THE RELATIONSHIP BETWEEN SMARTPHONE USE AND SLEEP DISTURBANCES IN ADOLESCENTS: A REVIEW OF THE SELECTED LITERATURES

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Abstract

In recent years, the rapid development and wide spread of smartphone technology of has transformed the daily life of adolescents. The smartphone is a multi-purpose device and is especially important for the education of young people. While technological advancements offer many benefits, the increase in smartphone use has a significant impact on adolescent health, especially sleep. Adequate sleep is very important for the physical, emotional and cognitive development of adolescents. Adequate sleep in adolescence supports academic performance, mental health and well-being. The research problem of this study is to investigate whether there is a connection between smartphone use and sleep disturbances in adolescents. The main purpose of this research is to study the relationship between smartphone use and sleep disturbances in adolescents. Thematic analysis was used as the qualitative research methodology, with previous research papers serving as secondary data sources in data collection. The research revealed that adolescents use smartphones more than four hours a day. Mostly used in the evening and at night before going to bed. In particular, the time spent sleeping by adolescents is directed towards activities such as using social media, sending text messages, and playing video games. Also, spending a lot of time with smartphones tends to go to bed later and wake up earlier, resulting in less sleep time. Adolescents report poor sleep quality due to smartphone addiction. Research has also revealed that blue light from smartphone screens inhibits the production of melatonin, a hormone essential for regulating sleep-wake cycles. Disruption of melatonin production leads to difficulty initiating and maintaining sleep. Adolescence is a period of emotional development. There they continue to be tempted to use the mobile phone at night. Further research is needed to assess the effectiveness of different intervention strategies to reduce the negative impact of smartphone use on adolescent sleep quality.

Keywords: Adolescents, Mental Health, Sleep Disturbances, Smartphone, Technology

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Introduction

Technology encompasses a broad range of tools, systems and devices designed to solve problems and improve efficiency. These innovations enhance quality of life. From the invention of wheel to development of the internet, technological advancements have profoundly shaped human civilization. In the modern era technology manifests in various forms. This includes information and communication technologies (ICTs). Medical technologies, transportation systems and industrial machinery are also significant. These technologies have revolutionized how people communicate. They access information more easily and perform tasks efficiently. Furthermore, they interact with the world in transformative ways.

The rapid development of digital technology particularly since the late 20th century, has led to proliferation of personal electronic devices such as computers. Tablets and smartphones. These devices have become integral to daily life. They offer unprecedented connectivity. They provide access to vast amounts of information. Users can perform a wide range of functions remotely.

The internet, a cornerstone of modern technology, has facilitated global connectivity. It enables the sharing of information at unprecedented scale. This transformation affects industries. It also impacts economies and social structures. However, the integration of technology into daily life presents challenges. Issues related to privacy and security are significant concerns. There is also potential for negative health impacts. These include problems associated with excessive screen time and digital addiction (Owens et al, 2013)

Smartphones, a subset of personal electronic devices, are handheld devices that combine functionalities of a mobile phone with those of computer. Over time smartphones have rapidly evolved. These devices have become multifunctional tools essential in modern life. They enable users to make calls. Users can also send text messages. Additionally, users can access the internet use social media and take photographs. Smartphones also allow the utilization of myriad applications. These applications serve various purposes. These purposes include productivity, entertainment and education. The integration of advanced features such as high-resolution cameras and GPS navigation has enhanced usability. Biometric security and powerful processors have made smartphones indispensable for many users.

With the development of technology, the smart phone plays a special role in communication. They facilitate instant communication. Call texts and messaging apps constitute powerful tools in this regard. Social media platforms enable users to connect. They share experiences with global audiences. Smartphones also serve as primary sources of information. They allow users to access news, weather updates and educational resources on the go. Additionally, they offer numerous entertainment options. These include music videos, games and eBooks.

Despite their numerous benefits, smartphones also pose certain risks. Particularly when it comes to health and well-being. Excessive use of smartphones especially before bedtime. Linked to various negative outcomes. Sleep disruption. Eye strain and increased stress levels are also concerns. The convenience and constant connectivity offered by smartphones can lead to addictive behaviors where individuals feel compelled to check their devices frequently even at expense of their sleep and overall health. Understanding the impact of smartphone use on health and developing strategies to mitigate these risks is essential for maintaining a balanced and healthy relationship with technology (Fuller et al, 2017).

The widespread integration of smartphones into everyday life has significantly transformed the way adolescents communicate, access information and be entertained. While these devices provide many benefits, including educational resources and social connections, recent experts have suggested that excessive smartphone use has a negative impact on adolescent health, particularly sleep. According to Straker (2022), a smartphone is defined as a "portable device with a touch screen interface that can be used with stylus or finger touch". Adequate sleep is critical during adolescence, a period characterized by rapid physical, emotional, and cognitive growth.

Sleep disturbances, including delayed sleep onset, reduced sleep duration, and poor sleep quality, have been consistently linked to excessive smartphone use, particularly when devices are used before bedtime (Twenge et al., 2017). Prior research has shown that engaging and stimulating content accessed through smartphones can increase cognitive and emotional arousal, making it difficult for teenagers to relax and sleep. While these findings have established a correlation between smartphone use and sleep disturbances, they primarily focus on general smartphone use or screen time.

However, there remains a significant gap in the literature regarding the specific smartphone usage patterns (e.g., the type of content accessed, the duration and timing of use, and the role of individual differences such as gender or sleep habits) that may contribute to sleep disturbances. Furthermore, much of the existing research does not explore how cultural and social factors influence adolescents' smartphone use and its impact on sleep quality. Additionally, strategies to mitigate the negative effects of smartphone use on sleep have been underexplored in empirical studies, leaving a practical gap in understanding how to address these sleep disturbances in adolescents effectively.

Therefore, this study aims to investigate the relationship between specific patterns of smartphone use and sleep disturbances in adolescents, with the goal of identifying both psychological and behavioral factors contributing to these disruptions. By doing so, this research seeks to provide a more nuanced understanding of how smartphone usage affects adolescent sleep and propose targeted interventions to mitigate its adverse effects. Although existing research has established a link between smartphone use and sleep disturbances in adolescents, several critical gaps remain. Most studies focus on general correlations without delving into the specific patterns of smartphone use that most significantly impact sleep. Additionally, there is limited research on how these disturbances affect various aspects of adolescent health, such as cognitive performance, emotional regulation, and academic achievement. Understanding these nuances is crucial for developing effective interventions. This study aims to fill these gaps by providing a comprehensive analysis of how different smartphone usage patterns-such as timing, frequency, and content-affect sleep quality, onset, and duration. By addressing these gaps, the research seeks to offer insights that can inform targeted strategies to mitigate negative sleep outcomes and promote healthier smartphone habits among adolescents.
Smartphone addiction can be understood through various psychological theories. The behaviorist theory posits that behaviors are learned by the environment. Smartphone addiction is a learned behavior resulting from the stimulus-response-consequence principle. According to psychodynamic theory, smartphone addiction can be seen as a way to avoid frustration or seek pleasure and forgetfulness (Aljomaa et al., 2016).

The theory of optimal flow (Csikszentmihalyi, 1990) suggests that people repeatedly engage in activities that provide satisfaction or joy. Thus, smartphone addiction can be viewed as an activity that offers satisfaction and joy, leading to addiction (Csikszentmihalyi, 1990). Social identity theory emphasizes the influence of group norms on addiction. This theory proposes that "when and to the extent that people define themselves in terms of shared social identity, they will be more likely to

influence each other" (Haslam et al., 2018). In this context, smartphone addiction can be seen as a phenomenon shaped by group norms.

Research Problem

The growing popularity of smartphone use among teenagers is worrying for their sleeping patterns. Although there is increasing evidence linking excessive smartphone use with sleep problems, the specific nature of this relationship and the underlying factors are not yet clear. Therefore, this research seeks to bridge the gap in understanding how different dimensions of smartphone usage (such as screen time, content type and usage patterns) lead to adolescent sleep disturbances.

Main Objective

The major aim of this review will be to analyze and synthesize related existing literature focusing on smartphone usage with respect to adolescent sleep disorders in relation to key patterns contributing factors along potential mechanisms involved. In addition, it intends to identify gaps from present day studies while advising on more studies about combating sleeping problems associated with mobile phones among teenagers.

Research Methodology

This study adopts a mixed-methods systematic literature review to investigate the impact of smartphone use on sleep disturbances in adolescents, synthesizing both qualitative and quantitative research. A comprehensive search was conducted using databases like PubMed, PsycINFO, and Google Scholar with terms such as “smartphone use,” “sleep disturbances,” and “adolescents.” Inclusion criteria focused on studies involving adolescents aged 12-18, addressing the relationship between smartphone use and sleep issues. Both qualitative and quantitative studies were included to provide a broader understanding of the topic. The data was analyzed using thematic analysis, which allowed for identifying key themes like sleep onset delay and reduced sleep duration. This mixed-methods approach ensures a more nuanced and holistic view of how different smartphone usage patterns influence sleep problems, making it an appropriate methodology for addressing the complex relationship between technology use and adolescent sleep.

Findings/ Discussion

The impact of smartphone use on adolescent sleep is multifaceted, involving both physiological and behavioral factors. The emission of blue light from smartphones disrupts melatonin production, leading to delayed sleep and poorer sleep quality. Additionally, the engaging nature of smartphone activities, such as social media use and gaming, can result in bedtime procrastination and increased cognitive arousal, further contributing to sleep disturbances. This study reviewed 25 research papers on the topic, analyzed through thematic analysis, to provide a comprehensive understanding of the complex relationship between smartphone use and sleep. The findings underscore the need for targeted interventions to effectively address these issues.

The Effect of Blue Light on Sleep

A primary mechanism by which smartphone use disrupts sleep is through the emission of blue light. Research has found that blue light, which has a wavelength of 450-495 nanometers, suppresses melatonin production more than any other wavelength of light. Melatonin is a hormone produced by the pineal gland in the brain it helps regulate sleep-wake cycles. Normally, melatonin levels rise in the evening, promoting feelings of sleepiness and signaling the body that it's time to sleep. However, exposure to blue light from smartphones and other electronic devices can inhibit melatonin production, which delays sleep and reduces sleep quality.

A number of studies have investigated the effects of blue light on sleep. A study by Chang (2015) et al. found that participants who used light-emitting e-Readers before bed took longer to fall asleep, experienced less evening sleepiness, and had lower melatonin levels compared to those who read printed books. Similarly, a study by Figueiro (2017) et al, showed that exposure to blue light from tablets and smartphones significantly suppresses melatonin levels and delays sleep time.

Aspects of Smartphone Use and Sleep Behavior

In addition to the physiological effects of blue light, behavioral aspects of smartphone use also influence sleep disruption. Excessive use of smartphone leads to sleep disorders. The phenomenon of "sleep delay" is also a significant factor in sleep disruption. This happens when people delay going to sleep because they engage in activities on their smartphones. Research by Kroese et al (2014), found that individuals who engaged in sleep delay reported poorer sleep quality and shorter sleep duration. Moreover, the interactive nature of smartphones, which often involves responding to notifications and engaging in conversations, can increase cognitive arousal and make it difficult for individuals to relax and fall asleep.

Sleep Quality and Duration

There is a significant relationship between the effect of smartphone use on sleep quality and duration. Many studies have shown that excessive smartphone use is associated with poorer sleep outcomes. A meta-analysis by Exelmans and Van den Bulck (2016), found that higher levels of smartphone use were consistently associated with shorter sleep duration, longer sleep onset latency, and poorer sleep quality. Similarly, a study by Arora et al (2014) reported that adolescents who use their smartphones for more than two hours a day are more likely to experience sleep disturbances and difficulty waking up in the morning.

The quality of sleep is also affected by the content consumed on smartphones. Watching videos, playing games, and engaging in emotional conversations increase arousal and make it difficult to fall asleep. Furthermore, constant exposure to social media can lead to feelings of anxiety and stress, which can further exacerbate sleep problems. A study by Levenson et al. (2017), found that greater social media use was associated with increased risk of developing sleep disturbance and insomnia symptoms.

Mental Health and Sleep

The relationship between smartphone use, sleep and mental health is complex and bidirectional. Poor sleep quality and duration can have a significant impact on mental health, increasing the risk of depression, anxiety and other mood disorders. In contrast, people with mental health problems are more likely to use their smartphone excessively, especially at night, as a coping mechanism. A study by Twenge et al. (2017), found that adolescents who spend more time on electronic devices, including smartphones, are more likely to report symptoms of depression and suicidality. The study also revealed that these teenagers are more likely to not get enough sleep. Similarly, a study by Lin et al. (2016), reported that problematic smartphone use was associated with poorer sleep quality and higher levels of anxiety and depression among college students.

Experimental Studies on Smartphone Use and Sleep

The pervasive use of smartphones in modern society has led to growing concerns about their impact on various aspects of health, particularly sleep. Numerous experimental studies have sought to understand how smartphone use affects sleep patterns, quality, and overall health. This paper will review key

experimental studies that explore the relationship between smartphone use and sleep disruption, focusing on the mechanisms involved and potential interventions.

One of the critical studies in this area was conducted by Chang et al. (2015), which investigated the effects of light-emitting e-Readers on sleep. The study involved 12 healthy young adults who were exposed to either an e-Reader or a printed book before bedtime over two weeks. The e-Reader emitted blue light, while the printed book did not. Participants read on either the e-Reader or a printed book for four hours before bedtime in a controlled laboratory setting. The results showed that those who used the e-Reader took significantly longer to fall asleep, had reduced evening sleepiness, and lower melatonin levels compared to those who read the printed book. The study concluded that blue light from electronic devices can delay sleep onset and disrupt sleep quality by suppressing melatonin production.

Another notable study by Levenson et al. (2017) examined the relationship between social media use and sleep disturbance among young adults. The study involved 1,788 young adults aged 19-32 who completed an online survey assessing social media use and sleep disturbances. Participants reported their frequency of social media use and sleep patterns. The study has found a significant association between high social media use and increased sleep disturbances. Participants who checked social media frequently throughout the day and particularly before bedtime were more likely to report difficulties falling asleep and maintaining sleep.

Research by Kroese et al. (2014) explored the concept of bedtime procrastination and its impact on sleep duration. The study involved 177 participants who completed an online survey measuring bedtime procrastination, self-regulation, and sleep habits. Participants reported their typical bedtime, wake-up time, and the extent to which they engaged in activities on their smartphones before bed. The results indicated that individuals who frequently engaged in bedtime procrastination by using their smartphones reported shorter sleep duration and poorer sleep quality. The study highlighted that the engaging nature of smartphone activities can delay bedtime and reduce overall sleep duration.

Figueiro et al. (2011) examined the possibility of reducing the negative sleep-related effects from blue light exposure by using blue light filters in their study. The investigators, at the end of two hours before bedtime, had 20 college students exposed to a tablet screen with and without blue light filters. Measurements for melatonin and sleep parameters were taken using polysomnography. The melatonin suppression relative to that of unfiltered blue light was significantly reduced using a blue light filter, and its sleep onset latency and sleep quality improved. Therefore, it is suggested that blue light filters can be one of the effective interventions to minimize adverse influences of smartphone use on sleep.

A study by Kalmbach et al. (2020) examined the effectiveness of Cognitive Behavioral Therapy for Insomnia (CBT-I) in improving sleep among individuals with high smartphone use. The study involved 60 participants who reported insomnia symptoms and high smartphone use before bedtime. Participants were randomly assigned to receive either CBT-I or a control intervention. The CBT-I group received six weekly sessions focused on sleep hygiene, stimulus control, and cognitive restructuring. The results showed that participants who received CBT-I reported significant improvements in sleep quality, sleep duration, and reduced smartphone use before bed compared to the control group. This study demonstrated that CBT-I could effectively address sleep problems associated with excessive smartphone use.

Jean et al. (2017) reported that the use of electronic devices, exposure to social media, and reading news online increased the odds of short sleep duration, with clear exposure-response relationships observed

for electronic devices after 2 or more hours of use each day. Other activities related to short sleep duration, such as homework time, working for pay, and TV watching, were relatively stable or decreased over this time period, making it unlikely.

The study, according to Scott (2019), offers a new normative profile of UK adolescent social media use and sleep. Results strongly support there being statistically and practically significant associations between use and sleep patterns, with a particular potential for a later pattern of sleep onset. Sleep education and interventions are recommended to center around supporting young people in the balancing of online interactions with an appropriate and adequate sleep on school nights.

The study, according to Hale (2015), This work was conducted systematically, searching and updating the scientific literature on the association between screen time (e.g., television, computers, video games, mobile devices) and sleep outcomes in school-aged children and adolescents. We reviewed 67 papers published from 1999 until early 2014. They found that in 90% of these, screen time is adversely associated with sleep outcomes, primarily duration and timing. However, some of the results are partially driven by screen type, participant age and gender, and day of the week.

Conclusion

Based on the findings discussed, it is evident that both physiological and behavioral factors contribute to sleep disturbances related to smartphone use in adolescents. The emission of blue light from smartphones significantly impacts melatonin production, leading to delayed sleep onset and reduced sleep quality. Behavioral aspects, such as bedtime procrastination and increased cognitive arousal from engaging with smartphones before bed, further exacerbate sleep issues. The studies reviewed highlight a consistent relationship between excessive smartphone use and negative sleep outcomes, including shorter sleep duration and poorer sleep quality. Additionally, the content consumed on smartphones, such as social media and gaming, can increase emotional arousal and stress, which negatively impacts sleep. This comprehensive understanding of the relationship between smartphone use and sleep disturbances underscores the need for effective intervention strategies, such as the use of blue light filters and cognitive-behavioral therapy, to mitigate the adverse effects on adolescent sleep health.

The proliferation of smartphones has revolutionized modern society and provides unparalleled convenience and connectivity. However, adolescents are facing sleep quality problems due to these technological advancements as they resort to the use of cell phones.

Experimental studies show that excessive smartphone use and sleep latency are associated with decreased sleep duration and poorer sleep quality. Research has revealed that teenagers experience these symptoms due to excessive smartphone use. The link between smartphone use and sleep extends to mental health. Poor sleep increases the risk of depression, anxiety and other mood disorders.

Adolescents should be educated to reduce the harmful effects of overuse of mobile phones. Therapeutic approaches such as cognitive behavioral therapy have the potential to improve sleep quality and reduce late-night smartphone use. Despite significant progress in understanding the impact of smartphone use on sleep, there are areas of research that need further investigation. Future research should explore the long-term effects of smartphone use on sleep across different populations and identify more effective strategies for reducing sleep disruption. Conditions arising due to the rapid evolution of technology should be explored.

Finally, there are two main areas of positive and negative effects through the smartphone, and as negative effects, it is essential to identify and address the negative effects on sleep. By adopting appropriate interventions and promoting awareness of healthy smartphone usage practices, adolescents can enjoy the benefits of technology without compromising their sleep, physical health, and mental health. It enables to build overall well-being.

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