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Synthesis

How important is it?

Undesirable sleeping behaviours are characterized by inadequate, poor-quality, and disrupted sleep-wake patterns. They range from bedtime resistance and frequent night waking to sleeping disorders (e.g., sleepwalking or bedwetting) that require behavioural interventions, surgical intervention, or pharmacological treatments. Undesirable sleeping behaviours are extremely common in early childhood and affect 20% to 30% of preschool children. In most cases, it is a benign and temporary phenomenon that requires no intervention. Yet, severe sleep disturbances can persist if not treated, which may potentially affect early parenting relationships and several areas of children's development.More specifically, sleep problems in children are a significant source of distress for families. Daytime fatigue in parents may lead to mood disturbances and to less effective parenting. Furthermore, poor sleep or insufficient sleep duration in children may negatively impair their cognitive (language and learning), behavioural (hyperactivity, irritability), emotional (negative emotion regulation and self-control), and physical (unhealthy weight) development. Accordingly, healthy sleep habits are crucial and early detection and interventions for sleep problems in children are warranted.

What do we know?

Infants' sleep development is highly related to the maturation of the central nervous system. During the first few months, active sleep (REM) occupies 50% of the sleep time of newborns. As babies mature, the duration of active sleep decreases and the duration of quiet sleep (non-REM) and waking state increases. Sleep problems in the first few months could be the result of a poor organization between these two regulation processes. As infants reach adult proportions of active and quiet sleep (REM sleep occupies about 25% of the sleep time), sleep-wake state consolidationoccurs. At six months, they have the physiological maturity to sleep at least six consecutive hours per night. As for the amount of nocturnal sleep they require to be well rested and to develop in an optimal manner at different ages, 3 to 12 year-old children usually need to sleep at least 10 to 11 hours per night.

The majority of sleep problems are psychosocial in nature and tend to co-occur. Sleep-onset association disorder (SOAD) is a common sleep problem where children learn to fall asleep only under certain conditions or associations (e.g., being rocked or fed). As such, children with SOAD may have difficulty to quickly fall back asleep after night waking due to their inability to self-soothe. In contrast, children with limit setting sleep disorder (LSSD) do not experience as much night waking but have difficulty falling asleep. In addition to night waking and sleep onset problems, children may also experience a range of undesirable behaviours occurring during their sleep or sleep-wake transitions, including sleepwalking, sleep talking, bedwetting, bruxism (i.e., grinding or clenching the teeth during sleep), sleep terrors, and rhythmic movement disorders (rocking the entire body from one side to another, rolling the head against the pillow). While some sleep disturbances appear early in infancy (sleep terrors and rhythmic movement disorders), others appear at a later age (bruxism and sleepwalking).

Sleep problems are influenced by both biological and environmental factors. On the one hand, children may have a genetic predisposition to partial arousal, in turn affecting their sleep-wake consolidation. Similarly, infants with neurological problems tend to exhibit abnormal sleep patterns. On the other hand, child factors may impair sleep consolidation including, fatigue, difficulties in the perinatal period (e.g., long delivery), difficult temperament, fever, chronic illnesses and neurodevelopmental delay. Premature infantsdo not have a higher likelihood of experiencing sleep problems than full term infants. In fact, sleeping problems in the first six months are less common in preterm than in full-term infants. With regards to parental factors, anxious, over-protective or mothers with a history of insecure attachment are more prone to have children with sleep problems. Along the same line, some parenting practices influence the development of sleep problems. For instance, infants whose parents actively rock or hold them until asleep have more difficult to self-soothe following a nocturnal awakening. Similarly, co-sleeping has been associated with a greater prevalence of sleep problems and sudden unexpected infant death (SUID) in the Western culture. However, it is important to point out that 99% of bed sharing deaths can be explained by the presence of at least one and usually multiple risk factors for sudden infant death syndrome (SIDS),such as maternal smoking, sleeping position, use of alcohol and/or drugs by the bedsharing adults, and soft mattresses or heavy blankets.

What can be done?

In addition to traditional pharmacological methods, a variety of behavioural interventions involving the participation of the parents have been developed to reduce or eliminate undesirable sleeping behaviours. Before resorting to medication, parents are encouraged to first explore non-pharmacological methods. Not only are they highly effective, but their effects also tend to be more durable than that of medication. Yet, to increase their efficacy, behavioural methodsshould be implemented as quickly as possible to foster optimal child development. In addition, child and parent factors, as well as the environmental condition to which the child is exposed, should be taken into account.

Behavioural methods are selected based on the specific sleeping difficulties the child encounters. Here is a list of commonly used strategies:

- **Scheduled awakenings**: requires parents to awaken the child every night 15 to 30 minutes prior to the usual time of the episode of sleepwalking or sleep terror. The child is kept fully awake for five minutes before letting him go back to sleep.
- **Extinction or gradual extinction**: involves the immediate or progressive withdrawal of parental attention to help the child learn to fall asleep on his own.
- **Positive routines**: requires parents to implement regular, systematic, and predictable bedtime routines using quiet, pleasant activities, and praise for compliance.
- **Shaping and positive reinforcement**: requires parents to praise and provide tangible rewards for achieving appropriate sleep.
- **Transitional objet**: requiresparents to provide children with a transitional object (blanket, stuffed animal or pacifier) to help them self-soothe when trying to fall asleep without their mother’s presence.

In addition to interventions, adequate parenting practices are highly suggested. More specifically, parents are encouraged to gradually remove themselves from the bedside when children are falling asleep or to place them awake in their bed so they learn to fall asleep on their own. Furthermore, in order to prevent SIDS to occur, breastfeeding and room sharing (rather than bed sharing) are recommended. Finally, both parents and service providers should be educated on infant and child sleep behaviours in order to become familiar with sleeping habits and effective sleep management strategies and to be conscious of the potentially serious consequences of poor or insufficient sleep.

Organization and Development of Sleep in Early Life

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Introduction

Our understanding of the development of sleep patterns and behaviours in human infants and young children has advanced significantly since the 1950s, when polysomnographic (PSG) recordings first described the neurophysiology and organization of rapid eye movement (REM) and non-rapid eye movement (NREM) sleep states.[1,2] Today, in the U.S., standards of practice, official nosologies and certification processes have been established. The American Academy of Sleep Medicine certifies clinical laboratories and the technicians who record sleep, and the American Boards of Internal Medicine, Pediatrics and Psychiatry/Neurology have collectively agreed to certify board eligible clinicians in a new sub-specialty, Sleep Disorders Medicine. A pediatric section of the Associated Professional Sleep Societies (APSS), the national professional organization of sleep specialists, held its first scientific meeting in 2005 and has met annually ever since.

How is sleep measured? Polysomnography remains the “gold standard,” recording a number of psychophysiological systems: peripheral muscle tone (electromyogram, EMG) from sub-mental muscles, horizontal and vertical eye movements (electrooculogram, EOG) from electrodes placed peri-orbitally, the electroencephalogram (EEG) from an array of scalp electrodes, and cardiac, respiratory and peripheral motor activity from thermistors placed around the chest, airway and limbs. Eye movement, muscle tone and EEG patterns are the primary parameters used to score REM and NREM sleep states. Patterns of obstructed breathing, heart rate irregularity and episodic behaviours, including limb movements, are associated features useful in diagnosing specific sleep disorders.

The EEG pattern during REM sleep is low voltage, fast, resembling the EEG of wakefulness, the EMG pattern is inhibited and the EOG is characterized by bursts of vertical and horizontal

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saccadic eye movements. Heart and respiratory rates are rapid and irregular. In REM sleep, neuronal firing, neurotransmitter release and uptake, and metabolic rates also resemble patterns of waking. Mental activity during REM sleep is present and is reported as dreams. Thus, during REM sleep, an individual appears asleep, but for the most part the central nervous system is highly activated. In infants, REM sleep has been called Active Sleep.

In contrast to the psychophysiological activation of REM sleep, NREM sleep is characterized by more basal, organized patterns of physiological inhibition. Both respiratory and heart rates are slowed and more regular. The EEG is synchronized with specific slower frequency waveforms. In infants NREM sleep is also called Quiet Sleep. The EEG of Stage 1 NREM sleep resembles the tracing of REM sleep; however, respiratory and heart rate patterns are regular, and saccadic eye movements are absent. The EEG of stage 2 NREM sleep contains K complexes and sleep spindles . Stages 3 and 4 NREM sleep have varying amounts of slow, high-voltage synchronized delta waves. In newborns, only two sleep states – REM sleep and NREM sleep – can be distinguished. By 6 months of age, the specific EEG waveforms that are used to sub-classify the four stages of NREM sleep have emerged.

In human newborns, REM sleep occupies 50% of total sleep time.[3] REM and NREM sleep states alternate with each other in sleep cycles that recur periodically through the sleep period approximately every 50 minutes. In the neonatal period, sleep begins with an initial REM period, and each sleep cycle includes as much REM sleep as NREM sleep. No early- and late-night differences in REM-NREM sleep distributions are found. The shift in the temporal organization of states during the course of a night's sleep, which begins in the second month of life, reflects the maturation of internal central nervous system timing mechanisms.[4] That is, biological clocks mature to regulate both the ultradian and circadian control mechanisms that result in sleep-wake state consolidation. REM sleep decreases proportionately as NREM sleep increases, and NREM Stage IV sleep moves to the first third of the sleep period as REM sleep becomes more prominent during the last third of the sleep period.[5-9] The circadian sleep-wake cycle changes from a polyphasic rhythm during the newborn period to a diurnal rhythm by 4-6 months of age, as sleep consolidates to the nighttime, and waking, except for 1-2 brief daytime naps, consolidates in the daytime.[10-12] The morning nap is usually given up in the second year of life and the afternoon nap in the third to fourth year of life.[9,13] Only recently have we begun to understand how these early biological developmental changes are affected by family, cultural and psychosocial influences.

Subject

Parental concerns about sleep in young children are common.[14,15] During the first year of life, parents often are most concerned about issues related to consolidation. That is, concerns about irregular napping and frequent and prolonged night waking. During the toddler period, concerns may shift more to behaviours that resist sleep. That is, concerns about going to bed at an appropriate time and falling asleep quickly and easily. They ask, “What is normal? What is to be expected? How will my child’s development be affected?” A large literature addresses these issues but relatively little is known about their origins.[16-21] Does the infant who awakens and cries regularly during the night, or the toddler who can’t fall asleep easily, become sleep deprived with subsequent developmental and/or behavioural consequences? Or, are these behaviours more distressing for the parent, especially the working parent, exhausted by repeated late evening and/or middle-of-the-night ministrations to their child? How long should these behaviours be tolerated? What should be done?

Research Context

Answers to the above questions about sleep are studied by several methods: polysomnography (traditionally in the laboratory, but now also in the home); actigraphy (usually in the home), videosomnography (usually in the home), and parent-report instruments such as sleep logs, sleep diaries and structured questionnaires. Often, many of these methods are used simultaneously.[22-25] Automated scoring algorithms for actigraphic recordings and, more recently, for video recordings make these methods popular as both clinical and research tools.[26,27] The actigraph may be worn for the entire 24-hour day, recording all of the subject’s sleep-wake activity. In contrast, the video camera records only the sleep and waking behaviour in bed. However, the video camera also records the contextual variables associated with going to bed, falling asleep and waking during the night. The more comprehensive research context for understanding the unfolding of infant sleep-wake patterns in early development utilizes a transactional model that assesses several of these multiple factors that impact the parent-child relationship.[28,29] Proximal influences on the relationship include the primary caregiver's current state of physical and psychological well-being, the primary caregiver’s own childhood experiences of being parented, including their experiences around sleep, current social support networks, the family’s economic and household condition, and the infant’s temperament and physical health. Stressors, such as infant physical illness or maternal depression also serve as proximal factors that directly impact parent-child interaction and the child’s sleep. How the young child falls asleep (alone, being rocked by a parent, with a pacifier, etc.) and the parental behaviours surrounding night wakings

(time to response, promotion of self soothing, etc.) all affect the consolidation of sleep. More distal factors in the transactional model include the broader cultural context and belief systems of the family and more indirect environmental influences.[30-33]

Key Research Questions

Questions for further research far outnumber answers currently available. Which of the several methods of measuring sleep in these young populations is most suited? How should the problems of concordance between different recording methods be resolved?[22,24,34,35] Is sleep organized differently in children with clinical disorders, especially neurodevelopmental disorders, than in typically developing children? Are the structured instruments and parent questionnaires valid for children with medical disorders? Large-scale, cross-cultural, population-based, longitudinal epidemiologic studies are essential if professionals are to advise parents about what the range of "normal" sleep behaviours are for a particular age group of children.[36,37] How are such studies to be mounted? Is co-sleeping salutary or harmful for the infant's health, physical well-being and autonomous development? What kinds of treatment (behavioural, psychopharmacologic, psychotherapeutic) should be employed and when? Which, if any, infant, parent or psychosocial factors optimizes sleep behaviour? What is the relationship between nighttime sleep disruption, daytime sleepiness and daytime behavioural disruption? What are the long-term implications of chronic sleep disturbances in early childhood?

Recent Research Results

There is a strong association between parent-infant interaction around sleep and the emergence of infant sleep behaviours. Parents who actively rock or hold their infant until asleep (i.e., more involved in settling their infant to sleep), in contrast to parents who allow their infants to fall asleep on their own, have infants who present more night waking problems.[38,39-41] These associations might result from a direct effect of parental behaviour on infant sleep or from infants with difficult temperaments who demand more parental involvement during the night.[42]

The important role of parents has been established by prevention studies that have demonstrated that changing parental knowledge about infant sleep prior to the child's birth can promote better sleep.[43,44] Moreover, clinical studies on behavioural interventions for clinical management of sleep problems have demonstrated that using parents as the primary interveners produces reliable and durable changes in infant sleep. Specifically, it has been shown that an infant's sleep can

improve dramatically when parents succeed in reducing their bedtime and nighttime involvement.[45,46] Thus, it is important to recognize that in early childhood, sleep behaviours may be specific to a particular relationship or setting. A child may nap at the daycare center but not at home (or vice-versa), or a child may fall asleep more easily when the babysitter puts the infant to bed than when the parent does (or vice-versa). Sometimes, infants and young children's sleep behaviours present differentially with mothers and fathers.

Many studies have reported that sleep disturbances in young children are fairly persistent and may be related to earlier sleep patterns. A recent study described the persistence of sleep problems from 12 months of age to 4 years in 12% of a sample with mostly night waking problems.[47] It has been reported that sleep problems tend to persist in up to 30% of children studied to 8 years of age.[48]

Studies in school age children suggest that nighttime sleep disruption may affect daytime behaviour, particularly with problems of irritability, hyperactivity and attention,[47,49-51] marital disruption and increased environmental stress.[52,53] A study in preschool children examined sleep patterns from parent diaries and reported that variability in amount of sleep, in bedtimes and in lateness of bedtime predicted less optimal adjustment in the preschool.[54] As expected, improvements in sleep with a therapeutic intervention with toddlers were associated with improvements in daytime behaviour.[55]

Conclusions

Sleep plays an important role in development, and patterns that develop early may persist with subsequent behavioural consequences. It is important to understand the complex array of biological and psychosocial factors that transact on the path to healthy sleep. Much more research is needed.

Implications for Policy and Service

Understanding how sleep develops normally, what factors promote healthy sleep and how sleep disorders emerge, is a lifespan issue of significant scope. The public health and economic burdens of disturbed sleep are staggering. Road fatalities related to sleepiness, especially when coupled with alcohol/drug use are crippling. Work-related injuries and work-related errors (particularly in the health professions) related to sleep loss and daytime sleepiness are also serious. In childhood, disorders such as attention deficit hyperactivity disorder and behavioural

disruptions in autism, traumatic stress disorder and depression are often associated with underlying sleep disorders. Children with fragmented or insufficient sleep may exhibit learning, retention and recall problems in school. They may be less able to inhibit emotional responses and, thus, be prone to impulsive or violent outbursts. Finally, in young infants and toddlers, disrupted and/or problematic sleep is a stress on the entire family. Child abuse may result as the worst-case scenario; parental inability to function appropriately at work (especially two working parents) may result as the best. The costs of disordered sleep to society, to the healthy development of children, and to the well being of families are huge. Early exposure to good sleep hygiene is an imperative.

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Development of Sleep and Sleep Problems in Preterm Infants

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Introduction

Behaviour is the only way infants can communicate their needs to parents and other caregivers. Clinicians use changes in infant behaviours to alert them to possible medical complications that need further investigation,[1] and researchers use specific infant behaviours to identify pain[2] and responses to interventions that modify neonatal care.[3] Sleeping and waking not only affect the infant's immediate response to stimulation but, because they reflect the functioning of the central nervous system, have also been found to be related to developmental outcomes.[4-8]

Subject

More than 12% of births in the U.S. are premature (less than 37 weeks of gestation). The sleep of premature infants differs from that of full-term infants. These differences may continue after the neonatal hospitalization.

Problem

Sleeping and waking behaviours affect the development of preterm infants in multiple ways. First, sleeping and waking affect the infant's ability to respond to stimulation. Second, infants with neurological problems exhibit abnormal sleep patterns. Sleep and wakefulness may also have direct effects on brain development and learning that continue after the infant has been discharged home. Finally, differences in the sleep-wake patterns of preterm infants as compared to those of full-term infants might lead to sleep problems after hospital discharge.

Key Research Questions

Research is needed to describe the development of sleep and waking in preterm infants and to examine factors in the hospital and home environment that affect this development, the relationship between sleep development in preterm infants and other areas of psychosocial

development, and to determine the extent to which sleep of prematurely born children continues to differ from that of children born at term after infancy and the degree to which these differences are related to sleep problems.

Research Context and Recent Research Results

A number of studies have shown that sleeping and waking affect preterm infants' response to stimulation. Preterm infants who were asleep showed less pronounced behavioural responses to painful procedures, such as heelsticks.[9] In the hospital, the preterm infant state changes frequently in response to nursing interventions or noise.[10] Preterms are rarely able to sustain quiet sleep during these interventions; they usually awaken.[11] In addition, sleeping position affects sleep patterns; preterm infants placed on their backs to sleep showed greater wakefulness, less quiet sleep, but fewer central apneas.[12,13]

Social interaction also affects and is affected by the sleep-wake patterns of preterm infants. Preterm infants exhibited less eye opening, and probably less waking, when interacting with their mothers than healthier preterms.[14] Mothers reported being aware of the sleep-wake behaviours of their preterm infants and using these behaviours when deciding to interact.[15] Healthier preterm infants opened their eyes more when with parents than when with nurses;[16] whereas sicker preterm infants spent more time in active sleep when with their parents.[17] Holding infants in skin-to-skin contact (kangaroo care) increased quiet sleep time as compared with periods when the infant was alone in the incubator.[18,19] Developmental care was associated with increased active and quiet sleep and decreased sleep latency,[20] and tactile stimulation was followed by greater amounts of sleep.[21] At four to six weeks (corrected age), breastfed premature infants cried more than formula-fed infants.[22]

Sleeping and waking reflect the underlying functioning of the brain.[23,24] The oscillations between sleep and waking originate in the brainstem, but their maintenance is due to interactions among neuronal populations that stretch from the brainstem to the cerebral cortex.[25] Sleep and wakefulness also have direct effects on brain development and learning. Because the nightly proportion of Rapid Eye Movement (REM) sleep is lower in adults than in infants, it has been hypothesized to be necessary for brain development.[26] This hypothesis has received some support from studies of full-term infants and animals.[27,28] Also, movements during active sleep – twitches, startles and rapid eye movements – may be needed for the development of neuromuscular and sensory systems.[4] The amount of active sleep is lower in the preterm neonates than in full-term

newborns and increases with age in preterm infants.[29,30]

Because of the close relationship between the brain and sleep,[4-6] it is not surprising that sleep organization undergoes significant development in the preterm period. The amount of active sleep decreases and the amounts of quiet sleep and waking states increase over the preterm period.[29-33] The organization of sleep states, particularly the regularity of respiration in quiet sleep, the percent of active sleep with rapid eye movements, and the length of awakenings, also increases.[4,29-32] Boys show less active sleep, more drowsiness and more wakefulness than girls.[33]

Similar changes continue in the early weeks after term, although the rate of development slows somewhat.[30,34,35] At the same adjusted ages, preterm infants have less sleep, longer episodes of quiet sleep, more body movements, more frequent REM episodes, more alertness and non-alert waking activity, and less drowsiness.[34] Preterm infants show day-night differentiation in sleep-wake patterns at similar ages or even earlier than fullterm infants.[35]

However, premature infants are more likely to have neurological insults. Preterm infants with neurological problems, such as intraventricular haemorrhage, have state patterns (less alertness, more active sleep and a narrower range of states) that differ from those of healthier infants.[36,37] Markedly abnormal neonatal electroencephalographic (EEG) patterns in infants with severe neurological problems are related to major neurological sequelae, such as epilepsy.[38] In addition, infants exposed prenatally to tobacco, alcohol or drugs exhibit abnormal state patterns, possibly as the result of neurological insults caused by the drugs.[39-43]

Consequently, sleeping and waking patterns of preterm infants have been associated with developmental outcomes.[5] Measures of sleep-wake states during the preterm period (the amount of crying, amount of rapid eye movements, quality of state organization, sleep cycle length and amount of night sleep) predict cognitive and motor development, as measured by the Bayley scores during the first year.[5,8,44] Developmental changes in the amounts of specific sleep behaviours during the first year are related to developmental outcomes in the second year.[45] Also, prematurely born children who showed a more rapid decrease in active sleep (more rapid development) in the preterm period averaged higher IQs and better language and fine motor abilities at three years than prematurely born children with slower active sleep development.[6] Further, the stability of sleep-wake patterns in the first month predicted later developmental handicap, including cognitive delays and seizures.[46,47] EEG sleep measures in preterm infants, even in the absence of specific neurological insults, have been related to risk for mortality and

abnormal or suspect neurological outcomes.[48]

Although many parents and clinicians believe that children born prematurely are at risk for sleep problems, the literature does not support this belief, except for sleep-disordered breathing. Sleeping problems in the first six months are actually less common in preterm than fullterm infants.[49] At twenty months, preterm infants were found to have less restful sleep than fullterm infants.[50] Sleep patterns and incidence of sleep problems assessed through parental interviews from birth through ten years did not differ between children born prematurely and those born at term.[51] Prematurely born children from eight to eleven years of age with single mothers or exposed to mild pre-eclampsia had a greater risk of sleep-disordered breathing than other prematurely born children.[52] Young adults who were born prematurely did not differ from adults born at term in sleep quality or amount but were at greater risk for sleep-disordered breathing.[53,54]

Conclusions

These findings indicate that sleep-wake patterns relate to the psychosocial development of preterm infants both directly, through effects on infant responsiveness and brain development, and indirectly, by influencing the types of social stimulation that preterm infants receive. Differences in the sleep-wake patterns of preterm infants as compared to full-term infants might lead to sleep problems after hospital discharge, but research to date has not found an increased risk for sleep problems, except for sleep-disordered breathing. The most provocative findings suggest that sleeping and waking patterns could be used for examining brain functioning in relation to later development. However, to date the associations between preterm sleep patterns and later development have been too small for clinical use. Longitudinal indices of sleep behaviours might be more accurate since they avoid problems of temporary abnormalities in sleep-wake patterns due to immediate responses to the environment or medical complications. Also, these indices would make it possible to examine the degree to which the brain is able to exhibit normal development despite insults.[27] Future research needs to examine the development of sleep-wake organization in combination with factors in the social environment and to explore the sleep of prematurely born children after the first year of life.

Implications for Policy and Service Perspectives

As intervention services are provided while infants are awake, service providers usually pay little attention to the sleep patterns of preterm infants, unless parents have complaints. However,

research findings indicate that both sleeping and waking can have important effects on psychosocial development. Service providers need to be aware of how sleep-wake patterns are affecting the parent/preterm infant interactions and intervene as needed to promote more mutually satisfying interactions. Also, atypical sleep-wake patterns need investigation because they may be signs of underlying medical or neurological problems. Although parental concerns that prematurity causes sleep problems can be dispelled, sleep problems in prematurely born children should be treated in the same ways as sleep problems in children born at term.

On the other hand, research that uses sleep-wake states to predict long-term developmental outcomes is not yet ready for implementation in practice. However, it has potential to be used as an adjunct to other diagnostic criteria to help providers to better determine which preterm infants could benefit from early intervention and which infants will develop normally even without intervention.

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Co-Sleeping, Breastfeeding and Sudden Infant Death syndrome

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Introduction

Cultural innovations and child care practices and, importantly, the dynamic social values and ideologies that legitimize them, shift quite rapidly relative to evolutionary-based changes in fundamental infant biology.[1] This raises the possibility that widely recommended infant care practices can be at odds with the human infant's biological, psychological and emotional needs and expectations, at least as inferred from the human infant's evolutionary past. This mismatch between human infant biological needs and contemporary caregiving practices or contexts may be particularly heightened in western industrialized cultures within which sudden infant death syndrome (SIDS) and/or sudden unexpected infant death in infancy (SUID) are both more salient and prevalent.[1,2]

Certainly infants sleeping separated from their caregivers at night (solitary room sleeping), infants sleeping on their stomachs (prone) to promote uninterrupted, early consolidation of adult-like sleep, and bottle-feeding with formula or cows milk rather than breast milk were all novel, culturally-sanctioned but scientifically-untested (as safe or best) infant care innovations.[1] It is now known that each of these practices has contributed to or led to thousands of SIDS deaths.[3-5] Many of these infant lives, we can infer, could have been saved had we more carefully examined and come to understand the biological validity of mother-infant safe co-sleeping, breastfeeding and infants sleeping on their backs (supine). This adaptive complex altogether maximized the protection of perhaps the most vulnerable primate of all, the human infant, born the least neurologically mature primate, the slowest developing and the most reliant on the mother's body for regulation and support.[1,6-8]

We describe here how the western dismantling of three fundamental evolved maternal nighttime infant caregiving practices, specifically, how to lay your baby down to sleep, how to feed your baby, and where to locate your baby for sleep, created the conditions that favored and fostered

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the emergence within western industrialized cultures of SIDS. We also discuss how the same underlying cultural beliefs that supported the idea that infants sleep best alone serve presently to permit the acceptance of an inappropriate set of assumptions related to explaining why some babies die unexpectedly while sleeping in their parents beds.[9] These assumptions are that regardless of circumstances, including maternal motivations and/or the absence of all known bedsharing risk factors, even nonsmoking, sober, breastfeeding mothers place their infants at significantly increased risk for SUID by bedsharing.

Subject

Sudden infant death syndrome (SIDS) is a medical syndrome first defined in 1963 and generally described as a "diagnosis by exclusion."[10] There is no animal model of SIDS and it has never been observed to occur naturally in any species other than humans.[2] While the standardization of a SIDS diagnosis has been and continues to be elusive and/or inconsistent, it is most often applied to situations in which an otherwise healthy infant between the ages of 8-16 weeks, especially, but up to 12 months, dies suddenly and unexpectedly presumably during its sleep and upon postmortem examination no apparent internal causal factor(s) explaining the death can be identified.[11,12]

While the general consensus is that there is no single, primary cause of SIDS, its expression depends on, as Kinney and Thach[13] describe it, the simultaneous presence of three factors: 1) some underlying infant vulnerability, likely congenital in origin; 2) some undefined, possibly species-specific characteristic unique to the human infant, especially relevant within a narrow developmental, critical period and, finally; 3) some kind of exogenous stressor. This last factor could be something stressful or deleterious to which the baby is exposed, or, possibly, something that is missing in the infant's "expected" micro-environment such as mother's breast milk, the delivery of breast milk and/or mother herself and the sensory experiences her presence offers her infant. Altogether this perspective comprises a model for SIDS research known as the "Triple-Risk-Model" proposed in 1994 by Filiano and Kinney[14] but also similarly conceptualized by McKenna.[2]

The congenital or developmental defects implicit to the "Triple-Risk Model" likely express themselves in a myriad of ways. One predominant theory proposes that many SIDS victims exhibit abnormalities in regions of the brain that control breathing and arousals during sleep. Specifically, intensive postmortem neurological studies of their brain tissues reveal a relatively

low density of acetylcholine (a neurotransmitter) nerve sites, which, at normal densities, function in critical ways to help re-initiate breathing following a sleep-related apnea or extended breathing pauses. These infants would be classified as having had an “arousal deficiency” before their deaths.[15-17]

Up until the last two decades, research into causes and correlates of SIDS bore little fruit in terms of elucidating preventative measures. However, the most substantial breakthrough in preventing SIDS and/or SUID (to date), perhaps surprisingly, came from adjustment of infant care behaviours. Specifically, modification of common parenting practices involving three of the most fundamental aspects of infant sleep: infant sleep position, feeding method, and where and with whom the infant sleeps (i.e. in a room by himself or in the close proximity of a committed caregiver) has led to significant reductions in the SIDS rates in many European and North American populations.[18,19]

The first indication that infant care practices could promote or reduce infant deaths came in the 1990s when it was discovered that merely placing an infant in the prone rather than supine position tripled an infant’s chances of dying.[20] Insights from epidemiological studies from England and New Zealand led to national and international “back to sleep” campaigns in almost all western industrialized countries. Prior to this discovery, in most western industrialized countries SIDS rates ranged between approximately 1.5 to 4 infants per 1000 live births (compared to industrialized counties in Asia, such as Japan, which has the lowest SIDS rates in the world, .05 infants per 1000 live births[21]) with enormous increases amongst minorities, especially impoverished indigenous peoples such as the Maori of New Zealand, the Cree of Northern Canada, and the Aborigines of Australia.[19,22,23] Native peoples in the United States demonstrated similar exponentially increased SIDS (or SUDI rates, see below), as much as two to seven the times the rates found amongst white Americans.[13,19] Despite significant declines among almost all cultural and/or ethnic groups, SIDS rates still remain the leading cause of death for infants between one month and one year of life in the United States and elsewhere.[13]

Problem

In the last two decades, efforts have been made to differentiate SIDS deaths from the different, but related, larger class of infant deaths referred to as SUID. This broader umbrella term includes, in addition to SIDS (which account for about 80% of SUID cases) other unexpected deaths of an infant due to either “natural causes” or unnatural causes.[13] The former includes

infant deaths resulting from mild infection or toxic response, genetic mutations, and/or inherited disorders such as fatty-acid oxidation. The latter includes homicides, as well as intentional suffocation, estimated at about 5% of SUID deaths, but also suspected or definite accidental suffocations, because of an overlay by another person, or an asphyxial wedging or strangulation, especially where the infant is not found dead in a crib but having been on a structure not specifically designed with infant sleep safety in mind (recliners, waterbeds, couches, sofas and/or adult beds).[9]

These definitional distinctions between SIDS and SUID are significant because they represent an increasing effort to standardize what is and is not considered a true SIDS death and what criteria one uses to arrive at a SIDS diagnosis. A large part of this shift is aimed at trying to separate a true SIDS from a preventable asphyxial death, as, for the most part, it is impossible to distinguish between intentional or non-intentional smotherings upon a SIDS autopsy.[24] Hence, with greater frequency, diagnostic judgments are being made based on deaths scene characteristics and descriptions of the infant's sleep environment.[25]

Indeed, if a baby dies in what is defined as an "unsafe sleep environment," such as all non-crib sleeping deaths, those babies are no longer regarded as SIDS deaths, when in fact, they could be.[9] More problematic is the fact that the SUID diagnosis is being applied abundantly in cases where an infant is found dead sleeping next to a parent on the same surface, no matter what the social or physical circumstances.[26]

Subsequently, by virtue of defining that an adult and infant are unable to safely sleep on the same surface together, such as what occurs during bedsharing, even when all known adverse bedsharing risk factors are absent and safe bedsharing practices involving breastfeeding mothers are followed, an infant that dies while sharing a sleeping surface with his/her mother is labeled a SUID, and not SIDS.[26] In this way the infant death statistics increasingly supplement the idea that bedsharing is inherently and always hazardous and lend credence, artificially, to the belief that under no circumstance can a mother, breastfeeding or not, safely care for, or protect her infant if asleep together in a bed.[27] The legitimacy of such a sweeping inference is highly problematic, we argue, in light of the fact that when careful and complete examination of death scenes, the results revealed that 99% of bedsharing deaths could be explained by the presence of at least one and usually multiple independent risk factors for SIDS such as maternal smoking, prone infant sleep, use of alcohol and/or drugs by the bedsharing adults.[28] Moreover, this new ideology is especially troubling because it leads to condemnations of bedsharing parents

that border on charges of being neglectful and/or abusive.

Recent Research

One of the most prominent recommendations that can be made to parents to reduce their infants' risk of SIDS is to practice mother-infant co-sleeping on separate surfaces (the American Academy of Pediatrics[27] calls this "room sharing"). The finding that mother-infant co-sleeping on separate surfaces confers reduced risk of SIDS but some forms of same surface co-sleeping increase risk (under certain circumstances, see below), has given rise to recent public health campaigns against any and all bedsharing in the United States.[29] However, when examined in detail, epidemiological studies reveal inconsistent findings as to whether or not, to what degree, or under what circumstances bedsharing represents a consistent risk factor for SIDS and/or SUID. Studies are plagued by inconsistent definitions of bedsharing (e.g., categorizing deaths on sofas or recliners as bedsharing deaths) and details of the circumstances within which infants die, leading several studies to show heightened risks for infants when sleeping with an adult,[30-32] whereas studies including appropriate covariates have shown modestly elevated[4,33] or no difference[34] in risk for bedsharing infants amongst breastfeeding, non-smoking mothers.

Complicating overly simplistic, reductionist recommendations against bedsharing, is the recent finding that breastfeeding is an independently protective factor against SIDS. Venneman and colleagues[5] recently demonstrated that infants who are formula fed are twice as likely to die of SIDS than breastfed infants based on a case control study of 333 SIDS cases compared to 998 aged matched controls in Germany, from 1998-2001, consistent with previously published reports.[35] While no studies show that co-sleeping in the form of bedsharing, specifically, is imperative for breastfeeding enhancement, many studies have shown that in order to get more sleep and to ease caring for their infants the decision to breastfeed often leads mothers to adopt routine bedsharing for at least part of the night[36-40] even where they never intended to do so.[41,42] Indeed, nearly 50% of breastfeeding mothers in the United States and Great Britain adopt bedsharing for some part of the night,[38,43-45] and breastfeeding women are twice as likely to sleep with their babies in the first month relative to mothers electing to bottle-feed.[39]

Implications

Given the mutually-reinforcing, positive relationship between mother-infant bedsharing and breastfeeding behaviour (and breastfeeding's role in reducing risk of SIDS), safe bedsharing may

actually exert a protective effect against SIDS, although this remains speculative. What is clear is that breastfeeding alone reduces the risk of SIDS and leads many mothers to practice at least occasional bedsharing. The decision to bedshare, in turn, further reinforces and increases breastfeeding in both the short term (feeds per night and total feeding time) and long term (number of months breastfeeding is maintained).[1] In total, this positive bedsharing-breastfeeding connection renders reductionistic and unqualified recommendations against the practice of bedsharing among nonsmoking, non-drug-using mothers especially problematic.[1,29]

Lost in the often contentious debate regarding the safety of bedsharing is the notion that unlike prone, solitary infant sleep or bottle-feeding with formula or cow's milk, mothers sleeping next to their babies and breastfeeding is an evolved suite of behaviors tracing to humans' phylogenetic roots as both primates and mammals.[1] Bottle-feeding and prone infant sleep are both uniquely Western behavioral norms that derived from historically contingent constellations of cultural practices and belief systems.[46] These two behavioral patterns have never had anything to do with promoting species-appropriate mother-infant biology. Consequently, in light of seminal scientific findings and medical recommendations, it was somewhat easy for public health campaigns to reduce the incidence and practice of prone sleep and bottle-feeding.[18] On the contrary, bedsharing (or co-sleeping, more broadly) and breastfeeding (in combination) are embedded in the fundamental, co-regulatory biology and behavioral repertoires of the mother-infant human dyad. They will not be easily eradicated nor should the relationship between mother-infant sleep bedsharing and breastfeeding be summarily and trivially dismissed without thorough scientific evaluation.

Conclusion

It is clear that bedsharing can, indeed, be particularly dangerous and should be avoided when drugs and alcohol are used, when mothers are smokers (before and after pregnancy), when other children are in the bed, if breastfeeding is not involved (as it changes the position of the infant in relationship to the mother's body and the sensitivity of each to the other), or if soft mattresses or heavy blankets are used.[4,34,47-51] It is also clear that co-sleeping on a sofa, a couch or a recliner is highly dangerous and should always be avoided.[48,49,52] For families that cannot arrange a safe bedsharing, however, separate surface co-sleeping (a bassinet next to the bed, or the crib or an attached cradle, a form of roomsharing) provides similar benefits without any risk. At the same time, an informed, breastfeeding mother who makes the conscious decision to practice bedsharing, should be supported in her choice to bedshare and should be given all the safety

information that present research has to offer.

Breastfeeding mother-infant dyads are biologically designed (emotionally, socially and physiologically) to sleep next to each other, and the fact that their proximity settles infants, increases sleep for both, and enhances breastfeeding makes this arrangement hard for parents to steadfastly avoid. The fact that this behaviour provides these significant benefits to mothers and infants makes it problematic to recommend, without careful consideration, how or if bedsharing should never be supported, and whether it is prudent to deprive parents of safety information as how to minimize bedsharing risks. In several regards the process by which recommendations against any and all bedsharing are being formulated violates the rules of evidence-based medicine. According to Sackett,[53] public health recommendations that emerge following the rules of evidence-based medicine should be formulated by reference to multiple lines of research evidence that moves beyond the exclusive use of epidemiological findings. Moreover, to be maximally successful public health recommendations must respect and be conscious of the values, ideologies and practical possibilities of those for whom recommendations are intended.[29]

Substantial lines of evidence from studies of human biology and evolutionary anthropology explain the underlying reasons why breastfeeding mothers are inclined to sleep with their infants.[1] In terms of SIDS research and public health campaigns on bedsharing, incorporating an evolutionary, anthropological approach, calling on diverse lines of evidence, to explore the practice of bedsharing and its interaction with breastfeeding and the mother-infant relationship, shifts the starting point from “How to eliminate bedsharing?” to “Why do parents bedshare?” and “How can those practicing bedsharing do it safely?”

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Factors Associated with Sleep Problems in Early Childhood

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Introduction

Child sleep problems have gained the attention of the scientific community in the 70s. Large epidemiological studies carried out in Australia, the United States, Italy, Brazil and Israel have found that about 30% of preschool children suffer from sleep problems.[1-5] No wonder sleep problems in children are one of the most frequent reasons for clinical paediatric consultations today.[6] Persistent sleep problems can affect several aspects of child development (physical, cognitive, social),[7,8] and can have negative consequences on the early parent-child relationship.[9] On the contrary, these functions also influence sleep. So it is better to create a virtuous cycle of sleep than a vicious one! It is therefore imperative to identify the factors likely to foster or to hinder good sleep so that childhood sleep problems can be treated.

Subject

The International Classification of Sleep Disorders[10] has grouped 84 different types of sleep problems into four categories: 1) dyssomnias, 2) parasomnias, 3) sleep disorders associated with psychiatric disorders, and 4) sleep disorders associated with medical disorders. Although knowledge about sleep problems was first acquired with adults, more and more researchers are now trying to better understand the two main types of sleep problems among children: dyssomnias and parasomnias. The “dyssomnia” diagnosis of the DSM-IV[11] is rarely attributed to young children. Gaylor and colleagues[12] established a more appropriate nosology for young children by recording two types of precursors to insomnia (protodysomnias):

1. Night wakings (>2 wakings/night [1–2 years] and >1 waking/night [2 years or older]); and

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2. Sleep onset problems (>30 minutes to fall asleep [1–2 years] and >20 minutes to fall asleep [2 years or older]) according to three degrees of severity:
    a. normal disturbance (1 episode per week),
    b. perturbation (2–4 episodes per week), and
    c. disorder (5–7 episodes per week), for at least one month.

It goes without saying that night waking or sleep onset problems are associated with a poor consolidation as well as a shorter duration of night-time sleep. Sleep problems are influenced by both biological factors[13-15] and environmental factors.[16,17]

Recent Research Results

According to the model of human sleep regulation, sleep is regulated by two physiological processes. Process S, or the homeostatic process representing the propensity to sleep, increases during waking and decreases exponentially during sleep. The circadian process (Process C) is independent of sleep-wake periods and controls the propensity to waking, and follows a cycle of roughly 24 hours.[18] It is the interaction of the two processes that enables adults to have about 8 hours of consolidated sleep and to remain awake for periods of 16 consecutive hours. The conceptual model of sleep-wake regulation in children is still being developed.[18,19] Sleep problems in the first few months could be the result of a poor orchestration of the emergence of these two regulation processes. For example, a slower maturation of S and/or C could lead to the presence of nocturnal waking or sleep onset problems in infants. However, it is normal to observe variability in the age at which a sleep-wake rhythm is consolidated,[20] which suggests that factors other than maturation of the two processes play a role in sleep consolidation. Children learn how to sleep, just as in any other developmental sphere. Sadeh and Anders[16] propose a theoretical model of child sleep, with a perspective including several systems or environmental contexts.

Intrinsic context (factors associated with the child). Certain child-specific characteristics influence the establishment of consolidated sleep. Two longitudinal studies covering the period of birth to 2 years[21,22] as well as other studies[23-25] have shown an association between poor sleep consolidation and difficulties in the perinatal period such as a long delivery, a low birth score (e.g. muscle tone, reflex), a birthweight less than 2500 grams, a prematurity index (e.g. < 37 weeks), or a low APGAR score (e.g., asphyxia), while other studies have not found such a relationship.[26-29] Difficult temperament has been reported as associated with sleep problems.[25,30-32]

The sex of the child, however, appears to have little effect on the development of a consolidated sleep-wake pattern.[6,25,33-35] Separation anxiety could also be a significant factor to examine since children with a higher level of separation anxiety have more night wakings.[36]

Extrinsic context (factors associated with the parent). Parent characteristics also influence the establishment of consolidated sleep insofar as they are associated with certain bedtime habits or practices. Anxious, over-protective or depressive mothers, or mothers who experienced insecurity in their attachment history, are more likely to have children with sleep problems compared to other mothers.[37-40] For example, studies have shown that depression in mothers affects children's sleep consolidation.[4,25,27,29,41,42] This relationship may be attributable to a modification of maternal behaviours (overprotection) hindering the child's learning of independent sleep habits.[37] Maternal age and education, however, show little effect on sleep consolidation in children aged 0 to 4 years.[23,27,40] Mothers who work outside the home reported that their children's sleep is more fragmented than that of children whose mothers are at home.[43,44] However, family structure seems to have little effect on the development of a consolidated sleep-wake rhythm in young children.[21,25,44]

Interactive context (factors associated with the parent-child relationship). Sleep is deeply rooted in a social context where parents seem to play a crucial role.[41,45] An epidemiological study carried out among premature and full-term infants suggested that the immaturity of the nervous system could be a less important factor in the development of sleep problems than inadequate parental behaviours.[29] Studies have shown that inadequate parenting behaviours at bedtime such as lack of parental presence while the child falls asleep are the best predictors of sleeping problems in young children (1- and 2-year-olds).[4,40,43] Anders & Eiben[46] go so far as to state that parent-child interactions at bedtime may predict the emergence of protodyssomnias in young children.

In Western culture, sleeping alone is considered a keystone in the concept of "a good sleeper."[41] In fact, the majority of paediatric professionals recommend that children sleep by themselves.[47] Sleeping in the parental bed (co-sleeping) is associated with a greater prevalence of sleep problems, especially among children over 4 years of age.[6] The majority of children with sleep problems (70%) have slept in the parental bed following a night waking compared to 23% of children without sleep problems.[48] It has been recognized that ethnicity and socio-economic status influence the practice of co-sleeping. Unlike Western cultures, the association between bed sharing and sleep problems is not reported in non-Western cultures,[50] nor in low-income,

non-Caucasian communities.[27] This absence of association may be explained by the fact that, in these cases, bed sharing is not a reaction to a night waking but rather, a repeated nightly habit. When it is in reaction to a child's night waking, co-sleeping is clearly associated with sleep problems.[40,51,52]

Some studies have shown a positive correlation between breastfeeding and signalled night wakings,[28,33,44,53] while other studies have not found such a relationship.[21,22,27,45,54] It is important not to think, however, that night breastfeeding hinders sleep consolidation, when the virtues of breastfeeding are numerous for the mother and the infant, and for the establishment of the attachment relationship between them. An overly hasty response to demand is more likely the cause of this association rather than the means of feeding per say.[55,56] Finally, children who have a transitional object (e.g. blanket, stuffed animal or pacifier) and who use it to comfort themselves or self-soothe when trying to fall asleep without their mother's presence are less likely to signal their wakings.[37,41]

Treatment recommendations

In the majority of cases of sleep problems in early childhood, behavioural methods involving the parents should be explored before resorting to medication (see review of behavioural treatments [57]). It is important to investigate the child's physical condition (e.g., colic, epileptic seizures) to make sure the sleep problem is not of medical origin. Given that a reduced amount of sleep does not foster optimal child development, it is important to break the vicious cycle of sleep problems as soon as they appear, or even to prevent them before they appear. Investigating parental behaviours surrounding the sleep period is of utmost importance in a clinical evaluation of a child with sleep problems. For example, if a child falls asleep in his parent's arms before being placed in his bed for the night, one recommendation to parents could be to place the child awake in his bed so that he learns to fall asleep on his own at bedtime and can transfer this learning to falling back asleep after a night waking. As well, it is important to emphasize the introduction of a transitional object (e.g., stuffed animal or blanket), and a warm, comforting, calming routine that fosters the child's autonomy during the sleep onset phase. In this way, the child will develop reference points in time and space that will reduce his separation anxiety and facilitate his ability to fall back asleep on his own during the night.[25] The effectiveness of behavioural strategies in establishing sleep consolidation at night is not empirically demonstrated in children less than 6 months old.[58] It is recommended to analyze the interconnectivity between the associated factors mentioned above and to aim for realistic targets based on the child's age so that they can learn

to sleep through the night. Finally, it is recommended that the proposed treatment should foster the development of a secure attachment relationship between the parents and the child.

Key Research Questions

For all these factors hindering the development of consolidated sleep in young children, it is important to keep in mind that it can be difficult to distinguish cause from effect: for example, if a child is not sleeping 6 consecutive hours at 6 months, the parent may be more likely to get the child out of bed to soothe him after a night waking. Controlled studies are therefore needed to understand the specific elements that foster a child's learning to self-soothe and the establishment of good sleep in early childhood. We also do not know if the behavioural methods reported above would have higher rates of success during critical developmental periods. We all know that each child has his or her own temperament. Future research studies could focus on evaluating the physiological sensitivity thresholds of "poor sleepers" compared to "good sleepers" in order to provide assistance adapted to children with difficult temperaments. We also have more and more immigrants from various countries. Unfortunately, there are too few studies on the sleep of immigrants and their children to be able to offer viable avenues for intervention. Rona and his colleagues[59] showed that recent immigration increases the risk of sleep problems in young children. Another promising research avenue would be to study early childhood sleep problems with twins in a laboratory setting in order to find out the relative contribution of genetics and the environment.

Conclusions

The study of normal and pathological child sleep is of utmost importance for understanding child development. It has been shown that a higher proportion of children with chronically short or poor sleep prior to age 3-and-a-half demonstrate higher levels of hyperactivity, poorer performance on standardized cognitive tests and a higher risk of obesity at age 6 as compared to children who have slept about 10-11 hours per night in early childhood.[7,8] One of the messages to retain is that we should not wait too long to seek help, as the more a child's sleep problems persist, the greater the risk that they become chronic.

Implications for Policy and Services

Sleep problems in young children are one of the main motives for consultation in paediatrics. Early childhood health professionals should be knowledgeable about the ontogeny of sleep so

that they are able to distinguish between “normal” sleep disturbances, symptomatic of the normal sleep maturation process, and “real” early childhood sleep problems. In addition, they should be able to closely explore interactions between the baby and the parents so as to determine whether the problem comes from a physiological disorder or from a behavioural disorder. Parents of children who have been weaned from night feedings should have access to services that provide behavioural treatment methods offered by sleep specialists. During prenatal classes and in the newborn guide received at the hospital, parents should be made aware of the behaviours to establish in order to foster good sleep habits in their newborn, because sleep problems that become chronic in young children can have significant repercussions on their development and on family life. Finally, given the strong prevalence of sleep problems in early childhood, the transfer of knowledge by sleep specialists should be extended to people in all fields, from daycares to government authorities.

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Early Childhood Parasomnias

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Introduction

Sleep is one of the cornerstones of proper infant development. Recent studies show that insufficient sleep duration has extremely detrimental consequences on several developmental areas (for reviews, see references [1] and [2] and the article by Petit and Montplaisir in this Encyclopedia). When we think of childhood sleep problems, we immediately imagine nights frequently interrupted by multiple awakenings; but the child's sleep can also be disturbed by a variety of parasomnias.

Subject

The American Academy of Sleep Medicine defines parasomnias as undesirable physical events or experiences that occur during entry into sleep, within sleep, or during arousal from sleep.[3] Sleepwalking and sleep terrors are examples of the latter. In the third edition of the International Classification of Sleep Disorders, sleepwalking is defined as "complex behaviors that are usually initiated during partial arousals from slow-wave sleep".[3] Sleepwalking typically starts during the school years. Sleep terrors are an early childhood parasomnia which can start as early as 18 months of age. This parasomnia also consists of partial arousals from slow-wave sleep "often accompanied by a cry or piercing scream, accompanied by autonomic nervous system and behavioral manifestations of intense fear.... Sometimes there is prolonged inconsolability associated with a sleep terror."[3] The child's resistance to consolation, the sudden end of the episode and its occurrence at the beginning of the night distinguish sleep terrors from nightmares, which are a REM sleep parasomnia that fully awaken the dreamer. The next morning the child usually has no recollection of the sleepwalking or sleep terror episode, whereas the memory of a nightmare is generally retained. For most children, sleepwalking and sleep terrors episodes are benign and do not affect the sleep quality or quantity. However, in a

small proportion of cases, they are more disruptive and present a potential for injury.

Sleep talking (somniloquy) is defined as the condition of talking in one's sleep, with varying degrees of comprehensibility.[3] It can occur during periods of slow-wave sleep or REM sleep. Rhythmic movement disorders are characterized by standard repetitive motor behaviours that occur particularly (but not exclusively) when falling asleep and include rocking the entire body from one side to another, rolling the head or banging it, generally against the pillow or the head of the bed.[3] Bedwetting (enuresis) is involuntary voiding (urination) during sleep. A diagnosis of bedwetting is made after the age of 5 when a child still wets his bed during sleep at least twice a week.[3] Bruxism is characterized by grinding or clenching the teeth during sleep.[3] It is generally associated with brief arousals and may cause jaw pain and tooth wear.

Recent Research Results

Parasomnias are extremely common in early childhood. It is a rare child who does not display any. However, few prospective studies have been done on a large sample of preschool children. A longitudinal infant-development study of approximately 2000 children born in 1997-1998 in the province of Quebec (Canada) studied the prevalence as well as the appearance and disappearance of early childhood parasomnias. The study concluded that for the period from 2½ to 6 years of age, parasomnia prevalence was distributed as follows: sleep talking = 84.4%; bruxism = 45.6%; sleep terrors = 39.8%; sleepwalking = 14.5%; rhythmic movement disorders = 9.2%.[4] The prevalence of enuresis (bedwetting), which is only diagnosed after the age of 5, was 21.4% at 5 years and 16.1% at 6 years. For both bedwetting and sleepwalking a boy-girl gender difference of two to one was observed.[4] On the other hand, girls experienced more nightmares.[5] There did not appear to be a boy-girl difference in the prevalence of sleep terrors, sleep talking, bruxism or rhythmic movement disorders.

Some parasomnias appear early in infancy, while others manifest later.[4,6-9] Sleep terrors and rhythmic movement disorders are recognized as early childhood parasomnias, and few new cases are reported after the age of 4 years. Unlike these conditions, however, the prevalence of bruxism and sleepwalking is fairly low in early childhood and increases gradually with age. Interestingly, children who experience sleep terrors in early childhood are more likely to sleepwalk later in childhood than children who did not have sleep terrors.[10] One-third of the children who had sleep terrors will develop sleepwalking later in childhood.[10]

Genetic factors are involved in some parasomnias, such as sleepwalking, sleep terrors, restless legs syndrome, bruxism, bedwetting and nightmares.[11-13] To illustrate, children with one parent with a history of sleepwalking had 3 times the odds of becoming a sleepwalker, and children with both parents with a history had 7 times the odds of becoming a sleepwalker compared with children with no parental history of sleepwalking.[10] The same is true for restless legs syndrome: the prevalence in children is twice as high when there is at least one parent affected with the syndrome (13.0%) compared to children without a parental history (6.9%).[14] Moreover, some parasomnias have been observed to coexist. Persistent sleepwalking often coexists with sleep terrors or sleep talking in the same individual.[4,8] A genetic predisposition to partial arousal in slow-wave sleep (dissociated state) explains this relationship. Genetics produce a predisposition that external factors will accentuate. Factors that can precipitate sleep terrors or sleepwalking are fatigue, sleep deprivation, noisy sleep environment,[15,16] fever,[17] certain medications affecting the central nervous system[18] and other sleep disorders such as sleep apnea syndrome.[19] Other parasomnias, such as nightmares and bruxism, can be triggered by occasional stress. Generally, studies show that sociodemographic factors and family adversity have little or no effect or influence on the appearance of parasomnias.[4,7,8,20,21]

To summarize, the experience of an early childhood parasomnia is common and normal and often has a genetic component. In most cases, it is a benign and temporary phenomenon that requires no intervention other than to reassure the child and its parents. Most parasomnias tend to disappear in adolescence.[8,22] However, there are some more persistent or more severe parasomnias that can come to disturb the sleep not only of the child but also the family, entail injury or a high risk of injury (in the case of rhythmic movement disorder, sleepwalking, or intense sleep terrors) or produce psychological distress (especially in the case of enuresis and frequent nightmares).[23,24]

The treatment of problematic parasomnias differs according to the specific type of parasomnia. In most cases, non-pharmacological methods should be explored before medication is tried.

- With sleepwalking and sleep terrors, for example, the usual therapeutic approach, especially with young children, is scheduled awakenings.[23] This method consists of keeping a record of the onset of episodes for about 2-3 weeks, to establish the usual time that the episodes occur. Then the child is pre-emptively awakened every night 15 to 30 minutes before the usual time of the episode, for a period of about one month; the child must be kept fully awake for about 5 minutes and then allowed to go back to sleep.[25] The episodes

cease to recur after the scheduled awakenings stop.

- For severe bruxism an acrylic dental guard is usually recommended. A dental guard not only prevents tooth wear, it also really helps to reduce the number of episodes of muscular activity related to grinding of teeth.[26]
- Several interventions are available for bedwetting according to the specific cause of the problem: excessive production of urine, a bladder that is hyper-reactive or has a small capacity, or difficulty in awakening in response to sensations of a full bladder. For the latter, a bedwetting alarm with a sensor that is placed under the child's undergarment or pyjama is often used for children of six years and over. The device emits a sound or a vibration when the child starts to urinate and the child must get up and finish his micturition in the toilet. The child progressively learns to wake himself up when he feels his bladder is full. Pharmacological treatments, such as desmopressin and oxybutynin, are more often used to treat excessive urine production and hyper-reactive bladder respectively. These treatments can also be used in combination (for review, see reference[27]).
- An effective technique for controlling recurring or especially terrifying nightmares in young children consists of going back over or rehearsing the nightmare in the imagination or on paper to invent a different ending.[28]
- Young children who manifest a rhythmic movement disorder, such as head banging, head rolling or body rocking, must simply be watched to ensure they do not injure themselves by making changes in the sleep environment. For most children, this form of self-soothing does not entail risk of harm. However, it is possible through conditioning to replace this falling-asleep ritual with something more acceptable to the parents.

Some parasomnias can serve as indicators to the parents that the child is experiencing a problem or insecurity. Parasomnias that persist for years (such as sleepwalking, night terrors, bruxism) have been associated with separation anxiety or just plain anxiety.[4,8] It is important to note that the problem of frequent night wakings has been associated with separation anxiety.[4] Similarly, frequent nightmares are often a sign of anxiety or emotional distress, even sometimes of traumatism. Bedwetting has also been shown to be associated with delays in acquiring certain motor and language development milestones.[29] This association is probably the indicator of an underlying problem in central nervous system development and not a result of the parasomnia.

Key questions for further research

There are still very few studies on the potential consequences of early childhood parasomnias. Do these children have similar development difficulties in certain areas as children who chronically lack adequate sleep? It has been shown that children who regularly slept less than 9 hours a night had a lower cognitive performance, more hyperactive behaviour and a higher risk of overweight or obesity at school entry than children who regularly slept at least 10 hours a night.[2,30,31] Conditions that shorten sleep duration have a higher probability of affecting the child's development. Very little is known yet about the relationships between early childhood dyssomnias (frequent night wakings or sleep-onset difficulties) and parasomnias. Do children who sleep less well have more parasomnias?

There is also a glaring lack of controlled studies on the effectiveness of therapeutic interventions, pharmacological and non-pharmacological, for problematic parasomnias, especially for young children. Reports on effectiveness are often anecdotal.

Why are parasomnias more common in early childhood and why do they fade away later on? The physiopathology of most parasomnias has yet to be clarified. Better understanding of the neural mechanisms underlying these disorders might lead to better therapeutic approaches. From studies of twins, we do know that some parasomnias have a genetic basis. However, we have not yet been able to identify the specific genes that are in question in the appearance of various parasomnias.

Conclusions

It is now better understood that sound sleep is the basis of normal biological, social and emotional development; thus, it is vital that severe dyssomnias and parasomnias be treated as early as possible. On the other hand, the handful of studies that have been conducted on early childhood parasomnias show that they have, for the most part, few serious repercussions. Most do not seem to have a major impact on sleep duration.[4] This is worth mentioning because we now known that short sleep durations do have significant repercussions on several areas of early childhood development. However, when the parasomnia proves more serious or very disturbing, or when it entails risk of injury, intervention is desirable.

Implications for policies and services

To meet an ever more pressing need for the treatment of sleep disorders, intervention programs must be developed and offered at different levels and spread geographically so that they are easily accessible.

Parents need to receive detailed information on infant and child sleep, ideally in prenatal courses, to promote from the outset good sleep habits and age-appropriate sleep duration for the child, and to prepare them for the possibility of parasomnias.

Comprehensive training should be initiated for pediatricians on the characteristics of children's sleep (and its importance in development). As front-line healthcare providers, they need to be brought up to speed on behavioural as well as pharmacological approaches. They will then be in a better position to reassure the parents in cases where a parasomnia is not serious, or to offer treatment solutions (including referral to an appropriate specialist) where parasomnias are problematic or entail risk of injury.

Finally, given the prevalence of sleep disturbances and their effects, knowledge transfer should be extended to include government bodies and the general public. To this end, a bilingual Canadian public health campaign on sleep was launched in September 2019. The goal of this awareness campaign is to demystify sleep for the public, promote its importance, offer solutions to deal with sleep disorders and make healthy sleep a public health priority. The campaign website32 presents, in a simple and original way, scientifically valid knowledge. Finally, a group of specialists in early childhood sleep medicine should be set up to formulate public health policies based on empirical data.

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Development of the Sleep-Wake System and its Relationship to Children's Psychosocial Development

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Introduction

The maturation of the sleep-wake system and the consolidation of nocturnal sleep is a very prominent and rapid process in early childhood.[1,2] This process is influenced by the child's psychosocial context[1,3-14] and has a significant impact on the child's neurobehavioural and emotional functioning.[15-18] Furthermore, the child's sleep patterns or sleep disruptions have significant effects on the well-being of the parents.[5,7,19]

Subject

Sleep is affected by the child's psychosocial setting and has a significant impact on child development. The bi-directional relationships between sleep and psychosocial facets of the developing child constitute an important topic for child-care professionals. It is crucial for professionals to identify factors that could facilitate children's sleep, and to be sensitive to the impact poor or insufficient sleep can have on child development.

Problems

Sleep-wake patterns evolve rapidly during early development and are considered to be one of the major developmental or health concerns during this period. Surveys indicate that 20 to 30 percent of children are considered to be poor sleepers during the first three years of life.[3,14,20-24] High rates of poor sleep have also been documented in preschool and kindergarten children.[11,25] The high prevalence of sleep problems and their potential adverse effects on psychosocial development are the main research and clinical issues in early childhood.

Research Context

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A variety of research methods have been employed to study the relationship between sleep and psychosocial environment and development. Sleep in infants and young children has been studied using methods such as polysomnography,[26,27] time-lapse video,[1,28] actigraphy,[25,29,30] direct observations[31,32] and parental reports.[3,15,20] Most studies have been cross-sectional. Longitudinal studies in this field are extremely rare. Furthermore, most studies were correlative in nature and therefore preclude causal interpretations. Some experimental studies on the effects of sleep manipulation have been performed in older (school-age) children.

Key Research Questions

The extensive research in this field can be divided into three main research questions:

a. How do psychosocial factors affect the evolving sleep-wake patterns of the child?
b. What is the impact of poor or insufficient sleep on the child's psychosocial development? and
c. Which are the most effective psychosocial interventions for improving children's sleep?

Recent Research Results

A. *Psychosocial effects on children's sleep*

Parental characteristics such as personality, psychopathology, employment and education have been repeatedly associated with sleep in early childhood.[7-9,13,33-35] Parent-child bedtime interactions have been consistently shown to be linked to children's sleep. It has been demonstrated that parental presence and active involvement in soothing the child to sleep are associated with an increase in reported sleep problems.[1,3,36,37] Furthermore, most behavioural intervention methods for early childhood sleep problems are based on withdrawal of excessive parental involvement in the child's process of falling asleep or resuming sleep following a night-waking.[38-42] Another psychosocial factor that has received wide attention vis-à-vis sleep in young children is the issue of co-sleeping. Co-sleeping can represent a culturally or socially acceptable choice or a parental response to the child's sleep difficulties. In most studies, co-sleeping was associated with more frequent night-wakings and complaints about sleep,[43-46] although the association between co-sleeping and sleep problems appears to be dependent on socio-cultural factors. A fierce debate exists regarding the advantages and disadvantages of co-sleeping.[47-51] Among the more serious disadvantages of co-sleeping is the risk for very young babies to be suffocated or injured in the

parental bed.

Sleep is also associated with stress and trauma in early childhood.[52] For instance, short-term separation from the mother could result in sleep disruptions.[53,54] However, contrary to common belief, not all stressors lead to disrupted sleep and there are studies that suggest that sometimes escape to sleep is the preferred mode of bio-behavioural regulation of stress.[52]

B. *The impact of poor or insufficient sleep*

Years of research in animals and humans (mostly with adults or older children) have demonstrated that poor or insufficient sleep leads to compromised alertness, cognitive deficits and compromised physiological functioning. The research on this topic in young children is very limited and mostly of a correlative nature. Thus, poor sleep has been associated with difficult temperament.[55-59] However, other studies have failed to find such relationships.[60,61] A recent study of preschool children found that disrupted sleep patterns predicted less optimal adjustment in preschool.[15] Studies of school-age children have demonstrated links between poor or restricted sleep and compromised neurobehavioural functioning.[62-64] Furthermore, there is a growing body of evidence suggesting that sleep-related physiological phenomena (e.g., snoring and periodic leg movement syndrome), which are prevalent in children, are associated with compromised daytime functioning.[65-69]

The long-term effects of poor or insufficient sleep are not known. It has been suggested that sleep deprivation in early childhood during critical periods of brain maturation may lead to chronic adverse effects on psychosocial development. However, only limited data from longitudinal studies lend some support to this hypothesis.[11,18,70-73] For instance, severe sleep problems in infancy increased the likelihood of a diagnosis of ADHD at 5.5 years of age.[73]

C. *Effective interventions for sleep problems in early childhood*

Extensive research demonstrates the efficacy of behavioural approaches and parents' education in preventing and treating sleep problems in early childhood. Behavioural treatments have yielded very high success rates.[30,39,40,42,74] Prevention programs focused on educating expectant parents or parents of very young infants have shown a decrease in the occurrence of sleep problems.[75-77] Furthermore, a survey has shown that many parents utilize information available in the media to solve their children's sleep problems with high success rates.[78]

It is important to note that the success of these intervention programs is accompanied by positive effects on the family. Parents report an improved sense of competence and lower levels of stress following such interventions.[77,79,80] It is also important to emphasize that sleep problems in early childhood are very persistent if not treated.[8,14] Therefore, early detection and intervention programs for sleep problems in early childhood should become an integral part of any health services for children.

Conclusions

Research has demonstrated that even pediatricians who often serve as the primary source of help for parents with sleep-disturbed children have limited knowledge and education in this field.[81,82] Therefore, it is important to emphasize the need for extensive education of child-care professionals and parents in this area.

The following points highlight the main conclusions:

- Poor sleep can result from medical or behavioural-developmental factors.
- The prevalence of poor sleep and sleep-related disorders is very high in children.
- Poor sleep is associated with compromised neurobehavioural functioning and behaviour regulation in children.
- Children’s sleep disruptions have a significant negative impact on the family.
- There are very effective behavioural and medical interventions to improve sleep and prevent sleep disruptions.
- Sleep problems in early childhood are very persistent if not treated.
- Early detection and interventions for sleep problems in children can facilitate child development, reduce family stress and improve parent-child relationships.

Implications

Child-care professionals should obtain training in screening sleep problems in young children. Screening for sleep problems could be performed by obtaining specific information on the child’s sleep patterns and level of daytime fatigue. This information could be collected by interviewing the parents or by using specific screening questionnaires. Health services and education systems should have referral resources with experts trained in diagnosing and treating pediatric sleep

problems. It is important that such resources be easily accessible to parents so that available effective prevention and early intervention methods can be implemented as early as possible.

It is important to consider educating young children about the importance of sleep. There is a growing health concern that children in our era are getting less sleep than they need and that many of them are chronically sleep-deprived. Early education about the importance of sleep may encourage children not to sacrifice sleep for other attractions.

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Consequences of Short Sleep Duration or Poor Sleep in Young Children

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Introduction

Sleep is a major factor in a child's overall development. Yet the total duration of sleep among children (and even among very young children) is decreasing from one decade to the next.[1] A growing number of studies are showing that poor sleep, or sleep of insufficient duration, has deleterious consequences in all areas of child development.

Subject

The expressions "to sleep like a baby" or "to sleep like a child" are synonymous with having an excellent sleep. Yet epidemiological studies carried out in several countries around the world tell us that a significant percentage of young children have sleep problems. In fact, between one quarter and one third of children aged 1 to 6 years are reported to have sleep problems.[2-6] This prevalence is lower when estimated by pediatricians.[7] The two types of dyssomnias most common in young children are frequent night wakings and sleep onset problems (either bedtime resistance or difficulty falling asleep).

At 6 months of age, infants have the physiological maturity to sleep at least six consecutive hours during the night. This is what parents call "sleeping through the night." In fact, studies from the Quebec Longitudinal Study of Child Development (QLSCD) show that about 75% of children in Quebec sleep through the night at 5 months.[8] If this "learning" is delayed for too long and the child is still not sleeping though the night at 18 months, the chances of the child becoming a good sleeper without any intervention decrease significantly.[8] It is normal for children to wake up spontaneously during the night. A study using videosomnography[9] showed that children between ages 1 and 3 years wake up about three times a night. The difference between a "good sleeper" and a "poor sleeper" is the child's ability or inability to fall back asleep on his own after

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a nocturnal awakening. The good sleeper will self-soothe and fall back asleep quickly. The “poor sleeper” will signal his awakenings to his parents by crying (or by calling them), creating a high level of physiological activation and also prolonging the waking time through interaction with the parent. A study carried out using the QLSCD data[8] showed that 2-and-a-half-year-olds who had not learned to sleep through the night slept, on average, at least 1 hour 22 minutes less per night than good sleepers of the same age. This loss of sleep was not compensated by more sleep time during the day (naps); both groups slept about 2 hours during the day. Therefore, young children who have not learned to sleep through the night often have a chronic lack of sleep. The learning of independent sleep habits begins at bedtime. Children who learn to fall asleep on their own at bedtime know they will be able to fall back asleep on their own after a nocturnal waking.

Dyssomnia criteria adapted to young children have been established to guide clinicians.[10] For frequent night wakings, the occurrence of two or more signalled wakings per night (in children age 12 to 23 months) or one or more signalled awakenings per night (in children age 2 or over) constitutes a sleep disorder if it has been occurring every night (or almost every night) for more than one month and if the time spent awake totals at least 20 minutes. Children are considered to have a sleep onset problem if it takes them more than 30 minutes to fall asleep at age 12 to 24 months or more than 20 minutes to fall asleep at age 2 years or over. As well, a child is considered to have a sleep onset problem if a parent must stay with him until he falls asleep or if the child demands the presence of a parent more than two times an evening at the age of 12 to 23 months or more than once an evening at the age of 2 years or over.

Recent Research Results

Does fragmented sleep or sleep of insufficient duration really have measurable harmful consequences in children? The results of several recent studies show that insufficient sleep has a major impact in several areas of child development.

Sleep and behaviour

Lack of sleep manifests itself differently in preschool children than in adults. While adults display apathy and yawning, young children will display hyperactivity, irritability and a lower tolerance threshold. In children, short sleep duration and sleep problems are associated with behaviour problems.[11,12] Data from the QLSCD[13] showed that children who slept less than 9 hours before age 3 (even if the amount of sleep increased thereafter) were more likely to have a high score on the

hyperactivity-impulsivity scale at 6 years than children who had slept at least 10 hours throughout their early childhood. This longitudinal study, which examined a myriad of variables linked to child development, allowed for the control of factors that could have influenced this relationship. Another longitudinal and population-based study found that short sleep duration (≤10 hours) and frequent nocturnal awakenings (≥3 times) in 18-month-old children predicted concurrent and later behavioural problems at 5 years.[14]

Sleep and socioemotional development

Emotional regulation (or control) and emotional information processing are cornerstones of social competence. Yet, studies have shown that insufficient sleep affects emotional control and emotional information processing in children and adolescents.[14-17] Moreover, short sleep duration and nocturnal awakenings in toddlers were associated with social-emotional problems in a dose-response manner.[18] When compared to children with consolidated sleep, those with fragmented sleep displayed higher awakening cortisol levels and this correlated with higher ratings of negative emotionality.[16] We also noted more aggressive behaviours in 6-year-old children with sleep-onset difficulties that had persisted up to that age.[19]

Sleep and cognitive development

Several studies have shown that sleep deprivation affects the cognitive performances of adults. This relationship is less known in children but it is nonetheless very real and begins very early in their development.[20-22] It has been observed, for example, that the time slept at 12 to 18 months is associated with several executive function skills, such as working memory, impulse control and mental flexibility.[20] A study derived from the QLSCD[13] also shows that even short-term sleep deprivation at a young age (before 3 years) leads to deficits in verbal cognitive abilities (Peabody Picture Vocabulary Test) and non-verbal cognitive abilities (Wechsler Block Design subtest) later on (at ages 5 and 6). This effect of deprivation was still present after controlling for several potentially confounding variables such as birth weight, breastfeeding, parental age and education level, parental immigrant status, socioeconomic level, etc. Toddlers sleeping within the recommended 11-14 hr had more favorable cognitive development at age 6 compared with toddlers sleeping less than 11 hours or more than 14 hours.[23]

Sleep and language development

Language development has a cognitive basis and, consequently, is altered by sleep deprivation. The sleep-wake circadian rhythm at 7 months is predictive of language abilities at age 3.[21] A recent study carried out in twins[24] showed that poor sleep consolidation (calculated by the ratio of daytime to night time sleep) at 6 and 18 months was associated with poorer language skills 3.5 years later. This study also revealed that at 6 months, sleep consolidation is mostly determined by genetic factors, while at 18 months it is mostly determined by environmental factors. For example, it was shown that parental behaviours surrounding the sleep period of the young child were environmental factors that affected the child's sleep.[8] The results of this study[24] also suggest that sleep continues to play a role in language development throughout early childhood.

It seems that adequate sleep helps structure the foundations of language beginning at 6-7 months of age and fosters its development throughout early childhood. This suggests that the higher faculties, such as cognitive abilities and language, are dependent on proper development of physiological processes such as sleep organization, very early in the child's life.

Sleep and healthy weight

As afore-mentioned, children are sleeping less and less from one generation to the next, mainly because of later bedtimes.[1] Parallel to this, the incidence of childhood overweight and obesity is growing exponentially nearly everywhere in the world, especially in industrialized countries. Are these two phenomena related? Independent of several factors potentially associated with overweight, data from the QLSCD showed that for children who had generally slept 9 hours or less per night throughout early childhood (from 2.5 to 6 years), the risk of overweight or obesity at age 6 was four times greater than for children who had slept 11 hours per night during this same period.[25] This association was also shown in adults (see reference [26] for a review) and in younger children.[27] In fact, short sleep duration from 6 months to 2 years is a risk factor for overweight even at 3 years of age.[27] The mechanism underlying this relationship is becoming better understood. Even partial sleep deprivation leads to a deficit in glucose metabolism and changes the circulating levels of hormones such as ghrelin and leptin.[26] It has been shown that partial sleep deprivation carried out in a laboratory (4 hours of sleep) for two consecutive nights was enough to increase the secretion of ghrelin (appetite hormone) and to decrease that of leptin (satiety hormone).[28] This had the effect of increasing not only overall appetite, but especially appetite for carbohydrates. Moreover, it was shown that a trajectory of short sleep duration during early childhood was associated with less favourable dietary intakes at 6 years (e.g., lower consumption of fruits and vegetables and higher consumption of soft drinks).[29] In addition, boys

who had had shorter sleep durations in early childhood were also more likely, at 6 years of age, to eat at irregular hours, or to eat too much or too fast, than boys with longer sleep duration patterns.[29]

Childhood obesity is now a major public health concern, owing to its high prevalence and its association with many health problems such as diabetes, hypertension, cardiovascular diseases, chronic inflammation, bone deformations, orthopedic complications, hepatic sclerosis, precocious puberty, polycystic ovaries in girls and hypogonadism in boys, asthma, sleep apnea, exercise intolerance, not to mention low self-esteem and depression.[30] Given all these potential consequences of childhood obesity and the fact that, in 60 to 85% of cases, it tracks into adulthood,[31] it is imperative to prevent obesity in children. Ensuring that children get an adequate amount of sleep is one easy step in this direction. Notably, the relationship between increased sleep duration and decreased odds of being overweight or obese is particularly strong for children of low early socioeconomic status.[32] In addition to favouring a healthy weight, sufficient sleep would benefit several other areas of development.

Key Research Questions

The existence of a critical period at an early age for the beneficial effects of sleep requires further exploration. Sleep in the first three years of life is characterized by a very high percentage of REM sleep which occupies 50% of the sleep time of newborns and about 30% of sleep time from 6 months to 3 years, compared to rates of 20 to 25% after age 5. The percentage of *REM sleep* of a species is a function of its neonatal maturity (for a review, see reference [33]), which suggests that REM sleep plays a role in brain and body development. We know that human beings are very immature at birth compared to other animal species. Could this be the reason for this critical period?

By what physiological mechanisms does sleep influence development? What are the most important key elements: the total duration of sleep, the duration of nocturnal sleep only, consolidation (that is, non-fragmentation) of sleep, the duration of certain sleep phases (slow-wave sleep, REM sleep)? Are these elements different for different aspects of development? We now know, for example, that naps are essential to the development of various abilities in early childhood because the nighttime sleep is too far removed from the learning moments at this age to allow their transfer into memory; without naps, the new information is lost.

It would also be important to study dyssomnias caused by chronic health problems or slower biological maturation (linked to the genetic component found at 6 months) and to verify whether these lead to different consequences than those resulting from poor sleep habits (commonly called behavioural insomnia).

Conclusions

It now appears evident that sleep, of good quality and of sufficient duration, is a cornerstone of normal physical, cognitive, language and emotional development. The National Sleep Foundation's updated recommendations[34] are that newborns (0-3 months) sleep 14-17 hours per 24 hrs, infants (4-11 months) sleep 12-15 hours per 24 hrs, toddlers (1-2 years) sleep 11 to 14 hours per 24 hrs, and preschoolers (3-5 years) sleep 10-13 hours per 24 hrs . The data from the QLSCD tell us that a sufficient amount of sleep for children age 6 months to 3 years is crucial for an optimal development. Otherwise, certain unfavourable and irreversible effects on development occur even if the sleep duration later becomes normal. This suggests the existence of a critical maturation period of the nervous system during which sleep plays a key role. It is therefore vital to treat severe dyssomnias as early as possible to foster optimal development in children.

Implications for Policy and Services

It is of utmost importance that the entire population be informed about the crucial role of sleep in young children's development so that there is rapid intervention when a problem is detected. To foster sleep health in general, a bilingual Canadian public health campaign on sleep was launched in September 2019. The goal of this awareness campaign is to demystify sleep for the public, promote its importance, offer solutions to deal with sleep disorders and make healthy sleep a public health priority. The campaign website[35] presents, in a simple and original way, scientifically valid knowledge.

Early detection of sleep problems requires setting up monitoring structures adapted to pediatric populations. It would therefore be highly desirable for people working in pediatric and family services to receive extensive training on the prevention, detection and treatment of dyssomnias in young children. In fact, a new form of therapy has come into existence over the last 2 decades. Online evaluation and intervention programs are being established, given the paucity of easily accessible specialized services in pediatric sleep medicine. In Canada, an online intervention

program called “Better Nights/Better Days: A program for parents with children who have sleeping problems”[36] has been developed through the collaboration of researchers and clinicians from various provinces. It has even been adapted to treat insomnia in children with obstructive sleep apneas and in children with neurodevelopmental disorders. There is still much to be done, however, to respond to this urgent need.

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Tips for Parents: Prevention and Management of Sleep Problems

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Introduction

In the chapter on sleeping behaviour in the Encyclopedia on Early Childhood Development, the range of sleep problems and their consequences are thoroughly outlined. In this paper, tips for parents will be reviewed. The emphasis will be on the evidence that providing behavioural recommendations or "tips" is effective for the prevention and treatment of behaviourally-based childhood insomnia in young children. The paper will cover practical "tips" for those unfamiliar with this topic, as well as the evidence for the prevention and treatment of pediatric sleep disorders through parent education.

Subject

Pediatric sleep problems are very common. Approximately 25% of children experience some type of sleep problem.[1] These problems range from those that can be alleviated with behavioural strategies such as difficulty settling at bedtime or frequent night waking to sleep disorders based on structural pathology such as obstructive sleep apnea that require surgical or other intervention. The former problems, amenable to behaviourally-based strategies will be addressed.

Tips for parents on the prevention and management of sleep problems can be provided in many forms. Advice can be provided by primary health care providers either verbally or in writing (brochures, pamphlets, etc.). Parents can also find tips and strategies on their own through sources such as self-help books, magazines, other media or Internet sites. When information is provided in a healthcare setting, it can be either preventative (e.g., at well baby visits) or after evaluating and diagnosing pediatric sleep problems.

The resources available to healthcare providers and directly to parents may be based on personal opinion or research evidence. Advice available in print or on the Internet, may have a wide range

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(or lack) of scientific evidence. Examples of good Internet resources on pediatric sleep include:

- Canadian Sleep Society provides brochures on sleep in children and other topics (www.css.to)
- Canadian Pediatric Society has parent handouts on pediatric topics including sleep (www.caringforkids.cps.ca)
- American Academy of Pediatrics has a parenting corner including advice on sleep (www.aap.org)
- American Academy of Sleep Medicine has an educational website (www.sleepeducation.com)
- National Sleep Foundation has information for the public (www.sleepfoundation.org)

For the reader who is not familiar with this topic, some examples of the type of "tips" and the method which this information can be written for parents to prevent and manage behaviourally-based insomnia in young children are outlined, followed by the problems, research and key research questions. The tips are based on a combination of both research findings from sleep hygiene studies in adult and pediatric populations, as well as published "pediatric expert opinion" from leaders in the area of pediatric sleep medicine.

Tip #1: How much sleep does a child need? Parents need to be educated about the developmental changes and individual variation in sleep needs. Children's sleep requirements change with age. Their daytime sleep decreases until the age of 5 years when most children stop daytime napping. Total sleep requirements in a 24 hour period also decreases with age. It is important to remember that children vary at every age in the amount of sleep they require to be well rested. The most important question for a family is not how much sleep their child is obtaining but if they are well rested during the day. Expected normal hours of sleep vary by age (this information is available in several references).[1,2]

Tip #2: A child's bedroom; providing a safe, secure, quiet sleep environment. Where a child sleeps can vary from one family to the next. A child may sleep in his own room or have a shared bedroom with a sibling. The important "tip" about the child's bedroom is that regardless of where he/she sleeps, each child should have a consistent, comfortable sleep space. The bedroom should be comfortable (not too hot and not too cold), quiet and dark. If the room is too dark for a child, a night light can be used but should be kept on throughout the night. If there is light

coming into the room from street lights or sunlight in the morning, an easy “tip” is to use heavy curtains. “Exposure to morning bright light, as well as avoidance of light in the evening, can help set the circadian clock for the day and increase sleepiness at bedtime.” [1] Parents should also consider other noises in the house at night which may be disrupting sleep. Noises may be from other siblings or from televisions, computers, videogames or music and should be minimized.

Tip #3: Establishing a bedtime routine. It is important to provide a child with a short, consistent bedtime routine that changes with the developmental needs of a child over time. A good routine will help a child to relax and transition to sleep. The routine should include activities which are calming and ideally carried out in the child’s bedroom. The routine should be started 15-30 minutes before the set bedtime. A younger child would have a shorter routine. It is important that parents/partners and caregivers follow the same routine. The more regular, consistent and predictable the routine is, the easier it will become for a child to settle to sleep at bedtime. One of the basic principles of sleep hygiene for children is to “Have a set bedtime and bedtime routine.”[3]

Tip #4: Keeping a regular schedule. As much as possible parents should try to have their child’s bedtime and wake time consistent 7 days per week. Bedtime will become later with age but it should always be set to allow enough sleep each night. Even if a child goes to sleep late at times, keep the same wake time and not more than one hour later than the normal wake time. Although it may seem better to let a child “sleep in” and catch up on sleep, the more regular the wake time, the better sleep will be.

For a younger child who has a daytime nap, keep the nap times on a regular schedule. When possible, the nap should be in the child’s bedroom. Once a child is napping once per day, the nap will generally start as soon as lunchtime is finished. Irrespective of the start time, wake the child no later than 4 pm from afternoon naps so that it will be easier to fall asleep at bedtime.

Additional key points for setting a routine for children are the time meals are served and exposure to sunlight and darkness. Children should eat breakfast each morning at around the same time, both on weekdays and weekend days. You should not give a child heavy meals or large snacks late at night. However, a light snack with carbohydrates (for example, cheese and crackers, or fruit) may help a child fall asleep more easily. The impact of meals on sleep in children has not been studied, and this tip is extrapolated from adult studies.[4]

Tip #5: Teaching a child to fall asleep alone. A young infant should be placed in bed drowsy but awake.[3] Instead of nursing or feeding the infant until he is asleep, after the first few months of life, parents should stop feeding their baby when he is drowsy but not hungry. When a baby is older (over 6 months) he can be placed in bed awake and parents can gradually remove themselves from the bedside, allowing the infant to learn to fall asleep alone. When an infant wakes at night, parents can help her learn the difference between day and nighttime by decreasing the stimulation and ambient light in the evening and increasing it in the morning. A healthy thriving 6–month-old infant can be weaned off of nighttime feedings. In a study of the associations between sleep hygiene and sleep patterns in children ages newborn to 10 years, using a national USA poll, across all ages, "a late bedtime and having a parent present when the child falls asleep had the strongest negative association with reported sleep patterns".[5]

Tip #6: Encouraging daytime activities that help a child sleep at night. Children's sleep can be positively or adversely affected by daytime activities. For example, exercise can be positive or negative depending on the timing in relation to bedtime. Exercise during the day helps your child sleep better at night. Adults who exercise report that it is easier to fall asleep at night and have been shown to have deeper, more consolidated sleep. If a child does not get regular exercise at school, it should be scheduled outside of school hours. The ideal time for exercise is early in the day, as stimulating exercise, close to bedtime may cause sleep onset insomnia. It is best if very stimulating exercise or other activities ends two to three hours prior to bedtime. One study in adults with insomnia delivered an Internet-based behavioral intervention which included amongst other recommendations, a recommendation to increase daily exercise. The participants, as compared to the control group who received the intervention, significantly improved their sleep.[6]

Caffeine is a stimulant which can cause an "alerting effect" and keep a child (and adult) awake at night. If a child has caffeinated foods or beverages (e.g. chocolate, coffee, tea, coca-cola products) in the afternoon or evening, the effect of caffeine stays in the body for 3 to 5 hours and up to 12 hours. Some children sleep best by taking these products completely out of their diet. Other children can have caffeine in their diet but will sleep better if it is avoided for several hours before bedtime. Caffeine intake has been shown to interfere negatively with sleep in adults.[7] In one study of caffeine use in children in Grades 7 to 9, it was also shown to negatively impact sleep.[8]

Problems

It is important for healthcare providers to teach parents to encourage good sleep habits in their children from an early stage to avoid the development of poor sleep habits later on.[9] However, the timing of the delivery of this information must be considered. Parents must be educated about the development of the circadian rhythm in newborns which precludes any rigorous preventative sleep training until the infant is at least 4-6 months of age. Caregivers should be made aware, not just of "tips" to prevent and manage sleep problems but also "tips" for safe sleeping in the newborn period. These tips will not be covered in this section but are available on the websites of the American Pediatric Society[a] and the Canadian Pediatric Society.[b]

Healthcare providers must also be aware of the evaluation and diagnosis of sleep problems in children in order to provide behavioural strategies or "tips" only where appropriate. In some sleep disorders of childhood, (e.g., obstructive sleep apnea), although parents may also benefit from learning about behaviourally-based sleep strategies, this will only be one part of the treatment with the more significant part being evaluation and management of the upper airway obstruction.

One of the problems identified in the literature is the lack of knowledge of some healthcare providers about pediatric sleep disorders. Although this knowledge gap is not limited to pediatricians, there has been a previous publication regarding the ability of pediatricians in the US to provide sleep information to parents. In this study performed in 2001, a survey of over 600 pediatricians in the US demonstrated that there were significant gaps between "the basic knowledge about pediatric sleep and sleep disorders among pediatricians and in the translation of that knowledge into clinical practice."[10] In a recent review of pediatric sleep disorders, Stores G. also comments that "health education for parents and prospective parents often pays little regard to sleep."[11] Education about children's sleep should be part of the educational curriculum of healthcare providers during medical, nursing, psychology, social work, teaching and other relevant programs.

Research Context

The examples of "tips for parents" as provided in this paper are examples of information that can be provided to parents and caregivers to prevent and treat behaviourally-based insomnia. As described by Mindell and colleagues in the evidence-based review *Behavioral treatment of*

bedtime problems and night wakings in infants and young children , previous studies have demonstrated that behaviourally-based sleep management strategies when compared to pharmacologic treatment are “often more effective, and may be more acceptable to both parents and practicioners.”[12] However, there are many questions which remain unanswered about providing these “tips” or behaviourally-based interventions to parents and caregivers.

Key Research Questions

There are multiple sources of “sleep information for parents” in books, pamphlets, brochures, on the Internet, media presentations, parenting magazines etc. Research evidence documents that appropriate, timely parent education about sleep is important and effective. In the review previously mentioned by Mindell and colleagues, [12] 52 research studies were analyzed, which included five studies of more than 1,000 parents on Parent Education/Prevention Strategies. In these five studies, the aim was to evaluate whether parents benefited from receiving sleep education and prevention strategies during the prenatal period or the first 6 months of infancy. These studies are directly related to the first part of the theme of this paper; whether providing “tips” to parents can prevent sleep problems. The evidence provided by these five studies documents strong support for parent education/prevention as a strategy to prevent sleep problems in infants.[12]

Although there is evidence that providing education to parents about pediatric sleep is beneficial, there are many unanswered questions including but not limited to the following.

- What is the best method to deliver this information? Are individual sessions with parents better than delivering this information in a group?
- Who should deliver the information? Is it equally effective for a child psychologist, family practitioner, pediatrician, nurse, or other health care provider to provide information about sleep?
- What is the best format to deliver information to families about sleep? Is written information (a pamphlet, brochure or self-help book) more efficacious than delivering the information in person? What is the role of online learning modules?
- What is the role of providing this behavioural advice in addition to other treatment methods in a child with more than one sleep problem? Wiggs, in a review of the behavioural aspects of children’s sleep, points out that multiple sleep disorders may coexist in one child and it may be necessary to use multiple forms of treatment to address individual sleep disorders.[10]

- What is the role of providing “tips” to parents of children with special needs? There are many unanswered research questions about the delivery of this type of education to parents of children with special needs who may have behaviourally-based insomnia as well as other sleep disorders.

Recent Research Results

It is increasingly recognized from research studies that “behavioural intervention can be used successfully to manage childhood sleepiness.”[9] The previously cited recent review by members of a taskforce of the American Academy of Sleep Medicine (2006) outlined the evidence for the behavioural treatment of bedtime problems and night waking in infants and young children.[11] Strategies can be provided to parents both in a preventative manner, to encourage good sleep habits as well as for the treatment of behaviourally-based insomnia.[13-18]

There is also evidence that healthcare providers can help parents to improve sleep in children with autism and other developmental disabilities. In a recent publication by Reed and colleagues, education was provided to groups of parents of children with autism in a workshop format which lead to improvements in both subjective and objective measures of sleep.[19]

Conclusions

It is important and well recognized that healthcare providers should be aware of the resources available to educate families about sleep and sleep disorders in children. Health care providers who are aware of the significance of sleep problems in children will be able to provide these “tips” to prevent sleep problems as well as to evaluate when sleep problems occur and recognize when behaviourally-based “tips” will improve children’s sleep. Recognizing behaviourally-based insomnia in children and providing non-pharmacologic behaviour strategies are important skills. Further research as to how to provide this information to health care providers will add to the knowledge of these treatment strategies.

Implications for Policies and Services

The frequency of children’s sleep problems and the impact these problems have on daytime quality of life of both the child and the family is well recognized. The provision of simple “tips” such as the examples provided in this chapter to both prevent problems in sleep from occurring as well as to treat behaviourally-based insomnia in children can be provided directly to parents

or through their healthcare provider. Further research will be helpful to enhance the educational opportunities and curriculum of healthcare providers and determine the optimum method of delivering this information to families.

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Notes

[a] See also the American Pediatric Society / Society for Pediatric Research Website. Available at: http://www.aps-spr.org. Accessed February 27, 2013.

[b] See also the Canadian Pediatric Society Website. Available at: http://www.cps.ca/en/. Accessed February 27, 2013.

Services and Programs for Managing Infant/Child Sleeplessness

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Introduction

Sleep is an infant's main activity during early development; a child entering school has typically spent more time sleeping than engaging in any other activity. As this is such a primary aspect of early development, it is important to focus on any abnormalities with this activity and their consequences for the child, especially since sleep disorders in young children appear to be so prevalent. About 25 to 50% of six-to-12-month-olds have difficulty settling to sleep or wake in the night, and these figures do not decline dramatically as the child grows: by the age of three, 25% to 30% have sleep problems, with similar percentages reported for the three-to-five-year-old age group.[1] Rates are considerably higher for children with "special needs" (e.g., those with pediatric, psychiatric or neurological disorders or intellectual impairment).[2]

The term "sleep disorders" encompasses a number of diverse conditions; more than 80 different sleep disorders are listed in the International Classification of Sleep Disorders.[3] Although many types of sleep disorders can occur in the zero-to-five age group, sleeplessness appears to be the most common and intractable problem that clinicians and parents are faced with, and this is also the type of childhood sleep problem to which most of the research literature is devoted. Therefore, this paper will focus on services and programs for sleeplessness. France and Blampied[4] provide useful models of the various processes involved in the development of infant sleeplessness.

Subject

Increasingly, with advances in medicine, the efficacy of any intervention is not judged solely on the basis of the impact that it has upon the condition being treated. Other variables, such as acceptability, compliance and effects on other areas of functioning/daily life, have become salient aspects affecting treatment choices, and so it is with treatments for sleeplessness. It is important to establish positive associations between an intervention and a child's social or emotional

development, not only for children's welfare but also to convince parents, professionals and service/research funders that treatment for such common problems is desirable, despite possibly being costly (in terms of emotion, time or money), especially if it is likely to be of long-term benefit and perhaps reduce the likelihood of some other difficulties developing.

Problems

There are a variety of ways in which successful interventions for sleeplessness might be expected to affect a child's social and emotional development. Firstly, by reversing the direct effects of sleep loss that have been shown in other contexts to have a serious and widespread effect on children's cognitive function, educational performance and behaviour.[5,6]

Secondly, of course a child's sleep problem rarely only affects the child him/herself, but more often the whole family, who have the stress of living with the child's sleep problem while their own sleep is also compromised. Mothers of children with sleep problems are reported as having poorer well-being, and indeed family functioning can be so compromised that associations with marital problems and even possibly child physical abuse have been noted.[7,8]

Thirdly, some of the interventions involve teaching the parents techniques and skills that they could apply when dealing with their child in other contexts, so any subsequent improvements in the child may arise because there has been a change in more general parenting skills.

Prospective longitudinal studies on large cohorts of children are needed to determine the causal relationship between sleep disorders and pathological child development. It is also difficult to unravel the mechanism of action in any successful intervention's positive impact upon the child and family functioning, partly because reported studies have mainly relied upon subjective parent reports (of both the child's sleep and any associated social and emotional factors) and also because reports of these variables have typically been made by the same person (the mother), allowing for systematic bias.

Research Context

Because sleep disorders is such a broad term and sleep medicine cuts across many medical and associated specialties, the nature of appropriate treatment varies widely.[9] For problems of sleeplessness in young children, pharmacological interventions (sedation, usually in the form of sedative antihistamines or chloral hydrate; melatonin is a relatively novel approach, but its usage

and efficacy remain questionable)[10] have been the most frequently used treatment.[11] Behavioural therapy (i.e. teaching the parents various strategies they can use to help their child learn appropriate sleep behaviour and un-learn inappropriate behaviour) is now more favoured. Reviews suggest that both forms of intervention show short-term efficacy but that the effects of behavioural approaches are more durable.[12-14]

Behavioural techniques have been used preventively, with results suggesting that more consolidated sleep can be "taught" to occur,[15-18] although studies with long-term follow-up are required to establish true preventive efficacy.

It is important to establish the impact of interventions, not least because the techniques themselves are not without criticism; behavioural techniques that involve ignoring have been conjectured to be potentially harmful to the child,[19] although no empirical support has been found for this view.[20-22] Similarly, sedation raises concerns such as side effects, tolerance and re-bound sleeplessness upon discontinuation.[11] Parental resistance to usage can be an issue common to both types of approach.

Key Research Questions

When analyzing the efficacy of interventions for sleep disorders in young children, researchers have explored effects on the child's sleep primarily using parent reports (diary records or questionnaires) as the main outcome, although there have been limited studies using objective measurements, and more are needed. The child's functioning (typically, in pre-school children, assessing behaviour) and family functioning have both primarily been assessed through the use of questionnaires completed by mothers. Again, objective, independent measures are needed, as are long-term follow-up data.

With the efficacy of behavioural interventions being accepted, attention has more recently turned to aspects of delivering such treatment (e.g. the amount and nature of therapist time needed, the use of written information).[23,24]

Recent Research Results

Successful behavioural therapy with children's sleeplessness has repeatedly been associated with reductions in child problem behaviour[8,22,25] and improvements in parental mental health or marital satisfaction.[8,26-28] Even used preventively, significant effects on parenting stress and sense

of efficacy have been documented.[18] More positive interactions with the child have been reported by parents[8] and independently observed in some specific settings (e.g. during feeding).[29] However, a minority of studies have failed to find any associated changes[30] or have documented positive changes in both control and treatment groups,[31] suggesting that further work is needed to fully understand the complex relationship between child sleep problems, their treatment and the functioning of family members. It may be that there are as yet undiscovered protective or pre-disposing factors that affect outcome or treatment response.

Conclusions

Several studies have found links between successful behavioural treatment (and to a lesser extent, prevention) of the child's sleep problem and improvements in child and family functioning in ways likely to have a considerable impact upon the child's social and emotional interactions. Other types of sleep disorders (e.g. florid parasomnias, sleep terrors, excessive daytime sleepiness) have not been the subject of the current paper but are also likely to affect child development (e.g. limiting the child's activities due to embarrassment, inducing anxiety, reducing opportunity for experiences, etc.). Goodlin-Jones and Anders[32] highlight the need for research to investigate whether there are "critical times" that may particularly predispose to longer-term pathology for an individual child.

For the sake of completeness, it is worth acknowledging that children's sleep practices are culturally based and that cultural expectations will affect perceptions of what is acceptable or abnormal sleep behaviour.

Implications

Management of young children's sleeplessness is an important clinical area, both because it is so prevalent and because it can usually be relatively quickly and easily resolved with apparently widespread positive benefits. The empirical evidence supports the use of behavioural strategies (both in the short and longer term) as the treatment of first choice for dealing with childhood sleeplessness. To ensure that children receive appropriate treatment as soon as possible (or preventively), more sleep-related education for professionals (and parents) is needed so that sleep disorders are recognized, assessed and diagnosed. Current professional sleep education is globally poor.[33-36]

It should be recognized that behavioural interventions can be demanding of both parents' emotional resources and therapists' time, and results from research projects may not necessarily be extrapolated to a general clinic situation. As such, greater understanding of the "active" part of any intervention and means of simplifying its delivery and implementation should be considered a high priority.

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Interventions Available to Manage Infant/Child Sleep Problems

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Introduction

Childhood *sleeplessness,* in its many forms, clearly constitutes a major concern for parents (and therefore for health-care practitioners). Inadequate, disrupted, poor-quality, non-restful and at times elusive sleep is one of the most common complaints raised by parents to pediatricians and pediatric practitioners. In contrast,the relationship betweeninsufficient or disturbed sleepand the many manifestations of *sleepiness* is less frequently recognized by parents, but is nonetheless a major contributor to mood, behaviour, academic and health problems in childhood. The following presentation details the impact of sleep problems on children and families, the types of behavioural interventions available and future directions for research and clinical care.

Subject

A number of studies have examined the prevalence of parent- and child-reported sleep complaints in large samples of children, utilizing broad-based parent-report sleep surveys to assess for a variety of sleep problems, ranging from bedtime resistance to prolonged night wakings to parasomnias (e.g. sleepwalking or talking). Overall, approximately 25% of all children experience some type of sleep problem at some point during childhood, ranging from short-term difficulties in falling asleep and night wakings to sleepwalking, night terror and enuresis (bedwetting). Specific studies have reported an overall prevalence of a variety of parent-reported sleep problems ranging from 25 to 50% in pre-school-aged samples[1,2] to 37% in a community sample of four-to-10-year-olds.[3]

Furthermore, although many sleep problems in infants and children are transient and self-limited in nature, certain intrinsic and extrinsic risk factors (e.g. difficult temperament, chronic illness, neurodevelopmental delays, maternal depression, family stress) may predispose a given child to develop a more chronic sleep disturbance. A number of studies have also documented the persistence of infant sleep problems into early childhood.[4,5]

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Any discussion of the significance of pediatric sleep must underscore the importance of the relationships between sleep problems and mood, performance and behaviour. A wealth of empirical evidence from several lines of research clearly indicates that children experience significant daytime sleepiness as a result of inadequate or disturbed sleep, and that significant performance impairments and mood dysfunction are associated with such daytime sleepiness.[6-10] For example, mood problems in children with sleep disturbances are virtually universal, particularly exacerbation of negative mood and, equally importantly, a decrease in positive mood or affect. Regulation of mood, or the use of cognitive strategies to modulate and guide emotions, also appears to be affected by sleep quality and quantity; thus, chronic poor sleep during critical periods of development of affective regulation may have long-term consequences on emotional health. Children's behavioural responses to sleepiness, although highly variable, may be broadly described as manifestations of dysregulation of arousal, impairment of attention, and failure to inhibit inappropriate behavioural responses (poor impulse control). Higher-level cognitive functions regulated by the prefrontal cortex, such as cognitive flexibility and the ability to reason and think abstractly, appear to be particularly sensitive to the effects of disturbed or insufficient sleep. Finally, health outcomes of inadequate sleep include potential deleterious effects on the cardiovascular, immune and various metabolic systems, including glucose metabolism and endocrine function.

Vulnerable populations, such as children who are at high risk for developmental and behavioural problems due to poverty, parental substance abuse and mental illness, or violence in the home, may be even more likely to experience "double jeopardy" as a result of sleep problems. In other words, not only are these children at higher risk for *developing* sleep problems as a result of such conditions as chaotic home environments, chronic medical issues like iron deficiency anemia, and neglect, they are also less likely to be *diagnosed* with sleep problems because of limited access to health-care services and likely to suffer more serious *consequences* from those sleep problems than their less vulnerable peers. Children with co-morbid medical, psychiatric and developmental disorders are also at higher risk for both occurrence of and consequences from sleep problems.

Finally, sleep problems in children are also a significant source of distress for families, and may be one of the primary reasons for caregiver stress in families with children who have chronic medical illnesses or severe neurodevelopment delays. Furthermore, the impact of childhood sleep problems is intensified by their direct relationship to the quality and quantity of parents'

sleep, particularly if disrupted sleep results in daytime fatigue and mood disturbances, and leads to a decreased level of effective parenting.

Problems

It should be emphasized that it is often a challenge to arrive at an operational definition of “problematic sleep” in children. The range of sleep behaviours that may be considered “normal” or “pathologic” is wide and the definitions often highly subjective. It should be kept in mind that for clinical populations, the description of the sleep problem is often quite subjective and highly dependent on parents’ awareness of, expectations for, tolerance of and interpretation of the sleep behaviours.

In addition, it is also important to consider the cultural and family context within which sleep behaviours in children occur. For example, co-sleeping of infants and parents is a common and accepted practice in many ethnic groups, both in their countries of origin and in the United States. Therefore, the developmental goal of independent “self-soothing” in infants at bedtime and after night wakings, although clearly associated in a number of studies with fewer subsequent sleep problems in young children, may not be shared by all families.

Research Context

In general, behavioural treatment strategies for sleep problems in young children target difficulty in settling at bedtime and/or night wakings.Recognizing the need to standardize definitions for these presenting complaints, the International Classification of Sleep Disorders has operationalized clinically significant bedtime resistance, sleep onset delay and night wakings for infants and toddlers, setting forth specific criteria for several sleep disorders that present as settling difficulties and problematic night wakings. These include Sleep Onset Association Disorder (SOAD) and Limit Setting Sleep Disorder (LSSD).In SOAD,the child learns to fall asleep only under certain conditions or associations, such as being rocked or fed, and does not develop the ability to self-soothe. During the night, a child who experiences the type of brief arousal that normally occurs at the end of a sleep cycle (every 90 to 120 minutes) or awakens for other reasons is not able to get back to sleep without those same conditions being present. LSSDis, by contrast,a disorder most common in children preschool-aged and older, characterized by difficulties falling asleep and bedtime resistance (“curtain calls”), rather than night wakings. The prolonged sleep onset delay results in inadequate sleep duration. Most commonly, this disorder

develops from a parent's inability or unwillingness to set consistent bedtime rules and enforce a regular bedtime, often exacerbated by the child's oppositional behaviour.

Key Research Questions

Most of the studies regarding interventions for sleep problems in young children have focused on short-term behavioural interventions carried out by parents in the home setting; therefore, the presence of confounding variables is often a challenge. Researchers have taken a number of approaches to the issue of defining a "sleep problem" in these studies. Some use *a priori* definitions of disturbed or poor sleep (e.g. waking for longer than 30 minutes more than three times a week), while others have relied on comparison to "normative" populations or have based the definition of sleep problems on what the parent subjectively identifies as problematic. Although some studies have attempted to utilize more "objective" measures of sleep quality and quantity (e.g. actigraphy, videography), most have relied on more subjective parental reports of improvement.

Recent Research Results

There is now a solid body of literature regarding empirically-based non-pharmacologic treatment of bedtime problems and night wakings in infants, toddlers and preschoolers.[11-42] These treatments are based on basic behavioural principles that reduce or eliminate some behaviours (e.g. crying) and reinforce others (appropriate bedtime behaviours). These general strategies include ignoring, differential reinforcement, shaping and behavioural chaining.

Although applications of these basic behavioral principles require tailoring for children, they are similar to empirically-based behavioural treatments for adult insomnia, such as sleep restriction and stimulus control.[43] Specific behavioural treatments for bedtime problems and night wakings in infants and young children that have adequate empirical support include the following: (1) extinction (unmodified standard; graduated; with parental presence); (2) scheduled awakenings; (3) positive routines +/- response cost; (4) bedtime fading; (5) positive reinforcement; and (6) parent education. The level of empirical support for these behavioural interventions has been assessed in the psychology literature using the Chambless criteria, which were developed in order to conduct a systematic assessment of the efficacy of specific treatments.[44] Under this rubric, a given treatment technique is evaluated as well-established if there are adequate, well-designed studies by at least two investigators; treatments may also be classified as probably

efficacious or as promising interventions if they have met less rigorous criteria. There is currently evidence to support extinction and parent education as well-established, graduated extinction and scheduled awakenings as probably efficacious, and positive routines as a promising intervention. There have been a number of methodologies employed in studies that have examined the efficacy of these behavioural treatments, including multiple baseline, within-subject, between-group and ABAB designs. A variety of subjective and objective assessment measures have been used in these studies, including parent report, sleep diary, actigraphy, audiotape, and videotapes. Finally, outcome measures utilized have included: child sleep variables (bedtime resistance, night wakings); child daytime mood and behaviour variables; and parent sleep and behavioural variables (mood, marital satisfaction).

Conclusions

There is a solid body of literature supporting empirically-based non-pharmacologic treatment of bedtime problems and night wakings in infants, toddlers and preschoolers. Numerous studies have been conducted employing behavioural strategies that lend significant support to the development of evidence-based practice parameters for these common sleep problems. These studies have utilized a breadth of empirical designs and a variety of subjective and objective outcome measures across multiple domains. Not only is there compelling evidence to support the efficacy of a number of specific non-pharmacologic treatments for bedtime and night-waking problems, but studies have also demonstrated that these strategies are often superior to pharmacologic treatments and more acceptable to parents and practitioners. Behavioural sleep management strategies have the further advantage of potentially generalizing to the management of other daytime behavioural issues.

Implications

Given the prevalence and potential impact of sleep problems in children, as well as the consequent stress on families and economic consequences,[45,46] it is imperative that effective behavioural interventions continue to be developed and empirically tested. In addition, a number of other important variables that affect the type, relative prevalence, chronicity and severity of sleep problems must be taken into consideration when designing and implementing these interventions:

- child variables – e.g. temperament and behavioural style, individual variations in circadian preference, cognitive and language delays;
- parental variables – e.g. discipline styles, parents' education level and knowledge of child development; and
- environmental variables – e.g. physical environment, family composition and lifestyle issues.

The need to develop strategies aimed at *prevention* of sleep problems, especially in young children, emphasizes the importance of education for both parents and providers. Furthermore, early detection of sleep problems in children necessitates the development of *systems* for age-appropriate screening and surveillance of pediatric populations.

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Services and Programs Proven to be Effective in Managing Pediatric Sleep Disturbances and Disorders, and Their Impact on the Social and Emotional Development of Young Children

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Introduction

During the preschool years dramatic changes take place in a typical child's sleep, while enormous changes in physical, linguistic, cognitive and social development occur which profoundly alter both waking activities and sleep regulation. Establishing sleep habits which meet a child's individual needs and are adapted to his culture and family circumstances is vital to individual and family well-being. Within a broad range of individual, familial and cultural variations[1] by the end of the preschool period a child who is a "good" sleeper will have a regular but not ritualized, emotionally and socially positive, pre-bed routine, free of resistance and coercion. The chid will be put to bed awake, without difficulty, by a variety of caregivers, and sleep independently wherever appropriate to family culture and circumstances. Sleep onset will be rapid both initially and after later wakings, without crying, calling-out or adult attention, unless he is ill or needs care, so that sleep is of age-appropriate duration and quality.[2,3,4]

Achieving this outcome requires continuous, dynamic, learned adjustments affecting every aspect of sleep and involving all parents, caregivers, siblings and other family members. This is influenced by child temperament; parental adjustment; resources and practices; maternal health and well-being, and family/community circumstances.[3] Careful assessment of family circumstances and environment and child development is necessary in diagnosing pediatric sleep disturbances (PSDs).[5,6] Sleep may be measured by parental diaries,[7] activity monitoring,[8] videosomonography[9] and clinic-based, multi-channel physiological recording (polysomnography).[10] Questionnaires for assessing children's sleep have recently been comprehensively reviewed [11,12,13] and while the psychometric quality of many is poor there are a few that meet required standards.[11]

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Subject

PSDs are a common reason for attending family health services[14,15] and may broadly be differentiated into a psycho-social group focussed on parent-child interaction, and a group (henceforth referred to as the bio-maturational group) in which atypical biological, especially neural, maturation appears to be critical.[16,17]

Psycho-social PSDs include:

1. Problems of bed resistance and sleep location. Children may resist/delay being prepared for and placed into bed (with tantrums, escape/avoidance, and demands for pre-bed rituals) and/or may sleep often in locations other than where parents desire (e.g., co-sleeping with parents or siblings) because the child moves or is moved from their own cot or bed to stop or prevent them crying and obtain sleep.
2. Problems of sleep-onset delay and recurrent night waking, where the infant or child needs parental attendance and attention to initially go to sleep or to resume sleep after later wakings.
3. Fears and anxieties associated with bedtime, night-time, and sleep.

Bio-maturational PSDs include:

1. Parasomnias, which are undesirable behaviour occurring during sleep or sleep wake transitions, including sleepwalking/talking, sleep terrors, and rhythmic movement disorders such as head banging and body rocking and also nocturnal enuresis (bedwetting), and
2. Circadian rhythm disorders, in which the individual's sleep-wake phases are not in synchrony with those of the family or community.

Psycho-social PSDs commonly co-occur, and may affect 15 – 35% of families.[18,19] Bio-maturational PSDs are much less common, chronically affecting 1- 3% of families,[20] but children with parasomnias often also exhibit psycho-social PSDs.[20] Little evidence links PSDs to family demographic variables, but more boys than girls may be affected by parasomnias.[21]

Obstructive sleep apnea and other breathing difficulties are primarily problems of airway functioning and respiratory control during sleep.[22] Any infant or child with symptoms of sleep

apnea (noisy breathing and profuse sweating) or anoxia (lack of oxygen) needs urgent medical evaluation. Some infants experience episodes of anoxia (lack of oxygen) while asleep, often resulting in death in infants aged > 12 months (Sudden Infant Death Syndrome; SIDS). Risk of SIDS is reduced by placing infants on their back to sleep[23] and by breastfeeding, and avoiding exposure to cigarette smoke and co-sleeping.[24]

Problems

PSDs predict sleep disturbances and behavioural difficulties later in childhood[25,26,27] and potentially throughout life,[28,29] and sleep quality is linked to intellectual, emotional and social development.[30] If chronic or severe, PSDs are stressful for the child, siblings and parents, contributing to attachment difficulties, disruptions of learning, depression, family conflict and marital breakdown[15,26] and to overmedication with prescription and non-prescription drugs.[18]

Research Context

Considerable research has investigated the developmental neurophysiology of sleep from infancy onwards. Over the first months of life sleep is coordinated into a day-night pattern and consolidated.[4,31] Cycles of rapid-eye-movement sleep (REM) and non-REM sleep shift from rapid cycling and 1:1distribution at birth to a 1:2 distribution at 8 months, and deep, non-REM sleep (associated with parasomnias) predominates early in sleep, while REM (associated with awakenings, dreams and nightmares) occurs more later.[21] Research into factors predictive of PSDs reveal associations with first-born status, colic, difficult infant temperament, maternal depression and insecure adult attachment, and diversity in parenting strategies.[3] There is more treatment research for psycho-social than for bio-maturational PSDs, and this has shifted from mostly case studies to well-controlled investigations. Some treatments have achieved empirically validated status as well-established, probably efficacious [i.e., effective] or promising[32,33,34,35,36] using criteria from Chambless and Hollon.[37]

Key Research Questions

Research has focussed on how to facilitate the development of infants' ability to self-soothe so that sleep initiation is under child- rather than other-related cues. Understanding the behavioural trap[2] by which parent-child interactions shape and maintain sleep disruptions has stimulated development of behavioural treatments and adaptations thereof, with concerns as to their effectiveness, acceptability, impact on attachment, adjustment and family well-being, and

cultural appropriateness.

Recent Research Results

As noted above, family interventions for PSDs need to begin with careful functional assessment and analysis that considers the well-being of the whole family, not just the target child,[38,39] from a developmental perspective. Parent education, at about birth or later, on infant sleep management[40,41] and in regulating breastfeeding to optimize night sleep duration[42] facilitates sleep development and may prevent PSDs developing.[43]

Systematically structuring pre-bed routines using quiet, pleasant activities and praise for compliance (termed Positive Routines) reduces pre-bed tantrums and resistance.[44] Crying and calling out etc during initial settling time or following later night wakings is reduced or eliminated by a range of interventions [variously called Extinction, Graduated Extinction, and (Graduated) Planned Ignoring[34]]. All involve the immediate or progressive (graduated) delay/withdrawal of parental attention for sleep-disruptive behaviour, thereby (in principle) removing the reinforcer for the behaviour, a process termed behavioural extinction.[2] In older, more verbal children, this withdrawal of attention can be supplemented by adding shaping and positive reinforcement (praise, tangible rewards) for achieving appropriate sleep[45,46] and/or by using strategies such as the Bedtime Pass[47] and Social Stories[48] (modelling combined with rewards). For infants over 6 months, modifying the withdrawal of adult attention by adding Parental Presence, in which the parent lies near the child but does not interact with them until the child goes to sleep[49,50] reduces distress to low levels, and is now regarded as best practice for children 6 to 24 months of age.[49] Positive Routines may be supplemented by adjusting bedtime later or earlier depending on sleep latency (Bedtime Fading) and by removal from bed and being kept awake when not sleeping (Response Cost).[51] Combining reducing doses of a sedative drug with planned ignoring also reduces distress,[52,53] but sedative drugs used alone have at best short-term effects.[33,54]

Parents need to be carefully prepared for any intervention, supported during it,[55] and warned of the possibility of both initial brief increases in the frequency or intensity of behaviour following the removal of reinforcers (post-extinction response bursts), which may exacerbate sleep disturbance briefly upon treatment initiation,[52] and the possibility of spontaneous recovery of PSD following illness or changes in routine.[55] Whether unmodified or modified, procedures involving withdrawing parental attention are largely non-stressful for parents and positive for the

family[56,57,58,59] and, importantly, have no reported adverse effects on child well-being or development.[60,61] Night-time fears/anxieties are reduced by treatments involving relaxation, modelling coping, positive thoughts/imagery, and positive rewards for "bravery."[62,63]

There is comparatively little controlled research into treatments for bio-maturational PSDs.[35] Scheduled awakenings, in which parents use baseline information to predict the time of a parasomnia event and wake the child 15-30 min beforehand has successfully treated sleepwalking and sleep terrors.[64] Waking (via a urine alarm) is also an effective treatment for nocturnal enuresis,[65,66] though this is generally used only for older children. Infants and children with chronic illness, disabilities and special needs may experience high rates of PSDs. There is little systematic research on treatment for such children[67] but considerable research interest is evident in recent systematic reviews.[68,69]

Conclusions

The neuro-development of sleep and its importance to development is relatively well-understood. PSDs are systematically described and diagnosed, and the psycho-social versus bio-maturational distinction is well-established, however the causes of and risk-factors for PSDs are less well specified. Development of good sleep habits in the first year of life depends on the infant learning to self-soothe and on the parents avoiding inadvertently reinforcing sleep-disruptive behaviours. Teaching parents how to structure their bed-time and sleep-related interactions with their infant/child so that self-soothing occurs and sleep-disruptive behaviour is not reinforced may prevent as well as treat PSDs. These treatments may be tailored, by gradual adjustment of parental attention, parental presence, and/or brief use of sedatives, so as to reduce stress, apprehension and infant distress, with parental presence being most strongly recommended as contemporary best practice.[49] Effective interventions promote family well-being and do not adversely affect chid development. More research is needed into bio-maturational PSDs, into services for families facing chronic child illness and disabilities, and into cultural factors.

Implications

- Staff working in pediatric/family services settings need regular training in empirically-based best-practice for the both functional analysis and diagnosis and the treatment of PSDs.

- PSDs need to be understood and treated within an ecological perspective on the child and the family.
- Parental and staff expectations that interventions will be stressful or distressing, or that they will have long-term ill-effects on the child or the family, can be countered by substantial evidence to the contrary where well-designed and properly supported interventions are used.
- Untreated, chronic PSDs, especially if severe and/or disruptive have the potential for long-term negative consequences for the child and his/her family and should be treated promptly and effectively.
- While interventions (other than for children who are ill, disabled, or have special needs) are typically brief, parents need good preparation for and support during the critical time.
- Interventions which employ best-practice procedures should have relatively rapid positive effects and these should be maintained long-term. If positive effects are not observed reasonably rapidly procedures should be checked for fidelity to the implemented program.
- Research needs to focus on improving and extending preventive interventions; matching treatments to families; improving the range and quality of services for children who are ill, disabled, or have special needs; and assessing long-term impacts on the target child and her/his family.

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