattern, while insufficient or disturbed sleep can in turn drive the child toward more screen use, creating a vicious circle (Dibben et al., 2023; Silva et al., 2026). Longitudinal studies indicate that chronic screen exposure may alter circadian patterns and that this may affect sleep regulation in the long term.

A systematic review conducted in school-aged children (6-14 years) reported that prolonged screen exposure negatively affects children's emotional well-being, behavioral regulation, and sleep quality, and that this effect is also related to physical growth and cognitive development (Qi et al., 2023). In another systematic

review of children aged 6-12 years, sleep was consistently associated with cognitive performance, emotional well-being, and fewer behavioral problems; in some studies, sleep was reported to act as a mediator in the relationship between screen use and behavioral difficulties (Félix & Candeias, 2025).

Experimental studies also suggest that the relationship may be more than an observational association. In the randomized controlled trial by Garrison and Christakis (2012), supporting healthier media use habits in preschool children was shown to reduce sleep problems.

The available evidence shows that the effect of screens on sleep cannot be explained by "minutes spent looking at a screen" alone. The physical presence of the device in the child's sleep environment, notifications, overnight access to the device, and the arousal the device creates before sleep are also important.

Mechanisms by Which Screens Affect Sleep

Light Exposure and Melatonin Suppression

One of the effects of screens on sleep is light exposure. Short-wavelength light in particular has been shown to suppress melatonin secretion and delay the circadian rhythm (West et al., 2011).

Using light-emitting devices in the evening hours may delay sleep onset and reduce alertness the following morning. In the controlled study by Chang et al. (2015), individuals who used a light-emitting e-reader in the evening had lower melatonin levels, longer sleep-onset latency, and reduced next-morning alertness compared with those who read a printed book.

This is of particular importance for children. Experimental studies in preschool children have shown that melatonin suppression in response to evening light may be more pronounced than in adults (Hartstein et al., 2022). Limiting screen use in the evening hours is therefore especially important in young children.

Cognitive-Emotional Arousal and Digital Design

The effect of screens on sleep cannot be explained by light alone. Video games, social media, messaging applications, and fast-paced digital content can increase cognitive and emotional arousal in the child. Interactive content in particular can make it difficult for the

child to put the screen down. Digital design features such as notifications, autoplay, infinite scrolling, and personalized content recommendations can cause screen use to last longer than planned.

The AAP's 2026 technical report emphasizes that design features of digital platforms intended to sustain user engagement for as long as possible may reduce the time available for healthy behaviors such as sleep, physical activity, and face-to-face interaction (Munzer, Milkovich, et al., 2026).

Rather than simply telling children to “turn off the screen,” it may therefore be more effective to establish a calming pre-sleep routine.

Time Displacement

One of the most important effects of screen use on sleep is that the screen takes the place of time that should be reserved for sleep.

Because the day is limited to 24 hours, an increase in time spent in front of screens may reduce the time available for sleep, physical activity, outdoor play, reading, or time spent with the family. This is particularly evident in nighttime screen use (Munzer, Milkovich, et al., 2026).

In the study by Foley et al. (2013), screen-based activities occupied a substantial amount of time in the pre-sleep period, and children who fell asleep later used screens more. In contrast, children who devoted more time to calm activities such as reading and self-care fell asleep earlier.

When evaluating the effect of screen use on sleep, therefore, the question should not only be “how many hours of screen time?” but also “which activity is screen use replacing?”

Device in the Bedroom

The presence of a television, telephone, tablet, or other screen device in the bedroom is also important for sleep. In the meta-analysis by Carter et al. (2016), the presence of a device in the bedroom was associated with shorter sleep duration and adverse sleep outcomes even in the absence of active use.

Keeping a smartphone next to the bed in particular may lead to fragmented sleep because of incoming notifications during the

night or the child checking the device. It is therefore recommended that the bedroom be made as screen-free a space as possible.

Screens and Sleep by Age Group

Infants

Sleep needs are very high in the first period of life. According to the World Health Organization, infants aged 0-3 months need 14-17 hours of sleep and infants aged 4-11 months need 12-16 hours. The World Health Organization does not recommend sedentary screen time for infants under one year of age. The main problem with screen use in infancy is not only the direct effect of the screen itself. Screen use can displace parent-child interaction, movement, and the time reserved for sleep. In this period, it is recommended that the child's sedentary time be spent not with screens but with activities such as interaction with the parent, reading, play, lullabies, and storytelling (World Health Organization, 2019).

Toddlers and the Preschool Period

Preschool children need approximately 10-13 hours of sleep in a 24-hour period. The World Health Organization states that sedentary screen time in children aged 2-4 years should not exceed one hour per day, and that less is better (World Health Organization, 2019).

In children under five, sleep is regarded, together with physical activity and sedentary behavior, as one of the fundamental components of a healthy daily life. In this age group, increased screen time may reduce the time available for physical activity and sleep (Çelik, 2026).

Establishing a regular sleep routine is important in this period. Preferring routines such as a bath, reading, quiet play, and conversation with the parent instead of screen use before bedtime can make it easier for the child to prepare for sleep.

Intervention studies in preschool children have shown that supporting age-appropriate, healthy media use can improve sleep problems (Garrison & Christakis, 2012).

School-Aged Children

School-aged children need 9-12 hours of sleep per day (Paruthi et al., 2016). In school-aged children, screen use should be evaluated together with sleep, behavioral regulation, emotional well-being, and academic functioning.

In the systematic review by Qi et al. (2023), increased screen exposure in the 6-14 age group was reported to be negatively associated with sleep quality, emotional-behavioral outcomes, and academic performance.

In this age group, maintaining regular bedtimes and wake times, particularly on school days, is important. Care should be taken to ensure that screen use does not take precedence over basic daily activities such as homework, reading, physical activity, and sleep.

Adolescents

Adolescents need 8-10 hours of sleep per day (Paruthi et al., 2016). The biological delay in sleep phase that occurs during adolescence may contribute to making the relationship between screens and sleep more pronounced; at the same time, school start times and social life may also lead to insufficient sleep in the adolescent (Munzer, Milkovich, et al., 2026).

Telephone use before bedtime, social media, messaging, and video games in particular can delay the transition to sleep in adolescents. The prospective study by Nagata et al. (2024) showed that screen use behaviors around bedtime were associated with sleep outcomes.

Social media use is also important in adolescents. Constant notifications, online social interaction, and content following can cause screen use to extend beyond the planned duration (Nursalam et al., 2019). When evaluating screens and sleep in adolescents, therefore, the purpose and timing of device use must be explored.

Children with Neurodevelopmental Differences

In children with neurodevelopmental differences such as autism spectrum disorder and attention-deficit/hyperactivity disorder, the relationship between screen use and sleep may be more complex (Ophir et al., 2023).

In these children, screens may be used not only for entertainment but also for calming, communication support, or behavioral regulation. Evaluating screen time alone is therefore not sufficient.

In the meta-analysis by Ophir et al. (2023), the association between autism spectrum disorder and screen time was evident in the initial analyses but diminished when publication bias was taken into account. As emphasized in the chapter by Durak (2026), in children with neurodevelopmental disorders the co-occurrence of screen use and developmental difficulties does not imply causality.

In children with neurodevelopmental differences, therefore, the fundamental question should be not “How much screen time?” but “For what purpose is the screen used, and to what extent does it displace the child's sleep, movement, communication, and learning?”

Differences by Content and Device Type

Television

Although television is a traditional screen medium, it remains important for children's sleep patterns. In particular, having a television in the bedroom or keeping the television on continuously to fall asleep can cause light and sound stimuli to persist (Carter et al., 2016; Munzer, Milkovich, et al., 2026).

Video Games

The interactive nature of video games can increase cognitive and emotional arousal, especially when they are played before bedtime. In online and multiplayer games, the fact that the end point of the game may be outside the child's control can also delay bedtime (Munzer, Milkovich, et al., 2026).

Setting the duration of play in advance, particularly in the evening hours, and transitioning to calm activities before sleep can therefore be recommended.

Social Media

Social media use involves not only viewing content but also messaging, checking notifications, and continuous social interaction.

These features can push screen use into the nighttime hours, especially in adolescents.

The AAP's 2026 report emphasizes that the relationship between digital media and sleep may be bidirectional and that social media use is an important area of assessment for sleep, particularly during adolescence (Munzer, Milkovich, et al., 2026).

Family and Environmental Factors in the Screen-Sleep Relationship

A child's screen use behavior is not determined by individual characteristics alone. Parents' attitudes, the media rules established within the family, and parents' own screen use behaviors are also important. Children may model their parents' behavior. When parents are asked to limit their child's screen use, they should therefore also be advised to review their own screen habits.

Establishing shared, predictable rules within the family can reduce the likelihood of screen use becoming a source of conflict. Setting a “screen-free time” before bedtime that applies to the whole family can be a practicable approach. The AAP's current 2026 approach likewise proposes a socioecological model that evaluates media use not only in terms of the child's daily screen time but together with the child's developmental characteristics, family relationships, the features of digital platforms, and environmental conditions (Munzer, Parga-Belinkie, et al., 2026).

During the COVID-19 pandemic, school closures, increased time spent at home, and the shift of education to digital channels led to important changes in children's screen use.

In the study by Oflu et al. (2021) of 253 children, the proportion of children with a daily screen time of one hour or more rose from 57.7% before the pandemic to 88.9% during the pandemic. In the same period, the proportion of parents setting limits on screen time decreased.

In the study by Buldu et al. (2025), which evaluated 457 children and adolescents, the proportion of children with a technological device in the bedroom increased during the pandemic and pre-sleep routines decreased. Increases were also reported in problems such as bedtime resistance, inability to sleep alone, and difficulty falling asleep. Because schools were closed, bedtimes and

wake times shifted later; despite this, total sleep duration appeared to increase.

These findings show that, in addition to screen use itself, changes in the structure of daily life can also affect children's screen use and sleep habits.

Clinical Guidance and Practical Recommendations

Current approaches to screen use do not merely impose strict time limits; they consider the child's age, developmental characteristics, family routines, and the effects of screen use on daily life together.

The World Health Organization does not recommend screen use under one year of age and recommends that sedentary screen time between 2 and 4 years of age be limited to one hour per day (World Health Organization, 2019).

The AAP's current 2026 policy statement brings to the fore the evaluation of the impact of screen use on the child's sleep, physical activity, face-to-face communication, and family relationships (Munzer, Parga-Belinkie, et al., 2026).

The following core recommendations stand out in clinical practice:

- Screen use should be avoided for approximately one hour before bedtime.
- Televisions, tablets, and telephones should not be kept in children's bedrooms.
- Leaving notifications on throughout the night should be avoided.
- Bedtimes and wake times should be kept as regular as possible.
- Alternatives to screens, such as reading, quiet play, conversation, and relaxation activities, should be established.
- Care should be taken that content is appropriate to the child's age and developmental level.
- Screen use should not take precedence over sleep, physical activity, school responsibilities, and family relationships.
- Parents should model healthy screen use for their children.

When screen time is being reduced, it is important to offer the child workable alternatives rather than relying on prohibition alone.

Filling the gap created by reduced screen time with activities such as physical activity, outdoor play, free play, reading, and time spent with the family can provide a more sustainable approach.

The “displacement principle” emphasized by Buldu (2026) is important in this respect. Because the day is limited to 24 hours, an increase in the time devoted to screens means a decrease in the time devoted to another activity. In the SCREENS trial conducted in Denmark, reducing recreational screen time resulted in an increase of approximately 45 minutes per day in children's non-sedentary leisure activities, supporting this approach (Pedersen et al., 2022).

Clinical Assessment: The Screen-Sleep History

In children presenting with a sleep problem, routinely questioning screen use is worthwhile. Rather than asking only about total daily screen time, the assessment should cover the following areas:

Device and content

- Which devices are used?
- Is there television, tablet, telephone, or computer use?
- Are video games or social media used?
- Is the content appropriate for the child's age?

Timing

- At what time is a screen last used?
- Does screen use continue after the child gets into bed?
- Is the telephone or tablet checked when the child wakes during the night?

Sleep environment

- Is there a device in the child's bedroom?
- Is the telephone next to the bed?
- Are notifications on throughout the night?

Family routines

- Do the parents use screens before bedtime?
- Is there a shared screen rule at home?
- Is there a regular, calm routine before bedtime?

This approach can be more useful in identifying the possible role of screen use in a sleep problem than questioning total screen time alone.

Conclusion

Studies show a consistent association between screen exposure and adverse sleep outcomes in children and adolescents; this relationship arises from the combined operation of biological (circadian rhythm and melatonin suppression), psychological (cognitive-emotional arousal), behavioral (time displacement), and contextual (device in the bedroom, digital design) mechanisms. The clinical approach should therefore not focus on daily screen time alone. When, where, for what purpose, and with what content screens are used should be evaluated. Keeping the period before bedtime screen-free, removing electronic devices from the bedroom, establishing a regular sleep routine, and replacing screens with developmentally appropriate alternatives are among the core recommendations.

The current AAP approach evaluates screen use not merely as an individual behavior but within a broader system formed jointly by the child, the family, the digital environment, and the social context (Munzer, Parga-Belinkie, et al., 2026). This approach supports making healthy digital habits a natural part of family life, rather than simply telling children to “use screens less.”

Kaynakça/References

Buldu, E. (2026). What instead of screens? Alternative activities and healthy digital balance in children and adolescents. In Y. Deniz (Ed.), *Children, screens, and development: A pediatric guide for counseling families* (pp. 139-157). BİDGE Yayınları.

Buldu, E., Oflu, A. T., Tahta, E. G., & Bükülmez, A. (2025). Investigation of the impact of COVID-19 pandemic process on sleep habits of children and adolescents. *Genel Tıp Dergisi, 35*(1), 1-6. https://doi.org/10.54005/geneltip.1423970

Carter, B., Rees, P., Hale, L., Bhattacharjee, D., & Paradkar, M. S. (2016). Association between portable screen-based media device access or use and sleep outcomes: A systematic review and meta-analysis. *JAMA Pediatrics, 170*(12), 1202-1208. https://doi.org/10.1001/jamapediatrics.2016.2341

Çelik, E. (2026). Screen exposure in children and its effects on sleep: Screen-induced sleep disorders. In Y. Deniz (Ed.), *Children, screens, and development: A pediatric guide for counseling families* (pp. 83-100). BİDGE Yayınları.

Chang, A.-M., Aeschbach, D., Duffy, J. F., & Czeisler, C. A. (2015). Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proceedings of the National Academy of Sciences of the United States of America, 112*(4), 1232-1237. https://doi.org/10.1073/pnas.1418490112

Dibben, G. O., Martin, A., Shore, C. B., Johnstone, A., McMellon, C., Palmer, V., Pugmire, J., Riddell, J., Skivington, K., Wells, V., McDaid, L., & Simpson, S. A. (2023). Adolescents' interactive electronic device use, sleep and mental health: A systematic review of prospective studies. *Journal of Sleep Research, 32*(5), e13899. https://doi.org/10.1111/jsr.13899

Durak, U. (2026). Screen burden in children with neurodevelopmental disorders: Autism, ADHD, and other developmental conditions. In Y. Deniz (Ed.), *Children, screens, and development: A pediatric guide for counseling*

families (pp. 57-82). BİDGE Yayınları. https://doi.org/10.70269/10.70269/5715463712

Félix, A., & Candeias, A. (2025). Sleep as a developmental process: A systematic review of cognitive, emotional, and behavioral outcomes in children aged 6-12 years. *Clocks & Sleep, 7*(4), 66. https://doi.org/10.3390/clockssleep7040066

Foley, L. S., Maddison, R., Jiang, Y., Marsh, S., Olds, T., & Ridley, K. (2013). Presleep activities and time of sleep onset in children. *Pediatrics, 131*(2), 276-282.

Garrison, M. M., & Christakis, D. A. (2012). The impact of a healthy media use intervention on sleep in preschool children. *Pediatrics, 130*(3), 492-499.

Hale, L., & Guan, S. (2015). Screen time and sleep among school-aged children and adolescents: A systematic literature review. *Sleep Medicine Reviews, 21*, 50-58. https://doi.org/10.1016/j.smrv.2014.07.007

Hale, L., Kirschen, G. W., LeBourgeois, M. K., Gradisar, M., Garrison, M. M., Montgomery-Downs, H., Kirschen, H., McHale, S. M., Chang, A.-M., & Buxton, O. M. (2018). Youth screen media habits and sleep: Sleep-friendly screen behavior recommendations for clinicians, educators, and parents. *Child and Adolescent Psychiatric Clinics of North America, 27*(2), 229-245. https://doi.org/10.1016/j.chc.2017.11.014

Hartstein, L. E., Diniz Behn, C., Akacem, L. D., Stack, N., Wright, K. P., Jr., & LeBourgeois, M. K. (2022). High sensitivity of melatonin suppression response to evening light in preschool-aged children. *Journal of Pineal Research, 72*(2), e12780. https://doi.org/10.1111/jpi.12780

He, X., Pan, B., Ma, N., Li, D., Kong, W., Liu, Q., Liu, X., Wang, X., Deng, X., & Yang, K. (2025). The association of screen time and the risk of sleep outcomes: A systematic review and meta-analysis. *Frontiers in Psychiatry, 16*, 1640263. https://doi.org/10.3389/fpsyt.2025.1640263

Munzer, T., Milkovich, L. M., Madigan, S., Tomopoulos, S., Parga-Belinkie, J., Ajumobi, T., Cross, C., & Gerwin, R. (2026).

Digital ecosystems, children, and adolescents: Technical report. *Pediatrics, 157*(2), e2025075321. https://doi.org/10.1542/peds.2025-075321

Munzer, T., Parga-Belinkie, J., Milkovich, L. M., Tomopoulos, S., Ajumobi, T., Cross, C., Gerwin, R., & Madigan, S. (2026). Digital ecosystems, children, and adolescents: Policy statement. *Pediatrics, 157*(2), e2025075320. https://doi.org/10.1542/peds.2025-075320

Nagata, J. M., Cheng, C. M., Shim, J., Kiss, O., Ganson, K. T., Testa, A., He, J., & Baker, F. C. (2024). Bedtime screen use behaviors and sleep outcomes in early adolescents: A prospective cohort study. *Journal of Adolescent Health, 75*(4), 650-655. https://doi.org/10.1016/j.jadohealth.2024.06.006

Nursalam, Octavia, M., Tristiana, R. D., & Efendi, F. (2019). Association between insomnia and social network site use in Indonesian adolescents. *Nursing Forum, 54*(2), 149-156. https://doi.org/10.1111/nuf.12308

Oflu, A., Bükülmez, A., Elmas, E., Tahta, E. G., & Çeleğen, M. (2021). Comparison of screen time and digital gaming habits of Turkish children before and during the coronavirus disease 2019 pandemic. *Turkish Archives of Pediatrics, 56*(1), 22-26. https://doi.org/10.14744/TurkPediatriArs.2020.41017

Ophir, Y., Rosenberg, H., Tikochinski, R., Dalyot, S., & Lipshits-Braziler, Y. (2023). Screen time and autism spectrum disorder: A systematic review and meta-analysis. *JAMA Network Open, 6*(11), e2346775. https://doi.org/10.1001/jamanetworkopen.2023.46775

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Pedersen, J., Rasmussen, M. G. B., Sørensen, S. O., Mortensen, S. R., Olesen, L. G., Brønd, J. C., Brage, S., Kristensen, P. L., & Grøntved, A. (2022). Effects of limiting recreational screen media use on physical activity and sleep in families with children: A cluster randomized clinical trial. *JAMA Pediatrics*, *176*(8), 741-749. https://doi.org/10.1001/jamapediatrics.2022.1519

Qi, J., Yan, Y., & Yin, H. (2023). Screen time among school-aged children of aged 6-14: A systematic review. *Global Health Research and Policy, 8*, 12. https://doi.org/10.1186/s41256-023-00297-z

Silva, R. L., Gonçalves, B. P. C., Ferreira, M. H. L., & Junior, N. C. (2026). Consequences of screen time on sleep quality in children and adolescents: A scoping review. *Journal of Pediatric Health Care*, *40*(1), 79-97. https://doi.org/10.1016/j.pedhc.2025.08.005

West, K. E., Jablonski, M. R., Warfield, B., Cecil, K. S., James, M., Ayers, M. A., Maida, J., Bowen, C., Sliney, D. H., Rollag, M. D., Hanifin, J. P., & Brainard, G. C. (2011). Blue light from light-emitting diodes elicits a dose-dependent suppression of melatonin in humans. *Journal of Applied Physiology*, *110*(3), 619-626.

World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. World Health Organization.

BÖLÜM 6

SLEEP AND GROWTH FAILURE IN CHILDREN

Fuat BUĞRUL[1]

Introduction

Sleep in childhood is not merely a passive process of rest and energy conservation; it is an active physiological process that contributes to growth, neurodevelopment, immune function, and metabolic balance. In particular, the fact that most of the pulsatile secretion of growth hormone (GH) occurs during deep sleep (slow-wave sleep) (Takahashi et al., 1968; Van Cauter & Plat, 1996) has led to the recognition of a direct link between sleep quality and duration and somatic growth.

In clinical practice, when a child presents with growth failure, nutritional, endocrine, gastrointestinal, and chromosomal causes are investigated meticulously, whereas sleep duration, sleep quality, and possible sleep disorders are often overlooked. Yet chronic insufficient sleep, obstructive sleep apnea (OSA), restless legs syndrome, chronic insomnia, or an irregular sleep–wake rhythm may cause measurable disturbances of the growth hormone axis and thereby contribute to short stature and inadequate weight gain (Bonuck et al., 2009; Marcus et al., 1994; Nieminen et al., 2002). The evidence for this relationship is strongest for OSA; data for other sleep disorders are more limited (Zaffanello et al., 2024).

In this chapter, the relationship between sleep physiology and growth hormone secretion, the mechanisms by which sleep disorders affect growth, the clinical assessment approach, diagnostic methods,

[1] Asst. Prof., MD, Division of Pediatric Endocrinology, Department of Pediatrics, Selçuk University Faculty of Medicine, Konya, Türkiye, ORCID: 0000-0002-2276-4410

and treatment options are systematically reviewed in light of the current literature.

Epidemiology and Clinical Significance

Population-based studies show that a considerable proportion of school-aged children sleep less than the recommended amount for their age; this proportion rises further in adolescence with early school start times and increasing use of digital devices (American Academy of Pediatrics, 2014; Carter et al., 2016). Obstructive sleep apnea, in turn, affects approximately 1-5% of children and peaks between 2 and 8 years of age, when adenotonsillar hypertrophy is common (Kaditis et al., 2016; Marcus et al., 2012).

In some children referred to growth clinics, the underlying cause is not an endocrine or systemic disease but an unrecognized sleep disorder (Bonuck et al., 2009; Kaditis et al., 2016). Early recognition of this condition often offers a simple, inexpensive, and treatable intervention before invasive or costly endocrinological investigations are undertaken. Therefore, including sleep assessment early in the growth failure diagnostic algorithm both reduces diagnostic delay and lessens unnecessary testing.

Sleep Physiology and the Growth Hormone Axis

Recommended Sleep Durations by Age

According to the consensus statement of the American Academy of Sleep Medicine (AASM), age-appropriate total sleep duration should be used as a reference point when evaluating growth and development (Paruthi et al., 2016) (Table 1).

Table 1. Recommended total sleep durations by age group

Age group	**Recommended total sleep duration**	**Predominant sleep feature**
4-12 months	12-16 hours (including naps)	High proportion of REM sleep
1-2 years	11-14 hours (including naps)	N3 proportion increasing
3-5 years	10-13 hours (including naps)	N3 proportion near its peak

6-12 years	9-12 hours	Highest N3 proportion
13-18 years	8-10 hours	N3 proportion begins to decline

Source: Summarized from Paruthi et al. (2016), American Academy of Sleep Medicine consensus statement.

Sleep Stages

Sleep is divided into two basic states: non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. NREM sleep is further divided into N1 (light sleep), N2 (intermediate-depth sleep), and N3 (deep sleep / slow-wave sleep, SWS). In children, N3 is prominent during the first third of the night, and its share of total sleep time increases as age decreases (Ohayon et al., 2004).

In the neonatal period, approximately half of total sleep consists of REM sleep; this proportion declines with age and approaches adult values in the preschool years (Ohayon et al., 2004). The proportion of deep sleep (N3) is highest particularly between 3 and 10 years of age (Ohayon et al., 2004); this suggests the clinical importance of the relationship between deep sleep and GH secretion in childhood.

Pulsatile Secretion of Growth Hormone

Growth hormone is secreted in a pulsatile manner by somatotroph cells of the anterior pituitary, and this secretion is regulated by the balance between hypothalamic growth hormone-releasing hormone (GHRH) and somatostatin (Van Cauter et al., 1998). In healthy individuals, most daily GH secretion (approximately 70% in adult men) occurs during nocturnal sleep, particularly in synchrony with the first N3 period in the first half of the night (Takahashi et al., 1968; Van Cauter & Plat, 1996; Van Cauter et al., 1998).

The neuroendocrine basis of this relationship can be summarized as follows: during slow-wave sleep, a reduction in hypothalamic somatostatin tone and an increase in GHRH pulsatility trigger GH release from the pituitary. At the same time, the physiological decline in corticotropin-releasing hormone (CRH) and cortisol levels during deep sleep creates a favorable hormonal

environment for GH secretion (Van Cauter & Plat, 1996; Van Cauter et al., 1998).

Clinical note: Even short-term sleep restriction alone may reduce the amplitude of that night's GH peak in healthy individuals (the data are based mainly on adult studies); however, this situation must become chronic for growth failure to manifest clinically. Indeed, in adults, the blunting of the nocturnal GH pulse after sleep deprivation has been shown to be compensated during the daytime, with total 24-hour GH secretion remaining similar (Brandenberger et al., 2000).

Indirect Effects on IGF-1 and the Growth Plate

GH stimulates the synthesis of insulin-like growth factor-1 (IGF-1) in the liver and peripheral tissues; IGF-1, in turn, directly supports chondrocyte proliferation and endochondral ossification in the growth plate. It has been proposed that recurrent disruption of the nocturnal GH peak in chronic sleep insufficiency may, over time, reduce average 24-hour GH secretion and the associated IGF-1 level, leading to slowing of growth velocity. However, this hypothesis is contested: in adults, 24-hour GH secretion can be preserved after sleep deprivation (Brandenberger et al., 2000), and reviews of the GH–sleep relationship in children report heterogeneous findings (Zaffanello et al., 2024). In contrast, in children with OSA, GH secretion has been shown to be impaired and IGF-1 levels to increase after adenotonsillectomy (Bar et al., 1999; Nieminen et al., 2002).

Effects of Sleep Disorders on Growth

Obstructive Sleep Apnea (OSA)

In children, OSA most commonly develops as a result of upper airway obstruction due to adenotonsillar hypertrophy and causes recurrent hypoxemia, hypercapnia, and sleep fragmentation (arousals) (Kaditis et al., 2016; Marcus et al., 2012). These recurrent awakenings disrupt the continuity of deep sleep stages and shorten the critical windows in which GH secretion occurs (Nieminen et al., 2002). The main mechanisms linking OSA to growth failure can be summarized as follows:

- Recurrent arousals lead to fragmentation of N3 sleep.

- It has been proposed that chronic intermittent hypoxia may cause a picture resembling resistance in the GH–IGF-1 axis; low IGF-1 levels and a postoperative increase have been reported in children with OSA (Bar et al., 1999; Nieminen et al., 2002).
- Together with increased energy expenditure (respiratory effort), loss of appetite may reduce caloric intake (Marcus et al., 1994).
- Elevated inflammatory markers (IL-6, TNF-α) are thought to have a negative effect on growth (Kheirandish-Gozal & Gozal, 2019).

It has been reported in the literature that children with moderate-to-severe OSA show marked "catch-up growth" in height and weight percentiles after adenotonsillectomy (Bar et al., 1999; Bonuck et al., 2009); this finding is among the strongest clinical evidence supporting a causal relationship between OSA and growth failure. However, most of these studies are observational, and randomized data focusing specifically on growth outcomes are limited (Bonuck et al., 2009).

Chronic Sleep Deprivation and Behavioral Insomnia

Chronic sleep restriction resulting from increased screen time, irregular bedtimes, parental difficulty in setting limits, or behavioral insomnia of childhood follows a more insidious clinical course (Carter et al., 2016; Mindell et al., 2006). In these children, even in the absence of obstructive findings, total sleep duration falling below age-appropriate recommendations may reduce the number of GH peaks occurring during the night; however, data directly demonstrating this mechanism in children are limited (Zaffanello et al., 2024).

In addition, insufficient sleep has been associated with decreased leptin and increased ghrelin levels (these findings are based mainly on adult data) (Taheri et al., 2004); this hormonal change may disrupt appetite regulation and contribute to inadequate and unbalanced nutrition and, consequently, to slowing of growth velocity. However, pediatric studies show that short sleep duration is more consistently associated not with short stature but with increased body mass index and obesity (Chen et al., 2008); in

infants, an association has been reported between sleep duration and bursts of growth in length (Lampl & Johnson, 2011).

Circadian Rhythm Disorders

In circadian rhythm disorders such as delayed sleep phase syndrome, total sleep duration may sometimes be preserved even though sleep timing is delayed; however, the need to wake early in the morning because of school schedules leads to chronic sleep debt and interruption of deep sleep stages (American Academy of Pediatrics, 2014). In adolescents, this is particularly important during the pubertal growth spurt, when height gain is at its fastest.

Restless Legs Syndrome and Periodic Limb Movements

Restless legs syndrome and periodic limb movements, which are associated with iron deficiency, delay sleep onset and cause micro-arousals throughout the night, disrupting sleep architecture (Allen et al., 2018; Picchietti et al., 2013). In these children, both poor sleep quality and the underlying iron deficiency itself may have adverse effects on growth and development.

Summary of Pathophysiological Mechanisms

The common pathways through which different sleep disorders lead to growth failure are summarized in Table 2.

Table 2. Main mechanisms by which sleep disorders affect growth

Sleep disorder	Main mechanism	Effect on growth
Obstructive sleep apnea	Arousals, intermittent hypoxia, inflammation	Reduced GH peak, increased energy expenditure
Chronic sleep restriction	Reduced N3 duration	Reduced number of GH pulses, appetite imbalance
Circadian rhythm disorder	Shift of sleep phase	Chronic sleep debt, N3 fragmentation
Restless legs / PLMD	Micro-arousals, iron deficiency	Impaired sleep continuity

Source: Prepared by the author.

Points to Consider in Differential Diagnosis

When growth failure and a sleep disorder coexist, it should be determined whether the sleep problem is the primary cause or the consequence of another condition (e.g., obesity, Prader-Willi syndrome, craniofacial anomalies, neuromuscular diseases). For example, in Prader-Willi syndrome, both central and obstructive sleep apnea components may coexist with underlying hypothalamic dysfunction, and growth failure forms a multifactorial picture (Deal et al., 2013; Goldstone et al., 2008). Therefore, genetic evaluation should also be considered in the presence of syndromic findings, dysmorphic features, and developmental delay.

Clinical Assessment Approach

History

A detailed sleep history should be obtained from every child presenting with growth failure (Kaditis et al., 2016; Marcus et al., 2012). The main topics to be asked about are as follows:

- Bedtime and wake time, total sleep duration, weekday–weekend difference
- Snoring, witnessed apneas, mouth breathing, restless sleep
- Night sweats, frequent awakenings, history of nightmares/parasomnias
- Excessive daytime sleepiness, inattention, behavioral problems (Bass et al., 2004)
- Screen use, caffeine intake, bedroom environment
- Family history of OSA, obesity, or restless legs syndrome

Physical Examination

Signs of adenotonsillar hypertrophy (mouth breathing, hyponasal speech, tonsil size), craniofacial anomalies (retrognathia, high-arched palate), neck circumference, and body mass index should be assessed (Marcus et al., 2012). Retrospective review of growth charts is important for determining when the slowing of growth velocity began; this may coincide temporally with the onset of sleep problems.

Standardized Questionnaires and Scales

Structured questionnaires can be used for screening in the clinical assessment: the Children's Sleep Habits Questionnaire (CSHQ) (Owens et al., 2000), the Pediatric Sleep Questionnaire (PSQ) (Chervin et al., 2000), and the OSA-18 quality-of-life scale (Franco et al., 2000) are among the most commonly used. Although these scales are not diagnostic, they are helpful in deciding which patients should be referred for polysomnography; however, the sensitivity and specificity of clinical history, physical examination, and questionnaires in distinguishing OSA from primary snoring are limited (Marcus et al., 2012).

Case Example

A six-year-old boy presents with slowing of growth velocity over the past year. The history reveals loud snoring every night, occasional witnessed breathing pauses, and daytime mouth breathing. Physical examination shows grade 3 tonsillar hypertrophy and a mild mouth-breathing pattern. On the growth chart, height has fallen by 2 percentile lines over the past 12 months, while weight gain has been preserved. Laboratory tests reveal borderline-low thyroid function and IGF-1 levels. Overnight polysomnography shows an obstructive apnea–hypopnea index of 12/hour (moderate-to-severe OSA). After adenotonsillectomy, a marked increase in height velocity and upward correction of the percentile curve (catch-up growth) is observed at 6 months.

This case shows that even a mildly low isolated IGF-1 level does not necessarily indicate primary growth hormone deficiency and may return to normal with treatment of the underlying sleep disorder (Bar et al., 1999; Bonuck et al., 2009).

Diagnostic Methods

Polysomnography (PSG)

Overnight laboratory polysomnography is the gold standard for diagnosing childhood sleep disorders (Aurora et al., 2011; Marcus et al., 2012). Simultaneous recording of EEG, EOG, EMG, respiratory effort, nasal airflow, oxygen saturation, and capnography channels allows objective determination of the apnea–hypopnea index (AHI), sleep stage distribution, and arousal index. PSG is

recommended in children with growth failure who also have a history of snoring or witnessed apneas (Kaditis et al., 2016).

Actigraphy and Sleep Diaries

Wrist actigraphy performed at home together with sleep diaries helps to objectively assess total sleep duration and sleep pattern, particularly when behavioral insomnia or a circadian rhythm disorder is suspected (Smith et al., 2018).

Endocrine Evaluation

In cases of growth failure in which a sleep disorder is suspected, IGF-1, IGFBP-3, thyroid function tests, complete blood count, iron parameters, and, if necessary, GH stimulation tests should be requested to exclude other causes of growth failure (Grimberg et al., 2016). This step is critical for distinguishing whether the sleep disorder is a concomitant or triggering factor or the main cause.

Treatment Approaches

Adenotonsillectomy

In children diagnosed with moderate-to-severe OSA due to adenotonsillar hypertrophy, surgical treatment (adenotonsillectomy) is the first-line option (Kaditis et al., 2016; Marcus et al., 2012; Mitchell et al., 2019). Studies show a marked increase in height and weight percentiles within the first 6-12 months after surgery (Bonuck et al., 2009); this catch-up growth is attributed to improved sleep architecture and the resulting normalization of GH secretion. In the randomized controlled CHAT trial, early adenotonsillectomy, compared with watchful waiting, markedly improved the rate of polysomnographic normalization and measures of symptoms, behavior, and quality of life; however, no significant difference was found in the primary outcome of attention and executive function testing (Marcus et al., 2013).

Sleep Hygiene and Behavioral Interventions

In children with behavioral insomnia or insufficient sleep duration, treatment is based on sleep hygiene education (Mindell et al., 2006):

- Establishing fixed bedtimes and wake times

- Stopping screen use at least 1 hour before bedtime (Carter et al., 2016)
- Keeping the bedroom quiet, dark, and cool
- Limiting caffeine intake in the afternoon
- Establishing a consistent, calming pre-sleep routine

Treatment of Circadian Rhythm Disorders

In patients with delayed sleep phase, morning light therapy and gradual shifting of bedtime (chronotherapy) may be applied (part of the evidence is based on adult studies) (Auger et al., 2015); in selected cases, low-dose melatonin may be used under physician supervision and for a limited period (Bruni et al., 2015).

Treatment of Iron Deficiency and Restless Legs Syndrome

In children with restless legs syndrome and low serum ferritin, oral iron replacement may improve both sleep quality and, indirectly, growth parameters (Allen et al., 2018); however, direct evidence for an effect on growth parameters is limited.

Multidisciplinary Follow-up

In cases in which growth failure and a sleep disorder coexist, joint follow-up by pediatric endocrinology, sleep medicine/pulmonology, and otorhinolaryngology clinics is recommended (Kaditis et al., 2016). Monitoring growth velocity at 3-6-month intervals after treatment is an important indicator for evaluating the effectiveness of the intervention.

Conclusion

Sleep is a physiological process that lies at the center of the growth hormone axis and directly affects the growth process. Conditions such as obstructive sleep apnea, chronic sleep deprivation, circadian rhythm disorders, and restless legs syndrome can disrupt deep sleep stages, reduce growth hormone secretion, and lead to clinical growth failure.

Taking a detailed sleep history routinely in the evaluation of growth failure, performing objective assessment with polysomnography when necessary, and treating the underlying sleep disorder is an approach that, in many cases, requires no drug therapy yet produces marked and measurable positive effects on growth.

Sleep assessment should therefore be regarded as an integral part of the diagnostic algorithm for growth failure.

Key Points for Clinical Practice

The information covered in this chapter can be summarized in the following key points for translation into daily clinical practice:

- A sleep history (duration, snoring, witnessed apneas, sleep schedule) should be routinely obtained from every child presenting with growth failure.
- Patients with a history of snoring, witnessed apneas, or mouth breathing should be referred for polysomnography.
- An isolated low IGF-1 level should not be interpreted as growth hormone deficiency before the sleep disorder has been treated.
- Monitoring growth after adenotonsillectomy is an important clinical indicator of treatment effectiveness.
- Sleep hygiene counseling should be considered the first-line treatment in children with behaviorally based sleep restriction.
- If syndromic findings or developmental delay are present, a genetic/syndromic cause underlying the sleep disorder should be investigated.
- Follow-up after treatment should include assessment of growth velocity at 3-6-month intervals.

Kaynakça/References

Allen, R. P., Picchietti, D. L., Auerbach, M., Cho, Y. W., Connor, J. R., Earley, C. J., Garcia-Borreguero, D., Kotagal, S., Manconi, M., Ondo, W., Ulfberg, J., & Winkelman, J. W. (2018). Evidence-based and consensus clinical practice guidelines for the iron treatment of restless legs syndrome/Willis-Ekbom disease in adults and children: An IRLSSG task force report. *Sleep Medicine, 41*, 27-44. https://doi.org/10.1016/j.sleep.2017.11.1126

American Academy of Pediatrics. (2014). School start times for adolescents. *Pediatrics, 134*(3), 642-649. https://doi.org/10.1542/peds.2014-1697

Auger, R. R., Burgess, H. J., Emens, J. S., Deriy, L. V., Thomas, S. M., & Sharkey, K. M. (2015). Clinical practice guideline for the treatment of intrinsic circadian rhythm sleep-wake disorders: An update for 2015. *Journal of Clinical Sleep Medicine, 11*(10), 1199-1236. https://doi.org/10.5664/jcsm.5100

Aurora, R. N., Zak, R. S., Karippot, A., Lamm, C. I., Morgenthaler, T. I., Auerbach, S. H., Bista, S. R., Casey, K. R., Chowdhuri, S., Kristo, D. A., & Ramar, K. (2011). Practice parameters for the respiratory indications for polysomnography in children. *Sleep, 34*(3), 379-388. https://doi.org/10.1093/sleep/34.3.379

Bar, A., Tarasiuk, A., Segev, Y., Phillip, M., & Tal, A. (1999). The effect of adenotonsillectomy on serum insulin-like growth factor-I and growth in children with obstructive sleep apnea syndrome. *The Journal of Pediatrics, 135*(1), 76-80.

Bass, J. L., Corwin, M., Gozal, D., Moore, C., Nishida, H., Parker, S., Schonwald, A., Wilker, R. E., Stehle, S., & Kinane, T. B. (2004). The effect of chronic or intermittent hypoxia on cognition in childhood: A review of the evidence. *Pediatrics, 114*(3), 805-816.

Bonuck, K. A., Freeman, K., & Henderson, J. (2009). Growth and growth biomarker changes after adenotonsillectomy: Systematic review and meta-analysis. *Archives of Disease in*

Childhood, 94(2), 83-91. https://doi.org/10.1136/adc.2008.141192

Brandenberger, G., Gronfier, C., Chapotot, F., Simon, C., & Piquard, F. (2000). Effect of sleep deprivation on overall 24 h growth-hormone secretion. *The Lancet, 356*(9239), 1408.

Bruni, O., Alonso-Alconada, D., Besag, F., Biran, V., Braam, W., Cortese, S., Moavero, R., Parisi, P., Smits, M., Van der Heijden, K., & Curatolo, P. (2015). Current role of melatonin in pediatric neurology: Clinical recommendations. *European Journal of Paediatric Neurology, 19*(2), 122-133. https://doi.org/10.1016/j.ejpn.2014.12.007

Carter, B., Rees, P., Hale, L., Bhattacharjee, D., & Paradkar, M. S. (2016). Association between portable screen-based media device access or use and sleep outcomes: A systematic review and meta-analysis. *JAMA Pediatrics, 170*(12), 1202-1208. https://doi.org/10.1001/jamapediatrics.2016.2341

Chen, X., Beydoun, M. A., & Wang, Y. (2008). Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity, 16*(2), 265-274. https://doi.org/10.1038/oby.2007.63

Chervin, R. D., Hedger, K., Dillon, J. E., & Pituch, K. J. (2000). Pediatric Sleep Questionnaire (PSQ): Validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems. *Sleep Medicine, 1*(1), 21-32. https://doi.org/10.1016/S1389-9457(99)00009-X

Deal, C. L., Tony, M., Höybye, C., Allen, D. B., Tauber, M., & Christiansen, J. S. (2013). Growth Hormone Research Society workshop summary: Consensus guidelines for recombinant human growth hormone therapy in Prader-Willi syndrome. *The Journal of Clinical Endocrinology & Metabolism, 98*(6), E1072-E1087. https://doi.org/10.1210/jc.2012-3888

Franco, R. A., Jr., Rosenfeld, R. M., & Rao, M. (2000). Quality of life for children with obstructive sleep apnea. *Otolaryngology–Head and Neck Surgery, 123*(1), 9-16.

Goldstone, A. P., Holland, A. J., Hauffa, B. P., Hokken-Koelega, A. C., & Tauber, M. (2008). Recommendations for the diagnosis and management of Prader-Willi syndrome. *The Journal of Clinical Endocrinology & Metabolism, 93*(11), 4183-4197. https://doi.org/10.1210/jc.2008-0649

Grimberg, A., DiVall, S. A., Polychronakos, C., Allen, D. B., Cohen, L. E., Quintos, J. B., Rossi, W. C., Feudtner, C., & Murad, M. H. (2016). Guidelines for growth hormone and insulin-like growth factor-I treatment in children and adolescents: Growth hormone deficiency, idiopathic short stature, and primary insulin-like growth factor-I deficiency. *Hormone Research in Paediatrics, 86*(6), 361-397. https://doi.org/10.1159/000452150

Kaditis, A. G., Alonso Alvarez, M. L., Boudewyns, A., Alexopoulos, E. I., Ersu, R., Joosten, K., Larramona, H., Miano, S., Narang, I., Trang, H., Tsaoussoglou, M., Vandenbussche, N., Villa, M. P., van Waardenburg, D., Weber, S., & Verhulst, S. (2016). Obstructive sleep disordered breathing in 2- to 18-year-old children: Diagnosis and management. *European Respiratory Journal, 47*(1), 69-94. https://doi.org/10.1183/13993003.00385-2015

Kheirandish-Gozal, L., & Gozal, D. (2019). Obstructive sleep apnea and inflammation: Proof of concept based on two illustrative cytokines. *International Journal of Molecular Sciences, 20*(3), 459. https://doi.org/10.3390/ijms20030459

Lampl, M., & Johnson, M. L. (2011). Infant growth in length follows prolonged sleep and increased naps. *Sleep, 34*(5), 641-650. https://doi.org/10.1093/sleep/34.5.641

Marcus, C. L., Brooks, L. J., Draper, K. A., Gozal, D., Halbower, A. C., Jones, J., Schechter, M. S., Sheldon, S. H., Spruyt, K., Ward, S. D., Lehmann, C., & Shiffman, R. N. (2012). Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics, 130*(3), 576-584. https://doi.org/10.1542/peds.2012-1671

Marcus, C. L., Carroll, J. L., Koerner, C. B., Hamer, A., Lutz, J., & Loughlin, G. M. (1994). Determinants of growth in children

with the obstructive sleep apnea syndrome. *The Journal of Pediatrics, 125*(4), 556-562.

Marcus, C. L., Moore, R. H., Rosen, C. L., Giordani, B., Garetz, S. L., Taylor, H. G., Mitchell, R. B., Amin, R., Katz, E. S., Arens, R., Paruthi, S., Muzumdar, H., Gozal, D., Thomas, N. H., Ware, J., Beebe, D., Snyder, K., Elden, L., Sprecher, R. C., … Redline, S. (2013). A randomized trial of adenotonsillectomy for childhood sleep apnea. *The New England Journal of Medicine, 368*(25), 2366-2376. https://doi.org/10.1056/NEJMoa1215881

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1263-1276. https://doi.org/10.1093/sleep/29.10.1263

Mitchell, R. B., Archer, S. M., Ishman, S. L., Rosenfeld, R. M., Coles, S., Finestone, S. A., Friedman, N. R., Giordano, T., Hildrew, D. M., Kim, T. W., Lloyd, R. M., Parikh, S. R., Shulman, S. T., Walner, D. L., Walsh, S. A., & Nnacheta, L. C. (2019). Clinical practice guideline: Tonsillectomy in children (update). *Otolaryngology–Head and Neck Surgery, 160*(1_suppl), S1-S42. https://doi.org/10.1177/0194599818801757

Nieminen, P., Löppönen, T., Tolonen, U., Lanning, P., Knip, M., & Löppönen, H. (2002). Growth and biochemical markers of growth in children with snoring and obstructive sleep apnea. *Pediatrics, 109*(4), e55. https://doi.org/10.1542/peds.109.4.e55

Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: Developing normative sleep values across the human lifespan. *Sleep, 27*(7), 1255-1273. https://doi.org/10.1093/sleep/27.7.1255

Owens, J. A., Spirito, A., & McGuinn, M. (2000). The Children's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep, 23*(8), 1043-1051.

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Picchietti, D. L., Bruni, O., de Weerd, A., Durmer, J. S., Kotagal, S., Owens, J. A., & Simakajornboon, N. (2013). Pediatric restless legs syndrome diagnostic criteria: An update by the International Restless Legs Syndrome Study Group. *Sleep Medicine, 14*(12), 1253-1259. https://doi.org/10.1016/j.sleep.2013.08.778

Smith, M. T., McCrae, C. S., Cheung, J., Martin, J. L., Harrod, C. G., Heald, J. L., & Carden, K. A. (2018). Use of actigraphy for the evaluation of sleep disorders and circadian rhythm sleep-wake disorders: An American Academy of Sleep Medicine clinical practice guideline. *Journal of Clinical Sleep Medicine, 14*(7), 1231-1237. https://doi.org/10.5664/jcsm.7230

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS Medicine, 1*(3), e62. https://doi.org/10.1371/journal.pmed.0010062

Takahashi, Y., Kipnis, D. M., & Daughaday, W. H. (1968). Growth hormone secretion during sleep. *The Journal of Clinical Investigation, 47*(9), 2079-2090. https://doi.org/10.1172/JCI105893

Van Cauter, E., & Plat, L. (1996). Physiology of growth hormone secretion during sleep. *The Journal of Pediatrics, 128*(5, Pt. 2), S32-S37.

Van Cauter, E., Plat, L., & Copinschi, G. (1998). Interrelations between sleep and the somatotropic axis. *Sleep, 21*(6), 553-566. https://doi.org/10.1093/sleep/21.6.553

Zaffanello, M., Pietrobelli, A., Cavarzere, P., Guzzo, A., & Antoniazzi, F. (2024). Complex relationship between growth

hormone and sleep in children: Insights, discrepancies, and implications. *Frontiers in Endocrinology*, *14*, 1332114. https://doi.org/10.3389/fendo.2023.1332114

BÖLÜM 7

SLEEP IN CHILDREN WITH CHRONIC ILLNESSES: A PEDIATRICIAN'S PERSPECTIVE

Şeyma ŞİMŞİRGİL KARA[1]

Introduction

Sleep during childhood is not merely a time for the body to rest; it is a process during which growth, learning, and memory consolidation occur, the immune system is strengthened, emotions are balanced, and functionality is restored for the entire day. Therefore, while healthy sleep is valuable for every child, it becomes a fundamental health indicator that requires special attention in children with chronic illnesses.

For a child living with a chronic illness, the night is not a respite from the illness. A child with asthma may wake up startled by coughing or shortness of breath; for a child with epilepsy, seizures or the fear of seizures can make the night more exhausting than the day; a child with type 1 diabetes—or their family—may stay awake all night due to anxiety about hypoglycemia and the need to monitor glucose levels. Chronic pain, itching, frequent urination, hospitalizations, treatment procedures, and certain medications can also make it difficult to fall asleep or stay asleep.

Therefore, the relationship between chronic illness and sleep is often not one-sided. Illness can disrupt sleep; disrupted sleep, in turn, can affect a child's daytime functioning, ability to cope with the illness, adherence to treatment, and quality of life (Biemans et al., 2023; Xavier et al., 2024).

What matters here is not just how many hours a child sleeps. A study evaluating children and adolescents aged 8-19 with chronic

[1] MD, Sinop University Faculty of Health Sciences, Sinop, Türkiye, ORCID: 0000-0001-6894-5631

illnesses showed that, in general, children were able to meet the sleep durations recommended for their age (Biemans et al., 2023; Paruthi et al., 2016). However, in the same study, approximately 22% of the children reported poor sleep quality (Biemans et al., 2023). This finding demonstrates that the assumption "My child sleeps long enough, so their sleep must be good" is not always accurate. The time it takes to fall asleep, nighttime awakenings, fragmented sleep, and whether the child wakes up feeling rested in the morning are just as important as total sleep duration.

Moreover, when chronic illness is involved, sleep problems are not limited to the child alone. Administering medication at night, checking blood sugar levels, monitoring breathing or seizures, staying with a child in pain, or being constantly on alert out of anxiety that "something might happen at night" can also disrupt parents' sleep. It has been reported that poor sleep quality, symptoms of insomnia, and chronic sleep deprivation are more common in families of children with chronic illnesses than in families of healthy children (Xavier et al., 2024).

Therefore, when evaluating the sleep of a child with a chronic illness, it is essential to consider not only the child's sleep but also the parent's nighttime experience.

How Does a Chronic Illness Disrupt Sleep?

In a child with a chronic illness, sleep problems rarely have a single cause. The illness itself, accompanying symptoms, treatments used, medical procedures required at night, and the child's or family's anxiety related to the illness can all combine to affect sleep.

Pain, coughing, shortness of breath, itching, frequent urination, or medical procedures required at night can delay the child's ability to fall asleep or disrupt the night with repeated awakenings. Among these symptoms, pain, respiratory problems, and incontinence, in particular, have been reported as significant factors that can impair sleep quality (Biemans et al., 2023).

It is important to distinguish between the time spent in bed and truly restful sleep. A child may have spent nine hours in bed; however, if they wake up repeatedly during that time, are in pain, are coughing, or have difficulty falling back asleep, they may not wake up feeling sufficiently rested in the morning.

The “state of nighttime vigilance” that accompanies chronic illness should also not be overlooked. Some children fear having a seizure at night, experiencing shortness of breath, a drop in blood sugar, or waking up in pain; the same anxiety often grips the parent as well. Such a state of vigilance can make it difficult for both the child and the parent to achieve the necessary level of relaxation during sleep.

Therefore, when evaluating sleep problems in a child with a chronic illness, the first step is to determine what is disrupting sleep. The solution often lies not in going to bed earlier, but in improving nighttime control of the illness, alleviating pain, rescheduling treatment times, or identifying a co-occurring sleep disorder.

Sleep in Asthma and Chronic Respiratory Diseases

Asthma is one of the conditions where the bidirectional relationship between sleep and chronic illness is most easily observed. A child with asthma may appear quite well during the day but wake up repeatedly at night due to coughing, wheezing, chest tightness, or shortness of breath.

Studies on asthma and sleep in children show that as asthma control worsens, sleep problems may also increase. Difficulty falling asleep and fragmented sleep are more common in young children with poorer asthma control. Even in children whose asthma is considered well-controlled, nighttime awakenings may occur more frequently and last longer compared to healthy children (Reiter et al., 2022).

Some studies evaluating school-aged children with mild-to-moderate asthma have reported that nighttime awakenings occur in approximately one-third of cases (Reiter et al., 2022).

However, the relationship is not simply that “asthma disrupts sleep.” Poor sleep quality can also affect the child’s fatigue, attention, and ability to cope with the disease the following day. Some studies have found a link between poor sleep quality and more severe asthma symptoms (Reiter et al., 2022). Therefore, during a follow-up examination of a child with asthma, not only daytime cough or exercise capacity but also nighttime sleep should be assessed.

In a child with asthma, regular snoring, labored breathing during sleep, pauses in breathing, sleeping with the mouth open, noticeable sweating, or having an unusually hard time waking up in the morning should not be attributed solely to asthma. Asthma and sleep-related breathing disorders can coexist in the same child.

From the pediatrician to the family: Recurrent coughing or shortness of breath at night in a child with asthma is an important sign indicating that disease control needs to be reevaluated.

Epilepsy and Sleep

There is a close and complex relationship between sleep and epilepsy. Sleep alters the brain's electrical activity; therefore, in some types of epilepsy, seizures may occur specifically during sleep or upon waking. On the other hand, seizures themselves, epileptic activity occurring throughout the night, and certain antiepileptic medications can also affect sleep architecture (Kim & Yang, 2023).

Sleep deprivation is particularly significant in children with epilepsy. Because sleep deprivation can increase the likelihood of seizures in some individuals, regular sleep is considered a supportive component of epilepsy management (Kim & Yang, 2023).

Sleep patterns in children with epilepsy do not follow a uniform pattern for everyone. A child's chronotype—which reflects whether their daytime wakefulness and energy rhythm is more aligned with the morning or the evening—has been linked to the severity of sleep disorders in children with epilepsy; it has been reported that sleep problems may be more pronounced in children with a chronotype closer to the evening type (Özçelik & Karadağ, 2023). A study following newly diagnosed children with epilepsy also demonstrated that children exhibit distinct "sleep phenotypes"; in some children, difficulty falling asleep was predominant, while in others, nighttime awakenings or daytime sleepiness were more prominent (Oyegbile-Chidi et al., 2022). These findings suggest that the same sleep recommendations cannot be applied to every child with epilepsy, and that the assessment must be individualized for each child.

Therefore, the fact that a child with epilepsy may go to sleep at very different times on weekdays and weekends—or, particularly during adolescence, may chronically get insufficient sleep—is

significant not only in terms of daytime fatigue but also in terms of seizure management.

Sleep problems in children with epilepsy are not limited to seizures. Difficulty falling asleep, frequent nighttime awakenings, daytime sleepiness, and irregular sleep schedules may also occur. For some children who experience nighttime seizures, the anxiety of wondering, “Will I have a seizure while I’m asleep?” can make it difficult to go to bed. Similarly, parents may listen for their child’s voice throughout the night or frequently check on them by going into their room. A systematic review and meta-analysis examining the sleep of parents of children with epilepsy also confirms this observation; it shows that sleep quality and duration in these families can be significantly more negatively affected compared to families with healthy children (Tsai, Tsai, et al., 2023).

There are also intervention studies showing that sleep problems in children with epilepsy can be systematically addressed. A five-year follow-up of a randomized trial evaluating the long-term outcomes of behavioral sleep interventions supports the clinical significance of specifically addressing sleep problems in these children (Tsai, Lee, et al., 2024).

From the pediatrician to the family: Explaining the importance of regular sleep to the child in a calm and reassuring manner reinforces the consistency of bedtime and wake-up times, adequate sleep duration, and the regular implementation of treatment. In a child with epilepsy, newly onset snoring, marked daytime sleepiness, or previously unobserved nighttime movements—such as parasomnias—are symptoms that may mimic seizures and should be evaluated in consultation with a doctor.

Type 1 Diabetes and Sleep

For children and adolescents with type 1 diabetes, nighttime is not a time when disease management comes to a complete halt. Blood glucose monitoring, insulin injections, symptoms of hypoglycemia or hyperglycemia, and alarms from continuous glucose monitoring systems can disrupt the sleep of both the child and the family.

The relationship between type 1 diabetes and sleep is bidirectional. While disrupted sleep can affect metabolic control and self-management behaviors, glucose fluctuations and interventions required at night can also disrupt sleep (Griggs et al., 2020; Jaser et al., 2020; Silva et al., 2022).

Studies show that adolescents with type 1 diabetes may experience shorter sleep duration and more sleep disturbances compared to their peers without diabetes. Treatment of nocturnal hypoglycemia and device alarms are among the diabetes-specific causes of nighttime awakenings (Jaser et al., 2020).

There is also evidence suggesting that sleep duration, quality, and regularity may be associated with diabetes self-management. Therefore, sleep is an often-overlooked aspect of diabetes management, particularly in adolescents (Griggs et al., 2020; Jaser et al., 2020).

Short sleep duration and irregular sleep patterns can affect not only glycemic control but also the long-term cardiovascular risk profile; an association has been found between short sleep duration and certain cardiovascular risk markers in adolescents with type 1 diabetes (Wu et al., 2022).

Adolescence is a unique period in this regard. When schoolwork, social life, and screen time are added to adolescents' natural tendency toward later bedtimes, sleep duration may decrease. Adolescents with type 1 diabetes, in addition to these factors, must manage glucose monitoring, insulin administration, and device alarms. Therefore, the extent to which diabetes management disrupts nighttime sleep in an adolescent who appears constantly fatigued must also be assessed.

Continuous glucose monitoring systems have significantly improved diabetes management and safety; however, frequent alarms may contribute to fragmented sleep and, over time, "alarm fatigue" in some families. Alarm thresholds or device settings should not be altered by the family at the expense of safety; if the issue is significant, it should be evaluated in consultation with the diabetes care team.

This state of constant vigilance is not merely a subjective impression. A systematic review examining nighttime care for children with type 1 diabetes shows that parents' nighttime sleep is

frequently interrupted and that this can lead to chronic fatigue over time (Howard et al., 2025). Consequently, recent studies have argued that sleep problems should be systematically screened for during routine checkups for children with type 1 diabetes (Bengtsen et al., 2025).

From the pediatrician to the family: The goal is to minimize unnecessary sleep disruption as much as possible while maintaining metabolic stability; it should not be expected that the child will not wake up at all during the night.

Chronic Kidney Disease and Sleep

Sleep problems in children with chronic kidney disease can be influenced by many factors, including the stage of the disease, fatigue, itching, metabolic changes, hospital visits, and, in particular, the need for renal replacement therapy.

It has been reported that fatigue related to sleep and rest is a significant issue affecting quality of life and school functioning in these children (Karava et al., 2022). Data suggest that sleep problems may be more common, particularly in children with advanced-stage disease and those undergoing dialysis.

Itching is also one of the factors that can disrupt sleep in chronic kidney disease. In children with advanced disease and those receiving renal replacement therapy, nighttime itching can make it difficult to fall asleep and may increase nighttime awakenings (Taner et al., 2024).

Snoring and sleep-related breathing disorders in children with chronic kidney disease are another aspect that should not be overlooked. A recent study has shown that the prevalence of sleep-related breathing disorders in these children may be higher than previously thought (Kumar et al., 2025); therefore, regular snoring should be considered not only as a natural consequence of the disease but also as an independent finding that requires evaluation.

However, the results of current studies are not entirely consistent. Indeed, in the same study (Taner et al., 2024), no significant difference was found in the total scores of the sleep scale used between children with chronic kidney disease and healthy controls.

Therefore, the generalization that “every child with chronic kidney disease sleeps poorly” is incorrect. The risk of sleep disorders should be assessed in conjunction with the severity of the disease, symptom burden, treatment modality, and the child’s individual characteristics.

It is also important for families to distinguish between fatigue and sleepiness. When a child with chronic kidney disease says, “I’m very tired,” the problem may not always be insufficient sleep. Anemia, metabolic disorders, disease activity, or treatments may also contribute to fatigue.

From the pediatrician to the family: A newly emerging, noticeable sleep problem, nighttime itching, excessive daytime sleepiness, or a significant decline in school performance are important signs that may warrant a reassessment of disease activity.

Sleep in Chronic Pain and Rheumatologic Diseases

There is a strong interaction between pain and sleep. While pain makes it difficult for a child to fall asleep and stay asleep, poor sleep can also affect the child’s ability to cope with pain the next day. Over time, pain, poor sleep, and fatigue can create a self-perpetuating cycle.

Longitudinal studies on chronic pain in children and adolescents show that sleep disturbances, fatigue, and the impact of pain on daily life are interrelated over time (Roman-Juan et al., 2025).

Juvenile idiopathic arthritis is a prime example of this relationship. Joint pain, morning stiffness, inflammation, and limited mobility can affect nighttime sleep. Even if a child feels they have slept for a long time, sleep may be fragmented due to increased movement and brief awakenings.

Studies using actigraphy have reported that sleep fragmentation and fatigue may be more pronounced in children with juvenile idiopathic arthritis compared to their healthy peers (Ward et al., 2016).

The physiological signs of fragmented sleep are not limited to actigraphy. A recent study examining heart rate variability in children with juvenile idiopathic arthritis shows that autonomic

nervous system balance may differ in these children throughout the night and that this may be associated with fatigue and sleep quality (Lopes et al., 2025).

Focusing solely on sleep hygiene is not sufficient for these children. If a child wakes up due to pain, pain control and disease activity should be assessed first. Pain management, appropriate physical activity, preventing prolonged daytime bed rest, regular sleep schedules, and any sleep-related anxieties—if present—should be addressed together.

From the pediatrician to the family: Even if your child's daytime pain appears to be under control, be sure to ask how they sleep at night; sleep disturbances are often an overlooked aspect of pain management.

Cancer, Cancer Treatment, and Sleep

The causes of sleep problems in children undergoing cancer treatment are quite varied. In addition to the disease itself, chemotherapy, steroid treatments, surgical procedures, radiation therapy, pain, nausea, hospitalization, anxiety, and nighttime medical interventions can disrupt normal sleep patterns.

It has been reported that sleep problems are common in pediatric cancer patients during treatment and may persist in some children even after treatment (Daniel et al., 2024; Sheikh et al., 2021). For this reason, sleep should be assessed not only during the active treatment period but also during survival follow-up.

Some treatments have direct effects on sleep. Corticosteroids used in the treatment of acute lymphoblastic leukemia—particularly dexamethasone—have been reported to be associated with impaired sleep quality, increased daytime sleep, and changes in the circadian rhythm in some children (Sheikh et al., 2021).

The hospital environment itself is also a significant factor affecting sleep. Vital sign measurements, serum and medication administration, light, noise, people entering and leaving the room, and the unfamiliar setting can disrupt a child's sleep.

In these children, excessive daytime sleepiness, difficulty sleeping at night, and reduced physical activity can become a self-perpetuating cycle over time. However, it is also not appropriate to completely prohibit daytime sleep in a child undergoing active

treatment and experiencing severe fatigue. The goal is to maintain as normal a day-night rhythm as possible while allowing the child to rest according to their medical needs.

Although research on behavioral and other interventions targeting sleep in pediatric oncology is increasing, the evidence remains limited (Daniel et al., 2024). An encouraging development in this field is the initiation of a systematic review of assessment tools designed to measure sleep quality in pediatric oncology; a recent systematic review aims to guide clinicians by discussing which measurement tools are more appropriate for which age group and stage of treatment (Rostagno et al., 2025). Therefore, the approach for a child with a significant sleep problem should be planned in collaboration with the oncology team.

From the pediatrician to the family: Significant insomnia, excessive daytime sleepiness, snoring, breathing pauses, uncontrollable pain, or severe mood changes—beyond what might be considered a natural consequence of treatment—are important findings that should be shared with the treatment team.

Inflammatory Bowel Disease and Sleep

In inflammatory bowel diseases (IBD), such as Crohn's disease and ulcerative colitis, sleep is often an early indicator that the disease is silently flaring up. Abdominal pain, nighttime diarrhea, the need to get up frequently to use the bathroom, and the inflammation in the intestines itself can delay a child's ability to fall asleep and lead to repeated awakenings throughout the night.

A recent study conducted among adolescents with IBD shows that sleep disturbances do not occur in isolation; rather, they present as a "cluster of symptoms" alongside fatigue, pain, and mood symptoms (Malloy et al., 2026). This finding suggests that when evaluating sleep problems in a child with IBD, attention should be paid not only to gastrointestinal symptoms but also to accompanying fatigue and mental health.

However, there is also a promising finding: regular physical activity can positively affect sleep quality in these children; a significant improvement in sleep quality has been observed in children with IBD who participated in an exercise program (Trivić et al., 2024). This suggests that sleep hygiene in IBD management

should not be limited to bedtime alone; daytime activity levels must also be taken into account. During active disease episodes, pain and the need to use the bathroom are, of course, priorities; rather than forcing exercise, gradually increasing activity as the disease is brought under control is a more realistic approach.

From the pediatrician to the family: Even when your child's intestinal disease appears to be in remission, frequent nighttime awakenings, startling due to abdominal pain, or waking up unusually tired in the morning are signs that disease activity should be reevaluated and should be discussed with your doctor.

Atopic Dermatitis and Sleep

In children with atopic dermatitis (eczema), nighttime itching is perhaps the symptom most closely intertwined with sleep. Itching delays the child's ability to fall asleep, leading to repeated awakenings throughout the night and the recurrence of skin-scratching behavior; this further compromises skin integrity, creating a self-perpetuating vicious cycle.

A large-scale, community-based study conducted with school-aged children revealed that sleep disturbances associated with atopic dermatitis are not limited to daytime fatigue but are also closely linked to the child's mental health; it was found that anxiety and depressive symptoms were reported significantly more frequently in children with disrupted sleep (Lin et al., 2026).

This finding indicates that, when monitoring atopic dermatitis, it is essential to assess not only skin lesions but also how well the child sleeps at night and their daytime mood. Regular skin care aimed at reducing nighttime itching—moisturizing, avoiding triggers, and using topical treatment when necessary—can actually be considered an indirect intervention for sleep and mental health.

From the pediatrician to the family: Restless sleep in a child with eczema is an important sign that disease control needs to be reevaluated. Frequent nighttime awakenings, scratch marks on the skin, excessive morning fatigue, or changes in behavior and mood are findings that support this evaluation.

What Should a Pediatrician Ask During a Sleep Assessment?

During checkups for children with chronic illnesses, sleep issues are often overshadowed by other symptoms of the disease. Yet even a brief sleep history can provide important information.

The child's bedtime and wake-up times, how long it takes to fall asleep, how many times they wake up at night, the reasons for waking, whether they snore, whether breathing pauses are observed during sleep, daytime sleepiness, whether they wake up feeling rested in the morning, and their weekday versus weekend sleep patterns should be assessed.

In addition, disease-specific questions should be asked: Does the child wake up because of pain? Is there coughing or shortness of breath at night? How much do sensor alarms disrupt sleep? Are there nighttime seizures or a fear of seizures? Do medication times overlap with sleep? Is there itching or frequent urination? Do joint pain or morning stiffness affect sleep? Have there been changes in sleep patterns during treatment, for example with steroids?

Finally, the parent's sleep and the family's nighttime care burden should also be assessed.

There are also scales developed to systematically screen for sleep issues in children with complex chronic illnesses. One such tool, the Sleep Screening Scale for Children and Adolescents with Complex Chronic Illnesses (SCAC), aims to provide a standardized assessment that can be administered quickly in clinical practice (Kubek et al., 2023). The use of such a tool can help prevent variations in sleep history reporting from one clinician to another.

Which Findings Should Be Discussed with a Doctor?

The following findings are sufficient reasons to take your child to the doctor, regardless of the specific condition they have. In a child with a chronic illness, waking up every night does not necessarily indicate a serious sleep disorder. However, regular and noticeable snoring, labored breathing during sleep, pauses in breathing, waking up gasping for air, cyanosis, morning headaches, excessive daytime sleepiness, newly onset bedwetting, significant attention problems, or learning difficulties should be given special attention.

If regular snoring is accompanied by one or more of these symptoms, an evaluation for obstructive sleep apnea may be warranted. In appropriate children, overnight polysomnography is one of the primary diagnostic methods (Kang et al., 2022).

In children with chronic illnesses, the onset of a new sleep problem, a marked increase in nighttime pain, frequent shortness of breath, new nighttime movements, progressively increasing daytime sleepiness, unusual difficulty waking up in the morning, and a significant decline in school performance are all situations that warrant a discussion with a doctor.

Serious concerns on the part of the family regarding the child's sleep safety are also sufficient grounds for an evaluation.

Ten Basic Principles for Supporting Sleep at Home

1. **First, assess the control of the illness at night.** If the child is waking up due to pain, coughing, shortness of breath, itching, or another symptom of illness, simply changing the bedtime will not solve the problem.
2. **Establish as regular a bedtime and wake-up schedule as possible.** Going to bed at vastly different times each day—especially during the school year—can disrupt the biological rhythm.
3. **Establish a calm and predictable bedtime routine.** Medication or medical procedures may be part of this routine; however, try to ensure the child does not perceive bedtime solely as "treatment time."
4. **Discuss the balance between medical care and sleep with the treatment team.** Do not change the times of nighttime medications or check-ups on your own; however, if there are unnecessary sleep disruptions, report this to your doctor.
5. **Adjust daytime naps according to your child's condition.** Rest may be necessary during periods of active illness or treatment. However, long daytime naps taken late in the day can delay nighttime sleep in some children.
6. **Try not to let screen time become a tool for falling asleep.** Using a phone or tablet, especially after getting into bed, can make it harder to fall asleep. For children with chronic illnesses, phones are often kept by the bedside due to

medication reminders, glucose monitoring apps, or health notifications; in these cases, silencing notifications or leaving only necessary alerts, such as safety alarms, active can reduce unnecessary screen use.

7. **Do not dismiss a child's fears.** Questions such as "Will I have a seizure while I'm sleeping?", "Will my blood sugar drop?", or "Will I have trouble breathing?" may stem from actual experiences with illness. Explain an age-appropriate and reassuring bedtime routine to the child.
8. **Do not view regular snoring as merely a habit.** If snoring is accompanied by breathing pauses, restless sleep, or daytime problems, inform your doctor (Kang et al., 2022).
9. **Try to protect parents' sleep as well.** If possible, share nighttime care duties and try to create periods when caregivers can sleep uninterrupted from time to time (Smith et al., 2022; Xavier et al., 2024).
10. **Do not view herbal or hormonal supplements that facilitate sleep as the first line of treatment.** In children with chronic illnesses, medical, behavioral, and environmental causes of sleep disturbances should be investigated first. Even over-the-counter products, including melatonin, should not be started without consulting a physician, taking into account the child's medical condition and medications.

Conclusion: A Message from the Pediatrician to the Family

For a child living with a chronic illness, good sleep does not mean sleeping uninterrupted and perfectly every night. Some nights, blood sugar levels will need to be checked. Some nights, there may be coughing. Sleep schedules may change during treatment. Pain may increase, or a night spent in the hospital may not be as comfortable as one at home. However, none of this means that sleep is unimportant. For children with chronic illnesses, sleep is not a separate issue distinct from the illness; it is an integral part of the child's development, daytime functioning, quality of life, and holistic care. Therefore, jointly assessing the child's and family's sleep is one of the seemingly small but important steps toward making life with a chronic illness more sustainable.

Kaynakça/References

Bengtsen, C. P. A., Paulsrud, C., Thorsen, S. U., et al. (2025). Screening for sleep disturbances in children and adolescents with tics, headache disorders, or type 1 diabetes. *Journal of Child Neurology*. https://doi.org/10.1177/08830738251331750

Biemans, C. F. M., Nijhof, S. L., Gorter, J. W., Stevens, G. W. J. M., van de Putte, E. M., Hoefnagels, J. W., van den Berg, A., van der Ent, C. K., Dudink, J., & Verschuren, O. (2023). Self-reported quantity and quality of sleep in children and adolescents with a chronic condition compared to healthy controls. *European Journal of Pediatrics, 182*(7), 3139-3146. https://doi.org/10.1007/s00431-023-04980-8

Daniel, L. C., Catarozoli, C., Crabtree, V. M., Bridgeman, M., van Litsenburg, R. R. L., & Irestorm, E. (2024). Sleep interventions in pediatric oncology: A systematic review of the evidence. *Pediatric Blood & Cancer, 71*(10), e31202. https://doi.org/10.1002/pbc.31202

Griggs, S., Redeker, N. S., Jeon, S., & Grey, M. (2020). Daily variations in sleep and glucose in adolescents with type 1 diabetes. *Pediatric Diabetes, 21*(8), 1493-1501. https://doi.org/10.1111/pedi.13117

Howard, V., Maguire, R., & Deane-King, J. (2025). Around-the-clock: Caregiving at night for juveniles living with type 1 diabetes—A systematic review. *Psychology, Health & Medicine*. https://doi.org/10.1080/13548506.2025.2468529

Jaser, S. S., Hamburger, E., Bergner, E. M., Williams, R., Slaughter, J. C., Simmons, J. H., & Malow, B. A. (2020). Sleep coach intervention for teens with type 1 diabetes: Randomized pilot study. *Pediatric Diabetes, 21*(3), 473-478. https://doi.org/10.1111/pedi.12991

Kang, M., Mo, F., Witmans, M., de Santiago, V., & Tablizo, M. A. (2022). Trends in diagnosing obstructive sleep apnea in pediatrics. *Children, 9*(3), 306. https://doi.org/10.3390/children9030306

Karava, V., Goutou, S., Dotis, J., Kondou, A., Charela, E., Dadoudi, O., Eleftheriadis, T., Stefanidis, I., & Printza, N. (2022). Fatigue and quality of life in children with chronic kidney disease. *Children, 9*(9), 1414. https://doi.org/10.3390/children9091414

Kim, K. M., & Yang, K. I. (2023). Sleep and epilepsy. *Sleep Medicine Research, 14*(2), 61-65. https://doi.org/10.17241/smr.2023.01781

Kubek, L. A., Claus, B. B., Rostásy, K., et al. (2023). Development and preliminary validation of the Sleep Screening for Children and Adolescents with Complex Chronic Conditions (SCAC). *Journal of Sleep Research*. https://doi.org/10.1111/jsr.13881

Kumar, N., Joice, R. J., Rajan, R. J., et al. (2025). Prevalence of sleep disordered breathing in children with chronic kidney disease. *Pediatric Nephrology, 40*, 2661-2668. https://doi.org/10.1007/s00467-025-06767-5

Lin, K.-H., Chang, Y.-J., Chang, T.-M., et al. (2026). Impact of sleep disturbance on mental health in schoolchildren with atopic dermatitis: A population-based study. *JAAD International*. https://doi.org/10.1016/j.jdin.2025.08.013

Lopes, M. C., Roizenblatt, S., Soster, L. A., et al. (2025). Sleep in juvenile idiopathic arthritis: An exploratory investigation of heart rate variability. *Brain Sciences, 15*(6), 648. https://doi.org/10.3390/brainsci15060648

Malloy, C., Kroenke, K., Monahan, P. O., et al. (2026). Symptom cluster profiles in adolescents with inflammatory bowel disease: A cross-sectional study using ImproveCareNow data. *Journal of Pediatric Gastroenterology and Nutrition*. https://doi.org/10.1002/jpn3.70365

Oyegbile-Chidi, T., Harvey, D., Dunn, D., et al. (2022). Characterizing sleep phenotypes in children with newly diagnosed epilepsy. *Pediatric Neurology*. https://doi.org/10.1016/j.pediatrneurol.2022.07.016

Özçelik, A. A., & Karadağ, M. (2023). Chronotype and sleep disorders in children with epilepsy. *Epileptic Disorders*. https://doi.org/10.1002/epd2.20034

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Consensus statement of the American Academy of Sleep Medicine on the recommended amount of sleep for healthy children: Methodology and discussion. *Journal of Clinical Sleep Medicine, 12*(11), 1549-1561. https://doi.org/10.5664/jcsm.6288

Reiter, J., Ramagopal, M., Gileles-Hillel, A., & Forno, E. (2022). Sleep disorders in children with asthma. *Pediatric Pulmonology, 57*(8), 1851-1859. https://doi.org/10.1002/ppul.25264

Roman-Juan, J., Ceniza-Bordallo, G., Sánchez-Rodríguez, E., Jensen, M. P., & Miró, J. (2025). Fatigue, sleep disturbance, and pain interference in children and adolescents with chronic pain: A longitudinal study. *Pain, 166*(4), 927-935. https://doi.org/10.1097/j.pain.0000000000003432

Rostagno, E., Rivi, V., Sarti, P., et al. (2025). Evaluating sleep in pediatric cancer: A scoping review of assessment tools for quality and care. *Cancer Medicine*. https://doi.org/10.1002/cam4.71051

Sheikh, I., Roth, M., & Stavinoha, P. L. (2021). Prevalence of sleep disturbances in pediatric cancer patients and their diagnosis and management. *Children, 8*(12), 1100. https://doi.org/10.3390/children8121100

Silva, R. A., de Piano, A., Fernandes, V. de F. T., Evangelista, N. M. de A., Figueiredo, C. C., Pacheco, L. de A., & Colares Neto, G. de P. (2022). Evaluation of sleep characteristics in children and adolescents with type 1 diabetes mellitus. *Revista Paulista de Pediatria, 40*, e2020407. https://doi.org/10.1590/1984-0462/2022/40/2020407

Smith, S., Tallon, M., Clark, C., Jones, L., & Mörelius, E. (2022). "You never exhale fully because you're not sure what's

NEXT": Parents' experiences of stress caring for children with chronic conditions. *Frontiers in Pediatrics, 10*, 902655. https://doi.org/10.3389/fped.2022.902655

Taner, S., Ekberli, G., & Güneş, S. (2024). The effect of sleep habits on quality of life in pediatric patients with chronic kidney disease. *Cureus*. https://doi.org/10.7759/cureus.64585

Trivić, I., Sila, S., Mišak, Z., et al. (2024). Exercise leads to better sleep in children with inflammatory bowel disease. *Pediatrics International*. https://doi.org/10.1111/ped.15788

Tsai, S.-Y., Lee, W.-T., Lee, C.-C., Jeng, S.-F., & Weng, W.-C. (2024). Five-year follow-up of a clinic-based sleep intervention for pediatric epilepsy: A randomized clinical trial. *Journal of Sleep Research, 33*(3), e14059. https://doi.org/10.1111/jsr.14059

Tsai, S.-Y., Tsai, H.-Y., Lin, Y., et al. (2023). Sleep and its disturbance in parents of children and adolescents with epilepsy: A systematic review and meta-analysis. *Nature and Science of Sleep, 15*. https://doi.org/10.2147/NSS.S437349

Ward, T. M., Yuwen, W., Voss, J. G., Foell, D., Gohar, F., & Ringold, S. (2016). Sleep fragmentation and biomarkers in juvenile idiopathic arthritis. *Biological Research for Nursing, 18*(3), 299-306. https://doi.org/10.1177/1099800415609997

Wu, N., Jamnik, V., Koehle, M. S., et al. (2022). Associations between sleep characteristics and cardiovascular risk factors in adolescents living with type 1 diabetes. *Journal of Clinical Medicine, 11*(18), 5295. https://doi.org/10.3390/jcm11185295

Xavier, W. da S., Abreu, M. P., Nunes, M. D. R., Silva-Rodrigues, F. M., da Silva, L. F., de Araújo, B. B. M., De Bortoli, P. S., Neris, R. R., & Nascimento, L. C. (2024). The sleep patterns of children and adolescents with chronic conditions and their families: An integrative literature review. *Children, 11*(2), 207. https://doi.org/10.3390/children11020207

BÖLÜM 8

POSTOPERATIVE SLEEP IN CHILDREN

Sabit DERE[1]

Introduction

Postoperative recovery cannot be defined solely by wound closure or hospital discharge. The child's ability to rest, maintain daytime alertness, and resume age-appropriate activities should also be assessed. Sleep complaints are a component of this process that are readily recognized by families, yet their causes are not always easily distinguished. The statement “not sleeping” may encompass awakening due to pain, resistance to sleep, going to bed later than usual, or a desire to sleep next to a parent. These manifestations do not indicate the same underlying mechanism or the same need for intervention.

In children undergoing ambulatory surgery, both parent-reported and actigraphy-detected sleep changes have been reported (Kain et al., 2002). In contrast, a recent pediatric observational study, predominantly following minor procedures, could not demonstrate significant disruption in sleep–wake timing or subjective sleep quality (Meewisse et al., 2025). Therefore, postoperative sleep is not a uniform phenomenon. Data from a healthy child undergoing a brief procedure should be interpreted separately from those of a child monitored in the intensive care unit after major surgery.

In scientific evaluation, baseline status is pivotal. In a child who snored, had difficulty falling asleep, or slept irregularly prior to surgery, attributing all post-discharge complaints to anesthesia may be misguided. On follow-up, a newly emergent problem, a

[1] MD, Department of Pediatric Surgery, University of Health Sciences, Beyhekim Training and Research Hospital, Konya, Türkiye, ORCID: 0000-0003-2035-1521

worsening of a preexisting problem, and first-time recognition by the family should be differentiated. This chapter relates the available pediatric data to clinical practice and family counseling while maintaining that distinction.

Differences Between Anesthesia and Natural Sleep

Although general anesthesia and natural sleep share some neural regulatory systems, they do not represent the same physiological state. In natural sleep, NREM and REM stages occur cyclically, whereas the alterations in consciousness and electroencephalographic changes produced by anesthetic drugs depend on the agent and dose used. Time spent in the operating room cannot be assumed to replace nocturnal sleep. The neurophysiological framework proposed by Brown et al. (2010) explains this distinction; however, it is not a pediatric interventional study that directly determines the frequency or duration of postoperative sleep problems in children.

Sleepiness in the first hours after anesthesia and sleep patterns over the subsequent nights should be evaluated separately. In the immediate postoperative period, assessment focuses on emergence and respiratory safety. For complaints arising over the following days, pain, daily routine, the hospital experience, and baseline sleep characteristics become more relevant. This temporal distinction helps avoid labeling every change in wakefulness as a “sleep disorder” and prevents attributing prolonged complaints solely to persisting effects of the anesthetic agent. For interpreting individual cases, the medications administered and their timing should be known.

Agitation or delirium observed during emergence from anesthesia is also not synonymous with nightmares or bedtime resistance. The study by Kain et al. (2004) examined the relationships among preoperative anxiety, emergence delirium, and subsequent maladaptive behaviors. Although these outcomes are interrelated, this does not mean they represent the same diagnosis. In particular, when explaining behavior in the postanesthesia care unit, pain and other medical causes should be evaluated, whereas sleep complaints that persist at home must be characterized separately.

Various mechanisms have been proposed to explain the impact of surgical stress on sleep, including inflammation, neuroendocrine responses, and circadian regulation. However, not every finding from adult or experimental models should be extrapolated directly to children. In pediatric studies, anesthesia, the surgical intervention, fasting, anxiety, and the hospital environment often vary together. Accordingly, it is difficult to determine how much of any observed difference in sleep is attributable to anesthesia alone. Comparison groups in which anesthesia is administered without surgery are valuable for addressing this question (Meewisse et al., 2025).

In clinical discussion, rather than using categorical statements such as “anesthesia invariably disrupts the biological clock,” it should be recognized that outcomes vary according to the methods employed and the pediatric population studied. While parental observations should be considered, any claim of causality must be confined to measured findings. In particular, a change identified on a behavioral scale does not justify concluding that REM sleep has decreased; commenting on sleep architecture requires appropriate physiological measurements.

Findings from Pediatric Research

In the study by Kain et al. (2002), 92 children undergoing ambulatory surgery under general anesthesia were compared with 77 children recruited from the community. In 47% of the surgical group, a sleep problem was identified by at least one measure—either actigraphy or the post-hospital behavior questionnaire—while 14.4% showed a decrease of at least one standard deviation in sleep percentage on actigraphy. This discrepancy indicates that the reported frequency of “sleep problems” is sensitive to the definition employed. Therefore, these findings cannot be used as a single prevalence estimate for all surgical patients.

MacLaren and Kain (2008) used actigraphy to evaluate the five nights before and after surgery in 55 children aged 6-12 years undergoing adenotonsillectomy. Postoperatively, sleep efficiency decreased, with a clinically meaningful reduction reported in approximately one-third. Higher anxiety and postoperative pain were associated with adverse sleep patterns. Here, sleep efficiency

denotes the proportion of time in bed that is spent asleep; it is not synonymous with total sleep time. The findings pertain to the early recovery period and do not assess the long-term respiratory benefits of surgery.

In a longitudinal follow-up by Rabbitts et al. (2017) of 60 children aged 10-18 years undergoing major surgery, sleep quality and efficiency were reduced at two weeks postoperatively compared with preoperative levels and returned to baseline by the fourth month. Lower nocturnal sleep quality was associated with higher next-day pain intensity. In contrast, no such association was demonstrated for sleep duration or efficiency, and daytime pain did not predict subsequent nocturnal sleep. Thus, not every measured sleep variable shares the same relationship with pain.

The study by Meewisse et al. (2025) provides an important counterexample. Among 117 children aged 1-11 years who received anesthesia for elective surgery or magnetic resonance imaging, assessed with sleep diaries and parent questionnaires, no significant shift in the mid-sleep point and no deterioration in subjective sleep quality were demonstrated on the night after anesthesia. The predominance of minor ambulatory procedures in the surgical cohort and the reliance on diary- and parent-report measures limit the generalizability of these findings to major surgery.

The common conclusion of these studies is that postoperative sleep is a clinically assessable endpoint. Differences among the findings do not diminish the scientific value of the topic; rather, they underscore the need to specify which children were evaluated, after which procedures, and by what methods. In particular, an unchanged group mean does not prove that no child experienced a problem. Conversely, a high rate observed in a selected sample does not indicate that all children will be similarly affected.

The Relationship of Pain and Medication Use with Sleep

Difficulty attaining a comfortable position due to pain and nocturnal awakenings are important components of the postoperative sleep history. However, the relationship between sleep and pain cannot be inferred solely from their co-occurrence. Daily measurements that assess temporal relationships allow investigation of whether the prior night's sleep is associated with next-day pain.

Data from Rabbitts et al. (2017) support such an association. This finding is not a randomized treatment result demonstrating that a sleep intervention definitively reduces pain.

In the study by Rogers et al. (2024), 106 participants aged 11-19 undergoing ambulatory orthopedic surgery were monitored over the first 14 days with repeated ecological momentary assessments. Indicators of sleep insufficiency were associated with next-day pain and opioid use, and analyses identified a pain-mediated pattern. Monitoring medication use with an electronic medication bottle cap was a strength of the study. However, a mediation model alone does not establish biological causality in observational data. Whether a sleep-focused intervention reduces opioid requirements should be tested separately.

In the surgical cohort of Odegard et al. (2024), which included 167 participants aged 13-20 years, the proportion reporting sleep problems was 16.2% preoperatively and 24.6% at postoperative follow-up. Baseline sleep problems and psychiatric comorbidities were associated with a worse sleep trajectory, while no significant association was demonstrated with prescribed opioid use. This result does not prove that opioids are without effect on sleep and respiration. The studies differ in measurement frequency, definitions of medication use, and follow-up periods; moreover, both samples include participants older than 18 years.

In clinical practice, adequate analgesia should be distinguished from sedation. A child who appears quiet or drowsy may not have adequate pain relief. The Society for Pediatric Anesthesia recommendations address opioid use alongside other analgesic modalities and emphasize the importance of monitoring tailored to patient characteristics and family education (Cravero et al., 2019). Co-administration of opioids with other sedatives requires particular caution because of the risks of oversedation and respiratory depression. Medications should not be added solely to induce sleep in the child.

The plan provided to the family should clearly state the purpose of each medication, the circumstances in which it should be used, and the course of action to take in the event of unexpected somnolence. Before attributing nighttime awakenings solely to behavioral resistance, the pain pattern should be reviewed.

Conversely, somnolence is not an indication to administer additional analgesia. Supporting sleep requires an assessment that concurrently considers pain, safety, and daytime functioning (Cravero et al., 2019).

Differences by Type of Surgery and Baseline Status

The name of the surgical procedure alone does not determine the sleep trajectory. The extent of the operation, length of hospitalization, mobility restrictions, initial pain, and comorbidities are important. Changes observed over weeks in adolescents undergoing major surgery should not be presented as the expected course after a short ambulatory procedure (Meewisse et al., 2025; Rabbitts et al., 2017). This distinction is particularly necessary when providing families with a timeline. The fact that measurements in a study were taken at the second week or the third month does not mean that every patient will experience problems up to that point.

Adenotonsillectomy is an example in which early sleep effects must be distinguished from the longer-term therapeutic objective. In the first few days, pain and dysphagia can impede rest; subsequently, the aim of the procedure in an appropriate patient is to reduce upper airway obstruction during sleep (MacLaren & Kain, 2008; Mitchell et al., 2019). Therefore, the presence of restless sleep immediately after surgery, by itself, does not indicate treatment failure. Likewise, a parental report of improved sleep over a short period does not establish that the respiratory problem has completely resolved.

In the Childhood Adenotonsillectomy Trial (CHAT), 464 children aged 5-9 years were assigned to early surgery or to supportive-care observation. At the 7-month assessment, surgery was associated with greater improvements in symptoms, quality of life, and polysomnography results, whereas no significant difference between groups was demonstrated on the primary attention and executive function test (Marcus et al., 2013). This finding indicates that one should not assume sleep-related benefits will be of the same magnitude across all developmental outcomes. The study was not designed to evaluate the safety of the first postoperative night.

The tonsillectomy guideline recommends overnight in-hospital observation for children younger than three years and for

those with severe obstructive sleep apnea. Criteria for severe apnea include an obstructive apnea–hypopnea index of at least 10 per hour or an oxygen saturation nadir below 80% (Mitchell et al., 2019). These thresholds are specific to the tonsillectomy context and should not be used as universal discharge criteria for all pediatric surgeries.

In children with baseline sleep-disordered breathing, preoperative counseling, analgesia, and the monitoring plan may be affected (Cravero et al., 2019; Mitchell et al., 2019). When neurodevelopmental differences, communication difficulties, or sensory sensitivities are present, the evaluation should be interpreted in comparison with the child's usual behaviors. Because postoperative sleep data for these children are limited, the need for individualized assessment should be emphasized rather than quoting a specific deterioration rate. The family's recognition of the child's signs of pain and distress contributes to this assessment.

Sleep and the Environment in Intensive Care Settings

Postoperative sleep in the intensive care unit is evaluated in a clinical context that differs from sleep on the ward or at home. The need for monitoring, mechanical ventilation, sedation, pain management, and nighttime nursing care procedures may coexist. A child's eyes being closed or remaining immobile for extended periods does not indicate that they are experiencing natural, restorative sleep (Brown et al., 2010). Therefore, when “sleep duration” is reported in the ICU, the method of measurement should be specified, and time spent under sedation should not be equated with natural sleep.

The 2022 PANDEM guideline published by the Society of Critical Care Medicine addresses pain, agitation, delirium, environmental factors, and early mobilization in an integrated manner. Environmental and behavioral modifications that reduce excessive noise are recommended to support sleep hygiene and comfort; however, the quality of evidence in this area is low (H. A. B. Smith et al., 2022). The existence of a guideline recommendation is not synonymous with an intervention having been confirmed by robust randomized trials. This distinction should be maintained when explaining the rationale for sleep-related care practices.

The clinical corollary of environmental modification is to reduce preventable interruptions without compromising necessary treatment. The care team can individualize, for each patient, which interventions can be bundled and which practices will support a day–night cycle. However, analgesia, respiratory monitoring, or necessary clinical assessments should not be delayed simply to avoid disturbing sleep. This balance should be recalibrated as the child's illness severity and monitoring needs change. In discussions with the family, it should be made clear which awakenings are essential.

Evaluation for delirium should not be limited to observation of sleep alone. PANDEM recommends routine delirium screening in pediatric intensive care patients using validated tools (H. A. B. Smith et al., 2022). Disturbances in the sleep–wake cycle and agitation may prompt such an assessment but are not diagnostic in isolation. Conversely, interpreting the symptoms merely as “failure to adapt to the hospital environment” may delay medical evaluation. The medication history should also be reviewed when interpreting symptoms that arise after prolonged use of sedatives or opioids.

Transferring sleep-related information during transitions from intensive care to the ward or home is beneficial. The pre-hospitalization routine, recently used medications, nocturnal breathing, and changes observed by the family can be documented together. Support for sleep should not be pursued as a stand-alone intervention separate from other recovery goals. Family involvement, soothing strategies appropriate to the child's developmental level, and clinically permitted activities are components of this integrated approach. No definitive effect size should be promised regarding how much these measures will change sleep or length of hospital stay in an individual patient.

Family-Centered Preparation and Home Sleep Support

A family-centered approach aims not only to provide parents with general information but also to incorporate the child's needs and the family's caregiving capacities into the treatment plan. In a randomized trial by Kain et al. (2007) involving 408 children and their families, a family-centered behavioral preparation program improved certain perioperative anxiety and recovery outcomes compared with standard care and other comparator groups.

However, this study should not be presented as direct evidence for preventing sleep disturbances at home; its primary endpoints were anxiety, recovery analgesia, and emergence delirium.

The clinical application of this finding to sleep counseling is to initiate preparation before surgery. The child's usual sleep patterns, ability to sleep independently, soothing routines, and prior hospital experiences can be ascertained. Providing an age-appropriate explanation of the procedure and discussing changes that may occur after discharge enhance the predictability of care. The aim is not to eliminate all anxiety or to impose a flawless sleep program on the family. Rather, families should be equipped to recognize when they can continue with their own plan and when they should contact the healthcare team.

In supporting sleep after discharge, it may be reasonable to return to the child's usual evening routine as feasible, keep the nighttime environment calm, and preserve the day–night distinction. These practices reflect the adaptation of general pediatric sleep principles to the surgical context; none has been individually proven to hasten postoperative recovery. Recommendations for age-appropriate sleep duration have been developed for general health (Paruthi et al., 2016). There is no widely accepted rule endorsing the addition of a fixed number of hours beyond the normal requirement for all children undergoing surgery.

In young children, the need for caregiver proximity may temporarily alter the home routine. A sustainable form of support should be established with the family; nighttime awakenings should not be considered merely habitual until pain or respiratory problems have been excluded. Particularly during the acute recovery period, behavioral goals should not take precedence over medical needs. Safe sleep principles for infants should be maintained; if postoperative positioning is required, this should be clearly defined by the surgical and anesthesia teams.

Home observation can be undertaken without turning it into a burdensome program of detailed measurements. Brief logs of sleep onset, notable awakenings, pain, and medication times help to structure the follow-up visit. The family's sleep deprivation and caregiving burden should also be assessed. In particular, who will be responsible for nighttime medication administration and monitoring

should be clarified (Cravero et al., 2019). The success of sleep support is evaluated not only by uninterrupted nighttime sleep, but also by the child's daytime functioning and the family's ability to maintain safe care.

Assessment and Follow-up

In assessing postoperative sleep complaints, the time of onset, clinical course, preoperative status, and daytime effects should be elicited together. At the initial visit, it should be clarified whether nighttime awakenings coincide with pain, fear, respiratory difficulty, or other symptoms. For persistent complaints, asking only about total sleep time is insufficient. Sleep-onset latency, the frequency of awakenings, daytime napping, and the resumption of school or play activities also characterize the clinical picture.

Parent report, child self-report, and objective measurement provide different information. Actigraphy, when appropriately indicated, can aid in multi-night assessment of the sleep–wake pattern, whereas polysomnography is a distinct study focused on sleep stages and respiratory events. The American Academy of Sleep Medicine actigraphy guideline addresses its use in certain pediatric sleep disorders with conditional recommendations (M. T. Smith et al., 2018). This does not justify the routine use of such devices after every operation. In particular, in surgical patients with restricted mobility, the potential for immobility to be classified as sleep should be considered when interpreting the measurement.

Difficulty arousing, slowing or pauses in breathing, cyanosis, and marked work of breathing should not be dismissed as routine sleep complaints; they require urgent evaluation. Use of opioids or other sedative medications is an important consideration in this assessment (Cravero et al., 2019). Uncontrolled pain, inadequate fluid intake, and procedure-specific warning signs should also be addressed in accordance with discharge instructions. Adding over-the-counter sedatives to improve sleep may mask the underlying problem and compromise safety.

A single “normalization day” applicable across all procedures cannot be defined. Clinical decisions should be guided by whether symptoms have diminished and by the child's functional status. If problems persist or worsen despite reductions in pain and

acute care needs, baseline sleep disturbances, psychiatric symptoms, and other medical causes should be reassessed. In adolescents, the observation that preoperative sleep and psychiatric symptoms are associated with the subsequent course supports including these domains in follow-up (Odegard et al., 2024).

Conclusion

Postoperative sleep in pediatric surgery is a clinical issue supported by direct pediatric research; however, the evidence is not uniform across procedures and age groups. Observational studies delineate relationships among sleep, pain, and psychological symptoms, yet further research is needed to determine the extent to which sleep-specific interventions improve surgical outcomes. In practice, ascertaining baseline sleep patterns, ensuring pain control and respiratory safety, minimizing environmental disruptions, and involving the family in the care plan constitute the core approach. Family counseling should explain transient changes while also highlighting symptoms that warrant further evaluation.

Kaynakça/References

Brown, E. N., Lydic, R., & Schiff, N. D. (2010). General anesthesia, sleep, and coma. *The New England Journal of Medicine, 363*(27), 2638-2650. https://doi.org/10.1056/NEJMra0808281

Cravero, J. P., Agarwal, R., Berde, C., Birmingham, P., Coté, C. J., Galinkin, J., Isaac, L., Kost-Byerly, S., Krodel, D., Maxwell, L., Voepel-Lewis, T., Sethna, N., & Wilder, R. (2019). The Society for Pediatric Anesthesia recommendations for the use of opioids in children during the perioperative period. *Paediatric Anaesthesia, 29*(6), 547-571. https://doi.org/10.1111/pan.13639

Kain, Z. N., Caldwell-Andrews, A. A., Maranets, I., McClain, B., Gaal, D., Mayes, L. C., et al. (2004). Preoperative anxiety and emergence delirium and postoperative maladaptive behaviors. *Anesthesia & Analgesia, 99*(6), 1648-1654. https://doi.org/10.1213/01.ANE.0000136471.36680.97

Kain, Z. N., Caldwell-Andrews, A. A., Mayes, L. C., Weinberg, M. E., Wang, S.-M., MacLaren, J. E., & Blount, R. L. (2007). Family-centered preparation for surgery improves perioperative outcomes in children: A randomized controlled trial. *Anesthesiology, 106*(1), 65-74. https://doi.org/10.1097/00000542-200701000-00013

Kain, Z. N., Mayes, L. C., Caldwell-Andrews, A. A., et al. (2002). Sleeping characteristics of children undergoing outpatient elective surgery. *Anesthesiology, 97*(5), 1093-1101. https://doi.org/10.1097/00000542-200211000-00010

MacLaren, J. E., & Kain, Z. N. (2008). Prevalence and predictors of significant sleep disturbances in children undergoing ambulatory tonsillectomy and adenoidectomy. *Journal of Pediatric Psychology, 33*(3), 248-257. https://doi.org/10.1093/jpepsy/jsm073

Marcus, C. L., Moore, R. H., Rosen, C. L., Giordani, B., Garetz, S. L., Taylor, H. G., Mitchell, R. B., Amin, R., Katz, E. S., Arens, R., Paruthi, S., Muzumdar, H., Gozal, D., Thomas, N. H., Ware, J., Beebe, D., Snyder, K., Elden, L., Sprecher, R.

C., … Redline, S. (2013). A randomized trial of adenotonsillectomy for childhood sleep apnea. *The New England Journal of Medicine, 368*(25), 2366-2376. https://doi.org/10.1056/NEJMoa1215881

Meewisse, A. J. G., Meijer, S. J., Choi, K. F., Kanters, S., et al. (2025). Effects of anaesthesia and surgery on sleep-wake timing and subjective sleep quality in children: An observational study. *Anaesthesia, 80*, 1466-1475. https://doi.org/10.1111/anae.16710

Mitchell, R. B., Archer, S. M., Ishman, S. L., Rosenfeld, R. M., Coles, S., Finestone, S. A., Friedman, N. R., Giordano, T., Hildrew, D. M., Kim, T. W., Lloyd, R. M., Parikh, S. R., Shulman, S. T., Walner, D. L., Walsh, S. A., & Nnacheta, L. C. (2019). Clinical practice guideline: Tonsillectomy in children (update). *Otolaryngology–Head and Neck Surgery, 160*(1_suppl), S1-S42. https://doi.org/10.1177/0194599818801757

Odegard, M., Barrington-Trimis, J., Keane, O. A., Ourshalimian, S., Kim, E., & Kelley-Quon, L. I. (2024). Disordered sleep in adolescents recovering from surgery. *Journal of Pediatric Surgery, 59*(10), 161545. https://doi.org/10.1016/j.jpedsurg.2024.03.060

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Rabbitts, J. A., Zhou, C., Narayanan, A., & Palermo, T. M. (2017). Longitudinal and temporal associations between daily pain and sleep patterns after major pediatric surgery. *The Journal of Pain, 18*(6), 656-663. https://doi.org/10.1016/j.jpain.2017.01.004

Rogers, A. H., Rabbitts, J. A., Saper, M. G., Schmale, G. A., Palermo, T. M., & Groenewald, C. B. (2024). Ecological

momentary assessment of sleep, pain, and opioid use among adolescents following surgery. *Sleep Advances, 5*(1), zpae039. https://doi.org/10.1093/sleepadvances/zpae039

Smith, H. A. B., Besunder, J. B., Betters, K. A., Johnson, P. N., Srinivasan, V., Stormorken, A., Farrington, E., Golianu, B., Godshall, A. J., Acinelli, L., Almgren, C., Bailey, C. H., Boyd, J. M., Cisco, M. J., Damian, M., deAlmeida, M. L., Fehr, J., Fenton, K. E., Gilliland, F., … Berkenbosch, J. W. (2022). 2022 Society of Critical Care Medicine clinical practice guidelines on prevention and management of pain, agitation, neuromuscular blockade, and delirium in critically ill pediatric patients with consideration of the ICU environment and early mobility. *Pediatric Critical Care Medicine, 23*(2), e74-e110. https://doi.org/10.1097/PCC.0000000000002873

Smith, M. T., McCrae, C. S., Cheung, J., Martin, J. L., Harrod, C. G., Heald, J. L., & Carden, K. A. (2018). Use of actigraphy for the evaluation of sleep disorders and circadian rhythm sleep-wake disorders: An American Academy of Sleep Medicine clinical practice guideline. *Journal of Clinical Sleep Medicine, 14*(7), 1231-1237. https://doi.org/10.5664/jcsm.7230

BÖLÜM 9

SLEEP IN CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

Umut DURAK[1]

Introduction

Sleep is far more than a period in which the child simply rests; it is a fundamental biological need closely tied to brain development, learning, memory, emotion regulation, behavior, and physical health. In children with neurodevelopmental differences, sleep difficulties are more common, tend to last longer, and spill more broadly into daytime life. A sleep problem should therefore never be treated as an inevitable part of the diagnosis, or as a secondary complaint the family simply has to endure. The goal of evaluating sleep is not only to improve the quality of the child's nights but also to strengthen daytime functioning, participation in education, and the family's quality of life. The regular sleep durations recommended by age in the American Academy of Sleep Medicine consensus are a useful starting point for the general pediatric population; in neurodevelopmental conditions, however, the questions must go beyond total duration: How long does the child take to fall asleep after getting into bed? How many times do they wake at night, and how long does it take to settle again? Is there snoring or pausing of breath during sleep? Is there restlessness or repetitive movement? Are bedtimes and wake times regular, and does the child wake refreshed in the morning? Brief screening tools such as BEARS can make this questioning systematic in everyday practice (Owens & Dalzell, 2005; Paruthi et al., 2016).

[1] MD, Division of Developmental Pediatrics, Department of Pediatrics, University of Health Sciences, Beyhekim Training and Research Hospital, Konya, Türkiye, ORCID: 0000-0002-1071-6841

Why Are Sleep Problems More Common?

No single mechanism explains sleep difficulty in neurodevelopmental conditions. Differences in circadian rhythm and melatonin secretion, sensory sensitivity, resistance to change and insistence on sameness, communication difficulties, anxiety, and problems with attention and self-regulation can all make the transition to sleep harder. Co-occurring conditions such as epilepsy, pain, gastroesophageal reflux, constipation, spasticity, dystonia, airway obstruction, and restless legs syndrome can fragment sleep. Stimulant medication taken late in the day, some antiepileptic or psychotropic drugs, long daytime naps, and irregular screen use can further aggravate the picture. Over time, the child's sleep behavior and the parents' responses can also reinforce one another, so that a problem that began as biological or medical becomes entrenched once behavioral and environmental factors are added.

Sleep as a Domain of Functioning

Although the consequences of disturbed sleep are often assumed to be confined to the night, the problem does not concern the night alone. Insufficient or fragmented sleep may be associated with a shortened attention span, slower cognitive processing, irritability, impulsivity, an increase in stereotypic behaviors, fluctuation in the use of learned skills, and daytime sleepiness. These findings can mimic the core features of a neurodevelopmental disorder or intensify existing ones. At the same time, much of this research is observational; it cannot be claimed that sleep is the cause of every behavioral change, or that all developmental symptoms will resolve once sleep improves. The clinical goal is to recognize the likely bidirectional relationship between sleep and daytime function and to identify the factors that can be changed.

The Core Message for Families

A sleep problem is not the child's fault, and it is not the parents' fault. It may have biological, developmental, medical, behavioral, and environmental layers. The solution, likewise, rarely lies in a single medication or a rigid rule; it usually rests on careful assessment, small and sustainable behavioral changes, treatment of

co-occurring conditions, and specialist referral when needed, used together.

The Development of Sleep Across Childhood

Sleep Architecture Changes with Age

A newborn's sleep is not a miniature copy of adult sleep. In the first months, sleep is distributed across day and night and becomes organized only gradually, under the influence of the circadian system, the feeding cycle, and environmental light. Newborn sleep cycles last roughly 50-60 minutes, and sleep usually begins with active sleep — the precursor of REM sleep, characterized by irregular breathing and movements of the face and limbs — while quiet sleep is the precursor of NREM sleep. Over the first year, nighttime sleep lengthens, daytime naps decrease, the longest uninterrupted sleep period settles into the night, and the cycles gradually approach 90 minutes. Frequent waking and short sleep blocks in the early months are therefore not, by themselves, a sign of illness (Bruni et al., 2014; Galland et al., 2012; Hirshkowitz et al., 2015).

Recommended Total Sleep Duration by Age

Total duration includes daytime naps within the 24-hour period. The AASM recommendations are 12-16 hours for 4-12 months, 11-14 hours for 1-2 years, 10-13 hours for 3-5 years, 9-12 hours for 6-12 years, and 8-10 hours for 13-18 years (Paruthi et al., 2016). Individual variability is very wide in the newborn period; the National Sleep Foundation regards a range of 14-17 hours as appropriate for 0-3 months (Hirshkowitz et al., 2015). In a systematic review, observed averages were 12.8 hours in infants, 11.9 hours in preschoolers, and 9.2 hours at school age (Galland et al., 2012). These figures are reference points, not targets; waking refreshed, daytime function, regularity, and sleep quality matter at least as much as duration. In adolescence, the biological delay of the sleep phase combined with early school start times creates a particular risk of chronic sleep debt (Galland et al., 2012; Hirshkowitz et al., 2015; Paruthi et al., 2016) (Table 1).

Table 1. Recommended total sleep duration and developmental features of the sleep pattern by age

Age period	**Recommended total sleep duration**	**Developmental features of the sleep pattern**
0-3 months	14-17 hours	Sleep consists of short periods spread across day and night; the day-night rhythm is still developing, and individual differences are marked.
4-12 months	12-16 hours	Nighttime sleep increasingly occurs in longer stretches; the number of daytime naps decreases with age.
1-2 years	11-14 hours	Daytime sleep usually consolidates into a single midday nap.
3-5 years	10-13 hours	The need for a daytime nap gradually decreases; the age at which it is dropped varies between children.
6-12 years	9-12 hours	Sleep occurs predominantly at night; school and transport schedules can affect whether an adequate sleep opportunity is provided.
13-18 years	8-10 hours	The biological tendency to fall asleep shifts later; early school start times can shorten sleep.

Source: Paruthi et al. (2016); for 0-3 months, Hirshkowitz et al. (2015).

Sleep Architecture

Sleep architecture refers to the distribution of REM and NREM stages across the night. N3 slow-wave sleep is prominent in childhood and declines with age; the proportion of REM sleep is very high in the newborn and decreases over the first years to approach adult-like levels in childhood. In neurodevelopmental disorders, differences may be reported at the level of group averages in sleep onset, total duration, efficiency, stage proportions, or overnight stability. These findings are not diagnostic: children with the same diagnosis differ widely from one another.

Why Duration Alone Is Not Enough

Spending ten hours in bed is not the same as sleeping for ten hours. Delayed sleep onset and overnight wakefulness reduce actual sleep. Even when duration appears age-appropriate, apnea, periodic limb movements, seizures, or frequent waking can undermine the restorative quality of sleep. Duration, timing, continuity, breathing, and daytime function therefore need to be evaluated together.

Crying, Colic, and Sleep in Infancy

From Normal Crying to Infantile Colic

Crying is the basic form of communication in infancy. In infantile colic, crying increases over the first weeks, usually peaks around weeks 6-8, and declines after the third or fourth month. In the Rome IV approach, infantile colic consists of recurrent, prolonged episodes of crying, fussing, or irritability that begin and end without an obvious cause in an infant younger than five months who is growing normally; the classic “rule of threes” is no longer a strict diagnostic requirement (Benninga et al., 2016). Colic is not a neurodevelopmental disorder and is usually self-limiting. Even so, excessive crying and sleep problems can occur together, and they affect parental sleep, mental health, and the parent-infant interaction (Harskamp-Van Ginkel et al., 2023; Singh et al., 2021).

The Relationship with Sleep

An overtired infant does not necessarily fall asleep more easily; they may settle more irregularly and with more difficulty. Prolonged crying extends wakefulness, and settling the infant always

by rocking, nursing, or motion can, over time, create strong sleep-onset associations. Nevertheless, frequent feeding and parental help are developmentally expected in the first three to four months. Leaving crying unanswered for long periods in pursuit of independent sleep is not the appropriate default at this age. The priorities are medical safety, caregiver support, day-night cues, and safe sleep.

Ruling Out Dangerous Causes First

Fever, lethargy, poor feeding, bilious vomiting, bloody stool, abdominal distension, respiratory difficulty, seizure-like events, trauma, a high-pitched or unusual cry, and failure to gain weight require evaluation. Cow's milk protein allergy, reflux disease, infection, and a surgical abdomen are investigated only when clinical findings point to them. Subjecting every colicky infant to broad testing, acid-suppressing medication, or a formula change is not good practice.

Evidence-Based Advice for Families

Hunger, the diaper, temperature, burping, and signs of illness are checked first. Calm carrying, gentle rhythmic movement, low-level continuous sound, a pacifier, and skin-to-skin contact can be tried. Wakefulness windows are observed; natural light and ordinary household sounds are used during the day, dim light and low stimulation at night. Parent education programs may reduce crying, although the certainty of the evidence is low (Gordon et al., 2019), and the colic and sleep outcomes of nonpharmacological methods are heterogeneous (Tanrıverdi et al., 2023). Benefit from L. reuteri DSM 17938 has been shown mainly in some exclusively breastfed infants and cannot be generalized to formula-fed infants (Simonson et al., 2021).

Safe Sleep and Caregiver Safety

For every sleep, the infant should be placed supine on a flat, firm surface without pillows, quilts, toys, or loose covers. Room-sharing is appropriate; sleeping with the infant in the same bed, in an armchair, or on a sofa is risky. Prone positioning, inclining the bed, or using positioning products on the grounds of colic or reflux is not safe (Moon et al., 2022). A caregiver who feels overwhelmed can

place the infant in their safe bed, step away briefly, and seek support; an infant must never be shaken. Depression, severe sleep deprivation, and thoughts of harming the infant should be asked about directly (Harskamp-Van Ginkel et al., 2023; Singh et al., 2021).

Sleep in Cognitive Impairment and Intellectual Disability

A Heterogeneous Clinical Group

Intellectual disability does not produce a single sleep phenotype. Reported rates of sleep problems vary from roughly 34% to 86% depending on the sample and the measurement method (Esbensen & Schwichtenberg, 2016; Richdale & Baker, 2014). Cognitive level, communication, the sensory profile, physical disability, epilepsy, psychiatric comorbidity, medications, and the underlying genetic syndrome can all shape the sleep pattern. Diagnostic overshadowing is a major risk: when night waking or a difficult new daytime behavior is attributed to the disability itself, organic problems such as pain, apnea, or seizures can be missed.

Reading Symptoms Through Behavior

A child with limited verbal and nonverbal communication may be unable to describe sleeplessness, reflux, fear, or discomfort in the legs. Tossing in bed, head banging, shouting, leaving the room, self-injury, daytime dozing, or new behavior problems may be the visible face of a sleep disorder. The family's account, direct observation, a sleep diary, and home video where needed are used together. Actigraphy contributes information about timing patterns; when breathing problems, seizures, or unusual movements are suspected, physiological investigation is required (M. T. Smith et al., 2018).

Syndrome-Specific Patterns

In genetic and metabolic disorders, the character of the sleep difficulty depends on the underlying condition. In Down syndrome, the anatomical features of the upper airway and hypotonia increase the risk of obstructive sleep apnea: airflow is interrupted by narrowing or collapse of the airway even though the child keeps making respiratory effort. Because the absence of reported snoring

or pauses does not exclude apnea, the American Academy of Pediatrics recommends polysomnography for all children with Down syndrome between ages 3 and 4 (Bull et al., 2022). In Prader-Willi syndrome, central apneas — in which respiratory effort itself transiently stops — can occur alongside obstructive apnea, particularly in infancy, and hypoventilation with carbon dioxide retention may develop; excessive daytime sleepiness is not explained by nocturnal breathing alone and may reflect differences in hypothalamic sleep-wake regulation, with narcolepsy-like features in some individuals (Duis et al., 2022). In Smith-Magenis syndrome, the disturbance of the biological clock and of melatonin timing is striking: in many individuals melatonin rises during the day rather than at night, producing fragmented nighttime sleep, early-morning waking, and daytime sleepiness (A. C. M. Smith et al., 2022). In Angelman syndrome, difficulty falling asleep, frequent night wakings, long periods of overnight wakefulness, and short or irregular sleep are prominent; the problems may ease with age in some individuals but can persist (Dagli et al., 2021). In Rett syndrome, night waking and sleep fragmentation may be accompanied by breathing problems, but the characteristic episodes of rapid breathing and breath-holding seen during wakefulness must be assessed separately from apneas arising in sleep (Zhang & Spruyt, 2022). Among metabolic disorders, Sanfilippo syndrome (mucopolysaccharidosis type III) can bring delayed sleep onset, long overnight wakefulness, and increased daytime sleep together with developmental regression and behavioral change; here, how sleep is distributed between night and day matters as much as the total amount (Mahon et al., 2014; Mumford et al., 2015).

Sleep Architecture and Duration

Studies of preschool children with developmental delay have reported shorter nighttime sleep, longer sleep onset, and more waking (Goodlin-Jones et al., 2008). Parent report and actigraphy or polysomnography do not measure the same thing: a child who lies still but awake can appear asleep on actigraphy. Group averages do not set a target duration for an individual child; the general age range is interpreted alongside the child's own two-week pattern and daytime function.

Intervention

Recommendations about sleep should be tailored to the child's capacity to understand, communicate, and carry out daily-living skills. The bedtime routine, for example, can be built from the same activities in the same order every evening — putting on pajamas, brushing teeth, a short book, getting into bed. The sequence can be shown with pictures; instructions should be short, and only one task should be requested at a time. The child's participation in the routine, or staying in their own bed, can be supported with a favorite activity or verbal praise. If the child needs a parent constantly present to fall asleep, that support can be reduced in small steps paced to the child's tolerance.

Pain, constipation, reflux, epilepsy, sleep apnea, and medication effects that contribute to the sleep difficulty should also be assessed. When present, they should be treated alongside the behavioral plan; night wakings caused by the child's discomfort must not be interpreted merely as habit or as a behavior problem.

Melatonin can be considered in some children whose difficulty falling asleep persists despite proper assessment and behavioral measures. In a randomized trial in children with neurodevelopmental difficulties, those receiving melatonin fell asleep sooner, but the gain in total sleep time was more limited (Appleton et al., 2012). Before starting treatment, the goal should therefore be stated explicitly: is the aim a shorter sleep onset, fewer night wakings, or longer total sleep? Benefit should be tracked against that goal together with possible side effects, and melatonin should not be treated as the remedy for every night waking.

Sleep in Autism Spectrum Disorder

Common Difficulties

In autism spectrum disorder, prolonged sleep onset, night wakings, short total sleep, early waking, and an irregular sleep-wake rhythm are frequently reported. Sensory sensitivity, resistance to changes in routine, anxiety, limited communication, gastrointestinal complaints, epilepsy, and co-occurring attention problems can all contribute. Associations have been shown between sleep problems and irritability, externalizing behaviors, executive functions, and

adaptive functioning; these relationships are mostly bidirectional, however, and causality cannot be established for an individual child (Cohen et al., 2014; Díaz-Román et al., 2018).

The Evidence-Based First Step

The American Academy of Neurology guideline recommends first evaluating co-occurring medical conditions and medications that may disturb sleep, and then applying behavioral strategies in partnership with the family (Williams Buckley et al., 2020). The core components are keeping the bedtime routine short and in the same order, regularizing bed and wake times, pairing the bed with sleep, reducing stimulating activity before bed, using appropriate reinforcement, and moving toward independence in steps matched to the child's developmental level. Visual schedules, social stories, timers, and “first-then” cards can be clearer than verbal explanation. Sensory adjustments should be individualized: room temperature, light, sound, pajama texture, and bedding can be arranged according to the child's tolerance — but the fact that a child finds a commercial product soothing does not mean its efficacy as a treatment has been demonstrated.

Parent Training

Parent-mediated sleep training is different from simply giving the family information. The problem is analyzed functionally, the family chooses a target, implementation is rehearsed, and difficulties are resolved during follow-up. Structured parent-training studies in autistic children have reported improvements in sleep habits and in some daytime behaviors (Johnson et al., 2013; Malow et al., 2014); the parents' own sleep is also frequently affected and deserves attention in its own right (Meltzer, 2008). The size and durability of the effect vary across programs. Plans of a few steps with regular follow-up should be preferred over protocols too complex for the family to carry out.

Melatonin

If marked insomnia persists despite well-implemented behavioral methods, melatonin can be considered. Guidelines recommend starting at a low dose, preferring pharmaceutical-grade preparations of known purity and dose reliability, and discussing the

expected benefit and possible side effects with the family (Williams Buckley et al., 2020). Randomized trials of prolonged-release melatonin have shown improvements in sleep duration and sleep onset, with secondary benefits for caregiver quality of life and child behavior in some studies (Gringras et al., 2017; Schroder et al., 2019). Melatonin is not, however, a substitute for addressing snoring and apnea, pain, seizures, or a mistimed sleep schedule. The dose, timing, co-medications, and continued need should be reviewed regularly by the physician.

Practices with Limited Evidence

Controlled studies of weighted blankets have not shown a clear benefit in objective sleep duration; the child and family may still prefer the product, but it should not be offered as a routine treatment (Gringras et al., 2014). Herbal products, antihistamines, and antipsychotics should not be used casually for sleep alone. The metabolic and neurological side effects of antipsychotics, in particular, are far more extensive than their possible sedative benefit.

Sleep in Attention-Deficit/Hyperactivity Disorder

Sleep difficulties occupy an important place in the assessment and treatment of children with attention-deficit/hyperactivity disorder (ADHD). Bedtime resistance, prolonged sleep onset, difficulty waking in the morning, and daytime sleepiness are frequently reported; in some children, night wakings and restless legs accompany the picture. Yet the same sleep problems and sleep architecture are not found in every child, and an ADHD diagnosis does not by itself indicate a specific sleep disorder. Parent reports do not always agree with actigraphy and polysomnography either. Rather than generalizations such as “children with ADHD sleep little” or “cannot sleep deeply,” the specific domain in which the child struggles should be identified (Cortese et al., 2009).

How Sleep Difficulties Relate to ADHD

The relationship between ADHD and sleep needs to be considered from several directions. ADHD symptoms can make it harder to prepare for bed and to maintain a sleep schedule, while insufficient or fragmented sleep can heighten inattention, irritability,

and difficulties with behavior regulation. In addition, an independent sleep disorder such as sleep apnea can produce daytime problems that resemble ADHD symptoms or can accompany true ADHD. The American Academy of Pediatrics therefore recommends screening for coexisting conditions such as sleep apnea in the ADHD evaluation (Wolraich et al., 2019). None of this means every case of ADHD can be explained by poor sleep. Treating the sleep problem may soften daytime symptoms in some children, but the ADHD diagnosis and its treatment still require their own evaluation. What matters clinically is distinguishing the child's ongoing ADHD symptoms from the difficulties added when sleep deteriorates (Cortese et al., 2013; Wolraich et al., 2019).

Bedtime, Sleep Onset, and Sleep Architecture

In ADHD, the bedtime struggle sometimes begins not after the child gets into bed but at the stage of winding down the day's activities. Stopping a game, turning off the screen, finishing preparations for the next day, and heading to bed demand planning and behavior regulation in sequence. Even when the child knows what to do, the process can stretch out because attention drifts to other stimuli, ending an activity is hard, or preparations are postponed. A delayed transition to bed should be distinguished from an inability to fall asleep once in bed.

Difficulty falling asleep likewise has no single explanation. A bedtime earlier than the child's biological sleep time, the behavioral interactions around bedtime, worries, or medication effects may each dominate in different children. Some children with delayed sleep onset fall asleep more easily at the later times they prefer; this pattern should not automatically be read as “refusing to go to bed” (Cortese et al., 2013).

Research on sleep architecture does not show a single, consistent ADHD pattern: findings on stage distribution, total duration, and overnight wakefulness are variable. A single night of laboratory recording may not capture the bedtime process at home or night-to-night variability. A normal polysomnogram therefore does not invalidate the sleep-onset difficulty the family reports, and a parent's statement that the child “sleeps very restlessly” does not by itself prove a disorder of sleep stages (Cortese et al., 2009; Owens et

al., 2009). An ADHD diagnosis also does not reduce the child's age-appropriate sleep need: an opportunity for 10-13 hours including naps at ages 3-5 and 9-12 hours at ages 6-12 should still be provided, with these ranges serving as the starting point for individual assessment — time in bed alone is not enough; how much the child actually sleeps, how they wake, and how alert they are during the day must also be considered (Paruthi et al., 2016).

Clinical Assessment

Whenever possible, the sleep history should be taken before ADHD medication is started, so that preexisting sleep difficulties can be compared with changes emerging after treatment. The interview should cover the time of getting into bed, the estimated time of falling asleep, night wakings, the morning wake time, and daytime dozing. The child's own account matters too: beneath what a parent describes as “not wanting to go to bed” may lie fear, physical restlessness, or simply not being sleepy yet.

NICE recommends monitoring changes in the sleep pattern during treatment with methods such as a sleep diary and adjusting medication accordingly when necessary (National Institute for Health and Care Excellence, 2018). Adding the time of medication doses and the evening's behavior to the diary helps the clinician make a key distinction: Is the child struggling to get to bed, lying in bed unable to sleep, or waking frequently after falling asleep? The same complaint of “sleeplessness” can call for different interventions. If snoring, pauses in breathing, labored breathing during sleep, or marked daytime sleepiness are present, sleep-disordered breathing should be investigated. Discomfort in the legs while resting in the evening, an urge to move them, and relief with movement suggest restless legs syndrome; moving a lot at night does not by itself establish that diagnosis. An ADHD diagnosis does not require polysomnography in every child — testing is chosen according to the sleep disorder actually suspected (Cortese et al., 2013; Wolraich et al., 2019).

Effects of ADHD Medications on Sleep

Viewing sleep difficulty purely as a medication side effect risks overlooking problems that existed before treatment. The effect

of stimulants on sleep should nevertheless be monitored systematically. A meta-analysis pooling objective sleep measurements from randomized trials found that stimulant treatment, on average, lengthened sleep onset, reduced sleep efficiency, and shortened total sleep time; these average results do not mean the same effect appears in every child (Kidwell et al., 2015). When a sleep problem develops, the dose, the timing of administration, and the duration of action should be reviewed, and it should be considered whether evening restlessness reflects the drug's continuing effect or the re-emergence of symptoms as it wears off. Medication adjustments should weigh daytime benefit and nighttime sleep together (Cortese et al., 2013; National Institute for Health and Care Excellence, 2018).

A drug that produces drowsiness has not necessarily improved nighttime sleep. In a small, prematurely terminated study of extended-release guanfacine, ADHD symptoms improved while total sleep time on polysomnography decreased. The finding illustrates that sedation must be distinguished from restorative, sufficient sleep — and that conclusions about all children should not be drawn from a single small study (Rugino, 2018).

Behavioral Interventions

The sleep intervention in ADHD should be matched to the type of difficulty the child experiences. For a child who cannot start the bedtime preparation, announcing in advance that an activity will end, making the preparation sequence visible, and setting a few concrete goals can help; the aim is to make the known rules easier to follow, not to re-explain them every evening. Behavioral programs can use regular sleep-wake times, a predictable bedtime routine, appropriate limits, and positive reinforcement. For a child who lies awake in bed for long periods, bedtime can initially be set close to the time the child actually falls asleep and then gradually moved earlier, while protecting an adequate sleep opportunity.

In a randomized trial by Hiscock et al. (2015) of 244 children aged 5-12 with ADHD and sleep problems, a brief behavioral sleep intervention reduced sleep problems and produced benefits in some daytime behaviors, quality of life, and daily functioning, with sustained effects reported at later follow-up (Sciberras et al., 2020).

The improvement in ADHD symptoms themselves was modest; the findings support the contribution of a sleep intervention to comprehensive ADHD care rather than its replacement. In a more recent study of 57 children aged 6-12 with ADHD and sleep problems, sleep-hygiene training was compared with the same training plus progressive muscle relaxation; both groups improved on sleep and some functioning measures (Türkmen Noyan et al., 2024). Because two active approaches were compared, the study does not show that all of the change came from the intervention or that muscle relaxation is necessary for every child, but it adds support for the feasibility of structured training and follow-up.

Physical Activity

Daytime physical activity can be treated as a component that supports the sleep plan in ADHD. In a randomized trial of 80 children aged 6-12, a 12-week program combining aerobic exercise with cognitive tasks had positive effects on executive functions and some sleep measures (Liang et al., 2022). The study does not show that every type of exercise produces the same result or that physical activity alone treats insomnia. In practice, enjoyable, regularly attended active games and sports can be built into the daily program; the goal is not to exhaust the child before bed but to establish a sustainable routine, adjusting the timing and intensity by observing how the child settles afterwards.

The Place of Melatonin

Melatonin is an option worth considering in some children with ADHD whose difficulty lies specifically in delayed sleep onset. In a placebo-controlled trial of 105 medication-free children aged 6-12 with ADHD and chronic sleep-onset insomnia, melatonin advanced sleep onset and increased total sleep time, but no significant improvement was shown in behavior, cognitive performance, or quality of life (Van der Heijden et al., 2007). The benefit to sleep should therefore not be interpreted as direct treatment of ADHD symptoms. If melatonin is considered, the target problem should be defined, and the timing, preparation, side effects, and continued need should be evaluated by the physician; it should not be used as an automatic solution for bedtime resistance,

breathing problems, or unexplained night wakings (Cortese et al., 2013; Van der Heijden et al., 2007).

Family Life, School, and Monitoring Treatment

Adapting the sleep plan to the family matters particularly for the evening preparations and the morning departure. For clinical follow-up it can be useful to record not only sleep-onset time but how long the bedtime preparation takes, how many reminders are needed, and how much difficulty the morning routine creates for the household — practical indicators that make treatment goals concrete. Information from school complements the night records: the teacher's observations on morning sleepiness, task initiation, sustained attention, and irritability are valuable. Still, not every change in school performance after a sleep intervention should be attributed to it; medication adjustments, the nature of the lessons, and co-occurring problems must also be considered. Although behavioral sleep studies show benefit in some daytime functions, these findings do not mean that academic achievement will rise in every child or that the need for ADHD treatment will disappear (Hiscock et al., 2015).

Sleep and Nighttime Care in Cerebral Palsy

In cerebral palsy, sleep difficulty is not just behavioral insomnia. Pain, hip problems, scoliosis, spasticity, dystonia, contractures, reflux, constipation, epilepsy, drooling, and breathing difficulty can all fragment the night. In children who cannot change their own position, pressure, discomfort, and the need for repositioning through the night interrupt the sleep of both the child and the caregiver. Assessment should therefore ask not only “How many times did the child wake?” but also “How many times a night does someone need to reposition, suction, feed, change, or give medication?”

Clinical Priorities in Assessment

In newly emerging nighttime restlessness, pain and medical causes are sought first. Increased tone, hip pain, skin pressure, an ill-fitting orthosis, reflux, and constipation are evaluated systematically. Snoring, paradoxical breathing, apneas, and morning fatigue raise the question of sleep-disordered breathing. Night positioning

systems should be planned with the physiotherapy and rehabilitation team around individual goals, comfort, pressure safety, and the family's capacity to use them; if a device's theoretical postural benefit clearly disrupts the child's sleep and the family's care burden, it should be reconsidered.

The Caregiver's Sleep

Significant associations have been reported between caregivers' sleep quality and their psychological well-being. In one cross-sectional study, 55% of children with cerebral palsy had sleep problems and 71% of caregivers had poor sleep quality; the children's sleep problems were associated with worse caregiver sleep, and caregiver sleep in turn with worse psychological health and well-being (Lang et al., 2021). Other studies have likewise linked children's sleep problems with maternal sleep and depressive mood (Adiga et al., 2014; Wayte et al., 2012). These data do not by themselves prove causality, but they strongly support measuring caregiver sleep as part of the treatment outcome.

A Family-Centered Solution

Reducing nighttime care is not always possible. In such situations the goals may be sharing tasks, appropriate assistive technology, daytime and nighttime care support, respite services, and the family's access to care for their own health needs. The clinician should not simply add new tasks to an exhausted family. The physical feasibility of a recommendation, the conditions of the home, the presence of other children, and the caregiver's musculoskeletal health should be discussed openly. Sometimes the meaningful outcome of treatment is not a small increase in the child's total sleep but the caregiver sleeping four uninterrupted hours for the first time.

A Team Approach

Pediatrics, pediatric neurology, otorhinolaryngology, pulmonology/sleep medicine, physical medicine and rehabilitation, physiotherapy, nutrition, psychology, and social work should collaborate as needed. Building a single, prioritized plan reduces the family's burden far more than issuing many separate recommendations.

Evidence-Based Conclusions and Recommendations

Clinical Recommendations

- 1. Sleep should be a routine part of neurodevelopmental follow-up; when a problem exists, it should be monitored with a diary and functional goals.
- 2. Breathing problems, pain, epilepsy, reflux, constipation, movement disorders, anxiety, and medication effects should be investigated.
- 3. The first step is a behavioral approach adapted to the developmental level: regular times, a predictable routine, appropriate reinforcement, and gradual parental withdrawal (Johnson et al., 2013; Malow et al., 2014; Morgenthaler et al., 2006; Williams Buckley et al., 2020).
- 4. In autism, if insomnia persists despite assessment and behavioral intervention, melatonin can be considered — at a low dose, correctly timed, as a reliable preparation, and with regular re-evaluation (Gringras et al., 2017; Schroder et al., 2019; Williams Buckley et al., 2020).
- 5. In ADHD, medication timing, rebound, apnea, restless legs, and circadian delay should be reviewed (Cortese et al., 2013; Kidwell et al., 2015).
- 6. In cerebral palsy, pain, tone, positioning, breathing, and nighttime care should be addressed together, and the caregiver's sleep should also be a target (Adiga et al., 2014; Lang et al., 2021; Wayte et al., 2012).
- 7. Weighted blankets, herbal products, and sedatives should not be recommended routinely without adequate evidence and safety evaluation (Gringras et al., 2014).

Recommendations for Special Education and Families

- 8. Sleep is not an alternative to special education but a contextual factor affecting readiness to learn; brief, objective observations from educators can be added to follow-up.
- 9. Goals should span sleep, activity, participation, and environmental factors, in line with the ICF framework (World Health Organization, 2001).

- 10. Caregiver burden is an independent outcome domain; night awakenings for care, uninterrupted sleep, and family functioning should be monitored.
- 11. The plan should be built jointly with the family, broken into small steps, and grounded in feasibility.
- 12. Snoring and apnea, marked daytime sleepiness, suspected seizures, loss of skills, severe pain, or a safety risk require specialist evaluation.

Conclusion

In neurodevelopmental conditions, sleep is not a minor accompanying symptom but a modifiable health domain that can shape the 24-hour functioning of the child and the family. The strongest approach investigates medical causes, puts behavioral methods first, uses evidence-based pharmacological options carefully when needed, and refuses to judge outcomes by nighttime duration alone. The aim is not to engineer a flawless night; it is to build a sustainable rhythm in which the child is more rested and participates more fully in learning and in life, and the caregiver's burden grows lighter.

Kaynakça/References

Adiga, D., Gupta, A., Khanna, M., Taly, A. B., & Thennarasu, K. (2014). Sleep disorders in children with cerebral palsy and its correlation with sleep disturbance in primary caregivers and other associated factors. *Annals of Indian Academy of Neurology, 17*(4), 473-476. https://doi.org/10.4103/0972-2327.144044

Appleton, R. E., Jones, A. P., Gamble, C., et al. (2012). The use of melatonin in children with neurodevelopmental disorders and impaired sleep: A randomised, double-blind, placebo-controlled, parallel study (MENDS). *Health Technology Assessment, 16*(40), 1-239. https://doi.org/10.3310/hta16400

Benninga, M. A., Faure, C., Hyman, P. E., St James Roberts, I., Schechter, N. L., & Nurko, S. (2016). Childhood functional gastrointestinal disorders: Neonate/toddler. *Gastroenterology, 150*(6), 1443-1455.e2. https://doi.org/10.1053/j.gastro.2016.02.016

Bruni, O., Baumgartner, E., Sette, S., et al. (2014). Longitudinal study of sleep behavior in normal infants during the first year of life. *Journal of Clinical Sleep Medicine, 10*(10), 1119-1127. https://doi.org/10.5664/jcsm.4114

Bull, M. J., Trotter, T., Santoro, S. L., Christensen, C., Grout, R. W., & the Council on Genetics. (2022). Health supervision for children and adolescents with Down syndrome. *Pediatrics, 149*(5), e2022057010. https://doi.org/10.1542/peds.2022-057010

Cohen, S., Conduit, R., Lockley, S. W., Rajaratnam, S. M. W., & Cornish, K. M. (2014). The relationship between sleep and behavior in autism spectrum disorder (ASD): A review. *Journal of Neurodevelopmental Disorders, 6*(1), 44. https://doi.org/10.1186/1866-1955-6-44

Cortese, S., Brown, T. E., Corkum, P., et al. (2013). Assessment and management of sleep problems in youths with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(8), 784-796. https://doi.org/10.1016/j.jaac.2013.06.001

Cortese, S., Faraone, S. V., Konofal, E., & Lecendreux, M. (2009). Sleep in children with attention-deficit/hyperactivity disorder: Meta-analysis of subjective and objective studies. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(9), 894-908. https://doi.org/10.1097/CHI.0b013e3181ac09c9

Dagli, A. I., Mathews, J., & Williams, C. A. (2021). Angelman syndrome. In M. P. Adam et al. (Eds.), *GeneReviews*. University of Washington, Seattle.

Díaz-Román, A., Zhang, J., Delorme, R., Beggiato, A., & Cortese, S. (2018). Sleep in youth with autism spectrum disorders: Systematic review and meta-analysis of subjective and objective studies. *Evidence-Based Mental Health, 21*(4), 146-154. https://doi.org/10.1136/ebmental-2018-300037

Duis, J., Pullen, L. C., Picone, M., et al. (2022). Diagnosis and management of sleep disorders in Prader-Willi syndrome. *Journal of Clinical Sleep Medicine, 18*(6), 1687-1696. https://doi.org/10.5664/jcsm.9938

Esbensen, A. J., & Schwichtenberg, A. J. (2016). Sleep in neurodevelopmental disorders. *International Review of Research in Developmental Disabilities, 51*, 153-191. https://doi.org/10.1016/bs.irrdd.2016.07.005

Galland, B. C., Taylor, B. J., Elder, D. E., & Herbison, P. (2012). Normal sleep patterns in infants and children: A systematic review of observational studies. *Sleep Medicine Reviews, 16*(3), 213-222. https://doi.org/10.1016/j.smrv.2011.06.001

Goodlin-Jones, B. L., Tang, K., Liu, J., & Anders, T. F. (2008). Sleep patterns in preschool-age children with autism, developmental delay, and typical development. *Journal of the American Academy of Child & Adolescent Psychiatry, 47*(8), 930-938. https://doi.org/10.1097/CHI.0b013e3181799f7c

Gordon, M., Gohil, J., & Banks, S. S. (2019). Parent training programmes for managing infantile colic. *Cochrane Database of Systematic Reviews, 12*, CD012459. https://doi.org/10.1002/14651858.CD012459.pub2

Gringras, P., Green, D., Wright, B., et al. (2014). Weighted blankets and sleep in autistic children: A randomized controlled trial. *Pediatrics, 134*(2), 298-306. https://doi.org/10.1542/peds.2013-4285

Gringras, P., Nir, T., Breddy, J., Frydman-Marom, A., & Findling, R. L. (2017). Efficacy and safety of pediatric prolonged-release melatonin for insomnia in children with autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(11), 948-957.e4. https://doi.org/10.1016/j.jaac.2017.09.414

Harskamp-Van Ginkel, M. W., Klazema, W., Hoogsteder, M. H. H., Chinapaw, M. J. M., & van Houtum, L. (2023). The need of having a plan in excessive infant crying — A qualitative study of parents' experiences of healthcare support. *Acta Paediatrica, 112*(3), 434-441. https://doi.org/10.1111/apa.16621

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donnell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. C., Setters, B., Vitiello, M. V., Ware, J. C., & Adams Hillard, P. J. (2015). National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health, 1*(1), 40-43. https://doi.org/10.1016/j.sleh.2014.12.010

Hiscock, H., Sciberras, E., Mensah, F., Gerner, B., Efron, D., Khano, S., & Oberklaid, F. (2015). Impact of a behavioural sleep intervention on symptoms and sleep in children with attention deficit hyperactivity disorder, and parental mental health: Randomised controlled trial. *BMJ, 350*, h68. https://doi.org/10.1136/bmj.h68

Johnson, C. R., Turner, K. S., Foldes, E., Brooks, M. M., Kronk, R., & Wiggs, L. (2013). Behavioral parent training to address sleep disturbances in young children with autism spectrum disorder: A pilot trial. *Sleep Medicine, 14*(10), 995-1004. https://doi.org/10.1016/j.sleep.2013.05.013

Kidwell, K. M., Van Dyk, T. R., Lundahl, A., & Nelson, T. D. (2015). Stimulant medications and sleep for youth with ADHD: A meta-analysis. *Pediatrics, 136*(6), 1144-1153. https://doi.org/10.1542/peds.2015-1708

Lang, C. P., Boucaut, A., Guppy, M., & Johnston, L. M. (2021). Children with cerebral palsy: A cross-sectional study of their sleep and their caregiver's sleep quality, psychological health and well-being. *Child: Care, Health and Development, 47*(6), 859-868. https://doi.org/10.1111/cch.12897

Liang, X., Qiu, H., Wang, P., & Sit, C. H. P. (2022). The impacts of a combined exercise on executive function in children with ADHD: A randomized controlled trial. *Scandinavian Journal of Medicine & Science in Sports, 32*(8), 1297-1312. https://doi.org/10.1111/sms.14192

Mahon, L. V., Lomax, M., Grant, S., et al. (2014). Assessment of sleep in children with mucopolysaccharidosis type III. *PLoS ONE, 9*(2), e84128. https://doi.org/10.1371/journal.pone.0084128

Malow, B. A., Adkins, K. W., Reynolds, A., et al. (2014). Parent-based sleep education for children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 44*(1), 216-228. https://doi.org/10.1007/s10803-013-1866-z

Meltzer, L. J. (2008). Brief report: Sleep in parents of children with autism spectrum disorders. *Journal of Pediatric Psychology, 33*(4), 380-386. https://doi.org/10.1093/jpepsy/jsn005

Moon, R. Y., Carlin, R. F., Hand, I., & the Task Force on Sudden Infant Death Syndrome and the Committee on Fetus and Newborn. (2022). Sleep-related infant deaths: Updated 2022 recommendations for reducing infant deaths in the sleep environment. *Pediatrics, 150*(1), e2022057990. https://doi.org/10.1542/peds.2022-057990

Morgenthaler, T. I., Owens, J., Alessi, C., et al. (2006). Practice parameters for behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1277-1281.

Mumford, R. A., Mahon, L. V., Jones, S., Bigger, B., Canal, M., & Hare, D. J. (2015). Actigraphic investigation of circadian rhythm functioning and activity levels in children with mucopolysaccharidosis type III (Sanfilippo syndrome). *Journal of Neurodevelopmental Disorders, 7*(1), 31. https://doi.org/10.1186/s11689-015-9126-5

National Institute for Health and Care Excellence. (2018). *Attention deficit hyperactivity disorder: Diagnosis and management* (NICE Guideline NG87).

Owens, J. A., & Dalzell, V. (2005). Use of the 'BEARS' sleep screening tool in a pediatric residents' continuity clinic: A pilot study. *Sleep Medicine, 6*(1), 63-69. https://doi.org/10.1016/j.sleep.2004.07.015

Owens, J. A., Sangal, R. B., Sutton, V. K., Bakken, R., Allen, A. J., & Kelsey, D. (2009). Subjective and objective measures of sleep in children with attention-deficit/hyperactivity disorder. *Sleep Medicine, 10*(4), 446-456. https://doi.org/10.1016/j.sleep.2008.03.013

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., Malow, B. A., Maski, K., Nichols, C., Quan, S. F., Rosen, C. L., Troester, M. M., & Wise, M. S. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785-786. https://doi.org/10.5664/jcsm.5866

Richdale, A. L., & Baker, E. K. (2014). Sleep in individuals with an intellectual or developmental disability: Recent research reports. *Current Developmental Disorders Reports, 1*(2), 74-85. https://doi.org/10.1007/s40474-014-0010-x

Rugino, T. A. (2018). Effect on primary sleep disorders when children with ADHD are administered guanfacine extended release. *Journal of Attention Disorders, 22*(1), 14-24. https://doi.org/10.1177/1087054714554932

Schroder, C. M., Malow, B. A., Maras, A., et al. (2019). Pediatric prolonged-release melatonin for sleep in children with autism spectrum disorder: Impact on child behavior and caregiver's

quality of life. *Journal of Autism and Developmental Disorders, 49*(8), 3218-3230. https://doi.org/10.1007/s10803-019-04046-5

Sciberras, E., Mulraney, M., Mensah, F., Oberklaid, F., Efron, D., & Hiscock, H. (2020). Sustained impact of a sleep intervention and moderators of treatment outcome for children with ADHD: A randomised controlled trial. *Psychological Medicine, 50*(2), 210-219. https://doi.org/10.1017/S0033291718004063

Simonson, J., Haglund, K., Weber, E., Fial, A., & Hanson, L. (2021). Probiotics for the management of infantile colic: A systematic review. *MCN: The American Journal of Maternal/Child Nursing, 46*(2), 88-96. https://doi.org/10.1097/NMC.0000000000000691

Singh, B. S. K., Danckaerts, M., & Van den Bergh, B. R. H. (2021). Helping families of infants with persistent crying and sleep problems in a day-clinic. *Frontiers in Psychiatry, 12*, 591389. https://doi.org/10.3389/fpsyt.2021.591389

Smith, A. C. M., Boyd, K. E., Brennan, C., et al. (2022). Smith-Magenis syndrome. In M. P. Adam et al. (Eds.), *GeneReviews*. University of Washington, Seattle.

Smith, M. T., McCrae, C. S., Cheung, J., Martin, J. L., Harrod, C. G., Heald, J. L., & Carden, K. A. (2018). Use of actigraphy for the evaluation of sleep disorders and circadian rhythm sleep-wake disorders: An American Academy of Sleep Medicine clinical practice guideline. *Journal of Clinical Sleep Medicine, 14*(7), 1231-1237. https://doi.org/10.5664/jcsm.7230

Tanrıverdi, D. Ç., Karaahmet, A. Y., & Bilgiç, F. Ş. (2023). Colic and sleep outcomes of nonpharmacological intervention in infants with infantile colic: A systematic review and meta-analysis. *Revista da Associação Médica Brasileira, 69*(5), e20230071. https://doi.org/10.1590/1806-9282.20230071

Türkmen Noyan, G., Direk, G. B., & Örengül, A. C. (2024). A randomized controlled trial of effects of sleep hygiene training and progressive muscle relaxation training in

children with ADHD. *Sleep Medicine, 117*, 169-176. https://doi.org/10.1016/j.sleep.2024.03.019

Van der Heijden, K. B., Smits, M. G., Van Someren, E. J. W., Ridderinkhof, K. R., & Gunning, W. B. (2007). Effect of melatonin on sleep, behavior, and cognition in ADHD and chronic sleep-onset insomnia. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*(2), 233-241. https://doi.org/10.1097/01.chi.0000246055.76167.0d

Wayte, S., McCaughey, E., Holley, S., Annaz, D., & Hill, C. M. (2012). Sleep problems in children with cerebral palsy and their relationship with maternal sleep and depression. *Acta Paediatrica, 101*(6), 618-623. https://doi.org/10.1111/j.1651-2227.2012.02603.x

Williams Buckley, A., Hirtz, D., Oskoui, M., et al. (2020). Practice guideline: Treatment for insomnia and disrupted sleep behavior in children and adolescents with autism spectrum disorder. *Neurology, 94*(9), 392-404. https://doi.org/10.1212/WNL.0000000000009033

Wolraich, M. L., Hagan, J. F., Jr., Allan, C., et al. (2019). Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics, 144*(4), e20192528. https://doi.org/10.1542/peds.2019-2528

World Health Organization. (2001). *International Classification of Functioning, Disability and Health (ICF)*. World Health Organization.

Zhang, X.-Y., & Spruyt, K. (2022). A meta-review of standard polysomnography parameters in Rett syndrome. *Frontiers in Neurology, 13*, 963626. https://doi.org/10.3389/fneur.2022.963626

BÖLÜM 10

PLAY THERAPY IN CHILDHOOD SLEEP DISORDERS: CLINICAL APPLICATIONS AND EVIDENCE-BASED APPROACHES

Hakan CANDAN[1]

Introduction

The Nature and Therapeutic Power of Play

Play is the most natural means by which children explore the world, express themselves, and acquire essential life skills (Genç & Tolan, 2021). Although it cannot be defined precisely, there is consensus that play is a voluntary activity that is intrinsically motivated, requires active engagement, and culminates in joyful exploration (Yogman et al., 2018).

Play is also a fundamental need for children's cognitive, physical, social, and emotional well-being (Milteer & Ginsburg, 2012). Play has been recognized as a right of every child by the United Nations High Commissioner for Human Rights (Milteer & Ginsburg, 2012). Moreover, for children, play is not merely a means of entertainment but also a way to explore the world, achieve mastery, and cope with their fears (Milteer & Ginsburg, 2012).

Play therapy is a specialized method aimed at resolving children's psychosocial problems through the healing power of play (Genç & Tolan, 2021). For children, play is a language, and toys are their words. When children with limited vocabulary cannot express themselves verbally, play provides one of the most important gateways to their inner world (Ginsburg, 2007).

[1] MD, Department of Pediatrics, University of Health Sciences, Beyhekim Training and Research Hospital, Konya, Türkiye, ORCID: 0000-0002-6871-6780

Effects of Play on Brain Development and Executive Functions

Play is not merely entertainment but a critical process that enhances brain structure and function (Yogman et al., 2018).

- **Brain structure:** Play supports executive functions, such as goal-directed behavior and ignoring distractions, by enhancing the functional organization of the prefrontal cortex (Genç & Tolan, 2021; Yogman et al., 2018). Play supports healthy brain development and enables children to acquire new competencies through interaction with their environment. In school settings, play and recess improve readiness to learn, learning behaviors, and problem-solving skills (Milteer & Ginsburg, 2012).
- **Neurochemical changes:** During play, production of brain-derived neurotrophic factor increases in the brain. This factor facilitates social learning by supporting synaptic growth and the survival of new neurons (Genç & Tolan, 2021).
- **Stress regulation:** The joy experienced during play and attunement with parents regulate the body's stress response and cortisol levels (Yogman et al., 2018).
- **Emotional resilience:** Through play, children learn to cope with challenges, negotiate, and resolve conflicts. Pretend play and fantasy allow children to confront their fears and gain a sense of control within a world of their own creation (Milteer & Ginsburg, 2012).
- **Parent-child bond:** Play offers parents a unique opportunity to see their children's world from the children's perspective. Children whose verbal abilities are not yet developed can express their emotions and frustrations through play, thereby establishing stronger bonds with their parents (Milteer & Ginsburg, 2012).

Play Therapy Approaches and Techniques

Play therapy encompasses different approaches according to the child's needs and the therapist's theoretical orientation (Genç & Tolan, 2021).

Child-Centered Play Therapy

In this approach, developed by Virginia Axline, the therapist accepts the child as they are and provides a safe environment. The therapist is nondirective; the child leads the play. This method is particularly effective for anxiety, difficulties with self-efficacy, and post-traumatic stress disorder (Genç & Tolan, 2021).

Cognitive Behavioral Play Therapy

This method involves structuring play activities to help children develop functional thoughts and behaviors. It is preferred for specific problems such as abuse, selective mutism, and enuresis (Genç & Tolan, 2021).

Filial Therapy

This approach strengthens family communication by teaching parents play therapy skills. The “serve-and-return” interactions established by parents with their children support development (Genç & Tolan, 2021).

Specialist-Guided Play Therapy

In this model, child development specialists or developmental-behavioral pediatricians design and supervise the intervention program, employing parallel talk, expansion, and interactive play strategies (Zhan et al., 2026). Studies involving toddlers with language developmental delay have shown that specialist-guided play therapy produces substantially greater increases in the language developmental quotient than clinic-based structured rehabilitation or parent-led home interventions alone (Zhan et al., 2026).

Although clinic-based structured therapies focus on specific language skills, they may not provide as natural a communicative context as play therapy; parent-led interventions provide language stimulation during daily routines, but their effectiveness may vary according to parental training and consistency of implementation (Zhan et al., 2026).

Clinical Areas of Application and Disorders

Autism Spectrum Disorder

Play skills are generally limited in children with autism, who experience difficulties with symbolic play and joint attention (Elbeltagi et al., 2023).

- **Floortime:** This approach aims to establish interaction through the child's interests by engaging at the child's developmental level (Elbeltagi et al., 2023).
- **JASPER:** This is a structured method focusing on improving joint attention and symbolic play (Elbeltagi et al., 2023).
- **Integrated play groups:** These groups bring together children with autism and typically developing peers to enhance social interaction (Elbeltagi et al., 2023).

Attention-Deficit/Hyperactivity Disorder

Play therapy is used as an adjunct to pharmacotherapy to increase children's attention spans and improve impulse control. Group games and rule-based activities, in particular, support the development of social skills (Genç & Tolan, 2021).

Anxiety and Depression

For depressive symptoms in the preschool period, such as lack of motivation and depressed mood, play therapy enables children to view events from different perspectives and develop problem-solving abilities. Objects that elicit fear and anxiety are addressed through play in a safe environment according to the "here and now" principle (Genç & Tolan, 2021).

Childhood Trauma

Children who have experienced trauma may externalize negative emotions through toys or roles with which they identify. Play is one of the most effective tools for alleviating the effects of trauma (Genç & Tolan, 2021).

Contemporary Challenges and Barriers

Despite recognition of the importance of play, the amount of time children spend playing is decreasing today (Ginsburg, 2007).

- **Academic pressure:** An emphasis on test-oriented achievement beginning in the preschool period restricts free play time and recess (Ginsburg, 2007).
- **Media and technology:** Prolonged screen time, averaging 4.5 hours per day, replaces physical activity and social interaction (Ginsburg, 2007).
- **Socioeconomic barriers:** Children living in poverty have difficulty accessing safe play spaces such as parks, contributing to developmental inequalities (Milteer & Ginsburg, 2012).

The Role of Play Therapy in Sleep Disorders

Difficulty initiating sleep, nocturnal awakenings, and resistance behaviors at bedtime are clinical problems that affect both children's daily functioning and family life. Pediatric insomnia is associated with recurrent difficulties initiating or maintaining sleep, or with sleep quality, despite age-appropriate opportunities for sleep, together with impaired daytime functioning in the child or family. In younger children, these difficulties are often described as bedtime problems and nocturnal awakenings, whereas the concept of insomnia becomes more prominent in older children (Meltzer & Mindell, 2014).

It is important to evaluate the emotional and behavioral processes accompanying sleep complaints. Particularly during the preschool period, nighttime fears may be associated with refusal to go to bed, delayed sleep onset, repeated nocturnal awakenings, and co-sleeping with parents. Kahn et al. (2017) emphasized that severe nighttime fears constitute a condition affecting the functioning of both children and their families. Accordingly, interventions focusing not only on sleep duration but also on fear, avoidance, parental involvement, and bedtime interactions have been investigated.

This section addresses the areas of application of play therapy in childhood sleep problems. Studies have examined the subject from different perspectives, including comparison of parent-involved cognitive behavioral play intervention with nondirective play (Kahn et al., 2017), investigation of a parent-child relationship-based play approach (Danesh et al., 2023), testing of a gamified bedtime behavioral program (Moore et al., 2007), and evaluation of

the level of evidence for general behavioral interventions in pediatric insomnia (Meltzer & Mindell, 2014).

Conceptual Framework of Play-Based Approaches

Play can provide a developmentally appropriate setting for young children to express their experiences and practice new behaviors. However, play therapy, cognitive behavioral interventions incorporating play, and gamified behavioral programs are not interchangeable concepts. Kahn et al. (2017) developed two distinct interventions: cognitive behavioral therapy incorporating parent-involved play and triadic expressive play therapy. In the former, psychoeducation, problem-solving, graded exposure, and reinforcement are implemented through play, whereas the latter emphasizes nondirective free play between the child and parent and acceptance of emotional expressions.

The filial play therapy approach used by Danesh et al. (2023) aims to modify parent-child interaction patterns. Parents are taught skills for establishing more constructive relationships with their children during play and supporting positive behaviors. Although sleep quality was assessed in this study, the primary context for participation was symptoms of internet addiction. The Bedtime Pass Program developed by Moore et al. (2007), by contrast, involves giving the child a card that can be used for one limited parental request after bedtime; it is a rule-based behavioral intervention rather than therapeutic free play.

This distinction is crucial for clinical interpretation. Whereas play therapy addresses the child's fears and relational experiences, a gamified behavioral program primarily aims to modify a specific target behavior. The benefits identified in the meta-analysis of behavioral interventions should not be interpreted as the effect size of play therapy alone (Meltzer & Mindell, 2014).

Parent-Involved Play for Nighttime Fears and Sleep Problems

The randomized controlled trial by Kahn et al. (2017) included 90 children aged 4-6 years with severe nighttime fears and their parents. Participants were assigned to cognitive behavioral therapy incorporating parent-involved play (CBT-PIP) or structurally equivalent nondirective triadic expressive play therapy

(TEPT). Both interventions consisted of two weekly 50-minute sessions involving the child and parent. Parent reports, daily sleep logs, and actigraphy were used for assessment.

During the first CBT-PIP session, the roles of avoidance and parental behaviors in maintaining nighttime fears were explained. The goal was for the child to progressively sleep in their own bed; proposed solutions were enacted using a dollhouse and human figures. Gradual approaches to feared situations were rehearsed through play, implemented in real life through homework, and reinforced with rewards such as stickers. During the second session, progress was evaluated and an implementation plan for the following weeks was developed (Kahn et al., 2017).

In the TEPT group, free play between parent and child was encouraged using the same toy materials; the therapist reflected emotions and behaviors and gently introduced the topic of bedtime when necessary. However, structured psychoeducation, exposure, problem-solving, and reward procedures were not added to this group. Thus, the emotional-expressive dimension of play could be compared with a play approach combined with behavioral techniques (Kahn et al., 2017).

The study found improvements in nighttime fears and both objective and subjective sleep disturbances in both groups. No significant superiority of CBT-PIP was identified for actigraphy-measured sleep outcomes. However, CBT-PIP was more advantageous in terms of parent-reported sleep problems, co-sleeping behavior, and treatment satisfaction. These findings suggest that cognitive behavioral techniques supported by play may be particularly beneficial for behavioral problems accompanying nighttime fears, but do not demonstrate that play alone is superior across all sleep parameters (Kahn et al., 2017).

Parent-Child Relationship-Based Play Therapy and Sleep Quality

Danesh et al. (2023) conducted a quasi-experimental study with a controlled pretest-posttest design involving 72 children aged 9-12 years. The children were selected from students who met the specified criteria on an internet addiction scale, with 36 participants allocated to each of the intervention and control groups. Mothers in

the intervention group received a play therapy approach aimed at modifying the parent-child relationship through ten weekly 90-minute sessions. Daily 30-minute play activities between mothers and their children were also considered part of the program.

Internet addiction, self-efficacy, and sleep quality were assessed together. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). In the intervention group, the reported mean sleep score was 1.75 before the intervention and 0.50 afterward; the corresponding scores in the control group were 1.81 and 1.78. The authors reported that the change in the intervention group was statistically significant ($p = 0.001$) (Danesh et al., 2023).

Two limitations should be particularly emphasized when interpreting these findings. First, the sample consisted of schoolchildren with internet use-related problems rather than patients with clinically diagnosed insomnia. Second, according to the PSQI threshold specified in the article, the baseline group means were already outside the range indicating poor sleep quality. Therefore, the observed change in scores does not mean that a diagnosed sleep disorder was treated or that the independent effectiveness of play therapy for pediatric insomnia was demonstrated. Nevertheless, the findings indicate that a play approach centered on the parent-child relationship warrants further investigation regarding sleep quality-related outcomes (Danesh et al., 2023).

A Gamified Behavioral Approach to Bedtime Resistance

In the randomized controlled study by Moore et al. (2007), 19 typically developing children aged 3-6 years with bedtime resistance were evaluated. Nine children were assigned to the Bedtime Pass Program and ten to a monitoring-only group. Resistance behavior was defined as crying, calling out to parents, or leaving the room after bedtime. Before enrollment, participants were screened for underlying sleep-disrupting conditions such as obstructive sleep apnea.

In the program, after being put to bed, the child uses a card granting permission to leave the room once or make one acceptable request of a parent. When used, the card is handed to the parent; behavioral extinction is then applied to subsequent requests for

additional attention. This structure aims to provide the child with a limited degree of choice while making parental responses predictable. However, the method should be described as a card-based behavioral intervention rather than nondirective play therapy addressing emotions (Moore et al., 2007).

Leaving the room, crying, and calling out decreased more in the intervention group than in the control group. The mean time required to settle after bedtime decreased from 43 to 25 minutes, and the findings were largely maintained at the three-month follow-up. Parents considered the intervention acceptable. However, the sample size of only 19 children limits the generalizability of the results to all pediatric sleep disorders (Moore et al., 2007).

This study demonstrates that a play-related theme and a tangible card may form part of a sleep behavior program that parents can implement. However, the principal active components of the intervention are behavioral limit-setting and extinction; therefore, the results cannot be attributed to the effect of play therapy alone (Moore et al., 2007).

Level of Evidence for Behavioral Treatments and the Position of Play Therapy

In the systematic review and meta-analysis conducted by Meltzer and Mindell (2014), 16 controlled studies and 12 within-group studies were evaluated, comprising data from a total of 2,560 participants. Significant improvements were identified in controlled studies regarding sleep-onset latency, number of nocturnal awakenings, duration of wakefulness during the night, and sleep efficiency. The authors rated the evidence supporting behavioral interventions for pediatric insomnia in young children as moderate and emphasized the lack of evidence for older children, adolescents, and groups with special needs.

The review addressed approaches based on learning principles, including extinction, graduated extinction, parent education, positive bedtime routines, and scheduled awakenings. The clinical aim of these techniques is to modify behaviors that affect sleep initiation and maintenance. However, the meta-analysis did not examine play therapy as a separate treatment category. Accordingly, this source should be used as a basis for comparison

with structured behavioral interventions for sleep problems rather than as evidence of the direct effectiveness of play therapy (Meltzer & Mindell, 2014).

When the four studies are considered together, three distinct areas of evidence emerge. The direct comparison of nondirective play and a cognitive behavioral approach incorporating play for severe nighttime fears (Kahn et al., 2017), the examination of sleep quality-related outcomes of parent-child relationship-based play (Danesh et al., 2023), and the evaluation of a gamified behavioral tool for bedtime resistance (Moore et al., 2007) represent different relationships between play and sleep. The meta-analysis of behavioral interventions provides broader evidence concerning the treatment of pediatric insomnia in general, but this evidence is not specific to play therapy (Meltzer & Mindell, 2014).

Clinical Practice and Research Needs

Based on these sources, the most prominent areas of application for play-based approaches are sleep problems accompanied by nighttime fears and bedtime behaviors. For nighttime fears, rehearsal using toy figures with parental involvement, graded exposure, and positive reinforcement are components of a structured intervention tested in a study (Kahn et al., 2017). Play sessions aimed at improving the parent-child relationship have also been associated with measurement of sleep quality in a different age group (Danesh et al., 2023).

In pediatric assessment, the type of complaint must be clearly identified: nighttime fears, bedtime resistance, difficulty initiating sleep, and nocturnal awakenings are not a single condition that will automatically respond to the same intervention. Screening for underlying sleep-disrupting factors in one study (Moore et al., 2007), and exclusion of significant medical illness and concurrent treatments in another (Kahn et al., 2017), serve as reminders that the research findings pertain to selected patient groups.

Future studies should investigate the independent effects of play therapy and its additional contribution to structured behavioral techniques in larger pediatric samples with defined sleep disorders. The use of sleep diaries and actigraphy alongside parental reports may reveal different dimensions of clinical improvement.

Comparative studies with long-term follow-up are particularly important for determining the extent to which short-term improvements are maintained (Meltzer & Mindell, 2014).

Conclusion

The existing literature indicates that play-based interventions may be used in the management of certain sleep problems in children. However, it should not be overlooked that these interventions do not represent the same methods or levels of evidence. In preschool children with severe nighttime fears, improvement has been reported following both nondirective expressive play and cognitive behavioral therapy incorporating parent-involved play; the latter approach was superior for certain parent-reported behavioral outcomes (Kahn et al., 2017). Although improved sleep quality scores were observed with filial play therapy focusing on the parent-child relationship, the baseline characteristics of the sample limit inferences regarding treatment effectiveness in diagnosed sleep disorders (Danesh et al., 2023). The gamified bedtime pass program was beneficial for resistance behaviors but should be regarded as a behavioral intervention distinct from conventional play therapy (Moore et al., 2007).

In conclusion, play therapy appears to be an approach that may be considered for selected pediatric sleep complaints, particularly when emotional and relational components are prominent. The broader evidence for behavioral interventions in pediatric insomnia, by contrast, is not specific to play therapy, and the independent effect of play therapy on diagnosed sleep disorders has yet to be demonstrated (Meltzer & Mindell, 2014). Nevertheless, with an increasing number of studies in this field, improved parental recording and feedback, and enhanced measurements such as actigraphy, play therapy may become a treatment option for pediatric sleep problems that improves the quality of life of parents and children.

Kaynakça/References

Danesh, F., Mohammadi, M., Naziri, G., & Fath, N. (2023). Investigating the effectiveness of modifying the parent-child interaction pattern based on filial play therapy on internet addiction, sleep quality, and self-efficacy in 9-12-year-old children. *Addiction & Health, 15*(4), 281-288. https://doi.org/10.34172/ahj.2023.1398

Elbeltagi, R., Al-Beltagi, M., Saeed, N. K., & Alhawamdeh, R. (2023). Play therapy in children with autism: Its role, implications, and limitations. *World Journal of Clinical Pediatrics, 12*(1), 1-22. https://doi.org/10.5409/wjcp.v12.i1.1

Genç, M., & Tolan, Ö. (2021). Okul öncesi dönemde sık görülen psikolojik ve gelişimsel bozukluklarda oyun terapisi uygulamaları [Play therapy practices in common psychological and developmental disorders of the preschool period]. *Psikiyatride Güncel Yaklaşımlar, 13*(2), 207-231.

Ginsburg, K. R. (2007). The importance of play in promoting healthy child development and maintaining strong parent-child bonds. *Pediatrics, 119*(1), 182-191. https://doi.org/10.1542/peds.2006-2697

Kahn, M., Ronen, A., Apter, A., & Sadeh, A. (2017). Cognitive-behavioral versus non-directive therapy for preschoolers with severe nighttime fears and sleep-related problems. *Sleep Medicine, 32*, 40-47. https://doi.org/10.1016/j.sleep.2016.12.011

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *Journal of Pediatric Psychology, 39*(8), 932-948. https://doi.org/10.1093/jpepsy/jsu041

Milteer, R. M., & Ginsburg, K. R. (2012). The importance of play in promoting healthy child development and maintaining strong parent-child bond: Focus on children in poverty. *Pediatrics, 129*(1), e204-e213. https://doi.org/10.1542/peds.2011-2953

Moore, B. A., Friman, P. C., Fruzzetti, A. E., & MacAleese, K. (2007). Brief report: Evaluating the Bedtime Pass Program

for child resistance to bedtime—A randomized, controlled trial. *Journal of Pediatric Psychology, 32*(3), 283-287.

Yogman, M., Garner, A., Hutchinson, J., Hirsh-Pasek, K., Golinkoff, R. M., Committee on Psychosocial Aspects of Child and Family Health, & Council on Communications and Media. (2018). The power of play: A pediatric role in enhancing development in young children. *Pediatrics, 142*(3), e20182058. https://doi.org/10.1542/peds.2018-2058

Zhan, Y., Liu, R., Dumbuya, J. S., & Lu, J. (2026). Specialist-mediated play therapy for toddlers with language developmental delay: A single-center observational pilot study. *Frontiers in Rehabilitation Sciences, 7*, 1830893. https://doi.org/10.3389/fresc.2026.1830893

BÖLÜM 11

FAMILIES' USE OF ARTIFICIAL INTELLIGENCE IN SLEEP COUNSELING: OPPORTUNITIES, RISKS, AND PRINCIPLES OF SAFE USE

Sümeyye ERTEK[1]

Introduction

Children's sleep is one of the pediatric topics about which families most often seek information in daily life. The newborn's night awakenings, the infant's safe sleep environment, the length of daytime naps, difficulty falling asleep, night fears, snoring, screen use, or melatonin—these questions are usually researched on the internet long before the outpatient visit. With the spread of generative artificial intelligence (AI) systems, this search has taken a different form from the classic search engine. Instead of choosing among dozens of web pages, the family can now type the child's age and problem and receive a conversational, seemingly personalized answer.

This convenience is particularly attractive to a sleep-deprived, exhausted parent. AI is accessible at any hour of the day; it can rephrase the question, simplify medical terms, explain in different languages, and offer the family a draft plan. Yet the same features create a new safety problem. Generative AI can use fluent, confident, and empathetic language regardless of how accurate the answer actually is. Incorrect or incomplete information can be presented more persuasively than an error on a classic web page. The World Health Organization specifically emphasizes that large language and multimodal models in health can produce false, incomplete, or biased information, and that users' overreliance on

[1] MD, Department of Pediatrics, Bursa City Hospital, Bursa, Türkiye, ORCID: 0000-0002-7636-2919

these outputs can create “automation bias” (World Health Organization, 2021, 2024).

For this reason, the fundamental question in sleep counseling is not “Should families use AI?” The technology is already becoming part of families' information ecosystem. The more useful question is this: For which purposes can AI be used safely, in which situations can it not replace physician assessment, and how should families question AI output? This chapter aims to offer a family-centered, evidence-based framework for these questions specific to children's sleep.

Why Is Generative AI Different from a Classic Internet Search?

While a search engine mostly directs the user to existing sources, generative AI constructs a new answer using the language patterns it has learned from the large text collections on which it was trained. This answer is not copied from a single source; the model produces the word sequence that appears most probable and contextually appropriate for the question. The practical consequence is that although the answer is linguistically very persuasive, not every piece of information in it has necessarily been verified.

Systematic reviews in health care show that large language models can produce useful and often accurate information for many questions, but that the methods, model versions, evaluation criteria, and safety reporting of the studies are extremely heterogeneous (Huo et al., 2025; Wei et al., 2024). In the JAMA Network Open systematic review covering 137 studies, most investigations did not adequately describe the model version, success criteria were often subjective, and ethical, regulatory, or patient-safety dimensions were addressed in less than one third of studies (Huo et al., 2025). The question “What percentage of medical questions does AI answer correctly?” therefore has no single, permanent answer.

The model version, how the question is phrased, the language used, re-asking the same question, and whether the model has access to current sources can all change the answer. A model that performs well today may be updated tomorrow; the free and paid versions of the same product may use different models. In family counseling, therefore, teaching the habit of verification is a more sustainable

approach than declaring any particular brand or model "trustworthy."

Are Families Really Using AI for Child Health?

Because this field is still developing rapidly, population-level usage rates vary by country, age, education, and access. A 2025 scoping review reported that health consumers use generative AI to understand health problems, question misconceptions, reach health services and resources, and prepare for professional consultations. Users' positive evaluations concentrated on accessibility, readability, and ease of use, while accuracy, reliability, privacy, and safety emerged as core concerns (Bautista et al., 2025).

A similar picture exists in pediatrics. A 2025 systematic review showed that ChatGPT and similar systems have been studied in pediatrics most often for patient/family education; they show potential in educational materials and in answering frequently asked questions, whereas accuracy is more variable in clinical decision-making and treatment plans (Douma et al., 2025). In a 2026 comparison using realistic parent-style pediatric questions, four different large language models showed overall moderate reliability and usefulness, and no model consistently achieved the health-literacy level desired for patient materials (Lahut et al., 2026).

These data suggest not that AI is worthless in family education, but that its purpose of use needs to be bounded. Explaining a concept and making a diagnosis or determining a medication dose in an individual child are not tasks at the same level of risk.

What Does the Evidence Specific to Children's Sleep Show?

In the sleep field we no longer have to rely on general health data alone. A study published in Academic Pediatrics in 2026 posed nine infant safe-sleep questions that parents might ask in real life to three large language models and compared the answers with the American Academy of Pediatrics 2022 safe-sleep recommendations. The models' mean accuracies differed significantly; although all models scored high on empathy, they performed better on direct guideline questions and worse on nuanced, context-dependent questions. The researchers noted that the answers could frequently

deviate from AAP recommendations and that pediatric oversight is necessary (Rothschild et al., 2026).

This finding is particularly important for sleep counseling. An explicit guideline question such as “Should the baby be placed on their back?” is easier than a question with multiple variables, such as “Can I put my three-month-old with reflux on their side?”, “She has started rolling over in her sleep—should I turn her back?”, or “Is this product temporarily safe during travel?” Real family questions are usually in the second group. The fact that AI gives a fluent answer does not mean it has weighed the nuances correctly.

In another 2026 pediatric study, ChatGPT answers to 41 questions covering vitamin D, food allergy, and sleep problems were evaluated by experts and parents. While experts identified partial or complete errors in more than about a quarter of the answers, 73.1% of parents found the AI information trustworthy and 88% indicated they would tend to keep using it (Tan et al., 2026). This result illustrates an important risk at the center of sleep counseling: perceived clarity and trustworthiness can be higher than actual clinical accuracy.

Insomnia studies in adult sleep offer a similar warning. In the study by Alapati et al. (2024), which evaluated 20 insomnia questions with different prompt formats, most answers were found clinically accurate; however, when sources and statistics were requested, only 80% of the references provided were real and relevant, and only 25% of the cited statistics could be verified within the source. A “show your sources” command is therefore useful, but the existence of the source and whether it truly supports the claim must be checked separately (Chelli et al., 2024).

On the other hand, it is also not correct to regard AI's specialist knowledge as entirely inadequate. In 2025 and 2026 studies, current large language models were able to show high accuracy on sleep-medicine case and examination questions; however, performance remained more limited on tasks requiring comprehensive differential diagnosis and clinical nuance (Patel et al., 2025, 2026). This distinction translates directly to family use: AI can be useful for focused information questions, but it should not replace the physician in making safe decisions that require evaluating the child's entire clinical context.

Potential Benefits of AI in Sleep Counseling

AI's greatest strength is not replacing health care but easing access to, and processing of, health information. Especially in a busy clinical setting, a family may forget many details after the visit. AI can be used as an auxiliary tool to help the family understand the plan the physician has recommended, adapt it to daily life, and follow it.

The first benefit is supporting health literacy. Concepts such as “circadian rhythm,” “sleep pressure,” “parasomnia,” “obstructive sleep apnea,” or “sleep-onset association” can be translated into plainer language for the family. The family can say, “Explain this in five sentences without medical terms,” or “Define, one by one, the concepts in this explanation that I don't know.” In this use, AI is not making a treatment decision; it is making existing information understandable.

The second benefit is preparation for the visit. A parent can turn the child's bedtimes, sleep-onset times, night awakenings, and morning wake times over one week into a table; organize the questions they want to ask the doctor; or have a symptom diary summarized. Presenting a one-week pattern clearly, instead of telling the physician “she wakes often at night,” can increase the efficiency of the clinical interview. Here AI's task is organizing data, not generating a diagnosis from the data.

The third benefit is making the family plan workable. If the physician has recommended, for example, gradually moving bedtime earlier, stopping screens before bed, and fixing the morning wake time, the family can ask AI for options to adapt these goals to their own daily schedule. A prompt such as “Our doctor gave these three goals; suggest a realistic evening routine for a household with two working parents and two siblings” can be useful once the clinical boundaries have already been set.

The fourth benefit is language and communication support. Families with different native languages can have clinical recommendations simplified in their own language, and short notes can be prepared for the grandmother, babysitter, or other caregivers. However, because meaning can shift after translation in high-risk topics such as safe sleep, the core recommendations should be compared against a reliable guideline.

The fifth benefit is helping the parent clarify their question. AI is sometimes more valuable for finding the right question than for the answer itself. “My three-year-old wakes twice a night; what information would it be useful to record before seeing the doctor?” is a far safer and more functional form of use than “Why is she waking —make a diagnosis.”

Where Does AI Create Risk?

The best-known risk is “hallucination”—the model producing information that is not actually true in a fluent and persuasive way. Sometimes the error is easy to notice; sometimes it is a small mistake embedded among correct statements. In health, the second situation is more dangerous. The WHO emphasizes that large language models can generate untrue, incomplete, or biased health information and that users may miss these errors because of the reassuring style (World Health Organization, 2021, 2024).

The second risk is currency. Infant safe sleep, medication recommendations, and some behavioral approaches can change over time with guidelines. The user does not always know up to what date the model carries information or whether it accessed a current source when answering. For a safety-critical topic in particular, the family should ask, “Which year of which guideline is this recommendation based on?” and, where possible, check the primary source.

The third risk is the illusion of over-personalization. Given the child's age, weight, bedtime, and symptoms, AI can produce an answer that looks individualized. But this is not the same as real clinical personalization. The model does not perform a physical examination; it cannot independently assess the growth curve, tonsil size, the neurological examination, family dynamics, previous treatments, or the accuracy of the information provided. It usually does not know an important detail the user did not type.

The fourth risk is model variability. The same question can produce different answers in different models, different versions, or on different days. The significant accuracy differences between models in the infant safe-sleep study are a concrete example (Rothschild et al., 2026). Asking another model for a “second opinion” on an answer is therefore not a reliable verification method;

both systems may be influenced by the same flawed internet patterns.

The fifth risk is hidden in the question asked of the AI itself. If the family asks a leading question such as “My child snores but is fine during the day—I don't need to see a doctor, right?”, the model may accommodate the user's assumption. A safe prompt should make uncertainty visible instead of seeking approval: “Which possibilities need to be ruled out in this situation, and which findings require physician assessment?”

High-Risk Sleep Topics: Where Should AI Stop?

Not all questions in children's sleep carry equal risk. Asking for two alternative bedtime routines for a preschooler and changing a two-month-old infant's safe sleep position do not produce the same clinical consequences. It is therefore useful to teach families topic-based risk classification.

Infant safe sleep is a high-risk area. The AAP recommends that throughout the first year the infant be placed supine for every sleep; that a firm, flat, non-inclined surface be used; that soft objects and loose bedding be removed from the sleep area; and that bed-sharing be avoided while room-sharing is practiced (Moon et al., 2022a, 2022b). These recommendations should not be loosened by AI on the grounds that “my baby sleeps better.” Questions about reflux, prematurity, starting to roll, swaddling, baby carriers, car seats, nests, inclined sleepers, and sleeping in the parents' bed are especially nuanced; an AI answer must be verified against the official safe-sleep guideline.

Snoring and sleep-disordered breathing are also in the high-risk group. Regular snoring, observed apneas, labored breathing, paradoxical breathing, marked mouth breathing, morning headache, daytime sleepiness, or behavioral changes may require evaluation for obstructive sleep apnea. AI can generate a list of possibilities from these symptoms but cannot make a diagnosis at home.

Medications and supplements are another red zone. Although melatonin is perceived as “natural,” the decision to use it in children should not be made by looking at bedtime alone. The American Academy of Sleep Medicine recommends that parents speak with a pediatric health professional before starting melatonin; that many

sleep problems be addressed first with schedule, habit, or behavioral changes; and that, if it is used, the dose and timing be determined professionally (American Academy of Sleep Medicine, 2022). Asking AI for a melatonin, antihistamine, or other sedative dose based on the child's weight is outside the boundary of safe use.

Nighttime events also require attention. Sleepwalking, night terrors, and confusional arousals are mostly benign parasomnias; however, some epileptic seizures, respiratory events, and other neurological conditions may be described by the family as “night fears.” For events that are stereotyped, frequently recurring, injury-producing, or accompanied by color change or breathing difficulty, an AI explanation alone should never suffice.

Similarly, heart-rate, oxygen-saturation, or sleep-stage data produced by wearables and home monitors should not be uploaded to AI with a request for a diagnosis. The measurement accuracy and algorithms of consumer devices are not equivalent to medical devices; moreover, the AAP does not recommend home cardiorespiratory monitors as a strategy to reduce SIDS risk (Moon et al., 2022b).

A Practical “Green-Yellow-Red Zone” Model for AI

Having families divide the area of use by risk level can be more functional than a long list of warnings. The classification below is not a strict medical rule but a practical framework that can be used in counseling (Table 1).

Table 1. A green-yellow-red zone model for AI use in children's sleep

Zone	Appropriate use	Examples	Core limit
GREEN	Low-risk information organization and education	Explaining general sleep needs by age; turning a sleep diary into a table; simplifying the physician's advice; preparing questions for the doctor	Use the answer for education; do not derive critical medical decisions.

YELLOW	Suggestions requiring professional verification depending on context	Night awakenings, dropping the daytime nap, behavioral sleep strategies, screen routines, adapting routines in neurodevelopmental differences	The child's development, family functioning, and medical history can change the outcome; verify the plan with the physician when needed.
RED	Diagnosis, medication, emergencies, and safety decisions	Off-guideline advice on infant sleep position/surface; melatonin or sedative doses; apnea/breathing difficulty; suspected seizures; cyanosis; diagnosis from wearable data	AI is not a decision-maker; current guidelines and professional assessment are required.

Source: Prepared by the author.

The purpose of this model is to move beyond the “using AI is safe/unsafe” dichotomy and assess the risk of the task. The same AI application can be quite useful in the green zone and dangerous in the red zone.

Privacy: What Does It Mean to Type a Child's Health Data into AI?

AI use in sleep counseling is not only a matter of accuracy; the privacy of the child's data also matters. Parents sometimes upload the child's name, date of birth, school information, diagnoses, medications, laboratory results, photographs, or detailed medical reports to get a better answer. Yet in consumer applications, the conditions under which health data are stored, whether they are used in model development, whether they are shared with third parties,

and under which legislation they are protected vary from service to service.

The WHO counts privacy, data security, and cybersecurity risks among the core governance issues for large language models (World Health Organization, 2021, 2024). A 2025 scoping review on information security and confidentiality in health chatbots identified data breaches, lack of transparency, inadequate consent, data-processing problems, and gaps in the legal framework as recurring problems (Talebi Azadboni et al., 2025).

The practical rule for families is simple: do not share identifying information that is not necessary to answer the question. Saying “my 4-year-old son” is sufficient for most information questions; adding the full name, exact date of birth, school name, or identity details is unnecessary. If a report or image is to be uploaded, the system's data-use terms should be known, and personal identifiers should be removed where possible.

In the United States example, HHS explicitly states that health data individuals voluntarily transfer to independent consumer applications are not always protected by HIPAA, and the FTC applies separate health data-breach rules for health applications outside HIPAA's scope (Federal Trade Commission, 2024; U.S. Department of Health and Human Services, n.d.). Although legal details vary by country, the general principle is universal: being “health-related” does not mean the data in an application are automatically protected with clinical-record-level confidentiality.

AI Literacy: What Should We Teach Families?

Digital health literacy is no longer just finding the right website. In the era of generative AI, the family should also know how an answer is produced and when it should be questioned. This new skill can be thought of as “AI literacy.”

The first principle is knowing the difference between an answer and a source. AI is not a source; it is a tool that produces a synthesis about sources. For critical recommendations, the family should want to see the original guideline or the page of a trusted institution. For infant safe sleep, medications, breathing disorders, and emergency symptoms in particular, this verification should be considered mandatory.

The second principle is asking about uncertainty. In addition to “What is most likely?”, questions such as “Which part of this answer are you unsure about?”, “What information is missing?”, “Which findings would change this recommendation?” and “In which situation is a pediatrician's assessment required?” can reduce the appearance of certainty in AI.

The third principle is asking for the date. A prompt such as “Use the most current AAP/AASM guideline and state the guideline's year” encourages a currency check. Even so, the reality of the guideline name and date the model provides should be verified.

The fourth principle is setting the boundary of personalization. The family can say, “Do not diagnose or give medication doses; write only the possible explanations, the information that should be recorded, and the red flags that require seeing a doctor.” This approach turns AI into a visit-preparation tool rather than a decision-maker.

The fifth principle is adjusting the health-literacy level. Studies show that AI answers can often be more complex than the recommended patient-education level (Alapati et al., 2024; Lahut et al., 2026). Prompts such as “Explain this so a 12-year-old could understand,” “If you use a medical term, define it in parentheses,” or “Summarize in at most five points” can improve readability.

Asking Safer Questions: Example Prompts for Families

The quality of AI output can be influenced by the prompt used. Studies show that prompts prepared under expert oversight in pediatric health information can be perceived by parents as highly trustworthy and persuasive (Leslie-Miller et al., 2024). This demonstrates, on the one hand, the power of prompt design and, on the other, that text that inspires trust must not automatically be accepted as correct.

Relatively safe examples in the sleep field include: “Give general information about normal sleep duration and daytime naps for a two-year-old; do not offer individual diagnosis or treatment, and state the name/year of the pediatric guideline you use.” “Below is my child's one-week sleep diary. Without diagnosing, only turn the bedtimes, sleep-onset times, awakenings, and total durations into a table.” “Our doctor recommended stopping screens one hour before

bed and fixing the morning wake time. Without changing these two goals, write three workable routine options for our family." "My child snores. Do not diagnose; write which signs I should observe and which findings require evaluation by a pediatrician/sleep specialist."

By contrast, prompts such as "How many milligrams of melatonin should I give my 18-month-old?", "My baby sleeps better on his stomach—tell me it's safe," "Watch this video and diagnose epilepsy versus night terror," or "Diagnose sleep apnea from my watch's oxygen readings" exceed AI's safe role. Writing the question correctly does not eliminate risk entirely, but it can prevent the wrong task from being delegated to AI.

The Physician's Role in Family-Centered Sleep Counseling

Simply prohibiting families from using AI is not realistic and can backfire in the counseling relationship. The more functional approach is to assess AI use, like internet use, with a routine, non-judgmental question: "Is there anything you have looked up about this on the internet or in AI applications?" This question gives the physician the opportunity to see what information the family has arrived with, what worry they carry, and whether there is any misunderstanding.

The family should be able to show the physician the text they received from AI. If the physician, rather than rejecting the whole text, confirms the correct parts and explains the problematic points, the relationship of trust is preserved and the family also learns to verify better in the future. This approach is consistent with the shared decision-making and information-sharing principles of family-centered care.

At the same time, it must be acknowledged that the physician cannot answer every question instantly and without limit. This gap is one of the main reasons families turn to AI in the night hours; surveys indicate that pediatric health care providers themselves are also increasingly familiar with these tools (Kisvarday et al., 2024). Clinical teams can place AI use in a safer context by providing reliable patient-education resources, short sleep information notes, red-flag lists, and follow-up plans.

AI can be particularly helpful at the stage of explaining and implementing the plan. After the clinical decision has been made by the physician and the family, AI can be used for low-risk tasks such as turning the plan into a family calendar, creating a sleep-diary template, preparing a short text to share among caregivers, or producing an age-appropriate social story for the child.

Children with Neurodevelopmental Differences

Families of children with autism spectrum disorder, attention-deficit/hyperactivity disorder, cerebral palsy, visual impairment, or intellectual developmental disorder may seek sleep information more often and in more complex forms. In these groups, the sleep problem should be addressed together with behavior, sensory regulation, medications in use, epilepsy, respiratory problems, motor limitation, and the family's care burden.

General-purpose AI systems may produce a standard “sleep hygiene” list without adequately accounting for this complexity. For example, recommending a dark and quiet room to a child with sensory sensitivity works for some families, whereas for another child a particular sound or light arrangement may facilitate regulation. Visual schedules can be useful for children with communication difficulties, but routine changes must be compatible with the child's functional needs and the family's capacity.

At this point AI can be an assistant that supports a functional, family-centered approach: it can be used to ask the family to list environmental facilitators and barriers, to consider the burden of a sleep plan on siblings and caregivers, or to break goals into small steps. However, medical components such as epilepsy, drug interactions, sleep apnea, or a serious behavioral crisis require professional assessment.

Equity and Access

AI has the potential to democratize health information. It can provide quick explanations for families facing language barriers, geographic distance, or limited access to health professionals. But the same technology can also produce new inequities. Paid models being more powerful, current-internet access features being tied to

subscriptions, differences in digital literacy, and language/culture imbalances in training data can all affect answer quality.

The WHO counts inclusiveness and equity among the fundamental principles of AI governance (World Health Organization, 2021, 2024). For children's sleep, this means cultural applicability, not just technical accuracy. Sharing a room, family bed arrangements, working hours, multi-child households, changing caregivers, and socioeconomic conditions shape the sleep plan. When AI assumes ideal conditions and gives the family unworkable recommendations, the information may be technically correct yet clinically useless.

In family-centered use, therefore, the approach of “take our family's real conditions into account, but do not compromise on safety guidelines” is important. The structural factors affecting the sleep plan can be described to AI without providing unnecessary personal identifying details about the family.

Checking an AI Answer in Five Steps

A simple checklist families can keep in mind can be suggested. Step one: Is this a low-risk information question, or a diagnosis/treatment/safety decision? Step two: Is the answer based on a current guideline, and does that guideline really exist? Step three: Does the model state uncertainty and alternatives, or does it speak with excessive certainty? Step four: Is there a situation requiring professional assessment, such as breathing difficulty, apnea, cyanosis, developmental regression, suspected seizures, injury risk, or medication use? Step five: Is sharing the child's identifying data really necessary to apply this advice?

These five questions give the family a basic safety filter without imposing the burden of verifying every answer at the level of a scientific paper. The aim is not to present AI as a technology to be feared, but to use it like a competent assistant for the right tasks.

The Future: AI Working with the Clinician

In the future, the safer form of health AI may lie not in general-purpose models independently suggesting diagnoses and treatments, but in the development of clinician-supervised systems tied to verified sources. The WHO likewise recommends defined

tasks, transparent evaluation, independent audit, and governance that prioritizes user safety for large models in health (World Health Organization, 2024).

In sleep counseling, an ideal system could draw information only from selected, current sources such as AAP/AASM according to the child's age, define safe-sleep rules as non-modifiable safety boundaries, automatically direct red flags to professional assessment, and process personal health data to appropriate security standards. Even such a system should be positioned as support for information transfer and follow-up processes, not as a replacement for the physician-patient relationship.

Moreover, because model performance changes continuously, a one-time validation cannot be considered permanent. Studies from 2026 show that current models can demonstrate high capability in pediatric knowledge and sleep medicine, but that reliability varies by task type (Lahut et al., 2026; Patel et al., 2026; Rothschild et al., 2026). Systems entering clinical use will therefore need to be re-evaluated regularly, version by version, with real-life scenarios and safety outcomes (Ratwani et al., 2024; Sittig & Singh, 2025).

Conclusion

Generative AI is permanently changing the way families seek information about children's sleep. Being fast, accessible, and conversational, it offers important opportunities for explaining sleep concepts, preparing for the clinical visit, organizing the sleep diary, adapting a physician-determined plan to family life, and supporting health literacy.

Nevertheless, fluent and empathetic language is no guarantee of clinical accuracy. Particularly in infant safe sleep, sleep-disordered breathing, medication and melatonin use, distinguishing seizures from parasomnias, and deriving diagnoses from consumer devices, AI should not be used as an independent decision-maker. The finding in pediatric studies that parental trust can exceed the accuracy identified by experts shows that counseling must impart critical AI literacy, not just information (Rothschild et al., 2026; Tan et al., 2026).

The most functional approach is neither to ban AI nor to accept it as a medical authority, but to define its role correctly: AI can teach the family to ask questions, understand, record, and organize information; but clinical decisions affecting the child's safety must be made within current evidence and professional assessment.

The core message that can be given to families in sleep counseling can be summarized as follows: Use AI not as an “answer machine” but as a “preparation and explanation tool.” Ask for the source of any critical recommendation, make uncertainty visible, do not share personal data unnecessarily, and for red flags seek help from a health professional, not from a screen.

Kaynakça/References

Alapati, R., Campbell, D., Molin, N., et al. (2024). Evaluating insomnia queries from an artificial intelligence chatbot for patient education. *Journal of Clinical Sleep Medicine, 20*(4), 583-594. https://doi.org/10.5664/jcsm.10948

American Academy of Sleep Medicine. (2022). *Health advisory: Melatonin use in children and adolescents*. American Academy of Sleep Medicine.

Bautista, J. R., Herbert, D., Farmer, M., et al. (2025). Health consumers' use and perceptions of health information from generative artificial intelligence chatbots: A scoping review. *Applied Clinical Informatics, 16*(4), 892-902. https://doi.org/10.1055/a-2647-1210

Chelli, M., Descamps, J., Lavoué, V., Trojani, C., Azar, M., Deckert, M., Raynier, J.-L., Clowez, G., Boileau, P., & Ruetsch-Chelli, C. (2024). Hallucination rates and reference accuracy of ChatGPT and Bard for systematic reviews: Comparative analysis. *Journal of Medical Internet Research, 26*, e53164. https://doi.org/10.2196/53164

Douma, H., McNamara, C., Bakola, M., & Stuckler, D. (2025). Leveraging ChatGPT to strengthen pediatric healthcare systems: A systematic review. *European Journal of Pediatrics, 184*(8), 478. https://doi.org/10.1007/s00431-025-06320-4

Federal Trade Commission. (2024). *Health Breach Notification Rule*, 16 C.F.R. Part 318.

Huo, B., Boyle, A., Marfo, N., et al. (2025). Large language models for chatbot health advice studies: A systematic review. *JAMA Network Open, 8*(2), e2457879. https://doi.org/10.1001/jamanetworkopen.2024.57879

Kisvarday, S., Yan, A., Yarahuan, J., Kats, D. J., Ray, M., Kim, E., Hong, P., Spector, J., Bickel, J., Parsons, C., Rabbani, N., & Hron, J. D. (2024). ChatGPT use among pediatric health care providers: Cross-sectional survey study. *JMIR Formative Research, 8*, e56797. https://doi.org/10.2196/56797

Lahut, D., Bilgin, D. D., Başıbüyük, M., Büke, Ö., & Karabayır, N. (2026). Reliability and readability of AI platforms for pediatric health advice: A comparative analysis. *Scientific Reports, 16*(1), 24131. https://doi.org/10.1038/s41598-026-54812-6

Leslie-Miller, C. J., Simon, S. L., Dean, K., Mokhallati, N., & Cushing, C. C. (2024). The critical need for expert oversight of ChatGPT: Prompt engineering for safeguarding child healthcare information. *Journal of Pediatric Psychology, 49*(11), 812-817. https://doi.org/10.1093/jpepsy/jsae075

Moon, R. Y., Carlin, R. F., Hand, I., & the Task Force on Sudden Infant Death Syndrome and the Committee on Fetus and Newborn. (2022a). Evidence base for 2022 updated recommendations for a safe infant sleeping environment to reduce the risk of sleep-related infant deaths. *Pediatrics, 150*(1), e2022057991. https://doi.org/10.1542/peds.2022-057991

Moon, R. Y., Carlin, R. F., Hand, I., & the Task Force on Sudden Infant Death Syndrome and the Committee on Fetus and Newborn. (2022b). Sleep-related infant deaths: Updated 2022 recommendations for reducing infant deaths in the sleep environment. *Pediatrics, 150*(1), e2022057990. https://doi.org/10.1542/peds.2022-057990

Patel, A., Contractor, H., Heninger, H., Vallamchetla, S. K., Li, P., Tao, C., & Cheung, J. (2026). Assessment of frontier large language models in sleep medicine. *Frontiers in Digital Health, 8*, 1769386. https://doi.org/10.3389/fdgth.2026.1769386

Patel, A., Ruoff, C., Helgeson, S. A., Carvalho, D. Z., Castillo, P. R., & Cheung, J. (2025). Diagnostic performance of large language models (LLMs) compared with physicians in sleep medicine. *Sleep Medicine, 134*, 106677. https://doi.org/10.1016/j.sleep.2025.106677

Ratwani, R. M., Bates, D. W., & Classen, D. C. (2024). Patient safety and artificial intelligence in clinical care. *JAMA Health*

Forum, *5*(2), e235514. https://doi.org/10.1001/jamahealthforum.2023.5514

Rothschild, E., Christian, J., Arar, C., et al. (2026). How correct is AI for infant safe sleep advice? Evaluating accuracy of ChatGPT, Gemini, and Claude against AAP guidelines. *Academic Pediatrics*. Advance online publication, 103398. https://doi.org/10.1016/j.acap.2026.103398

Sittig, D. F., & Singh, H. (2025). Recommendations to ensure safety of AI in real-world clinical care. *JAMA, 333*(6), 457-458. https://doi.org/10.1001/jama.2024.24598

Talebi Azadboni, T., Solat, F., Hematti, H., & Rahmani, M. (2025). Information security and confidentiality in health chatbots: A scoping review and development of a conceptual model. *Digital Health, 11*, 20552076251406637. https://doi.org/10.1177/20552076251406637

Tan, J., Wang, L., Wang, G., Yang, Y., Jia, F., Chi, X., Xie, X., Li, T., Yang, B., Zhang, H., Gong, M., Wu, Y., Shi, X., & Chen, W. (2026). Safety and user perception of general-purpose large language models in pediatric healthcare: Evaluations of ChatGPT by doctors and parents. *Digital Health, 12*, 20552076261427505. https://doi.org/10.1177/20552076261427505

U.S. Department of Health and Human Services, Office for Civil Rights. (n.d.). *Protecting the privacy and security of your health information when using your personal cell phone or tablet*. U.S. Department of Health and Human Services.

Wei, Q., Yao, Z., Cui, Y., et al. (2024). Evaluation of ChatGPT-generated medical responses: A systematic review and meta-analysis. *Journal of Biomedical Informatics, 151*, 104620. https://doi.org/10.1016/j.jbi.2024.104620

World Health Organization. (2021). *Ethics and governance of artificial intelligence for health: WHO guidance*. World Health Organization.

World Health Organization. (2024). *Ethics and governance of artificial intelligence for health: Guidance on large multi-modal models*. World Health Organization.


BİDGE