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Screen Time, Sleep, and Child Health: Current Evidence and Emerging Perspectives.

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Abstract

Background. The widespread use of digital devices has substantially increased children's exposure to screens, raising concerns about its potential impact on sleep. Adequate sleep is essential for healthy physical, cognitive, emotional, and behavioral development during childhood.

Aim. This review aims to summarize current evidence on the association between screen time, sleep and health in children and to discuss the potential mechanisms underlying this relationship.

Material and methods. Studies were selected from PubMed, including publications from 2020 to 2026. The search terms included „screen time”; „children”; „sleep disorders”, „children health”. Non-English articles were excluded.

Results. Available evidence suggests that excessive screen exposure, particularly during the evening and before bedtime, is associated with shorter sleep duration, delayed sleep onset, poorer sleep quality, and increased risk of sleep disturbances. Several mechanisms may contribute to these effects, including exposure to short-wavelength light and suppression of melatonin secretion, delayed bedtime, psychological and cognitive stimulation, and sleep disruption caused by notifications or overnight device use. Sleep disturbances associated with

excessive screen time may subsequently contribute to daytime fatigue, impaired attention and learning, behavioral difficulties, and adverse physical and mental health outcomes. However, the relationship is complex and may be influenced by age, type of device, content consumed, timing of exposure, and individual and family factors.

Conclusions. Further longitudinal and intervention studies are needed to clarify causality and determine effective strategies for reducing the negative effects of screen exposure on pediatric sleep. Promoting healthy sleep hygiene and limiting screen use, particularly before bedtime, should be considered important components of preventive pediatric care.

Key words: screen time; children; sleep disorders, children health

1. Introduction

New technologies, including mobile devices and interactive screen media, have become an integral part of young children's daily lives. Children born into the contemporary digital ecosystem are often referred to as “digital natives,” as they are exposed to digital technologies from an increasingly early age. Notably, the age at which children begin engaging with screen-based media regularly has decreased dramatically, from approximately four years in the 1970s to as early as four months of age today [1]. Although electronic devices offer substantial opportunities for learning, communication, and access to information, growing evidence suggests that excessive or inappropriate screen media use may adversely affect children's physical and psychosocial health, representing an emerging public health concern. Increased screen exposure has been associated with a range of potentially unfavorable outcomes, including a higher risk of overweight and obesity, behavioral difficulties, sleep disturbances, and poorer academic performance [1-4]. Given the rapid expansion of digital media use among children, understanding its potential short- and long-term health consequences has become increasingly important [1,4,5].

2. Research materials and methods

This study was conducted as a narrative literature review aimed at synthesizing current scientific evidence regarding screen time and sleep disorders in children, especially current evidence and potential mechanisms.

The search included the latest studies published between 2020 and 2026. Literature research was performed using PubMed, an online database including 381 citations for biomedical literature using the following keywords: „screen time”, „children”, „sleep disorders”, „children health”. The review included a variety of study designs, such as randomized controlled trials (RCTs), observational studies, clinical trials, systematic reviews, and meta-analyses.

For the current review, the following inclusion criteria were specified:

1. The articles include current developments and clinical practice.
2. Studies with novel ideas and in-depth research.
3. Twenty-one studies were eventually selected from the articles found for review. Articles were excluded after reviewing the papers because they did not meet our predefined inclusion criteria, while others that initially met the criteria were disqualified because they were not available in full or were not in English.

2.1 AI.

In preparing this work, the authors used ChatGPT for the purpose of checking grammar, punctuation and improving the readability of the article. After using this tool, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

3. Discussion

Sleep as an Essential Component of Quality of Life

Sleep is an essential physiological process that supports normal brain function and the maintenance of systemic homeostasis. It plays a key role in various biological processes, including metabolic regulation, memory consolidation, and emotional control. Both insufficient sleep and poor sleep quality may have significant adverse effects on health, increasing susceptibility to stress and contributing to reduced quality of life, mood disturbances, and cognitive impairment. In addition, persistent sleep disturbances have been associated with an elevated risk of metabolic and cardiovascular conditions, including hypertension, dyslipidemia, cardiovascular disease, and type 2 diabetes, as well as neurodegenerative disorders such as dementia [1-2].

In children and adolescents, adequate sleep is particularly important for proper neurocognitive development, learning, memory consolidation, and academic performance. Insufficient or disrupted sleep, including poor sleep quality, frequent awakenings, delayed sleep onset, and early morning awakening, may negatively affect cognitive functioning, learning capacity, and behavioral regulation [3-4]. However, differences in study methodology and the assessment of sleep-related outcomes make it difficult to establish fully consistent and generalizable conclusions. Difficulties with sleep initiation and maintenance are relatively common in this age group, while many children and adolescents do not obtain the recommended amount of sleep, potentially resulting in excessive daytime sleepiness. Sleep insufficiency may arise from both biological and environmental factors. Puberty-related changes in circadian rhythms and hormonal regulation can alter sleep patterns, whereas external influences, such as early school start times, academic demands, and demanding daily schedules, may further contribute to shortened and irregular sleep [2,6].

Integration of Electronic Devices into Children's and Adolescents' Lives

Over recent decades, smartphones, tablets, and other interactive electronic devices have become deeply integrated into the everyday lives of children and adolescents. These technologies provide numerous opportunities for communication, education, entertainment, and social interaction and have consequently become an important component of contemporary child and adolescent development. However, growing evidence indicates that excessive or inappropriate use of electronic devices may have unfavorable consequences, particularly for sleep and psychological well-being [1-6].

Screen Exposure and Sleep Quality

The association between screen exposure and sleep appears to be influenced by several factors rather than screen time alone. The duration of device use, the time of day when screens are used, and the nature of the activity or content accessed may all contribute to sleep-related outcomes. Evening and nighttime exposure appears to be particularly problematic, as prolonged engagement with digital devices may delay bedtime, increase mental stimulation, and interfere with the natural transition to sleep. Social media, online communication, and video games may be especially disruptive because they encourage prolonged engagement and continuous responsiveness. In contrast, activities such as educational work or digital reading may have a less pronounced effect, suggesting that the consequences of screen exposure depend partly on how devices are used [1,2,6].

Objective measurements of sleep, including actigraphy, support the observation that children with greater screen exposure may experience less favorable sleep patterns. Importantly, these associations may already be present during infancy and toddlerhood. Even relatively limited exposure to screens during the first two years of life has been associated with shorter total sleep duration [4,7].

The relationship may also depend on the type of device being used. Television viewing exceeding approximately one hour per day has been associated with more frequent sleep difficulties in toddlers, whereas comparable associations have not always been observed for computers or tablets [4].

Nighttime Screen Use and Circadian Regulation

Several mechanisms may account for the observed relationship. Evening exposure to screen light may interfere with melatonin secretion and circadian regulation, while stimulating digital content may increase cognitive and emotional arousal. In addition, screen use may directly displace time that would otherwise be allocated to sleep [3,7].

Excessive electronic device use before bedtime has been associated with poorer sleep quality, reduced total sleep duration, and increased difficulty falling asleep. Repeated exposure to screens during the evening may also interfere with normal circadian regulation and contribute to irregular sleep patterns. Over time, persistent disruption of sleep-wake rhythms may negatively influence the regulation of sleep and increase the likelihood of chronic sleep problems [4,6,7].

Bidirectional Relationship Between Screen Time and Sleep

The relationship between screen use and sleep is likely to be bidirectional. Insufficient or poor-quality sleep may increase daytime fatigue and encourage children and adolescents to spend more time using electronic devices, particularly for entertainment or passive activities. In turn, prolonged screen exposure, especially during the evening, may further delay sleep and reduce its duration. This interaction can create a self-perpetuating cycle in which excessive screen use and inadequate sleep reinforce one another [1-7].

Consequences for Cognitive and Psychological Health

Sleep disturbances associated with excessive screen exposure may have consequences extending beyond nighttime rest. Children and adolescents experiencing insufficient sleep may develop increased daytime sleepiness, difficulties with concentration and memory, reduced

academic performance, and impaired emotional regulation. Persistent sleep disruption may also increase vulnerability to psychological difficulties, including anxiety, depressive symptoms, irritability, and other mood disturbances. Because adequate sleep is essential for neurocognitive maturation, prolonged interference with normal sleep patterns may be particularly relevant during childhood and adolescence [8,9].

Screen Time and Physical Activity

High levels of screen exposure have also been associated with reduced physical activity and less participation in outdoor play. This relationship appears particularly relevant when prolonged screen use replaces active play and other forms of movement. Longitudinal observations suggest that extensive screen exposure during the second year of life may predict reduced participation in outdoor activities later in childhood [2,6].

However, the association between screen use and physical activity is not uniform. Some studies have found no clear relationship between screen exposure immediately before bedtime and subsequent physical activity, and objectively measured smartphone use does not necessarily correspond to lower activity levels in adolescents. This inconsistency emphasizes the importance of distinguishing between different forms of digital media use and considering the broader lifestyle of the child [6-10].

Adequate physical activity may also act as a protective factor. Children who remain physically active despite spending considerable time using electronic devices may experience fewer adverse health consequences than those whose screen use is accompanied by an overall sedentary lifestyle [9].

Screen Time and Early Neurodevelopment

The first years of life represent a particularly sensitive period for brain development. During this stage, children acquire language, motor, cognitive, and social skills primarily through direct interaction with caregivers and their environment. Excessive exposure to digital media during this period has therefore raised concerns regarding developmental outcomes [6,9,12].

Higher screen exposure in children younger than two years has been associated with developmental delays, while prolonged daily use in toddlers has been linked to difficulties in communication and everyday adaptive skills. These findings may partly reflect the displacement of developmentally important activities, such as talking with caregivers, shared reading, playing, manipulating objects, and exploring the physical environment [9,13-16].

Outdoor play appears to be particularly relevant in this context. In addition to promoting physical activity, outdoor and unstructured play provides opportunities to develop coordination, independence, problem-solving abilities, imagination, and social competence. Therefore, the potential developmental effects of screen use may arise indirectly through reduced exposure to these experiences [6,9,16].

Screen Time and Language Development

Language development may be particularly sensitive to the context in which digital media are used. Prolonged screen exposure and continuous background television have been associated with less favorable language outcomes, whereas carefully selected educational content may provide developmental benefits [9,17].

The presence of an adult during screen use appears to be an important modifying factor. Co-viewing allows parents or caregivers to explain unfamiliar concepts, ask questions, repeat vocabulary, and connect digital content with the child's real-life experiences. Consequently, passive exposure to a screen and socially interactive media use should not be considered equivalent [5].

Video communication may represent another potentially beneficial form of digital media use, particularly in very young children. Interactive video calls can facilitate communication with family members and provide opportunities for social engagement and language practice that are not available during passive television viewing [4,5,9,17].

Screen Time and Cognitive and Academic Functioning

As children enter school, excessive screen exposure may become increasingly relevant to attention, learning, and academic performance. Greater overall screen duration has been associated with poorer classroom attention and educational outcomes. Screen use may interfere with academic functioning not only through its direct effects on attention but also by replacing time that could otherwise be spent studying, reading, completing homework, or sleeping [5,17]. This displacement effect is an important concept when evaluating screen time. The potential consequences may arise because digital activities compete with other essential developmental and educational experiences rather than because every form of screen exposure is intrinsically harmful [1,9,17].

The type of screen activity may also influence cognitive outcomes. Educational programs and applications designed specifically for children's developmental level may provide opportunities

for learning, whereas prolonged exposure to passive entertainment may offer substantially fewer cognitive benefits [5].

Screen Time and Motor Development

Excessive screen exposure may also influence motor development, particularly when sedentary digital activities replace opportunities for movement and hands-on exploration. High levels of daily screen use in toddlers have been associated with poorer motor development and reduced physical competence [10,16].

Nevertheless, not all digital activities have identical effects. Certain interactive applications require precise finger movements and may temporarily support aspects of fine motor coordination in very young children. This potential benefit appears to be highly dependent on age and the characteristics of the activity and should not be interpreted as evidence that increased screen exposure improves overall motor development [9,10].

Screen time and bruxism

Sleep bruxism (SB) is a sleep-related masticatory muscle activity that may occur in both rhythmic and non-rhythmic patterns and affects a substantial proportion of children worldwide. Although SB is not considered a disorder in otherwise healthy individuals, it may reflect disturbances in factors regulating the central nervous system, including sleep and behavioral patterns [11].

Increasing screen time among children has been associated with poorer sleep quality, behavioral problems, emotional disturbances, and alterations in stress regulation. These factors may also contribute to the occurrence of sleep bruxism. Recent evidence suggests a significant association between excessive screen exposure and SB in children, indicating that prolonged screen use may be an important behavioral factor related to increased bruxism frequency. The potential mechanisms may involve screen-related sleep disruption and neurobehavioral changes, which could influence the central regulation of masticatory muscle activity during sleep [1,2,11].

Importantly, excessive screen time and sleep bruxism have also been linked to similar adverse effects on children's quality of life, including impaired cognitive and emotional functioning. Therefore, reducing excessive screen exposure and improving sleep habits may represent potentially modifiable factors in the prevention or management of sleep bruxism in children [1,4,5,11].

Screen Time and Social Development

Digital media can have both positive and negative implications for children's social development. Excessive passive screen use may reduce opportunities for direct communication, cooperative play, and learning to interpret facial expressions, gestures, and other non-verbal social cues [12-14].

On the other hand, interactive technologies can facilitate social connection. Video calls, age-appropriate collaborative games, and educational applications involving interaction may support communication and social engagement. Therefore, the social consequences of screen exposure depend strongly on whether the child is using technology in isolation or as a tool for interaction with other people [1,3,7,17].

The Importance of Content, Context, and Type of Screen Use

The effects of screen exposure are not uniform across all individuals. Differences in age, individual susceptibility, family environment, daily routines, and behavioral patterns may influence the extent to which electronic device use affects sleep. Family rules regarding technology, parental supervision, bedtime routines, and the availability of electronic devices in the bedroom may therefore play an important role in determining children's exposure to screens at night. These factors suggest that strategies aimed at reducing screen-related sleep disturbances should take individual and family circumstances into account [8,10].

One of the most important considerations emerging from the literature is that screen time should not be treated as a single, uniform exposure. The effects of digital media may differ according to the type of device, content, duration, timing, purpose of use, and social context [14,15].

Passive television viewing is fundamentally different from an educational application used together with a parent, an interactive video game involving movement, or a video call with a family member. Similarly, background television may influence children's attention and language environment even when they are not actively watching the screen [11-13].

Educational content, appropriate developmental level, and parental co-viewing may enhance the potential benefits of digital media. In contrast, prolonged exposure to entertainment content, particularly when it replaces sleep, physical activity, face-to-face interaction, or play, may be associated with less favorable outcomes [4-5].

Age-Dependent Effects of Screen Exposure

The consequences of screen exposure are likely to vary according to developmental stage. Infants and toddlers may be particularly susceptible because their development depends heavily

on direct interaction and sensory exploration. In preschool children, excessive screen use may interfere with language, motor, and social development, while in school-aged children it may become more relevant to attention, academic performance, and physical fitness. Adolescents may experience additional risks related to social media, nighttime device use, sedentary behavior, and psychological well-being [1-3].

This developmental perspective suggests that recommendations should not rely exclusively on a universal daily screen-time threshold. Instead, they should consider whether digital media use is appropriate for the child's age, developmental needs, and daily routine [18-20].

A Balanced Approach to Digital Media Use

The available evidence does not indicate that all forms of screen exposure are harmful. Digital technologies can provide educational opportunities, facilitate communication, support social relationships, and provide access to valuable information. The potential risks appear to be greatest when screen use becomes excessive, replaces essential developmental activities, or occurs in an inappropriate context [16-18].

Therefore, the objective should not necessarily be complete elimination of digital media but rather the development of balanced and developmentally appropriate patterns of use. Maintaining sufficient sleep, regular physical activity, face-to-face interaction, outdoor play, learning, and family time should remain priorities. Understanding the quality and purpose of screen use, rather than focusing exclusively on the number of hours spent in front of a screen, may provide a more accurate framework for assessing its influence on child health and development [20-21].

Strategies for Promoting Healthy Screen and Sleep Habits

Promoting healthy digital habits may help reduce the negative effects of electronic device use on sleep. Practical approaches include establishing consistent bedtime routines, limiting screen exposure in the evening, avoiding the use of electronic devices immediately before sleep, and keeping smartphones and other devices outside the bedroom when possible. Parental involvement is particularly important in younger children, as parents can establish appropriate boundaries and model healthy patterns of technology use. Educational interventions aimed at children, adolescents, parents, and caregivers may further support the development of balanced screen-use and sleep habits [5,9,15].

Parental Influence on Children's Screen Use

Parents may use access to electronic devices and screen time as a form of reward or behavioral reinforcement. At the same time, many caregivers recognize that excessive exposure to digital media may have unfavorable consequences for their children, potentially affecting behavior, social interactions, sleep patterns, and levels of physical activity. As the primary caregivers, parents have an important role in shaping children's daily habits and can influence their media use through supervision, monitoring, and the establishment of clear household rules [1,4,5].

Consistent parenting strategies and appropriate behavioral boundaries may contribute to the development of healthier habits in children. In the context of digital media, setting limits on the use of televisions, smartphones, tablets, computers, and other electronic devices has been associated with reduced overall screen exposure. Establishing specific rules regarding when, where, and for how long children can use electronic devices may therefore represent an effective approach to managing screen time. Additional technological solutions, including parental controls, password protection, content restrictions, and device-based time limits, can further support caregivers in regulating children's access to digital media [19-21].

The home environment also plays an important role in determining children's screen-related behaviors. Limiting screen use during specific periods of the day and avoiding the presence of televisions or other electronic devices in children's bedrooms may contribute to lower overall screen exposure. Establishing consistent routines around technology use can be particularly important in the evening, when excessive screen exposure may interfere with bedtime and sleep quality [18].

Parental behavior itself is another important determinant of children's media habits. Children frequently learn through observation and may reproduce behaviors demonstrated by their caregivers. Consequently, the amount of time parents spend using televisions, smartphones, computers, or other digital devices may influence children's own patterns of screen use. A household in which television or other screens are continuously present—for example, during meals or immediately after returning home from school—may normalize prolonged screen exposure and encourage children to adopt similar habits [2-4].

Therefore, parental involvement should extend beyond simply imposing restrictions. Caregivers can promote healthier digital behaviors by acting as positive role models, establishing consistent family rules, encouraging alternative activities such as physical exercise and social interaction, and creating screen-free periods and spaces within the home. A balanced approach combining reasonable limitations, parental supervision, and positive role modeling

may be particularly effective in reducing excessive screen exposure and supporting healthier lifestyles among children and adolescents [9].

5. Conclusions

The growing prevalence of screen-based activities among children highlights the need to consider screen time as an important and potentially modifiable determinant of child health. Current evidence suggests that excessive screen exposure is associated with a wide range of adverse outcomes, including sleep disturbances, behavioral and emotional difficulties, reduced physical activity, unfavorable dietary patterns, and metabolic and oral health consequences. Importantly, the relationship between screen time and health is complex and likely depends not only on the duration of exposure but also on its timing, content, context, and the individual characteristics of the child.

Several potential mechanisms may underlie these associations, including circadian disruption, sleep displacement, prolonged sedentary behavior, exposure to stimulating content, altered eating patterns, and neuroendocrine and psychosocial changes. Emerging evidence regarding associations with conditions such as sleep bruxism further indicates that the consequences of excessive screen use may extend beyond traditionally recognized sleep-related outcomes. Nevertheless, most available evidence remains observational, limiting conclusions regarding causality. Future longitudinal and mechanistic studies are therefore warranted to establish dose-response relationships and identify the patterns of screen exposure associated with the greatest risk. Meanwhile, promoting balanced digital media use alongside adequate sleep, physical activity, healthy nutrition, and parental guidance represents a pragmatic approach to supporting children's health and well-being.

6. Limitations of the Current Evidence

Several limitations should be considered when interpreting the available evidence. Studies examining the relationship between electronic device use and sleep differ substantially in their definitions of excessive screen exposure, methods of assessing screen time, and approaches to measuring sleep quality and duration. Such methodological variability makes direct comparison between studies difficult. In addition, many investigations rely on self-reported measures of both screen use and sleep, which may be affected by recall errors, social desirability, and subjective interpretation. Consequently, reported associations may not always accurately reflect actual patterns of device use or sleep behavior.

Another limitation is the relatively limited number of studies evaluating specific interventions designed to reduce screen-related sleep disturbances. Although strategies such as restricting nighttime device use, reducing evening screen exposure, implementing parental education programs, and modifying the digital environment appear promising, their effectiveness requires further investigation.

7. Future Research Directions

Future research should therefore place greater emphasis on well-designed longitudinal studies and randomized controlled trials capable of establishing temporal and potentially causal relationships between screen exposure and sleep outcomes. Research should also consider the characteristics of screen use rather than focusing exclusively on total daily screen time. Assessing the timing, duration, purpose, content, and context of electronic device use may provide a more comprehensive understanding of its impact on sleep.

More standardized definitions and objective methods of measuring both screen exposure and sleep are also needed. Such improvements could strengthen the evidence base and facilitate the development of effective, evidence-based recommendations aimed at promoting healthy sleep patterns and reducing the potential adverse effects of excessive screen use among children and adolescents.

8. Disclosure

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