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The Relationship Between Smartphone Use and Sleep Quality in Adolescents

Fatimah Azzahrah[1], Agus Sudaryanto[1*]

[1] Nursing Study Program, University of Muhammadiyah Surakarta, Surakarta, Central Java, Indonesia

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****Corresponding author***
Email:
agus_sudaryanto@ums.ac.id

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ABSTRACT
The prevalence of smartphone use among teenagers is rising in the digital age. The overuse of cellphones adversely affects sleep quality. Sleep quality is defined as ideal sleep according to an individual's need. The quality of sleep influences the physical and mental health of teenagers. Despite several studies on the effects of smartphone use, there is a paucity of research particularly addressing the correlation between the intensity of smartphone use and sleep quality in high school teenagers. This study aims to analyze the relationship between smartphone use and sleep quality in adolescents at SMAN 2 Sukoharjo. The study strategy used is descriptive correlational using a cross-sectional approach, performed in November 2024 at SMAN 2 Sukoharjo. The sample included 100 students, chosen by a simple random sampling method employing the Slovin formula. The use of smartphones was assessed by a validated and reliable questionnaire, while sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. The Spearman rank test was used for correlation analysis, revealing a significant association between smartphone usage and sleep quality among teenagers at SMAN 2 Sukoharjo ($r = 0.512$; $p = 0.001$), showing a moderately strong positive correlation. This research concludes that increased smartphone use correlates with poorer sleep quality in teenagers. teenagers and parents need education on the significance of time management and self-regulation in smartphone use to preserve teenagers' sleep quality. Further studies are encouraged to investigate the correlation between smartphone use and sleep quality in teens using a qualitative methodology.

Keywords: Smartphone Use, Sleep Quality, Adolescents.

ABSTRAK
Prevalensi penggunaan telepon pintar di kalangan remaja meningkat di era digital. Penggunaan ponsel yang berlebihan berdampak buruk pada kualitas tidur. Kualitas tidur didefinisikan sebagai tidur ideal sesuai dengan kebutuhan individu. Kualitas tidur memengaruhi kesehatan fisik dan mental remaja. Meskipun ada beberapa penelitian tentang efek penggunaan telepon pintar, masih sedikit penelitian yang secara khusus membahas korelasi antara intensitas penggunaan telepon pintar dan kualitas tidur pada remaja sekolah menengah atas. Penelitian ini bertujuan untuk menganalisis hubungan antara penggunaan smartphone dan kualitas tidur pada remaja di SMAN 2 Sukoharjo. Strategi penelitian yang digunakan adalah deskriptif korelasional dengan pendekatan cross-sectional, dilakukan pada bulan November 2024 di SMAN 2 Sukoharjo. Sampel meliputi 100 siswa, dipilih dengan metode simple random sampling dengan menggunakan rumus Slovin. Penggunaan telepon pintar dinilai dengan kuesioner yang tervalidasi dan andal, sedangkan kualitas tidur dievaluasi menggunakan kuesioner Pittsburgh Sleep Quality Index (PSQI). Uji peringkat Spearman digunakan untuk analisis korelasi, yang menunjukkan hubungan signifikan antara penggunaan telepon pintar dan kualitas tidur di kalangan remaja di SMAN 2 Sukoharjo ($r = 0,512$; $p = 0,001$), menunjukkan korelasi positif yang cukup kuat. Penelitian ini menyimpulkan bahwa peningkatan penggunaan telepon pintar berkorelasi dengan kualitas tidur yang lebih buruk pada remaja. Remaja dan orang tua perlu diberi edukasi tentang pentingnya manajemen waktu dan pengaturan diri dalam penggunaan telepon pintar untuk menjaga kualitas tidur remaja. Penelitian lebih lanjut dianjurkan untuk menyelidiki korelasi antara penggunaan telepon pintar dan kualitas tidur pada remaja dengan menggunakan metodologi kualitatif.

Kata kunci: Penggunaan *Smartphone*, Kualitas Tidur, Remaja.

INTRODUCTION

Along with the progress of the times, technological developments have also experienced significant acceleration. Many people in the world, including Indonesia, have used technology, one of which is the internet. The Indonesian Internet Service Providers Association (APJII) has released data on the number of individuals accessing the internet in Indonesia in 2024, the data states that there are 221,563,479 people accessing the internet. This data is calculated based on Indonesia's total population in 2023 which is recorded at 278,696,200 people. The results of a survey related to internet penetration conducted by APJII in 2024 show that the level of internet use in Indonesia is recorded at 79.5% of the entire population, which shows a significant increase in online access. There is an increase of 1.4% compared to the previous period (Arif, 2024).

The internet is widely reached through smartphones. A smartphone is a phone that has features with advanced technology that makes a person's work easier and can respond quickly. In this day and age, smartphones are used and needed by many people. Based on a report from Reportal, every year, there is a significant increase in the number of active smartphone users in Indonesia. In 2015, the number of active users was recorded at around 54 million, and this figure jumped sharply to reach 209.3 million in 2023, showing rapid growth in the adoption of digital technology in the country (Andalas, 2024).

Based on age, according to the Central Statistics Agency (BPS), the proportion of individuals who own/own the largest smartphone, namely 15-24 years old, is 92.14% in 2023 (BPS, 2024). According to the Ministry of Health, (2024), adolescents are 10-18 years old. This means that most of them use smartphones in the adolescent age group (Kementerian Kesehatan Republik Indonesia, 2024). Adolescence can be called a transition period that signifies a shift from the childhood phase to the adult stage. In this phase, there is a significant transformation, both physically and psychologically. Adolescents often show a high level of curiosity about the various things around them and a tendency to explore and try new experiences. One example is their interest in using smartphones, especially in today's era of advanced technology and information, where almost anyone can easily access and utilize these devices in their daily lives.

A person has a desire to use a smartphone because there is a factor. There are several things that can affect teenagers to use smartphones, including boredom and tiredness of studying so that they look for entertainment on smartphones, needs as a learning medium, fill their free time, and others. In line with research (Lestari & Sulian, 2020), various factors that play a role in increasing the risk of addiction to smartphone use among students, namely low levels of sensation seeking and lack of self-control are the main internal determining factors, the media aspect is an external element that makes the main contribution, this element is related to how often smartphones are And its features are shown in the media, learning saturation as a situational factor, and the need for social engagement that comes from within oneself as a social factor, students most often use Facebook apps and online games, so they often play them all the time.

Smartphones have many positive impacts on a person, with smartphones getting information quickly, communicating remotely, playing social media and games, studying, listening to music, shopping, and many more uses. On the other hand, excessive use of smartphones has a negative impact, especially if it is at night. Teenagers who use electronic devices including smartphones often stay up late, causing them to sleep deprived. In this case, experiences, the surrounding environment, and social and cultural elements can have an impact (Zakarisma & Muhlisin, 2025). Modern electronic devices equipped with backlighting, such as cell phones, tablets, and computers, emit light with richer short wavelengths, commonly referred to as blue light. In addition, artificial lighting sources such as fluorescent lamps and Light Emitting Diodes (LEDs) also produce blue light, which is known to suppress or delay the natural production of the hormone melatonin at night, thereby reducing drowsiness. Children who frequently use electronic devices at night are at risk of sleep disturbances because the quality and duration of their rest are reduced, which can lead to fatigue the next day. In particular, adolescents are more prone to sleep pattern disturbances due to exposure to blue light from electronic devices, especially from the use of smartphones before bedtime

(Pacheco, 2023). Good sleep quality is essential for improving cognitive function, especially memory retention, but poor sleep quality causes daytime sleepiness, which can affect students' academic grades (Sulistyani, 2021). Therefore, this study aims to analyze the relationship between smartphone use and sleep quality in adolescents at SMAN 2 Sukoharjo.

RESEARCH METHODS

This study adopts a correlational descriptive design that uses a cross-sectional approach. The cross-sectional method itself is a type of research that collects data from independent variables and dependent variables simultaneously in a certain period of time without intervention or manipulation of variables (Adiputra, 2021). This study involved 100 students from SMAN 2 Sukoharjo as a sample. The sample selection process was carried out in a random way using the Simple Random Sampling approach with inclusion criteria, among others, students of SMAN 2 Sukoharjo, students of grades X, XI, and XII, and students who were willing to be respondents. The exclusion criteria are students who do not have smartphones and are not willing to be respondents. The calculation of the respondents in this study was determined based on the Slovin formula:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}(e)^2}$$

Information:
n = Sample size/number of respondents
N = Population size
E = Percentage of tolerance for sampling error accuracy; e= 0,1

$$n = \frac{972}{1 + 972\ (0{,}1)^2}$$

n = 90,67 rounded to 91

Number of respondents = n + n (10%)
= 91 + 91(10%)
= 100 students

For this study, surveys about smartphone use and the Pittsburgh Sleep Quality Index (PSQI) sleep quality questionnaire from Buysse et al., (1989) are used as tools. The process for completing the smartphone use questionnaire involves marking selections on 11 statements based on the respondent's preferences, accompanied by the following descriptions: STS: Strongly Disagree; TS: Disagree; S: Agree; SS: Strongly Agree. The Pittsburgh Sleep Quality Index (PSQI) sleep quality questionnaire involves responding to brief questions 1-4 and selecting options for questions 5-10 concerning sleep patterns during the preceding month.

The questionnaire underwent validity and reliability testing to verify accuracy and consistency among 32 students from SMA Negeri 1 Kartasura. On November 13, 2024, respondents completed the questionnaire using the Google Form URL supplied by the researcher. The validity assessment uses the Pearson correlation coefficient (product-moment), whereas the reliability assessment utilizes Cronbach's alpha. The validity test findings for the 11-question smartphone usage questionnaire and the 10-question Pittsburgh Sleep Quality Index (PSQI) were deemed valid since the obtained scores exceeded 0.3494. The reliability test findings for the smartphone use questionnaire and the Pittsburgh Sleep Quality Index (PSQI) yielded a coefficient greater than 0.7, thereby confirming their dependability. Data processing methodologies use univariate and bivariate analysis by categorizing smartphone usage factors into four classifications: low, medium, high, and extremely high. We categorize the variable sleep quality into two categories: excellent and terrible. After that, the researcher used the Kolmogorov-Smirnov method to check for normality. The result was a p-value of less than 0.05, which meant that the data did not follow a normal distribution. For example, the p-value for smartphone use was 0.03 and the p-value for sleep quality was 0.01. The correlation test of two ordinal scale variables was carried out using the

spearman rank test. This research has received approval from the Health Research Ethics Commission of the Faculty of Health Sciences, University of Muhammadiyah Surakarta, as stated in the decree number No.599/KEPK-FIK/X/2024.

RESULTS

Table 1. Dispersal of various characteristics of respondents.

Characteristic	Frequency	Percentage (%)	Range	Minimum	Maximum	Mean	Std. Deviation
Class							
X	34	34					
XI	36	36					
XII	30	30					
Age							
15	25	25	3	15	18	16.23	0.920
16	35	35					
17	32	32					
18	8	8					
Gender							
Male	44	44					
Female	56	56					
Total	100	100					

Table 1 shows that the majority of respondents came from students who sat in class XI with a total of 36 (36%). Based on the age of the respondents, the majority are 16 years old with a total of 35 (35%). Regarding gender, the majority of participants in this study consisted of women, which amounted to 56 people or equivalent to 56% of the total participants. Range in age 3, youngest age 15 years, oldest age 18 years, median value (mean) 16,23, standard deviation value 0,920.

Table 2. Distribution of smartphone usage.

Penggunaan *smartphone*	Frequency	Percentage (%)	Range	Minimun	Maximum	Mean	Std. Deviation
Low	1	1	23	18	41	30.14	4.440
Moderate	45	45					
High	50	50					
Very high	4	4					
Total	100	100					

Table 2 shows that the results of the study were obtained from the intensive use of smartphones in adolescents at SMAN 2 Sukoharjo, the majority of respondents used smartphones with a high intensity with a percentage (50%). The range of smartphone use is 23, the lowest score is 18, the highest score is 41, the mean value is 30,14, and the standard deviation is 4,440.

Table 3. Distribution of Sleep Quality.

Sleep quality	Frequency	Percentage (%)	Range	Minimum	Maximum	Mean	Std. Deviation
Good	32	32	13	1	14	6.99	2.505
Bad	68	68					
Total	100	100					

Based on the results of the study presented in Table 3, the results of this research show that most of the adolescents who study at SMAN 2 Sukoharjo experience problems related to suboptimal sleep quality. This is reflected in a significant figure, reaching 68%, which indicates that the majority of respondents face difficulties in maintaining their sleep patterns. Sleep quality range 13, lowest score 1, highest score 14, mean value 6.99, and standard deviation 2.505.

Table 4. Cross-tabulation and the relationship between smartphone use and sleep quality.

Variable	Sleep quality		Total	r	P-Value
	Good	Poor			
Use of smartphones					
Low	1	0	1		
Moderate	27	18	45		
High	5	45	50	0.512	0.001
Very high	0	4	4		
Total	32	68	100		

Table 4 indicates that smartphone use is low among 1 respondent, moderate among 45 respondents, high among 50 respondents, and extremely high among 4 respondents. Among the total responders, 32 persons exhibited excellent sleep quality, while 68 others saw disruptions in their sleep quality. The normality test was conducted using the Kolmogorov-Smirnov method with a p-value of less than 0.05, indicating that the data is not normally distributed, with a significance value of 0.03 for smartphone usage and 0.01 for sleep quality. A Spearman Rank correlation test was used to assess the association between smartphone usage and sleep quality. The study yielded a p-value of 0.001 ($p < 0.05$), leading to the rejection of the null hypothesis (H0) and the acceptance of the alternative hypothesis (Ha), so suggesting a substantial link between the two variables. The correlation coefficient obtained was 0.512, suggesting a moderately substantial association between smartphone use and sleep quality. The magnitude of this positive coefficient (0.512) indicates a unidirectional correlation, indicating that increased smartphone use correlates with reduced sleep quality among respondents.

DISCUSSION

The study showed that the majority of respondents belonged to the 16-year-old age group. A person aged 10-19 years is called a teenager (Ministry of Health, 2024). The period when individuals develop mental health through the social environment by expanding their social sphere is adolescence (Rudolf & Kim, 2024). Another study was also conducted by (Sembiring & Harahap, 2021) regarding the relationship between the use of smartphones and its impact on sleep quality in students, in the study, the majority of respondents aged 16 years were adolescents.

This study revealed that of the 100 participants or respondents involved, as many as 44 people (44%) were male, while the other 56 people (56%) were female. Based on the available information, the female gender is the dominant respondent. Boys are not as much as girls and young women spend time on social media through smartphones (Abi-Jaoude et al., 2020). This study has similarities with the previous study Purnamasari, Hermawan, and Nurani, (2021) from a total of 191 respondents, 39 of whom (20%) are men, while the other 152 respondents (79.6%) are women. Based on this information, it can be concluded that the participants of this study are mostly women.

This study shows that among the 100 respondents involved, the use of smartphones among students at SMAN 2 Sukoharjo has significant results, there are 1 respondent (1%) has low smartphone use, 45 respondents (45%) have sufficient smartphone use, as many as 50 respondents (50%) show the level of smartphone use while the other 4 respondents had a very high level of smartphone use. Based on the results of the analysis, the number of respondents who use smartphones in the high category is more than respondents who are in the low, moderate, and very high smartphone use categories. Looking at the habits that are developing among teenagers today, there are two main factors that also affect their tendency to become addicted to using smartphones, namely factors that come from within the individual and factors that come from outside. Internal factors themselves come from personal impulses that encourage individuals to continue to hold or touch certain objects in specific situations, and external factors come from external impulses that force and encourage a person to hold and play a smartphone (Saputra, 2023).

Long-term intensive use of smartphones can lead to dependence or addiction to smartphones. Overdependence on smartphones refers to a condition when an individual experiences problems caused by excessive smartphone use due to a reduced ability to

voluntarily control smartphone usage time according to subjective goals (Lee, 2022). This research is similar to that conducted by Sutisna, Tohri, and Safitri (2024), finding that most respondents at SMK Kesehatan Rajawali are addicted to the use of smartphone devices. In contrast to the research (Septianingrum, 2020), the results of the study indicate that the majority of adolescents who study in the nursing program (Akper) of Dustira Hospital show a significant level of dependence on smartphone use. Researchers assume this difference is due to different learning habits and academic demands.

Too much use of smartphones can cause various health and social problems, including smartphone radiation, which can interfere with brain function and cause the formation of neoplasms from abnormal cells that develop into aggressive cancer in humans. Decreased eye health due to fatigue due to staring at the smartphone screen for too long can cause Computer Vision Syndrome (CVS). The sound of notifications on smartphones reminds of the potential for smartphone users to be curious to open incoming messages. Delayed sleep at night is caused by this, which can ultimately negatively impact the quality of sleep obtained (Rozak & Hernawan, 2024).

The results of the study showed that at SMAN 2 Sukoharjo, as many as 32 adolescents (32%) had good sleep quality, while 68 adolescents (68%) experienced poor sleep quality. This data shows that the number of adolescents with poor sleep quality is higher than those who sleep with good quality. Sleep quality can be understood as an individual's ability to sleep smoothly and maintain it throughout the duration of sleep. This includes how long a person sleeps as well as complaints that arise both during sleep and after waking up. The need for adequate sleep is influenced by two main factors, namely the number of hours of sleep (quantity of sleep) and the depth of sleep (sleep quality) (Sunbanu et al., 2021). Sleep quality can be assessed using aspects of sleep history, such as the average time to start falling asleep or the latency of starting to sleep, the typical duration of sleep, the number of awakenings, the typical time to start sleeping, waking up in the morning, and whether or not there is sleepiness during the day, and the use of certain medications (Trisnowiyanto et al., 2024).

Poor sleep quality reflects a situation where a person does not implement a consistent sleep routine, where the basic principle to be maintained is a balance between sleep and wakefulness. However, an equally important aspect in maintaining this regularity is the routine of going to bed earlier and waking up early in the morning (Woran et al., 2021). A study conducted by Woran (2021) showed that the number of respondents who had poor sleep quality was more than those who had better sleep quality, which showed that the majority of adolescents in SMAN 1 Langowan experienced sleep quality problems. Research conducted by (Supartini et al., 2021), shows that the results of most adolescents at SMP Budi Cendikia Islamic School Depok have poor sleep quality.

Environment, physical activity, stress levels, and smartphone use are all factors that affect sleep quality. The environment can speed up or slow down sleep. The presence or absence of normal stimuli can prevent people from sleeping, factors such as sound, temperature, ventilation, and light levels in the environment can affect the quality of a person's sleep. Physical activity causes fatigue, which requires long sleep times to maintain energy balance, which can affect a person's sleep quality. Stress can affect a person's ability to sleep, causing sleep disturbances and increased production of stress hormones such as cortisol. The use of smartphones until late at night can interfere with physical and mental sleep and rest (Nugraha et al., 2023).

Teens spend more time online activities using different technical devices, including smartphones, tablets, laptops, and PCs, for both educational and recreational objectives. These everyday routines may pose a health concern, since they may manifest as excessive behaviors that impact several facets of physiological and mental well-being. This is significant for an individual's overall health, since health-risk behaviors throughout adolescence are known to persist into adulthood. One impacted measure is sleep, which becomes shorter and irregular, with the onset and conclusion significantly influenced by problematic internet use. This may result from alterations in circadian rhythms and sleep patterns, heightened psychological and cognitive arousal, or melatonin suppression due to exposure to intense light before to bedtime (Kokka et al., 2021). Inadequate sleep adversely affects scholastic performance, emotional

stability, job efficiency, neurocognitive and psychomotor functions, physical and mental health, and overall quality of life (Fauziyah & Aretha, 2021).

An individual with inadequate sleep quality will have detrimental effects on the body, including increased susceptibility to illness, persistent fatigue, lack of concentration, and frequent drowsiness. Sleep deprivation may disrupt an individual's emotional condition, leading to worry, tension, and diminished performance (Arasy et al., 2023). Subpar sleep quality markedly exacerbates daytime dysfunction in teenagers, hence affecting their sense of social isolation, self-regulation, and emotional control (Wang et al., 2024). Extended sleep duration and enhanced sleep quality correlate with elevated physical fitness levels, indicating that sleep quality influences physical fitness in teenagers (Fonseca et al., 2021).

This research demonstrates a correlation between smartphone use and sleep quality. Increased smartphone use is often associated with diminished sleep quality. The findings are corroborated by several prior studies, including those by Ulfa, Sari, and Wibisono (2021), which demonstrate a significant correlation between smartphone usage and sleep quality in adolescents. This suggests that increased smartphone addiction among adolescents correlates with deteriorating sleep quality. Conversely, a reduction in smartphone addiction often improves an individual's sleep quality. Furthermore, research by (Alahdal et al., 2023) indicated that high school students in Makkah had difficulties with excessive smartphone use, often checking their devices, and neglecting scheduled tasks as a result of smartphone engagement. A significant link existed between smartphone addiction and sleep quality ($r = 0.261$; $p < 0.001$), indicating that respondents had worse sleep quality while hooked to cellphones. As for the research conducted by Sutisna, Tohri, and Safitri, (2024), indicates a substantial correlation between smartphone use and sleep quality, determined by the kind of activities engaged in by teenagers before to bedtime. These activities include using cellphones to view films, engage in gaming, or participate on social networking platforms. The quality of teenagers' sleep diminishes, adversely affecting their morning activities. Increased smartphone use correlates with poorer sleep quality. Factors that diminish sleep quality include the length and activity associated with smartphone use throughout the night or before to bedtime. Consequently, it is essential to educate teenagers on smartphone time management and for parents to supervise smartphone use to enhance their children's sleep quality.

CONCLUSION

The conclusion of this study is that the higher the intensity of smartphone use, the worse the sleep quality in adolescents. Education is needed for adolescents and parents about the importance of time management and self-control in using smartphones to maintain sleep quality in adolescents. It is hoped that the future researcher can research the relationship between smartphone use, and sleep quality in adolescents with a qualitative approach.

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