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Lifestyle Factors that Affect Youth's Sleep and Strategies for Guiding Patients and Families Toward Healthy Sleeping

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Abstract

Sleep is essential for optimal child and adolescent health, development, and academic performance. Lifestyle habits significantly influence child and adolescent sleep regulation, conferring either positive or negative effects on the attainment of sufficient and high-quality sleep. The primary objective of this paper is, thus, to review the lifestyle factors which may disrupt a child's sleep, on the one hand, and support healthy sleep, on the other. Lifestyle factors that have been found to negatively affect children and adolescents' sleep include: 1) exposure to modern technologies (e.g., television, computer and video games) leading to increased light exposure and night-time arousal; 2) consumption of wake-promoting substances, such as caffeine, that affect the physiological regulation of arousal and sleep; 3) consumption of late-evening meals; 4) aspects of the physical environment (e.g., air quality) that hinder sleep; and 4) cultural norms that place a low priority on sleep. Despite the negative impact of such factors on youths' sleep, such aspects are modifiable and can be easily targeted by simple and inexpensive interventions designed to promote healthy and sufficient sleep. This review offers several strategies to guide families in modifying unhealthy sleep habits and promoting refreshing, high-quality sleep.

Keywords: Lifestyle habits; Sleep; Health; Youth; Families

Abbreviations: SCN: Suprachiasmatic Nucleus

Introduction

Strong evidence indicates that sleep is extremely important to youth's health and success. Sleep deprivation has been empirically linked to obesity, diabetes, hypertension, metabolic syndrome, and cardiovascular problems [1-5]. In addition, poor sleep has been shown to impair academic performance, learning, memory and neurobehavioral functioning, especially in the context of activities that are essential for academic success, such as attention/response inhibition, memory, verbal creativity, problem solving, and general cognitive abilities (as reflected by IQ test scores) [6-10]. Poor sleep has also been linked to increased accidental injuries in younger children [11] and an increased risk of motor vehicle accidents, which is particularly relevant to adolescents of driving age [12-15]. Despite the very strong evidence indicating the importance of sleep, the sleep duration of children and adolescents has declined over time [16]. Recently, the Sleep in America Polls conducted by the National Sleep Foundation in 2004 showed that 34% of toddlers, 32% of preschoolers and 27% of school-aged children sleep fewer hours than their parents think they need. Although the optimal amount of sleep required in adolescence is reported to be at least 8.5 hours per night, as many as 70% of adolescent students get less than this amount of sleep [17] and more than half report feeling excessively tired or sleepy during the day [18]. Unfortunately, however, the significance of chronic sleep insufficiency is not adequately recognized in the current context of youth health.

Thus, we need to provide children and parents with tools to assist children in achieving sufficient sleep. For example, we could identify modifiable factors that influence the amount and quality of sleep among children and adolescents, and then target these factors as a means to optimize youth sleep.

Although sleep is a biological process, sleep habits are socially learned behaviors that are integrated with the natural rhythms of the body. Sleep physiology is regulated by two distinct physiological processes that interact to govern sleep timing and composition [19-21] The homeostatic sleep process (also known as process S) is a regulatory mechanism wherein sleep pressure accumulates as wake time lengthens and dissipates during a sleep episode. In contrast, circadian components (or process C) regulates the timing of sleep and awakening [22-24]. Process C is directly affected by environmental cues (see below for details), so the environment has a potent impact on sleep. This could be used to shape optimal sleep patterns, but if not cued properly, environmental factors can also create poor sleep patterns [25]. Because the rhythm of the circadian pacemaker (i.e., the "biological clock") is not precisely 24 hours, it must be realigned by an average of 0.2 hour each day through a process called "entrainment" [20]. The most powerful known synchronizer, or *zeitgeber* (from the German zeit, which means "time," and geben, which means "to give"), is the light-dark cycle [26,27]. Recent studies have shown that non-photic cues, such as food and activity levels, can also synchronize the Suprachiasmatic Nucleus (SCN) [28,29]. Thus, certain habits and environmental conditions, such as light exposure, meal times or engaging in stimulating activities, can affect the circadian and homeostatic sleep processes.

Lifestyle habits, which consist of repeated daily behavior, may positively or negatively affect a child's ability to obtain sufficient, high-quality sleep. Thus, we need to understand these elements in order to guide parents and children on optimizing sleep regulation and duration. The goals of the present paper are to: 1) review lifestyle factors that can affect youth sleep regulation, encourage later bedtimes and longer

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nighttime arousal, and disrupt and shorten sleep; and 2) review lifestyle habits that support healthy sleep and introduce strategies to modify the habits that negatively impact sleep.

Lifestyle Factors Affecting Sleep Regulation

The lifestyle factors that have been shown to affect the sleep regulation of children and adolescents include: modern technologies that cause light exposure and stimulate night-time arousal; consumption of wake-promoting substances (e.g., caffeine) that affect the physiological regulation of arousal and sleep; meal times; aspects of the physical environment (e.g., air quality) that hinder sleep; and cultural norms that place a low priority on sleep. Below, we will review each of these factors and their impacts on youth sleep.

Late-Night Use of Modern Technologies

A large percentage of children and adolescents have electronic media in their bedrooms and use these technologies late at night. A recent large study found that half of parents reported that their grade 5 children had a TV, DVD player and/or video game console in his or her bedroom, while 21% had computers and 17% had cellular phones [30]. Observational studies have consistently shown associations between media use and sleep problems among children [31-37]. These effects have been observed across cultures and in all media formats, including TV [36,38-40], video games [40-42], and computers [41,43,44]. The effects are also evident across the age spectrum, including preschoolers [32,37-39], school-aged children [31,33-36], adolescents and adults [43-45]. Access to and night-time use of electronic media has been associated with shortened sleep duration and excess body weight [30]. Children with increasingly more electronic media devices in their bedrooms reported shorter sleep durations, and students who used electronic devices on most or all nights reported sleeping less and more sleep problems [30]. The effect of night-time media use on sleep duration and quality is the result of: 1) the use of devices after bedtime at the expense of sleep; 2) the strong effect of light exposure [46], which suppresses melatonin and leads to circadian asynchrony, disrupted sleep and delayed sleep phase [47]; 3) the media content (exposure to violent media and games can lead to sleep problems); 4) sleep interruptions (cell phones and texting awakens children, and their content can increase arousal and make it difficult to disengage and fall asleep); and 5) poor parental control. In the latter context, Van den Bulck [41,48] has referred to electronic media exposure as an unstructured and boundless leisure activity that, unlike other hobbies or sports activities, has no clear endpoint. It has been suggested that the presence of a media device in the bedroom may indicate low parental control, contributing to increased exposure [48].

Caffeinated Beverages

Caffeine is a widely consumed psychoactive substance that activates dopaminergic reward circuits and produces behavioral effects similar to other dopaminergically mediated substances, such as cocaine and amphetamine [49]. Adenosine is a sleep-inducing neurochemical that decreases sensitivity to dopamine receptors and helps promote sleep. Caffeine blocks the adenosine receptor, increases the effect of dopamine on the D2 receptor and enhances the availability of dopamine, thus creating a stimulating effect [50]. As an adenosine antagonist, caffeine has been shown to attenuate electroencephalographic (EEG) markers associated with decreased homeostatic sleep pressure, thereby promoting wakefulness in humans [51]. Children may consume caffeine daily through caffeinated beverages. Energy drinks are particularly problematic, as they are treated as "dietary supplements" and are not subject to the same rules as soft drinks. In a recent study, 75% of children surveyed reported that they consumed caffeine on a daily basis, and the more caffeine the children consumed, the less they reported sleeping. In this study, children aged 5 to 7 years old consumed approximately 52 mg of caffeine per day, and children aged 8 to 12 years old consumed approximately 109 mg [52]. Habitual daily caffeine consumption has been related to sleep disruption, sleepiness [51,53,54], and impaired daytime functioning [55]. This is likely related to the long half-life of caffeine, which ranges from 3 to 7 hours [51]. Caffeine consumed during the afternoon or evening (e.g., dinnertime) is likely to last well into the night and affect the arousal system even at bedtime, hindering a child's ability to fall asleep.

Late-Evening Meals

Nutritional and hormonal cues are potent synchronizers of the circadian sleep process [56], and the feeding schedule can advance or delay the circadian phase. Under certain conditions of feeding, metabolic cues can alter both the master circadian clock and circadian responses to light [28,29,57,58]. Recent studies have shown that human mealtimes are important socio-environmental synchronizers of circadian rhythms, and late-evening meals have been associated with sleep onset delays, shortened sleep durations, and sleep deprivation [59]

Societal Values

A healthy diet, physical activity, and the proper amount of sleep are all interrelated and important for a child's health. Unfortunately, sleep is often neglected in this regard. Many perceive sleep time as lost time that could be spent more productively. In some ways, society's current view of sleep deprivation is similar to our past attitude toward smoking, which was characterized by ignorance, lack of concern regarding the serious consequences, and even humor. Our socio-cultural environment (long store hours, late-night sporting events, energy drinks, screen time, and artificial light exposure at night) does not promote healthy sleep habits, and people living in a 24/7 society place sleep low on their priority list. Parents' busy schedules and work hours may push dinner and family activities to later times. Children can also have busy schedules, as they are often enrolled in multiple extracurricular activities and attend late-ending social, sporting and school events that contribute to delayed bedtimes and short sleep durations. Sleep is often neglected as a crucial component of a healthy lifestyle, and sleep deprivation is not currently considered a public health concern. Thus, parents and children frequently push back bedtimes in order to accommodate other activities that are perceived as higher priority. Since school start times are fixed, children are unable to obtain sufficient sleep and become sleep deprived. Paradoxically, the effort to help children achieve more through late-night homework or extracurricular activities can have the opposite effect, as over-tired children will under-perform during the school day and may benefit far less from extracurricular opportunities.

Sleep is rarely integrated into programs and interventions designed to improve health. For example, weight regulation programs targeting childhood obesity typically focus on healthy eating and active living. Sleep is also not a typical focus of the government or pediatric practice, and the importance of sleep and its relevance to academic success is rarely addressed in educational programs aimed at optimizing academic performance. Thus, there is a general lack of awareness when it comes to the serious consequences of chronic sleep insufficiency on youth health and success.

In sum, certain lifestyle habits affect the physiological processes

associated with sleep regulation and reflect cultural norms that prioritize busy schedules over sleep, contributing to the high prevalence of sleep deprivation in children and adolescents. Fortunately, however, these habits can be changed. Below, we review practical strategies that can help children and their families develop healthy sleeping patterns.

Lifestyle Choices that Support Healthy Sleep

The concrete strategies listed below may help guide children and families toward healthy sleeping. It is important to note that the quality of evidence for these recommendations is fairly low, as most of the information regarding potential harmful and beneficial factors come from observational studies, rather than rigorously designed intervention trials.

The creation of fixed bed- and wake-times is a recommended step in developing sleep patterns that allow a child to get enough sleep. The body "gets used" to falling asleep at a certain time, but only if this time is relatively consistent. It is important to set a bedtime that allows the child to get enough sleep. Although activities may occur at different times on weekends/holidays versus the school week, a child's bedtime should differ by no more than 1 hour.

To encourage the habit of falling asleep easily at the desired time, parents should create a consistent and calm bedtime routine that includes relaxing activities over about 20-30 min in the room where the child sleeps. In addition, they should create an optimal sleeping environment that is quiet, dark and cool in the evening, and well-lit in the morning. Importantly, the sleeping environment should be associated with positive experiences and emotions, and parents should not use banishment to the bedroom or an early bedtime as punishment [60, 61].

Young children who still nap should be encouraged to nap during the day; however, children older than 5 years (especially adolescents) should avoid napping during the day, as this interferes with the natural sleep homeostasis and creates difficulties with night-time sleeping. If an adolescent feels sleepy during the day, a nap should be limited to 15-20 minutes and should be scheduled for the early afternoon.

Parents should keep electronic devices (e.g., televisions, computers, cell phones, etc.) out of the bedroom and limit internet use in the evening.

Children who consume caffeinated substances, such as sodas, hot chocolate or solid chocolate, should avoid caffeine for at least 3 to 4 hours prior to bedtime. Coffee and energy drinks should be avoided, and this should be explained to adolescents who seek out these types of snacks or beverages.

Regular exercise, particularly in the afternoon, can help deepen sleep. However, strenuous exercise (e.g., intense hockey or soccer practice) within 2 hours prior to bedtime can compromise the ability to fall asleep.

Healthy sleep education that raises the awareness of the general public to the importance of sleep and offers age-specific sleep recommendations will be essential for preventing common sleep problems and sleep deprivation in our youth. Such education should emphasize the importance of developing a lifestyle that is conducive to healthy sleep behavior and prioritizing sleep over competing activities. The message and delivery method should be tailored to specific age groups, and both parents and children should be taught why and how to encourage healthy sleep [62].

In sum, parents can take simple steps to optimize their child's sleep and decrease negative habits that are detrimental to sleep. An understanding and awareness of the importance of sleep could help motivate them to reevaluate existing habits and make room for new habits that promote healthy sleep. One potential way to motivate parents to engage in such a process will be to educate them regarding the critical importance of sleep and the detrimental impact of sleep deprivation on their child's health and success.

Conclusion

Lifestyle habits, which are aspects of everyday life, can have significant impacts on sleep regulation. Because these habits are modifiable, they could be targeted by simple and inexpensive interventions aimed at helping families achieve healthy and sufficient sleep.

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