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How excessive smartphone and internet use affects sleep in children and young adults

Authors:
Ziemba Michał
Otolaryngology Clinic, University Clinical Hospital in Bialystok, ul. M. C. Skłodowskiej 24a, 15-276 Białystok, Poland
https://orcid.org/0009-0003-2200-431X
michal.ziemba98@gmail.com

Ziemba Anna
Children and Youth Mental Health Center, University Children's Clinical Hospital Bialystok, ul. Jerzego Waszyngtona 17, 15-274 Białystok, Poland
https://orcid.org/0009-0005-8386-7199
ania220798@gmail.com

Moś Michał
Department of Urology - Prostate Cancer Unit, Bialystok Cancer Centre, ul. Ogrodowa 12, 15-027, Bialystok, Poland
https://orcid.org/0009-0006-4051-1923
michalmos97@gmail.com

Katarzyna Giedzicz
2nd Clinic of General, Gastroenterological, and Oncological Surgery, University Clinical Hospital in Bialystok, ul. M. C. Skłodowskiej 24a, 15-276 Białystok, Poland
https://orcid.org/0009-0003-0081-6341
k.giedzicz@gmail.com

Julia Kozakiewicz
Cardiology Clinic, University Clinical Hospital in Bialystok, ul. M. C. Skłodowskiej 24a, 15-276 Białystok, Poland
https://orcid.org/0009-0002-5435-3007
kozakiewiczjulia99@gmail.com

Aleksandra Okońska
2nd Clinic of Nephrology, Hypertension, and Internal Diseases with a Dialysis Center, University Clinical Hospital in Bialystok, ul. M. C. Skłodowskiej 24a, 15-276 Białystok, Poland
https://orcid.org/0009-0001-9036-7150
aokonska.stn@gmail.com

Corresponding author: Katarzyna Giedzicz, k.giedzicz@gmail.com

ABSTRACT

Introduction and purpose: In recent years, smartphones and the Internet have significantly affected the daily lives of children, teenagers, and young adults. However, excessive use of smartphones, especially before bedtime, has serious health consequences. The purpose of this study is to review recent research regarding the impact of excessive smartphone use by children and young adults on their sleep (including the ability to fall asleep, total sleep time, and overall sleep quality), systematize existing knowledge, and provide recommendations for sleep hygiene.

State of knowledge: Studies show that children and adolescents who spend a lot of time using mobile devices experience difficulty falling asleep, shortened sleep duration, and reduced sleep quality. These sleep problems can lead to serious health consequences, such as depression, anxiety, concentration problems, poor mood, and chronic fatigue. Using mobile devices before bed also affects the psychological processes involved in falling asleep. Activities such as browsing social media, reading the news, or playing games can increase levels of alertness and arousal, making it difficult to enter the relaxed state necessary for falling asleep. Additionally, content absorbed before bedtime can heighten stress and anxiety levels, further reducing sleep quality.

Conclusion: Educating young people about sleep hygiene, limiting screen time before bed, and promoting healthy sleep habits are key to improving sleep quality and mental health. Parents and educators should monitor the time children spend using mobile devices and implement policies to limit their use before bedtime. These measures can help enhance sleep quality and support overall mental well-being in young people.

Keywords: smartphone; internet; sleeping disorders; addiction; children; young adults

INTRODUCTION

The past two decades have witnessed rapid development in mobile technology and the Internet. Smartphones with unlimited network access have become an integral part of daily life, offering free access to vast amounts of information, social media, games, and communication applications. For many children, teenagers, and young adults, smartphones and the Internet are the main sources of entertainment, education, and communication.

According to statistics, children and young adults are spending more and more time online. For example, a 2015 study shows that 68% of high school students in the U.S. use a smartphone for more than 3 hours a day (1). Studies indicate that the average time spent using mobile devices and the Internet is increasing every year, and children are starting to use modern technologies at an increasingly younger age.

This problem has the greatest impact on the future of young users, so it seems most relevant to focus on this age group, where studies report the highest percentage of Internet addicts (2). Smartphone or Internet addiction is a form of behavioral addiction characterized by compulsive use of technology despite negative health, social, or emotional consequences. The statistics are alarming-a study conducted in Malaysia reveals that as many as 55.5% of young adults are addicted to smartphones (3). A similar study in the UK reports 39% (4), while in Japan, it is 40% (5). These numbers highlight the scale of the problem.

'Networkholism' is a condition in which a person develops behavioral disorders through contact with the Internet. It can manifest as a need for constant access to the web, intrusive and reflexive checking of notifications, or an inability to limit time spent online. Modern culture often promotes and rewards the constant use of technology. Social media, online games, and streaming apps are designed to attract users, especially children. Sometimes these are innocuous features implemented in applications, such as a reward system for logging in every day, while at other times, they are more insidious psychological traps, such as losing progress in a game.

One of the dangers associated with technology abuse is sleep disorders. Sleep plays a key role in mental health at any age. Its impact on the psyche is multifaceted-including emotion regulation, cognitive functioning, and mood stability. Sleep problems, such as insomnia or insufficient sleep, can lead to serious consequences, including an increased risk of depression, anxiety, and other mental disorders. In addition, abnormal sleep can interfere with daily functioning, reducing concentration, memory, and overall efficiency.

Understanding sleep problems is, therefore, crucial to promoting the mental health and well-being of young people.

AIM

The purpose of this paper is to analyze research findings and systematize current knowledge on the impact of excessive smartphone and Internet use on sleep ability, duration, and quality in children and young adults. This group was chosen because 'screen time' in this age range is the longest, and new technologies play an important role in their lives.

The objective of this publication is to determine how common excessive use of mobile technologies is before bedtime. It will also identify the mechanisms through which smartphone and Internet use affect the biological and psychological processes related to sleep and falling asleep.

Another aspect of this work is to analyze the long-term health effects of sleep disorders caused by excessive smartphone and Internet use, and to develop recommendations for sleep hygiene and healthy technology use that can be applied by parents, educators, as well as affected individuals themselves.

This paper is based on the latest scientific research and provides the data necessary to understand the issue at hand and mitigate its negative effects.

MATERIALS AND METHODS

To perform a systematic review, this publication was based on the analysis of materials and studies published on PubMed and Google Scholar, Springer, Frontiers databases and other scientific articles. For this purpose, the following keywords and their combinations were used for bibliographic search: "smartphone" "internet" "sleep" "children" "young adults" "addiction".

CURRENT STATE OF KNOWLEDGE

It is well known that mobile devices, such as smartphones, are among the most popular electronic devices today. A 2019 publication indicates that 95% of teenagers in the U.S. either own or have access to such devices (6). These impressive numbers are supported by other findings-a research paper from Egypt reveals that 96.5% of students use a smartphone before going to bed, and nearly half of them (46.9%) use it for more than 2 hours.

The youngest children should also be considered among these age groups. Studies show that two out of three children under the age of 4 are exposed to smartphone use (7). Unfortunately, large meta-analyses examining the prevalence of phone and Internet use before bedtime in this age group are lacking. Based on similar analyses in older users, we can only infer that the problem is also significant.

To effectively address the effects of technology overuse during evening hours, it is necessary to determine how phone use impacts the biological and psychological processes related to sleep. People who use smartphones in the late evening and night hours are much more likely to experience poor sleep quality. They need more time to fall asleep and often experience difficulties maintaining sleep continuity. Additionally, the total sleep duration is shorter compared to those who do not use smartphones before falling asleep (8).

Naturally, the consequences of these processes include greater daytime sleepiness (9). Long-term cohort studies confirm that people who use smartphones before bedtime have a higher risk of developing chronic sleep problems in the future (10). These difficulties arise from the disruption of the natural sleep-wake cycle. Blue light (wavelengths of 460–480 nm) emitted by smartphone screens has an inhibitory effect on melatonin production. Melatonin is the hormone that regulates the sleep cycle, and its production naturally increases in the dark. Light is detected by photoreceptors in the retina, which transmit signals to the suprachiasmatic nucleus (SCN) in the hypothalamus. The SCN regulates circadian rhythms, including melatonin production by the pineal gland.

Blue light activates photoreceptors (melanopsin), inhibiting melatonin production. Exposure to blue light in the evening can significantly lower melatonin levels, making it difficult to fall asleep and disrupting sleep rhythms (11).

Comparative studies show that people exposed to blue light have significantly lower melatonin levels compared to those exposed to light of a different wavelength or those who use blue light filters. For example, studies show that exposure to lower-intensity or warmer-colored light (such as red or yellow) has a much smaller effect on melatonin production.

Research conducted at Harvard Medical School found that blue light is twice as effective at inhibiting melatonin production as green light of the same intensity. Similarly, a study at the University of Toronto found that individuals wearing blue-light-blocking glasses had significantly higher melatonin levels in the evening compared to those who did not, despite exposure to computer screens.

Using phones before bed also affects various psychological processes related to falling asleep and sleep quality. Activities such as browsing social media, reading the news, or playing games can increase levels of alertness and arousal. These activities engage the mind, making it difficult to enter the relaxed state necessary for falling asleep. Content absorbed before bed-especially related to work, news, or stressful topics-can increase stress and anxiety levels. Experiencing negative emotions just before bedtime can lead to difficulty falling asleep and reduced sleep quality.

A lack of adequate sleep affects mental and physical well-being the next day. Such individuals are more likely to experience fatigue, difficulty concentrating, lowered mood, and daytime sleepiness. Studies show that excessive Internet use can lead to emotional problems such as anxiety, depression, and feelings of loneliness. Sleep deprivation also significantly affects mental health, contributing to concentration and memory problems, mood disturbances, and an increased risk of mental disorders.

Closely related to these issues is the phenomenon of FOMO (fear of missing out), which is particularly common among young social media users (12).

Sleep problems and depression in children and adolescents are closely linked. Research indicates that sleep difficulties can both lead to the development of depression and be a symptom of it. For example, studies have shown that children and adolescents who experience sleep problems are more likely to develop depression later in life (13). Sleep disturbances can affect neurotransmitter regulation in the brain, including serotonin and dopamine, which play key roles in mood regulation. Disrupted sleep can lead to neurotransmitter imbalances, increasing the risk of depression. Sleep problems and depression can reinforce each other, creating a vicious cycle—sleep difficulties worsen depression symptoms, while worsening depression further exacerbates sleep problems. Addressing both issues simultaneously is, therefore, essential for effective intervention.

A study by Roberts and colleagues (2008) found that children aged 11–17 with sleep problems were three times more likely to develop depression than their healthy peers (14). Insufficient sleep also negatively impacts physical health, increasing the risk of obesity, diabetes, heart disease, and a weakened immune system (15).

It is also important to note that smartphone use affects not only sleep-related processes but also other aspects of health. Prolonged screen time leads to a decrease in the frequency and amplitude of blinking and may negatively impact tear production (16). At the same time, excessive use of mobile devices can cause vision problems, such as eye strain, discomfort, pain, and dry eye syndrome (17).

DISSCUSSION

As demonstrated above, the problem of using phones before bed is a widespread phenomenon, and its consequences can be serious for users' health. Education on this topic should be one of the fundamental measures introduced to mitigate the negative impact of smartphones on sleep. For example, it could become an integral part of school curricula and health campaigns. Parents, teachers, and employers should be informed about the dangers of excessive device use during the evening and night hours (18). In addition, promoting sleep hygiene principles is highly recommended. These include establishing regular bedtimes, avoiding screen use at least an hour before bedtime, and creating an appropriate sleeping environment-such as a dark, quiet, and cool room (19).

It is also advisable to use apps and settings on mobile devices that reduce blue light emissions, as well as glasses that block blue light, to minimize its negative effects on melatonin production (20).

When discussing apps, it is worth mentioning those that allow users to monitor their sleep. Such apps often include reminders to turn off devices as bedtime approaches, analyze sleep habits, and provide tips for improving sleep quality (21). For younger users, setting limits on screen time, especially before bedtime, may be an important strategy to prevent excessive smartphone and internet use. Parents should monitor the time their children spend using these devices and establish rules to limit smartphone use in the bedroom (22). For individuals struggling with smartphone addiction, cognitive-behavioral therapy (CBT) aimed at reducing screen time and improving sleep habits may be recommended. These therapies can be particularly effective for adolescents and adults (23).

Many studies also highlight the positive effects of physical activity in improving sleep quality. Therefore, promoting sports and physical activity should also be prioritized. Research indicates that it is possible to reduce the negative effects of excessive smartphone use on sleep disorders by encouraging daily physical activity for more than one hour (24). Furthermore, encouraging young people to participate in any form of physical activity is always beneficial, as it helps reduce exposure to psychiatric symptoms caused by excessive smartphone use (25).

CONCLUSIONS

The rapid growth of mobile technology and the Internet over the past two decades has brought numerous benefits but also significant challenges, particularly regarding the health of children, adolescents, and young adults. Data on internet use by age group suggest that mobile technology has become an integral part of young people's lives, raising concerns about the long-term health consequences of this trend.

Excessive smartphone use before bed affects various aspects of sleep, including the ability to fall asleep, total sleep time, and sleep quality. Poor sleep has serious implications for mental health. Therefore, educational and preventive measures are essential to counteract the negative effects of excessive smartphone use. Parents, teachers, and employers should be informed about the dangers of using devices excessively before bedtime. Reducing the negative impact of smartphones on sleep requires an integrated approach that combines education, the implementation of sleep hygiene principles, assistive technology, and psychological support.

Implementing these recommendations, based on the latest scientific research, can help improve sleep quality and overall mental health for both children and adults. Further studies are needed to explore the wide-ranging effects of excessive smartphone and internet use on the human body, with a particular focus on children.

DISCLOSURE

Author's contribution

Conceptualization – Michał Ziemba, Julia Kozakiewicz, Anna Ziemba
Formal analysis – Michał Moś, Katarzyna Giedzicz, Aleksandra Okońska
Investigation – Michał Ziemba, Anna Ziemba, Julia Kozakiewicz
Data curation – Michał Moś, Michał Ziemba
Writing – rough preparation – Julia Kozakiewicz, Michał Moś, Julia Kozakiewicz
Writing – review and editing – Katarzyna Giedzicz, Aleksandra Okońska
Visualization – Katarzyna Giedzicz, Anna Ziemba, Michał Ziemba

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